

# **Emotional Processing and Episodic Memory**

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Abstract

The research reported within this dissertation investigates how individuals' capacity to assimilate emotionally disruptive events is associated with particular features of episodic and autobiographical memory formation. It is inspired by Rachman's (1980, 2001) formulation of emotional processing, and his subsequent proposals to explore the general mechanisms by which emotional disruptions are overcome. The specific rationale is informed by multilevel emotion theories, theories of post-traumatic stress disorder, and models of emotional processing. The research considered whether individuals who exhibit signs of a poor emotional processing style tend to encode events generally in a sensory-perceptual manner, with comparative deficits in their capacity to conceptually process data. Methodologically, the studies identify poor and effective emotional processors by using Baker et al.'s (2009) emotional processing scale as a grouping measure. The studies explore differences between groups of poor and effective emotional processors' performance over a range of memory tasks drawn from episodic and autobiographical memory studies to detect evidence for a sensory-perceptual style of event and stimulus processing which is presumed to be indicated by a surfeit of perceptual details, heightened reported vividness, and a relative lack in conceptual ordering, narrative coherence and verbal indexing. Three general categories of memory are explored: memory for experimentally presented item lists, memory for extended narrative presentations and memory for naturally occurring events retained in long-term autobiographical memory representations. The evidence suggests a tendency to process in a sensory-perceptual manner amongst poor emotional processors for both experimental item lists, as well as in long term autobiographical memory investigations, whereas few differences between groups emerged for the study of narrative recollection. There was little evidence, by contrast, that effective emotional processors were superior at the conceptual processing of events or data. These results are discussed in terms of providing confirmation for information processing accounts of emotional disruptions and disorders which stress the aetiological significance in psychopathological conditions of how events are encoded, rendering such events accessible to broader autobiographical memory bases and conceptual elaboration. Furthermore, the importance of establishing more robust and testable definitions of conceptual processing is stressed.

## Acknowledgements

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## In Memoriam

Glen passed away before he was able to submit the revised version of his thesis. With this completed version we, his supervisors, would like to acknowledge our gratitude to Glen for allowing us to share with him, even if temporarily, his rich and subtle philosophical perspective of psychology. We regarded him as one of the most able students we have supervised and are saddened at the premature loss of someone with such a promising talent.

Roger Baker  
Siné McDougall

## Declaration

This thesis has been composed by the undersigned. It has not been accepted in any previous application for a degree. The work, of which this thesis is a record, has been completed by myself, unless otherwise indicated in the text. I further state that no part of this thesis has already been, or is concurrently, submitted for any such degree or qualification at any other university.

Glen Howells

## List of Contents

1 Chapter 1: Review of Emotional Processing research and Episodic Memory.....	14
1.1 Emotions and Emotional Processing.....	14
1.1.1 Introduction: The Concept of Emotional Processing.....	14
1.1.2 Emotional Processing As A Clinical Concept.....	17
1.1.3 Emotions.....	21
1.1.4 Appraisal views.....	24
1.1.5 Summary.....	29
1.1.6 Cognitive impenetrability and multilevel theories of emotions...29	
1.2 Episodic Memory.....	37
1.2.1 Introduction.....	37
1.2.2 Episodic memory .....	38
1.2.3 Objections to Tulving.....	40
1.2.4 Conway and Pleydell-Pearce's Account.....	42
1.2.5 Summary .....	43
1.3 The differential effects of emotion on autobiographical memory .....	45
1.3.1 Introduction .....	45
1.3.2 Emotion as promoting sensory memory.....	47
1.3.3 Emotion as distorting recollection.....	50
1.3.4 Emotion as obscuring recall .....	53
1.3.5 Section Summary .....	55
1.4 Conceptual Processing and Emotional Processing .....	60
1.4.1 PTSD and Analogue studies.....	60
1.4.2 Conceptual versus data-driven processing.....	62
1.4.3 Summary.....	64
1.4.4 Constraining memory stores.....	64
1.4.5 Theories of flashbacks.....	66
1.4.5.1 Ehlers and Clark.....	66
1.4.5.2 Dual representation theory.....	68
1.4.6 Summary.....	70
1.5 Verbalisation and Emotional Processing.....	72
1.5.1 Therapeutic expression.....	72

1.5.2	Additional experimental findings.....	78
1.6	Section conclusion and comments.....	80
2	Chapter 2: Experimental Rationale and Methods.....	81
2.1	Rationale.....	85
2.1.1	Overview.....	85
2.1.2	Explanatory nature of the research.....	90
2.2	General features of the studies.....	90
2.2.1	Design .....	90
2.2.2	The Emotional Processing Scale .....	91
2.2.3	Grouping variables.....	93
2.2.4	Stimulus types.....	95
2.2.5	Measures.....	96
2.2.6	Presentation order of the studies.....	98
2.2.6	Ethical Measures And Participant Screening.....	100
3	Chapter 3: Studies 1-4: Effects of Emotional Processing Style on Recognition of Words and Images.....	102
3.1	Introduction.....	102
3.2	Study 1: Effects Of Emotional Processing Style On Autonoetic Recognition Judgements.....	106
3.2.1	Introduction.....	106
3.2.2	Method.....	111
3.2.3	Results.....	114
3.2.4	Discussion.....	115
3.3	Study 2: Effects of Emotional Processing style on recognition of verbal and pictorial items.....	119
3.3.1	Introduction.....	119
3.3.2	Methods.....	121
3.3.3	Results.....	122
3.3.4	Discussion.....	124
3.4	Study 3: Effects of emotional processing style on verbal processing of pictorial information.....	126
3.4.1	Introduction.....	126
3.4.2	Methods.....	128
3.4.3	Results.....	130
3.4.4	Discussion.....	132

3.5 Study 4: Effects of arousal on verbal processing	
of pictorial information.....	134
3.5.1 Introduction.....	134
3.5.2 Method.....	134
3.5.3 Results.....	136
3.5.4 Discussion.....	137
3.6 General discussion: Studies 1-4.....	138
3.6.1.Evidence for a sensory perceptual memory style .....	139
4 Chapter 4: Emotional Processing style and the Recall Of Narrative .....	143
4.1 Studies 5-7 General Introduction.....	146
4.2 Study 5: Effects Of Emotional Processing Style On Recall Of Visually	
Arousing Events.....	148
4.2.1 Introduction.....	148
4.2.2 Method .....	149
4.2.3 Results.....	153
4.2.4 Discussion.....	156
4.3 Study 6: Effects Of Emotional Processing Style On Recall Of Thematically	
Arousing Events.....	158
4.3.1 Introduction.....	158
4.3.2 Method.....	159
4.3.3 Results.....	162
4.3.4 Discussion.....	165
4.4 Study 7: Effects of Emotional Processing Style on Recall of Naturally	
Occurring event.....	167
4.4.1 Introduction.....	167
4.4.2 Method.....	168
4.4.3 Results.....	171
4.4.4 Discussion.....	173
4.5 Studies 5-7 General Discussion.....	175
5. Chapter 5: Effects of Emotional Processing Style of long term autobiographical	
memory representation.....	180
5.1 Studies 8-10 General Introduction.....	180
5.2 Study 8: Effects Of Emotional Processing Style on general features of	
Autobiographical memory.....	185
5.2.1 Introduction.....	185
5.2.2 Method .....	190

5.2.3	Results.....	193
5.2.4	Discussion.....	196
5.3	Study 9: Effects Of Emotional Processing Style On Flashbulb Memory and Significant Personal event representations.....	200
5.3.1	Introduction.....	200
5.3.2	Method.....	204
5.3.3	Results.....	206
5.3.4	Discussion.....	211
5.4	Study 10: Effects of Emotional Processing Style on Traumatic Memory Representations.....	215
5.4.1	Introduction.....	215
5.4.2	Method.....	217
5.4.3	Results.....	219
5.4.4	Discussion.....	223
5.5	Studies 8-10: General Discussion.....	226
6	Concluding Remarks.....	230
6.1	Introduction.....	230
6.2	Conclusions.....	232
6.2.1	Support for a sensory-perceptual style.....	232
6.2.2	Support For Conceptually Driven Processing style.....	237
6.3	Implications.....	243
6.4	Summary.....	254
7.	References.....	256
8.	Appendices.....	284
Appendix A	: Word Lists used in Study 1.....	284
Appendix B	: Stimulus Lists used in Study 2.....	286
Appendix C	: Stimulus Lists used in Studies 3 & 4.....	290
Appendix D	: Slide show and texts used in Study 5.....	294
Appendix E	: Materials used in Study 6.....	300
Appendix F	: Questions used in Study 7.....	314
Appendix G	: Questionnaire used in Study 9.....	318
Appendix H	: Questionnaire used in Study 10.....	319
Appendix I	: The Emotional Processing Scale.....	320

## List of Tables

Table 1: Summary of Memory Phenomena Reviewed .....	55
Table 2: Overview of studies conducted and reported on within this dissertation.....	99
Table 3: Mean percentage of remember responses (and standard deviations) for emotional processing groups across intervals.....	114
Table 4: Mean percentage of primed fragments (and standard deviations) from total fragments completed across groups and intervals.....	115
Table 5: Mean correctly recognised pictures (and standard deviations) as a percentage of total items across intervals and emotional processing groups.....	123
Table 6: Mean scores (and standard deviations) for words subtracted from pictures across group us and retention intervals .....	124
Table 7: Mean totals of pictures recognised across emotional processing groups and retention intervals.....	130
Table 8: mean number of lures participants stated having seen (and standard deviations) across emotional processing groups and intervals.....	131
Table 9: mean number if pictures correctly recognised (and stand deviations) in response to verbal retrieval cues.....	131
Table 10: mean responses (and standard deviations) according to cue across arousal and control groups.....	136
Table 11: Mean percentage (and standard deviations) of total recall constituted by different question type for story versions, emotional processing groups and retention intervals.....	155
Table 12: Mean percentage of total recall constituted by different question type for story versions, emotional processing groups and retention intervals .....	163
Table 13: Constitution of recall test according to question category.....	170
Table 14: Mean percentage (and standard deviations) of correct responses according to	

question type for emotional processing groups.....	171
Table 15: Mean latency (and standard deviations) in seconds to respond to word cues across emotional processing groups.....	194
Table 16: Mean vividness ratings (and standard deviations) of autobiographical memories formed in response to word cues across emotional processing groups.....	195
Table 17: Mean ratings (and standard deviations) of emotional processing groups for memory valence, rehearsal recency and emotionality.....	196
Table 18: Mean ratings (and standard deviations) of memory vividness, narrative coherence, valence and rehearsal for personally significant memory across emotional processing groups.....	207
Table 19: Frequency of Memory perspective reported for memory of personally significant event. ....	209
Table 20: Mean ratings (and standard deviations) of memory vividness, narrative coherence, valence and rehearsal for publicly significant events across emotional processing groups.....	210
Table 21: Frequency of Memory perspective reported for memory of publicly significant event. ....	211
Table 22: Comparison of qualities of traumatic memories for poor and effective emotional processors.....	221
Table 23: Frequency of memory perspective reported across groups for traumatic memory.....	222

## List of Figures

Figure 1: Schematic representation of Teasdale and Barnard's (1993) ICS model ....35

Figure 2: Schematic representation of Power and Dagleish's SPAARS model... ....36



## Chapter 1: Review of Emotional Processing research and Episodic Memory

### *1. 1.1 Introduction: The Concept of Emotional Processing*

In the ordinary course of our lives it seems natural to expect that we will encounter events, situations and stimuli which arouse emotional responses. Typically, such emotions will be ephemeral and quick to pass. At other times however events can be more difficult to assimilate: they may continue to elicit emotional responses long after they have passed, or their recollection may retain an intensity, vividness and emotional power which alone can disrupt the resumption of everyday life. In the most extreme instances, past events can survive not only as distressing recollections, but impair an individual's capacity to live an ordinary life (e.g. American Psychiatric Association [DSM-IV-TR], 2000).

Idiomatically, we have a number of terms to designate these processes. We 'get over' something, we 'move on'; in more extreme cases, we 'pick up the pieces' and 'come to terms' with what has happened. In more formal terms, these phenomena are described by the term *emotional processing*. Within therapeutic contexts, the incidence of post-traumatic stress disorder (PTSD), acute stress disorder (ASD), infantile trauma, and emotional dysregulations of many kinds, provide ample examples of cases where emotional processing fails (e.g. Rachman, 2001; Rauch & Foa, 2006). Our ordinary life, too, offers up many instances of where are our emotional responses seem somehow inordinate to the occasion: we may overreact, we may feel a certain way too long or too deeply, we may struggle to forget things we know ought not to bother us.

All such cases highlight a common feature of many instances of failures in emotional processing. These, namely, exhibit an *inappropriateness* of response. It is not emotionality *per se* that is problematic: intense emotional responses, say, in the presence of a brandished gun or yawning precipice, are both to be expected, and are in many cases functional. It is, rather, the fact that an emotional response persists, in intensity or duration, to an extent which serves no apparent purpose, and which often may be inexplicable to the person experiencing the emotion. The ordinary integration of affect and cognition, of knowing why one feels a certain way, of acting, planning and deciding in concert with one's feelings, appears in many cases of emotional processing failures to disintegrate (e.g. Power & Dalgleish, 1997). Emotions may become opaque and resist change, responses may be disproportionate and an irrationality begins to characterise one's affective reactions (e.g. Teasdale, 1999).

Why two individuals respond to or get over an apparently identical event differently must of course take into account a host of factors: cultural variation, idiosyncratic interpretations, different coping styles, psychosocial and material resources, divergences in the consequences of the event and so forth. Events differ between individuals in their significance such that it seems unlikely that any event can be truly identical for two people. Rather than pursue all these rich sources of variance between individuals in attempting to explore how emotional processing occurs, this dissertation investigates how individuals, already identified as exhibiting a *poor emotional* processing style, differ from individuals with an *effective* emotional processing style.

The dissertation specifically investigates interactions between emotional processing and memory. Speculatively, there are at least two general ways in which such interactions might be envisaged. The first is at a recollective level: put simply, an emotional

response may persist because it is cued by recollections of the original, precipitating event (e.g. Christianson, 1992). There may be any number of cues for such an event, and the recollection may conceivably occur at various levels of conscious attention. Nonetheless, affect associated with this event may continue to be relived in a disruptive and persistent way (e.g. Foa & Kozak, 1986). The second way in which memory and emotional processing may interact is more subtle, and can, broadly be characterised as involving learning processes. In the most general terms, past experience may produce not only unpleasant recollections, but inform our view of the world, our selves, and sources of threat or value. Our persistent emotional responses may reflect how, subsequent to an aversive event, our world appears to have changed (e.g. Janoff-Bullman, 1992). A victim of a life threatening accident, for example, who refuses to leave his or her house, may do so in part for fear of being revisited by recollections of the original event. Yet in another sense, this victim may be avoiding a threat: s/he now believes that the same incident will happen again. The victim is acting as if a new danger is in the world, and his/her emotional responses reflect this new danger which past experience has shown possible. The event has been, emotionally, unprocessed at a recollective level in that it can still produce harrowing memories: but also at a learning level, the individual appears to have been left with a certain (in fact irrational) belief about the presence of threat, and responds with fearful, avoidant behaviour.

The dissertation considers whether both these aspects may be partially determined by how an event is encoded and consolidated within memory. It seeks between-group differences in episodic/autobiographical memory performance comparing poor and effective emotional processors. It explores whether a particular style of processing of materials, and particular features of memory might reliably be associated with a particular emotional processing style.

### 1.1.2 *Emotional Processing as a clinical concept*

Emotional processing as a clinical concept originates in Rachman's 1980 article. It is here defined as '*a process whereby emotional disturbances are absorbed and decline to the extent that other experiences and behaviour can proceed without disruption.*' (p. 51).

It is presented as an attempt to draw together previous psychotherapeutic research beneath a single unifying concept, as well as to stimulate future research into a central clinical problem, namely how individuals overcome emotionally distressing events, and can subsequently resume life in an undisrupted fashion: '*...the main goals of this theoretical framework are: to introduce some order, to unify disparate findings, to identify new questions, and invite new solutions*' (p.56).

Rachman proposes the concept of emotional processing as a response to a particular theoretical impasse: whilst a number of therapeutic procedures such as flooding, modelling, systematic desensitisation and operant shaping were demonstrably effective in reducing distress following aversive experiences (p. 52), there was little understanding of precisely how, in terms of underlying psychological mechanisms, such treatments worked (p. 53). A benefit of Rachman's proposal was that a range of clinical presentations could be reconceptualised as failures of a single underlying process.

Consequently, understanding the mechanisms by which emotional processing occurs becomes invaluable to effective clinical practice, particularly given the fact that the vast majority of clinical presentations are broadly emotional disorders (Gross & Levenson, 1997).

In what is essentially a compilation of previously established clinical findings, Rachman goes on to list sets of protective and vulnerability state and trait factors exhibited by individuals liable either to successfully or unsuccessfully process emotionally disturbing

events. Thus, breakdowns in emotional processing are more probable with those manifesting neuroticism or introversion, with events experienced as intense, dangerous, unpredictable, irregular and in large chunks, and when concurrent stressors or distractors are experienced, or intense concentration required by other tasks during the period of exposure. Successful treatment typically encompasses a range of techniques such as '*engaged exposures, calm rehearsals, habituation training, catharsis, no distractions, vivid presentations, repeated practice and autonomic reactivity*' (p.57). Finally those factors which may impede successful processing are outlined: '*avoidance behaviour, agitated rehearsal, distraction, poor presentation, excessively brief presentations, immobility, fatigue, irregularity of stimulation and unresponsive autonomic reactions*' (p. 58).

Whilst the problem of how emotional disruptions are overcome is hardly new to psychology (e.g. Freud, 1910; James, 1890; Janet, 1925; Wolpe, 1958), the advantages of Rachman's proposal are its comparative lack of theoretical allegiance to any particular therapeutic tradition (*contra*, say, psychodynamic approaches which enlist a fairly baroque 'metapsychology' to explain the genesis of affective disorders e.g. Bucci, 1997; Rapaport, 1960). Furthermore, it attempts to characterise emotional processing as an intra-mental process, emphasising patients' trait and state vulnerabilities, as well as the significance of the precipitating event. This marks a subtle reorientation from the behaviourist paradigm prevalent within clinical practices at the time (see Teasdale, 1999). Indeed, Rachman (2001) later proposed that emotional processing be reentitled 'cognitive emotional processing'.

Interest in the underlying mechanisms by which individuals overcome distress and shock was increasingly drawn to the burgeoning research field of Post-Traumatic Stress

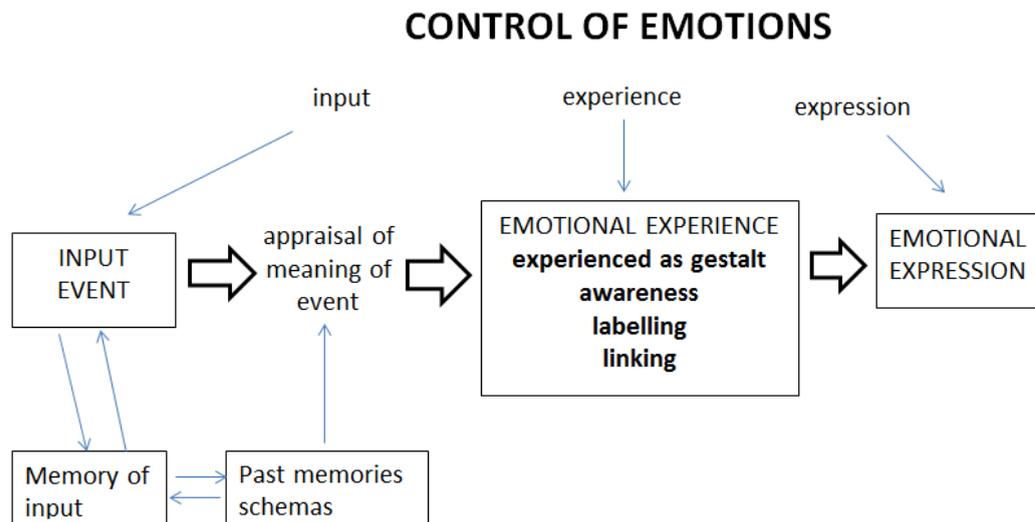
Disorder (see section 1.4.1). The benefits of this are the wealth of clinical data produced by such studies: the drawbacks are their focus on a specific type of emotional processing breakdown produced by a certain type of extreme stressor. A consequence may be that theories of PTSD lack sufficient generality to explain emotional processing across the full range of human emotional experience.

Attempts to address Rachman's proposal directly came in the notable forms of Foa & Kozak's network theory (1986), and in Teasdale's three modes of mind model (1999). Arguably the most considered engagement with Rachman's original appeal features in Baker's research, whose clinical work with patients suffering panic attacks revealed attempts to control emotional experience and expression to a significantly higher degree than normal individuals (2001). This appeared to be indicative of an emotional processing *style*, rather than simply a response to their condition or particular emotional experiences, as it was evident independent of the frequency or intensity of emotional experience. Baker's work and that of his colleagues proceeded to consider associations between emotional processing and psychosomatic conditions, examining associations between emotional processing scores and a range of clinical conditions such as breast cancer, eating disorders, depression, self-harm, addiction, as well as cross cultural differences (Baker et al, 2006).

Baker's model of emotional processing attempts to supplement Rachman's original speculations through a more informed clinical basis, drawing on more contemporary research and identifying through a process model a fuller range of factors implicated in the generation and maintenance of emotional responses. This has come to integrate findings from appraisal accounts, psychotherapy, emotion theory, and research on particular affective disorders. Within the model those factors likely implicated within the

control of emotion and dysfunctional emotional responses are organised and an account attempted in terms of mechanisms rather than simply outputs and conditions.

Figure: Baker's model of Emotional Processing (2001)



The input is characterised as an event, of any nature, capable of producing a negative emotional response: such an event is appraised, often at a subliminal level drawing upon memory resources and matching current input to previous experience. Such appraisal is likely shaped by a spectrum of influences, experiences and schemata. This has the potential to become problematic when the event is not responded to appropriately: feelings may be suppressed or overreacted to. The particular meaning which the event is conferred will then go on to characterise the nature of the emotional response: its expression will however be subject to the individual's emotional processing style. Critically at this stage emotional expression may be suppressed, smothered or constrained. The ordinary processing of the emotion is likely impeded by a number of dysfunctional strategies, and meta-affective deficits: such attempts to restrict its expression, inability to adequately label and connect emotional states, and deficient emotional awareness (Baker et al. 2006).

The culmination of this research has been the development and refinement of the emotional processing scale, which on the basis of Rachman's preliminary speculations, extensive clinical observation and symptomatology, psychotherapeutic research, and Baker's model of emotional processing measures indications of dysfunctional emotional processing. (see section 2.1.2).

Interest in the underlying mechanisms by which individuals overcome distress and shock was increasingly drawn to the burgeoning research field of Post-Traumatic Stress Disorder (see section 1.4.1). The benefits of this are the wealth of clinical data produced by such studies: the drawbacks are their focus on a specific type of emotional processing breakdown produced by a certain type of extreme stressor. A consequence may be that theories of PTSD lack sufficient generality to explain emotional processing across the full range of human emotional experience.

It should further be noted that the term 'emotional processing' is used somewhat ambiguously across the academic literature. Frequently it is taken to denote the processes by which emotions are generated (e.g. Verduyn, Van Mechelen, & Tuerlinckx, 2011), or how emotional information is processed (Taylor, Bomyea, & Amir, 2011; Yiend, 2010). In more clinically-oriented research, the term 'emotional processing' can imply a sense of catharsis, affective expression or emotional engagement (Hunt, 1998; Coughlin Della Selva, 2006). Whilst such processes may be therapeutically beneficial, this is a further empirical claim that of course needs to be substantiated by research: it is also not implicit in the specific sense of emotional processing that Rachman stipulates, which is the sense that shall be adhered to in this thesis.

### *1. 1.3 Emotions*

Definitive consensus on the nature of emotions has been elusive within the academic

community (e.g. Plutchik, 2001; Ekman, 1994; Averill 1980), although certain common features have attracted broad agreement amongst the majority of theorists within this area. Thus, emotions are typically characterised as composite, comprising affective, psychological and physiological dimensions (e.g. Keltner & Gross, 1999).

Furthermore, one particularly dominant orientation within emotion research, loosely termed the evolutionary perspective, stresses their biological basis, their phylogenetic antiquity and their usefulness in confronting immemorial environmental challenges or rewards (e.g. Ekman 1972; Panksepp, 1998). Such an orientation stresses the neurological substrates of emotions, their modularity and the comparatively fixed, stereotyped nature of the responses they elicit. Emotions have been preserved as adaptive and effective responses to classes of stimuli whose value or threat has been persistently encountered through human development (e.g. Darwin 1890).

Emotional reactions are, according to such a view, essentially functional: they coordinate responses across a range of subsystems within an organism's cognitive-motivational system. A feeling state is experienced which ensures both that attention is drawn to the stressor, or reward, and that the individual is impelled to devote cognitive resources towards it. Emotions thus prioritise a particular stimulus amongst a number of competing claims for action and attention (Oatley & Johnson Laird, 1987). At an information processing level, certain affective states promote attention and pre-attentive sensitivity to information relevant to that state (MacLeod, & Mathews, 1988; MacLeod, Mathews & Tata, 1986; Ohman, Flykt & Esteves, 2001). An 'action readiness' is also implicit within many emotional states such that an emotional encounter predisposes and prepares an individual to act in a certain way appropriate to the stressor or reward (Frijda, 1988). This has further consequences across autonomic nervous system responses, modulating endocrine systems, oxygen supply, heart rate and blood flow (see LeDoux, 1986).

Concomitant to such a perspective is the view of emotions as *universal* across cultures and stages of historical development. Such a view argues against emotions being learned or socially constructed, and seeks support for their relative invariance in linguistic research demonstrating the pervasiveness across languages of certain emotional descriptors (Oatley & Johnson-Laird, 1992), as well as cross-cultural research suggesting that emotions are expressed and understood through invariant facial expressions (e.g. Ekman & Keltner, 1997).

Such a perspective seems most applicable in the analysis of certain archetypal emotions, such as fear, sadness or happiness. Whether such an account obtains across the full palette of our emotional repertoire – wistfulness, say, or nostalgia – is questionable (cf. Ortony & Turner, 1990). Theorists typically focus on a narrow range of 'basic emotions' whose constituents vary between models, but usually contain sadness, happiness, anger, fear and disgust. More nebulous emotions, or 'self-conscious' emotions, i.e. those which presuppose some reflective social community to be realised (cf. Lewis, 2000) are seen as products of interactions between basic emotions, or composites of basic emotions and cognitive processes. Ekman (1999), a particularly noted proponent of this view, defines emotions as basic if they have a distinct neurocognitive bases, and are pervasively found across cultures and species. Others (e.g. Plutchik, 1980, 2002) suggest that an emotion is basic if it combines to form other, more complex emotions. Neither view has been undisputed by more socially constructivist-oriented researchers (e.g. Averill, 1980).

Such a basic emotions perspective can make sense of many of the fundamental data of emotions. At the forefront of such a perspective is a view of emotions as enabling rapid, coordinating responses to significant environmental changes. Such a view of

emotions might explain their intensity, and evolutionarily-prepared foundations, which might suggest why emotional materials can be difficult to process and emotional disruptions hard to overcome. In terms of emotional processing, it may also enlighten us as to why emotional difficulties can be particularly intractable and resistant to treatment. Emotional responses are legacies of millennia of human evolution, and their evolutionary momentum engenders responses likely to be persistent, powerful, and, to reprise Rachman's formulation, disrupt the resumption of ordinary behaviour.

#### *1.1.4. Appraisal views*

Nonetheless, this type of biological approach outlined above may deemphasise the particular role cognitive processes play in the generation, persistence and control of affective responses. Basic emotion views tend to stress a certain rigid, hardwired, stereotypical sequence of behaviours triggered by an environmental stimulus, change or threat to goals and self. A more cognitively-inclined perspective stresses how, for an emotional response to arise, a situation or stimulus must first be *interpreted* and its significance to the individual appraised. This process is understood as cognitive, if not always conscious, in nature, amenable to information processing, and adaptable in the light of changing circumstances and learning histories.

Such interactions can be witnessed at the most basic level in humans' capacity to repress emotions and constrain emotional behaviours to an extent which in terms of strict evolutionary survival is hard to account for (e.g. Gross, 1998, 2001). People willing to die for such abstract notions of their queen and country, suggest that both emotional responses (for personal survival) can be suppressed, or adapted to symbolic goals and ends. Furthermore, within our ordinary life, the overwhelming majority of 'threats and rewards' encountered are likely to be either:

(a) intermediary: leading to, or enabling some further reward or threat, for example money.

(b) symbolic: of little intrinsic worth, for example a trophy or some other symbol of status or achievement.

Or (c) culturally prescribed, for example, academic or professional achievement, which is only of credit or worth within some organised social system. The fact that these have little evolutionary precedent compels us to incorporate into our account of emotions the particular contribution that learning and cognitive constructions of events play.

Thus, more cognitively inspired perspectives see any experienced emotion as a product of intervening cognitive processes which interpret a situation for an individual and evaluate its significance for the individual's on-going plans and activities. Such cognitive processes are formally known as appraisals, and appraisal approaches originate, within modern psychological research, in Arnold's (1961) and Lazarus (e.g. 1966; Lazarus & Alfert, 1964) research half a century ago. The approach takes us from the deterministic emphases of biological accounts to one expressed by Frijda (1988) that 'emotions are determined by the meaning structure of an event in a precisely determined fashion' (p. 349). According to such views, emotion generation is not determined principally by the triggering of dedicated neural circuits in response to the occurrence of an invariant stimulus situation. Rather, they see as crucial the mediation of cognitive processes in analysing, interpreting and calculating the implications of any given event for the experiencing individual. What ultimately generates emotion is not the brute, 'objective' facts of a situation, but instead their appraisal which arises from the cognitive processing of environmental and subjectively experienced data (Smith and Kirby, 2001).

Empirical support for such a position came initially through Lazarus's research (Lazarus and Alfert, 1964; Speisman, Lazarus, Mordkoff, and Davison, 1964) exploring how, by supplementing an emotionally laden experience with conceptual information, the affective response could be moderated. Thus, participants in these experiments viewed potentially distressing films of male subincisions whilst listening simultaneously to different commentaries: those listening to dispassionate commentaries which stressed the scientific interest of the film, as well as those listening to commentaries which emphasised the importance of the ritual and suggested that subincision was not a painful procedure, were found to produce lower skin conductance responses, as well as to rate as less stressful the experience of watching the film, than participants in control conditions. In addition, Lazarus and Alfert (1964) found that by presenting commentaries mostly before the film was viewed rather than during it, led to the lowest skin conductance levels amongst participants when compared with controls.

Such findings provided strong impetus to the development of a school of appraisal theories, deemphasising the 'objective' features of an emotion arousing event and instead stressing the central role percipients' interpretations played. These offered attempts to formulate precisely the appraisal criteria which might predict the basis on which emotions are generated and might be differentiated (Frijda, 1986; Oatley and Johnson-Laird, 1987; Lazarus, 1991; Roseman, 1991; Smith and Ellsworth, 1985; Weiner, 1986). From this emerges a broad consensus on the dimensions significant in determining the quality and nature of emotional response: these include novelty and expectation, valence, relevance and conduciveness to the percipient's goals or concerns, agency or responsibility for the event, perceived control or coping potential, and the assessment of the agent's own actions in relation to moral standards or social norms. (Lazarus and Smith, 1988; Manstead and Tetlock, 1989; Reisenzein and Hofmann, 1990, 1993; Roseman, Spindel, and Jose, 1990; Scherer, 1988)

Although there are many variants of the appraisal approach, their central claim can be understood in one of two senses. First, that emotion can be explained in terms of a basic appraisal schema (e.g. Ortony, Clore & Collins, 1988). Here, sadness is understood as the emotion felt when a valued goal is lost, or fear is understood as the emotion felt when a physical or social threat is encountered. Such a view is essentially descriptive. A subtly different alternative (e.g. Scherer, 1984) stresses the causal role that appraisals play in generating emotions: it is the generation of appraisals that creates emotions, and variability in appraisals will lead to different emotions across individuals as well as within an individual's life.

This naturally leads to debates concerning precisely how conscious or automatic such appraisals are (e.g. Bargh & Morsella 2008; Fazio, 2001; Fazio, Sanbonmatsu, Powell and Kardes, 1986; Ferguson and Bargh, 2004), and how amenable to intentional modification. Nonetheless, such debates do not the central mediating role the processing of information plays in the genesis, and maintenance of emotions.

Appraisal views are particularly useful in accounting for the vast variability and flexibility of emotional responses. The same event, across occasions in an individual's life, may not always have the same significance, which enables responses to be appropriate to the local meaning of a particular event. Variability in responses across individuals may also be explained in a similar fashion: an event may elicit different responses to the extent that it is differently appraised, which is likely to be a function of idiosyncratic meaning and interpretation systems. (Kappas, 2001)

This versatility, which appears to be a hallmark of our emotional system, has been noted by Cosmides & Tooby (2000). Indeed, these authors suggest, the value of the emotional system is in providing an adaptive system of rapidly inducted motivational states which can respond to an infinite number of yet to be specified goals and threats, which can be

informed by experience, learning and culturally transmitted knowledge. By contrast, other motivational states such as thirst or hunger compel an individual to a specific homeostatic response (drinking or eating). Emotions are more adaptive, both in the range of stimuli by which they can (through learning) be elicited, as well as the range of behaviours they can trigger.

### *1.1.5 Summary*

Broad consensus appears to rest on the following features of emotion: they comprise a number of components taking place at phenomenological, physiological and affective levels; they rapidly mobilise an individual's response (e.g. Levenson, 1999), frequently motivate a particular action, and prioritise a certain stimulus such that it receive attention and response over competing claims (Johnson-Laird & Oatley, 1992). They represent an adaptive motivational system (Cosmides & Tooby, 2000) and can, as such, respond to culturally specified or idiosyncratically specified meanings conveyed through interpretative mechanisms and appraisals. Emotions can thus be highly functional and adaptive.

### *1.1.6 Cognitive impenetrability and multilevel theories of emotions*

Significantly, our ordinary experience of emotional responses is that they are also transparent: affect and cognition interacts in such a way that one knows why one feels, reacts and responds in a certain way. There is a correspondence between cognitive and affective responses such that our emotional lives are integrated within broader frameworks of attitudes values and appraisal. Our ordinary experience is one of synchrony – the various components of emotion work in a concerted, co-ordinated, and appropriate fashion to generate responses ordinate to their eliciting source. New information can modify emotional responses: our particular affective states motivate actions, and embody our values and evaluations. This conception of emotions outlined in the previous section, by stressing how cognitive and affective elements interact functionally, makes it difficult to account for failures in emotional processing where a response to an emotional event persists to an abnormal or inappropriate degree. Failures in emotional processing might often be argued to exhibit what could be labelled a 'non-veridical' element. That a reaction persists beyond the presence of an eliciting stimulus

(fearfulness, say, when a threat has passed), or a response develops out of all proportion to its cause, such that emotional reactions become dysfunctional, suggests that, at some level of the cognitive- affective system, an appraisal has been made as if a stimulus is still present, or as if an event's consequences persist. Furthermore in extreme cases, such responses are comparatively intransigent to cognitive intervention: sufferers may be quite aware of the irrationality of a response, yet such insight has little remedial effect upon it (Teasdale, 2005).

A characteristic of such failures may be the emergence of desynchronies (Lang, 1979; Marks, 1987), such that affective responses and cognitive appraisals conflict. In such a condition, the individual may experience an emotional state beyond any apparently useful or appropriate degree, and may feel little control or understanding of the emotional 'overreaction'. This sense of estrangement from one's affective reactions – that emotions have developed an autonomy and opacity to conscious inspection - seems to be a central feature of disruptions in emotional processing.

These observations are encapsulated in the notion of cognitive impenetrability, a term applied by Teasdale (1999) to designate the intractability of certain emotional responses within pathological conditions and which contrasts with the transparency typical of effective emotional processing. Our 'semantic' knowledge of the world is ordinarily easily revised and updated with the access of new information. I can believe, say, one day that Wilson is the prime minister and that the Beatles album is number one in the charts, and when this is no longer true I can modify my beliefs when new information contradicts it. This contrasts with certain emotional responses evident in, say, trauma sufferers, who are quite capable at a cognitive level of understanding that they are no longer under any actual physical threat, or that they have exaggerated the sequelae of the event yet still experience a high level of arousal, hypervigilance, and defensive reactions

when presented with cues triggering memories of the original event. Alternatively, a phobic may fully understand that, say, a spider presents no threat to him, but be unable to touch or even contemplate one.

A school of theories which collectively are labelled multi-level theories of emotion (Barnard & Teasdale, 1991; Leventhal, 1979; Johnson, 1983; Johnson and Multhaup, 1992; Power & Dalgleish, 1997; Teasdale & Barnard, 1993) laid the groundwork for understanding how emotional problems and disorders can develop a relative autonomy to cognitive intervention, conscious control and verbally-oriented therapeutic techniques. Essentially such approaches propose that emotional responses and the behaviours they engender can be generated through a variety of routes variously opaque, variously accessible to conscious awareness, and variously resistant to modification.

These 'multilevel theories' envisage human processing systems as receiving qualitatively distinct types of information, processed at different levels within a cognitive-affective system and contributing in concert or alone to the generation of emotional responses. Such theories allow for varying degrees of automaticity and cognitive involvement in processing and production of affective states. Any attempt to understand how emotions arise will need to take this variety of sources, and their interaction into account.

The specification within such theories that certain levels of representation and information processing are directly linked to emotion and others are not, allows multilevel theories to explain how we can engage in the calm reflection of an emotive topic, yet at other times be quite aroused when exposed to it. An event or stimulus may at different occasions have different implications for the self, and the processing of such implications occurs at higher executive levels within most multilevel models.

Nonetheless, all the models allow for some degree of direct or automatic activation of responses, where higher level processing is short-circuited. Accordingly, some of our

affective responses may be experienced as beyond our control, for reasons unknown to us. This has been typically problematic for unilevel theories which postulate the activation of certain representations held in long-term memory and generating emotional responses. Bower's network theory (1981) for example has frequently been criticized as unable to deal with a distinction between 'hot' and 'cold' cognitions as it presents a single channel of activation implicated whenever an item is encountered, and must presumably specify a single uniform response to stimuli. Within clinical contexts the discrepancy is equally conspicuous, as Teasdale (1999) points out how protracted discussion with a clinically depressed patient, challenging her beliefs that she is a failure, is likely to be greeted with intellectual assent but no underlying change to her abiding 'gut' feelings about herself.

An overview of some of the most prominent multi-level theories of emotion will now be provided.

Such multi-level theories originate in Leventhal's (1979) seminal model which proposed three levels of processing, hierarchically organised, each of which can generate emotions, although typically all three will contribute in concert. The most rudimentary level available to the neonate is the sensori-motor: a collection of innate, unconditioned, hardwired feature detectors, producing reflex-like uncontrolled reactions. They offer the adaptive benefits of enabling individuals to respond quickly to grossly encoded environmental threats and incentives. Sensory-perceptual mechanisms coordinate automatic responses without more sophisticated cognitive mediation and thus facilitate rapid and immediate interaction with the environment. The attendant emotions which are generated are short-lived, automatic and unreflective, untypical of the richer emotions typically felt by mature adults.

At a schematic level, the organism's learning of past contingencies and procedures is consolidated and organised. Stimulus patterns of events lead to activation of stored records of emotional experiences which can be considered as average, prototypical exemplars, or "schemata", of the emotions which an organism has developed throughout its life. Such schemata contain combined information concerning the conditions of the emotion-eliciting event itself, as well as the physiological and behavioural responses together with the concomitant subjective feeling. Incoming information which shares features with a schema and/or a specific stored instance, automatically reactivates and generates the associated emotional response.

The conceptual level of processing is characterised by reflective, propositional processes, as opposed to the template matching-like processes which were specific to the first two levels. This level comprises capacities to abstract from and reason about the environment on the basis of propositional memory structures, which are developed through comparisons between past experiences. Processes such as anticipating or problem-solving are typical for the conceptual level, and permit a more flexible, thoughtful response to emotional experiences compared to the processes involving the schematic and sensory-motor level. The formation of conceptual code in emotion processing plays, according to Leventhal, a crucial role in the control of emotional responses. Leventhal's model, significantly, opens up a broader conceptual framework through which to envision the development of emotions. It allows that each level is capable of eliciting emotion and thus enriches our notion of the routes by which emotion can be generated.

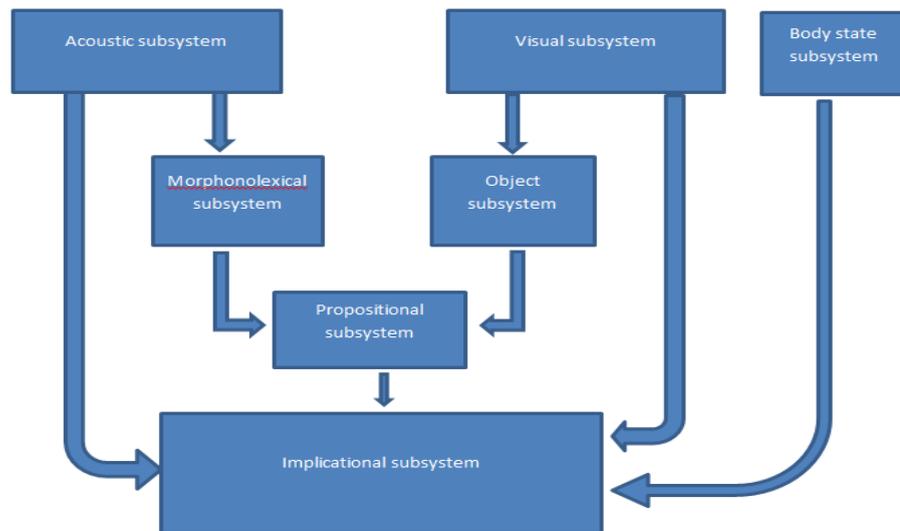
Teasdale and Barnard's (1993) greatly more complex interacting cognitive subsystems theory (ICS) offers a more specified model of cognitive affective relationships in terms of 9 interacting subsystems including sensory/proprioceptive, effector, propositional and implicational subsystems each of which receives and processes different types of

information. Each subsystem has its particular memory for information previously processed, and effects processes which update and access memory in addition to transforming information into a code or representation which can be processed by other subsystems.

Emotions are produced chiefly within the implicational subsystem, which receives and integrates information about an event or stimulus from other subsystems, such as the sensory or propositional. On this basis, the implicational subsystem matches patterns of incoming information against previously stored schemata, including emotion related 'affective themes'. Once a match is satisfied, emotional reactions are generated, which encompass overt behaviours, facial expressions, and physiological responses, are drawn from expressive patterns in the effector subsystems.

The quality and type of emotion derives from the match of incoming or inferred information to stored information about past emotional experiences, paralleling Leventhal's schematic level. Whilst ultimate, emotion-generating inferences occur in the implicational subsystem, the model allows for the possibility of different types of information processed at different levels, contributing to this final inference. A gun shot heard through the sensory subsystem or a suddenly palpitant heart could serve as inputs in the implicational subsystem and produce elements of implicational code. The implicational subsystem is the final mode through which all emotions are mediated, and adds emotional connotations to otherwise cold cognitions.

Figure 1: Schematic representation of Teasdale and Barnard's (1993) ICS model adapted from Eysenck & Keane (2005).

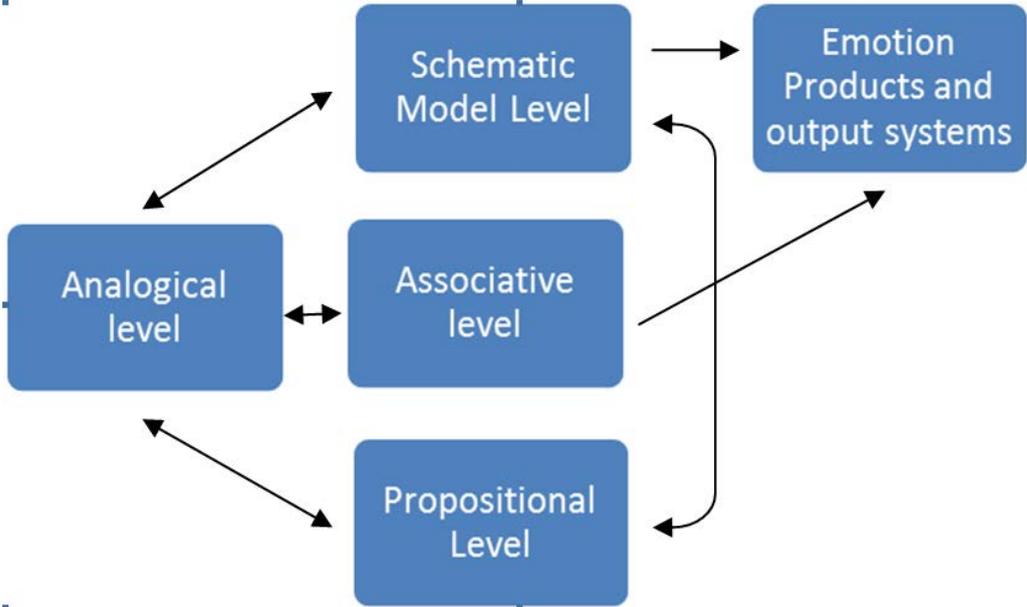


Power and Dalglish's (1997) SPAARS (schematic model, propositional, associative and analogue representational systems) model is the most recent within this set and extends the work of Teasdale and Barnard with increased emphasis upon clinical data. Four levels of representation are proposed: an analogical which comprises online images produced by different sense modalities, including visual, olfactory, auditory, gustatory, proprioceptive and tactile images. Propositional representations convey beliefs, thoughts, ideas, objects, concepts and their relationships at a semantic level. Such representations are explicit, abstract and discrete. Neither analogical nor propositional can directly elicit emotions. The schematic model level of representation contains higher order information about the world, self and others, and is abstracted from information presented at other levels of representation. It cannot be easily or exhaustively expressed in verbal form, and has strong parallels with Teasdale and Barnard's implicational subsystem. Finally, the associative level provides the basis for automatic processing to occur. Here associations are encoded through experience, or evolutionarily prepared responses are enabled. Both the associative and schematic level can generate emotion. The two representations are functionally dissociated in emotion processing: the associative level accounts for direct,

"single-step" access to information stored in memory established by repetition of event-emotion combinations, whereas the schematic model level includes the representations of self and goals that are relevant for appraisal processes.

Emotion elicitation in SPAARS is thus accounted for both by an appraisal process, performed at the schematic model level of meaning, and memory retrieval mediated by the associative level that bypasses any appraisal processes. As with ICS, the propositional level of representation, being "cold" and "non-emotional", cannot be directly involved in the elicitation of emotions, but contributes information to an appraisal process performed by the schematic model level or through the associative level.

Figure 2: Schematic representation of Power and Dalgleish's (1997) SPAARS model



Such models are presented largely as frameworks rather than fully specified theories whose purpose is to organise and account for data and observations, as well as to encourage a certain perspective on emotional phenomena and processing. They may not offer predictive accounts for how emotional dysfunctions arise. What they do, however,

offer, is the conceptual framework to account for emotional processing failures which proved difficult within the preceding discussion of the functional aspects of emotions. Crucially, they cast such failures in terms of the processing of information within a cognitive/affective system. Automatic responses, where dysfunctional, arise through a failure of environmental information to be processed and recoded such that it accesses higher-level meaning processes (schematic, or implicational subsystems). This failure produces emotional responses which may be autonomous and resist conscious intervention. In phenomenological terms this may be experienced as a persistent, ungovernable, opaque emotional overreaction to a relatively innocuous event, stimulus or situation, or one whose significance has declined. This suggests that emotional processing failures may in part be produced by how information is encoded or processed within a cognitive/affective system.

Teasdale himself notes that, whilst such multilevel theories may bring certain heuristic advantages, they run the risk of providing merely terminological innovations, if they fail to offer testable predictions for how emotional dysfunctions develop (1999). The following section, considering how episodic/autobiographical memory is influenced by a range of emotional events, aims to develop the hypothesis that emotional processing failures can be associated with a distinct form of memory processing which may itself reflect levels of information processing within a cognitive affective system.

## *1.2 Episodic Memory*

### *1.2.1 Introduction*

To the extent that emotional responses are generated by stimuli and situations that resemble those encountered in the past, representations of past experience are likely to

play a central role in determining our emotional reactions, as well as how dysfunctions in emotional processing arise. This, as has been outlined in the introduction, may happen at both a recollective level (through a tendency to retain affectively charged memories) and at a learning level (through modifying one's model of the world and the threats and risks it contains). Both levels are maintained by memory processes.

The means by which we represent the past to ourselves is labelled, variously, episodic or autobiographical memory. The following section will briefly review the concept of episodic and autobiographical memory. It will then consider how such memory is affected by emotional events and stimuli. It will suggest that certain aspects of these effects might be implicated in the deficient representation of past events, such that the type of non-veridical or inappropriate emotional responses characteristic of failures of emotional processing may be generated by a defective or poorly processed *memory* representation.

### *1.2.2 Episodic memory*

Within Tulving's original taxonomy (1984), semantic and episodic knowledge both comprise forms of declaratory memory, contrasted with procedural (non-declaratory) memory forms. As declaratory, they can be readily expressed in some verbal form. The distinction between episodic and semantic memories can, in rather broad terms, be characterised as the difference between 'remembering' and 'knowing', where remembering refers to the mental recollection of personally experienced events, and knowing the retrieval of decontextualized information which one has learnt on previous occasions. It is a distinction originally drawn in Tulving's 1972 discussion, and exhaustively elaborated over decades of laboratory research (for reviews, see Gardiner & Conway, 1999; Gardiner & Java, 1993; Gardiner & Richardson-Klavehn, 2000).

Tulving (2002, p. 5) states that '*Episodic memory is a recently evolved, late-developing, and early-deteriorating past-oriented memory system, more vulnerable than other memory systems to neuronal dysfunction, and probably unique to humans. It makes possible mental time travel through subjective time, from the present to the past, thus allowing one to re-experience, through auto-noetic awareness, one's own previous experiences. Its operations require, but go beyond, the semantic memory system.*'

The original impetus for this distinction arose from Tulving's work in word list memory experiments, which Tulving maintained, *pace* the prevailing orthodoxy, probed memory for *events* rather than the learning of new information (Tulving, 1972). If a participant is presented with a series of familiar words and after a retention interval asked whether these words appeared at the 'learning phase', Tulving reasoned, what was being tested was not learning as such, but memory for a specific event having taken place at a particular time and place. This needed, conceptually at least, to be contrasted with our knowledge of general facts about the world and the meanings of words. An analysis of the phenomenological components of episodic memory reveals its 'auto-noetic' quality (Tulving, 1983): that it contains a sense of subjective, lived experience which, say, recalling what the capital of Albania will not have. The recollection also has a sense of 'pastness' and spatio-temporal location.

The particular paradigm developed to probe semantic/episodic memory functioning, the 'remember/know' procedure (Tulving, 1985), requires participants to state whether they *remember* or simply *know* that a particular event or stimulus has been previously presented. Whilst this is unlikely to be 'process pure' (i.e. to test exclusively the use of a particular memory type (e.g. Jacoby, 1991; Jennings & Jacoby, 1993; Yonelinas, 2002)), its experimental use has revealed a number of dissociations in performance between

semantic and episodic memory tasks (e.g. Conway, Collins, Gathercole & Anderson, 1996; Dalla Barba, 1993; Gardiner & Java, 1991; Parkin & Walters, 1992). Lesion and neuropsychological investigations also reveal double dissociations in memory performance as well as differential activation according to memory task (for reviews, see Gardiner & Java, 1993; Buckner & Tulving, 1995).

Complications arise, however, when we consider the status of this distinction. As a classification of memory experience, it seems undeniable that the distinction holds. Tulving, however, proposes that the difference reflects the operation of separate *neurocognitive systems*. His most recent position (Tulving & Markowitsch, 1998) is presented within the *serial parallel independent model*. This sees semantic and episodic memories as being formed through items being encoded serially, stored in parallel systems and retrieved independently. Within a hierarchical structure, perceptual, semantic and episodic memory systems are organised such that perceptual systems operate at the lowest level, and higher levels draw output from them. Lower level systems can operate independently. Information must first be encoded through semantic memory to be registered at an episodic level. Retrieval is independent between systems, such that an experience can be retrieved in semantic or episodic format.

### *1.2.3 Objections to Tulving*

Whilst many (e.g. Anderson & Bower, 1973; McKoon & Ratcliff, 1979, 1986) concede the heuristic/classificatory benefit of this distinction, there is some debate as to its basis within separate neuro-cognitive systems. For example, Schank (1975) argues that the distinction cannot be taken as anything more than descriptive, as all conceptual knowledge must ultimately derive from experience (see Ortony, 1975, for a response).

Other critics (e.g. Donaldson, 1996) hold that, rather than reflecting the operation of a distinct neurocognitive system, episodic/semantic memory performance simply represents differences in response criteria. An alternative line of criticism sees the different memory forms Tulving identifies as originating in abstractive processes, such that auto-noetic/sensory-perceptual memory becomes condensed and reduced to a semantically based form (e.g. Anderson & Ross, 1980; Kintsch, 1980; McCloskey & Santee, 1981).

Conway and Pleydell-Pearce (2000) object to Tulving's account of episodic memory on the basis of its conceptual clarity. Central to the notion of episodic memory is spatio-temporal location – yet it is unclear how temporally, or spatially extended such memories can be. Might, for example, my recollections of how I spent last summer comprise a single episodic memory? And to the extent that such memories contain semantic, contextualising detail, that is an awareness of details not immediately given within the sensory-perceptual elements of the memory itself, where precisely is the borderline between episodic, and (personal) semantic memories? One particularly influential study (Conway, Gardiner, Perfect, Anderson & Cohen, 1997) taken to undermine the distinctness of semantic and episodic memory forms, tested undergraduate psychology students' knowledge of information presented in a lecture. Tests occurred at two intervals, six months apart. Participants were required to indicate whether they *remembered* or simply *knew* that a given answer was correct, based on the knowledge gained at lectures. Remember judgments were presumed to reflect memory of the specific learning episode (i.e. the lecture at which the information was imparted). Over the two testing intervals, there was a clear 'remember' to 'know' shift, at least in participants scoring the correct answer. This was taken as evidence for the operation of abstractive processes (Cermak, 1972, 1984; Herbert & Burt, 2001; Dewhurst, Conway

& Brandt, 2009) occurring upon episodic memories such that they lose detail and particularity, as well as the comparatively irrelevant detail concerning the occasion upon which they were formed, and become retained in a more abstract, semantic format, as reflected by 'know' judgments.

#### *1.2.4 Conway and Pleydell-Pearce's Account*

Difficulties implicit within the construct lead Conway and Pleydell-Pearce to recast episodic memory as an ancillary component within an autobiographical memory system. Drawing on findings from extensive research into autobiographical memory, Conway and Pleydell-Pearce (2000) reformulate episodic memory as '*event specific knowledge*' and Conway (2001) recharacterises Tulving's episodic memory as '*a memory system that retains highly detailed sensory-perceptual knowledge over retention intervals measured in minutes and hours*' (p.1375). This is accompanied by recollective experience to produce '*experience-near, highly event-specific sensory-perceptual details of recent events*'. Whilst ordinarily ephemeral, sensory-perceptual knowledge can become stabilised and retrieved over longer retention intervals for significant events. Conway's own research (1992; 1995; 1996) highlights the hybrid nature of long-term autobiographical memories, their tendency to contain details exhibiting various levels of specificity and semanticity. Such memories comprise semantic, contextualising detail, can be placed within autobiographical contexts, and yet are also accompanied by recollective experience with sensory-perceptual elements.

In his most recent model of autobiographical memory, Conway (Conway, 2001; Conway and Pleydell-Pearce 2000) presents sensory-perceptual as subserving a 'self-memory system' whose purpose is to ground the self's currently activated plans and goals in a complex system of self-knowledge based upon memories of an individual's

past experiences and achievements. Control processes operate within the self-memory system which generate cues used to activate autobiographical memory knowledge and from which specific memories are generated. A reciprocal relationship between active goals and knowledge base is specified such that memories of past incidents, achievements and performances inform and set boundaries for current goals. Autobiographical memory is seen as providing a foundation for the self, through making accessible memories and knowledge that are congruent with currently activated goals. The ABM system's primary goal is to 'ground the self', that is to provide a database of knowledge in the form of episodic like, or semantic memories, which represent what Conway terms the experiential self.

Conway's 'reconceptualisation' of episodic memory places sensory-perceptual memories within broader, overarching structures of self-knowledge and autobiographical themes. Conway argues that they are retrieved both through automatic cues as well as through conscious search probes which work down from general structures to increasing specificity terminating in the retrieval of material which is sensorily-rich and accompanied by a vivid sense of recollection. The broader context of this distinction comes from an approach to memory as ancillary to personal goals, represented in sophisticated hierarchical structures which may be thematically (work, relationships, family) or temporally (time I was living in Oxford) indexed. Stable access to episodic memories is achieved by their becoming linked to autobiographical memory structures.

#### *1.2.5 Summary*

Tulving's characterisation of episodic memory involves sense of self, pastness, recollective experience and spatio-temporal location. His ultimate position is that semantic and episodic memories reflect the operation of separate neurocognitive

systems. Objections to this account prefer a view of semantic memories as abstractions from the basic data of lived experience. Conway recasts Tulving's original formation to present sensory-perceptual knowledge as largely ephemeral and existing to update the individual's progress in their plans and activities. The autobiographical memory is indexed by larger themes relating to the self, and serving to ground the individual's interactions with his or her environment. Here autobiographical memories are typically hybrid, comprising various contextualising semantic components and sensory-perceptual knowledge. What Conway retains of Tulving's notion of episodic memory is its sensory-perceptual nature retaining elements of an experience within a specific temporal-spatial location.

One may remain agnostic as to whether this reflects the operation of different memory systems or the differential processing of a basic analogical (sensory/perceptual) memory representation; however one stands on the abstraction/separate systems debate, what is brought to light through such discussion is that personal memories of past experience are available in variously semantically/conceptually processed forms. It seems, introspectively at least, that most of what we can recall about ourselves and our experiences is available in a fairly reduced semantic format (e.g. 'personal semantic information', Kopelman, Wilson & Baddeley, 1989), frequently without 'autonoetic' recollective experience. Conway's model brings to the fore a crucial feature of episodic memory/event specific knowledge, namely its *sensory-perceptual basis*. That it is fleeting seems also true of the vast bulk of our encoded experience; that, in certain situations it can be retained and anchored to abiding 'autobiographical' memories seems also evident.

It will be recalled that multilevel theories of emotion all provide for sensory-perceptual representations and processing in the accounts of the generation of emotion. Ordinarily such representations are reduced or recoded to propositional formats/schematic level representations to produce affective responses. Two accounts (ICS, SPAARS) suggest how emotional dysfunctions can arise through automatic processing generating associative responses. This occurs through 'analogue' level representations cueing emotional responses and bypassing higher level appraisal processes, or when analogue formats are processed to a propositional level which itself can create an automatic emotional response. This may provide one of the sources of poor emotional processing.

In the following section, some empirical evidence will be reviewed that suggests that emotional events and emotional arousal tend to increase the formation of sensory-perceptual memories.

### *1.3 The Differential Effects of Emotion on Autobiographical Memory*

#### *1.3.1 Introduction*

Clinical, laboratory and naturalistic research provide ample support for the unnuanced assertion that emotion facilitates memory. This has been demonstrated both within animal and human studies (e.g. Cahill et al., 1996; Cahill & McCaugh, 1995, 1998; Christianson, 1992; Roozendaal, 2000). In terms of stimuli, emotional items have a greater likelihood of being recalled than neutral ones: this applies for emotional words (e.g. Kensinger & Corkin, 2003), pictures (e.g. Blake, Varnhagen, & Parent, 2001), or experiences (e.g. Pillemer, 1998; Rubin & Kozin, 1984; Porter & Birt, 2001). Stimulus valence, when isolated from arousal can also increase likelihood of recall (e.g. Ochsner, 2000). Beyond the encoding of stimuli, emotional arousal may well affect how

memories are consolidated during a storage period. A common finding (Anderson & Phelps 2001; LaBar & Phelps, 1998; Vuilleumier, Schwartz, Clarke, Husain & Driver, 2002) is that, over time, memories for neutral stimuli and events decrease whereas memories for arousing stimuli are maintained or improve. Further research suggests that emotional information tends to show enhanced recall after longer delays than relatively short delays suggesting that emotionally arousing memories are more likely to be converted into relatively permanent traces. By contrast, memories for non-arousing events are more vulnerable to disruption or less likely to remain accessible to retrieval processes. Kleinsmith and Kaplan (1963), for example, matched numbers with an emotional word and found that such associations improved recall only after delay, though not at immediate test. Sharot and Phelps (2004) essentially replicated these results. These findings have been explained both in terms of physiological factors, as well as in term of post event processing for arousing stimuli (Christianson, 1992).

Naturalistic studies confirm this pattern: researchers retaining diaries over long periods in order to investigate the nature of autobiographical memory have typically found that emotional events are easier to recall than non-emotional events (Brewer, 1988; Wagenaar, 1986). Questionnaire studies have shown that emotional events tend to be well remembered (Pillemer, 1998; Porter & Birt, 2001) although valence alone does not tend to be a strong predictor of memorability (Walker, Vogl & Thompson, 1997).

This pattern of findings may not surprise: emotional events are probably *worth* remembering. An emotional event may be the sort that is rehearsed in memory, but, as suggested above, it may not need to be to increase memorability. It may be that emotionality alone makes an event memorable. Viewed in more functional terms, this may be accounted for by the fact that emotional reactions are likely to occur in

situations of threat or reward. Sources of threat or reward are likely to be more *important* to remember than other phenomena as they, axiomatically, are intimately connected with our needs and desires as organisms active within an environment. Understood in these terms, emotion may be understood as resulting from encounters with reward and threat, and such encounters may be adaptively significant for an organism, and thus preferentially encoded.

### *1.3.2 Emotion as Promoting Sensory Memory*

A more intriguing pattern of findings suggests associations between emotional events and sensorily based memories. This is frequently reported as an increase in vividness, and the finding that emotional events tend to be more vivid is well established (e.g. Reisberg, Heuer McLean & O'Shaughnessy, 1988; Christianson & Loftus, 1987, 1990; Wagenaar & Groeneweg, 1990).

A number of naturalistic studies have shown how vividness, emotionality and accuracy of memory appear to be strongly correlated. Rubin and Kozin (1984), for example, found high correlations between participants' most vivid autobiographical memories and personal significance, surprise and personal change. Beyond correlations between vividness and emotionality, vividness has a curious relationship with accuracy of recall. At times heightened vividness appears to correlate with accuracy (Canli, Zhao, Brewer, Gabrieli, & Cahill, 2000; Kensinger, 2006). Brewer (1988) for example, reports that at recall, the more sensory detail available, the more accurate an autobiographical memory is likely to be. Flashbulb memory studies have frequently demonstrated a high degree of concordance in respondents' accounts of details (Bohannon, 1988, Rubin & Kozin, 1984; Winograd & Killinger, 1983). Conway, Collin, Gathercole and Anderson, (1996), furthermore, report that recall of sensory detail is strongly associated with

correct recognition. Pillemer, Goldsmith, Panter and White (1988) established that emotional intensity experienced at the time of the event was one of the strongest predictors of the clarity of a memory. Research within flashbulb memory phenomena (Talarico & Rubin, 2003; Talarico, Labar & Rubin, 2004), however, has questioned the straightforwardness of this relationship, suggesting that vividness may increase confidence in one's memory being accurate, rather than accuracy itself. The sense of confidence in the veracity of a memory that the availability of sensory detail brings may be specious (see Neisser, 1981, for a seminal discussion of this theme).

Pillemer (1998) and Robinson (1992) have studied how very vivid memories often arise from intensely emotional experiences of goal attainment or plan failure. As a further feature of their sensory basis, vivid emotional memories tend to include irrelevant details (Conway, 2001). Such details may persist in recollection as prominently as more significant 'plot-relevant' features of the original event. This may simply be a corollary of their sensory basis: a semantically based memory can be selective, whereas a sensorily-based memory can be less so and thus include details irrelevant to the gist or central significance of the event.

Experimental findings confirming this pattern come from Arntz, DeGroot and Kindt's (2005) study which tested conceptual/perceptual, implicit/explicit recall and recognition of an emotionally arousing film, finding memories for perceptual elements were enhanced whereas conceptual elements received no benefit, leading them to the conclusion that '*emotional memory is perceptual*' (p. 20).

A further, well documented (and well-disputed) field is that of flashbulb memories, first introduced to academic investigation by Brown and Kulik (1977). Their defining

features are an extraordinary vividness of recollection, associated with intense novelty, surprise and emotional reaction. Initially their study concerned events of public significance and consequentiality, and their definition was restricted to such events. Conway et al. (1994) and Finkenauer et al. (1998) established, however, that it was the emotional arousal, rather than the personal significance of an event that most strongly predicted the formation of a flashbulb memory. Similarly, other theorists (e.g. Pillemer, 1992; Singer, 2004) have considered equally vivid memories of personally momentous events, suggesting that they be re-entitled ‘memory of personal circumstances’ (Pillemer, 1990).

Controversy emerges from Brown and Kulik’s (1977) claim that a putative ‘now-print’ mechanism underlies the formation of such memories. Whether one believes that a specialised neural mechanism accounts for such phenomena, or whether they can be explained in terms of processes already operative within ordinary encoding of events (e.g. McCloskey, Cynthia, Wible & Cohen, 1988), their extraordinary ubiquity amongst the general population (Kulkofsky, Wang & Hou, 2010) does point to a clear association between heightened emotionality and vivid, highly veridical, sensorily-based recollection of events. This may include a sense of spatial setting, of a host of irrelevant peripheral details, of thoughts and feelings happening at the time, and of many of associated features.

What all such studies seem to suggest is that, rather than simply promoting memory globally, emotional events tend to be remembered vividly, or in sensory-perceptual form. Such memories are remarkably persistent and appear to resist reduction to semantic or reduced format. As such, they are ‘strongly episodic’ in Tulving’s original sense.

### *1.3.3 Emotion as Distorting Recollection*

Whilst in the previous section, emotion has been seen to have a generally facilitative effect upon memory, with a certain class of threatening stimuli, arousal has been shown to distort recall of an event by encouraging the encoding of certain details at the expense of others. Such details can often be central or sensory-perceptual aspects of the event which are experienced as shocking, repulsive or threatening. The line of research considering such distorting effects took its initiative from Easterbrook's (1959) attention cueing hypothesis which proposed that in moments of high arousal attention narrows to the immediate source of arousal. The weapon focus effect (Stebly, 1992) was the, initially anecdotal, claim, that in situations of threat witnesses' recall of an incident became so selective as to exclude recollection of any details other than the immediate source of threat. Both of these theoretical claims drove a large body of research into selective memory phenomena under conditions of arousal, culminating in our current understanding of the 'tunnel memory' phenomenon, (Safer, Christianson, Autry & Osterlund, 1998), the observation that individuals subjected to traumatic or emotionally intense experiences automatically narrow their attention to the immediate source of arousal, such that subsequent recall of the event excludes peripheral detail and produces a representation of the experience which is highly selective and partial. Such research explores the effects of emotional arousal in skewing recall for certain features of an event (Christianson, 1992; Heuer & Reisberg, 1990; Loftus, 1979; Yuille & Cutshall, 1986).

One favoured paradigm for exploring this effect involves presenting participants with a stimulus set comprising an aural narrative and a series of accompanying slides portraying a story of some kind (e.g. Burke, Heuer & Reisberg, 1992; Christianson & Loftus, 1987, 1991; Heuer & Reisberg, 1990). The experimental group's stimulus set includes an emotionally arousing image, typically one calculated to elicit shock or horror. The

control group will view a similar but more affectively neutral story. Recall and recognition measures investigate how the interposition of an arousing element affects memory. Initially there appeared to be a mixed pattern of memory enhancement within laboratory studies exploring the effects of arousal. Studies by Barton & Warren (1988), and Clifford & Scott (1978) endorse the pattern suggested by eyewitness literature (Deffenbacher, 1983; Loftus, 1979; Loftus & Doyle, 1987) such that memory deteriorates under conditions of arousal. Deffenbacher (1983), however, in a reviewing 21 studies reported an increase in eyewitness accuracy within 10 studies and a decline in 11 studies. Some resolution to this apparent paradox came from appealing to the Yerkes-Dodson (1908) law which suggests that up to a certain point arousal facilitates performance, but beyond this impairs it.

Alternatively, by considering which aspects of memory performance are enhanced by arousal levels, the increasingly implemented distinction, inspired by weapon focus effects and Easterbrook's hypothesis, between central and peripheral elements, and gist and basic level information enabled a more nuanced understanding of how memory might be both deleterious and beneficial to memory. Compared with normal recall and recognition, experimental groups exhibit heightened recall for certain aspects of the story, with impaired recall for others. In general recognition of central details tends to be enhanced, whilst recall of peripheral details deteriorates (Burke, Heuer & Reibserg, 1992; Christianson, 1984; Christianson & Loftus, 1991). When this distinction is further refined to categorise visual and verbal information regarding an event, Burke et al. (1992) found that recall of spatially peripheral details tended to deteriorate across all stages of the narrative, recall of spatially central details tended to deteriorate following the presentation of the emotionally arousing event, whilst gist and basic level information all tend to be promoted across all aspects (for reviews, see Christianson, 1992; Reisberg & Heuer, 2004).

Thus at the very least, experimental studies appear to point to some deviation from the ordinary encoding of events when emotional materials are introduced, though a loss of contextualising detail, as well as time, according to how central and peripheral information is defined to some dissociation between verbal and visual information (Burke, Heuer & Reisberg, 1992; Heuer & Reisberg, 1990; Reisberg & Heuer, 2004). Some parallel to this loss of contextualising detail can be found in boundary extension effects such that emotionally arousing images are remembered as being larger or ‘more zoomed in’ than they were originally presented (Intraub & Berkowitz, 1996; Candel, Merckelbach, & Zandbergen, 2003).

In terms of ecological validity, levels of arousal in such studies are typically low, and the emotions they elicit confined to shock or disgust. These studies may, however, suggest how an emotional event, by privileging the encoding and retention of certain event features, engender patterns of memory impairment and enhancement which deviate from our ordinary encoding of events and impair subsequent, veridical, reconstruction of experience. Central and gist features may be plot-relevant and particularly worth encoding; at other times, however, they may be attention grabbing or a source of immediate threat, which obscure crucial aspects of the context in which the event occurs..

Attempts to isolate the effects of arousal per se from that of emotion in general either through the administration of pharmacological stimulants (Christianson, Nilson, Mjorndal, Perris, Tjelliden, 1986; Christianson & Mjorndal, 1985; Strange, Hurlman & Dolan, 2003) or having participants exercise (Libkuman, Griffith, Nichols-Whitehead & Thomas, 1999) point to some facilitatory effects of arousal, the typical pattern of tunnel memory could not be alone accounted for in terms of pure arousal (see Reisberg & Heuer, 2004, for a discussion). Furthermore, attempts to explain the tunnel memory effect in terms of the surprising, novel or attention grabbing nature of the central arousal

inducing stimulus are unsuccessful (Kramer, Buckhout & Eugenio, 1990). Stimulus sets which have substituted the central arousal-inducing image for a bizarre or unexpected element (Christianson & Loftus, 1987) have not replicated the typical pattern of results.

Finally, the possibility that such findings are explained simply in terms of central elements receiving more attention, has been considered in a study by Christianson, Loftus, Hoffman and Loftus (1991) where exposure to the central arousing image was restricted allowing participants only one fixation. Here, despite participants' attention being restricted by the nature of the experimental design, central arousing elements tended nonetheless to monopolise recall suggesting that it was not attentional resources at encoding alone that could account for tunnel memory effects.

To summarise, there seems to be a distinctive effect of emotion per se even when rival factors have been controlled for. The tunnel memory phenomenon appears to be both relatively robust despite some theoretical uncertainty as to what and how to define central or peripheral elements, and what is ultimately lost from recall (see Christianson, 1992, for a discussion). Emotion can have the effect of impairing memory for certain aspects of a narrative. These may often be peripheral details. Dissociations may arise between central and peripheral as well as visual and verbal aspects of a narrative.

#### *1.3.4 Emotion as Obscuring Recall*

Reflecting upon Rachman's definition of emotional processing, post-traumatic stress disorder (PTSD) comprises an extreme instance of a failure to absorb and assimilate emotional disruptions and to resume life satisfactorily. Within DSM IV, PTSD is characterised as a pathological reaction following exposure to an extreme traumatic stressor (American Psychiatric Association [DSM-IV-TR], 2000). The traumatic stressor comprises direct personal experience of an event involving actual or threatened

death or serious injury to oneself or others, or a threat to one's personal integrity. A hallmark symptom of PTSD is re-experiencing of the original event. This may take the form of intrusive and persistent recollections, disturbing dreams or dissociated reliving which can last from seconds to hours. There is a vivid sense that the experience is actually occurring in all cases of reliving. Distress is often experienced when the sufferer is exposed to triggers that resemble or symbolise an aspect of the traumatic event. Consequently, sufferers will often avoid stimuli or situations related to the precipitating event. Psychic numbness may also attend the aftermath of trauma: diminished interest in activities previously enjoyed, an estrangement from other people and a reduced capacity for emotions. Symptoms of increased arousal or anxiety may also be evident in the form of sleep disturbances, hyper vigilance and an exaggerated startle response. Irritability, outburst of anger and difficulties concentrating or completing tasks may also arise (American Psychiatric Association, 2000).

The characteristics of the traumatic memory have attracted immense interest amongst researchers (e.g. Hellawell & Brewin, 2002; Janoff-Bullman, 1992; Lang, 1979; van der Kolk & van der Hart, 1991). First, because the reliving of the event is in itself a highly distressing experience, and a key symptom of PTSD. Second, because in the view of some, the nature of the memory is responsible for the maintenance of the disorder, and consequently, the modification through therapy of the nature of the memory is thought to be integral to recovery (e.g. Brewin & Saunders, 2001; Foa & Kozak, 1986; Foa & Riggs, 1993; Terr, 1991, 1994).

The features of the trauma memory most emphasised within clinical research are its fragmentariness, (e.g. Foa, Molnar & Cashman, 1995; van der Kolk & van der Hart, 1991) such that sufferers' recollection of the sequence of the traumatic event are frequently temporally disordered, with little narrative or causal cohesiveness (e.g. Foa &

Riggs, 1993). Relatedly, apparently insignificant features of the event may gain disproportionate prominence in victims' subsequent account. This gives such memories an uneven, incoherent nature. An intensely vivid quality characterises many such memories (Brewin & Holmes, 2003) which may be so intense as to produce feeling of reliving the original event. This is affectively-laden such that emotions experienced at the time of the trauma are re-experienced regardless of the absence of a currently experienced threat. Hotspots (Grey & Holmes, 2008; Grey, Young & Holmes, 2002) designate moments of most intensely felt fear and threat: these are largely visual or sensory based (Holmes, Grey & Young, 2005).

The trauma memory often resists intentional recall, and sometimes cannot be voluntarily retrieved (e.g. Brewin, Dalgleish & Joseph, 1996; Ehlers & Clark, 2000) at least within its entirety. In some instances complete amnesia for the event is reported. Nonetheless, involuntary recall is frequently induced by external stimuli which serve as reminders of the original event and trigger highly vivid flashbacks. Similarly interoceptive cues such as states of arousal or panic subsequently experienced may themselves trigger vivid recollection (e.g. Jones & Barlow, 1990). Affective states can be triggered by cues which have a superficial similarity to those associated with the traumatic event, but little meaningful connection, as portents of threat. For example, Reemtsma (cited in Ehlers & Clarke, 2000) reports experiencing intrusive memories whenever, after his release as a hostage, he heard the sound of footsteps, a sound he indelibly associated with the coming of his captors to his cell.

Thus many of the impacts emotion appears to have on ordinary episodic memory are heightened within the symptomatology of PTSD. Memories are particularly vivid, with a strong recollective quality. There is an impoverished semantic detail available

illustrated both by their resistance to voluntary recall, their tendency to be cued by physical and sensory cues, and the fragmentary, incoherent nature of the recollection. A consequence of this may be how the event is defectively reconstructed by the victim and how the threat is generalised to novel situations in an appropriate way.

These findings have been compiled from diverse research traditions each adopting the models and paradigms particular to their field. The nature of the memory, as well as their access to retrieval, appears to increase in sensory/perceptual content as the emotionality of the event increases. The type of memory patterns manifested within trauma victims bring to culmination a tendency highlighted throughout this section of the review. In brief, emotional events and the arousal accompanying them may promote the formation of sensory-perceptual memories. This characterises enduring autobiographical recollections and flashbulb memories where it is seen as unproblematic. Within traumatic memories it might be speculated that such encoding is associated with a memory representation that can become inaccessible, demonstrate an incoherent structure, and, at times, produce extreme distress on recollection. Tunnel memory phenomena also demonstrate how recollections of past events can be distorted by emotional arousing stimuli.

The memory phenomena here reviewed suggest that heightened emotionality can be associated with an increased tendency to form sensorily-based memories. In extreme instances, PTSD flashbacks, this may disrupt memory retrieval, such that voluntary, verbal cues can no longer access the original trace. Instead, sensorily based cues (situational reminders, interoceptive cues) may trigger recollection.

### 1.3.5 Section Summary

The central findings of the review so far are shown in table 1.

Table 1: Summary of memory phenomena reviewed

<i>Memory Dimension</i>	<b>Memory type</b>					
	<b>Ptsd flashbacks</b>	<b>Flashbulb</b>	<b>Autobiographical</b>	<b>Episodic</b>	<b>Repisodic*</b>	<b>Semantic</b>
<i>Vividness</i>	Exceptionally vivid	Very vivid	Vivid details	Mixed	Mixed	Not vivid
<i>Emotionality</i>	Extremely	Very emotional	Mixed	Mixed	Mixed	Generally not emotional
<i>Modality</i>	Sensory based	Largely sensory based	predominantly sensory elements	Contain sensory elements	Non specific sensory elements	Not primarily sensory
<i>Verbal indexing</i>	Poor verbal indexing	Verbally indexed	Verbally indexed	Verbally indexed	Highly verbally indexed	Essentially verbally indexed

*\*not included in the review, but can be seen as intermediary between episodic and semantic memory forms, these are defined by Neisser (1981) as memories which merge memories of events into a representative memory. and apparently identify the abstraction of repeatedly occurring, sensorily-based details from a recurrent class of experience.*

There appear to be a number of reasons why emotional arousal might be associated with increased sensory/perceptual knowledge: from a functional perspective, it seems fairly uncontroversial to assume that sources of reward are those to which we wish to return, and sources of threat those we wish to avoid. Such sources, by definition, are likely to elicit emotional responses (Rolls, 1999, 2005). As such, it makes sense that as information regarding emotional events will monopolise not only attentional but also mnemonic resources and tend to be more likely to be remembered (Brewin, 2001b; Brown & Kulik, 1977).

In such instances, sensory/perceptual knowledge may be prioritised for a number of reasons. First, the mechanisms underlying the encoding of emotional events are likely to be highly adaptive and phylogenetically primitive. As such they are likely to predate language as well as the sort of sophisticated categorisation of information that more abstractive, semantically based memories require (Öhman & Mineka, 2001). Second, a sensorily based memory is far richer than a semantic: consider how a photograph of a scene retains information which would be lost to all but the most exhaustive semantic accounts. A sensory-perceptual record can support a near infinite range of semantic descriptions depending on the purposes which that semantic account serves (see Brown and Kulik, 1977, for a similar point). Third, semantic accounts of experience necessarily *reduce* the experience. This reduction can only be effective if an individual can be certain of what can be eliminated from an account, whilst ensuring that still significant information is still preserved. We may for present purposes understand 'significant' as that which plays some causal role in contributing to a specific (emotionally experienced) outcome. Until we understand what the causal 'narrative' of an event was, it makes sense, from a functional perspective, to retain information in as much detail as possible. Sensory/perceptual information achieves this purpose.

The disadvantage to such encoding, however, may be that it retains information in such a format that it resists easy recoding to higher-level implicational/appraisal-based levels of emotional generation. As a consequence such memory forms are associated with emotional responses experienced as automatic, beyond rational control, and, at times, inordinate to their eliciting agent. This corresponds to a key sense of dysfunctional emotional processing whereby individual's responses are experienced as inappropriate, impenetrable and no longer functional.

In sum, this memory pattern of heightened sensory-perceptual forms might disrupt emotional processing in a number of ways. First, at a recollective level: highly vivid memories of emotionally distressing experiences may be more affectively charged than ordinary autobiographical memories. As such, recollection may be more unpleasant. This in itself may be a symptom of poor emotional processing. Such memories and situations which trigger them may consequently be avoided which may mean they cannot be integrated within ordinary autobiographical knowledge (e.g. Conway & Pleydell-Pearce, 2000; Ehlers & Clark, 2000).

At a retrieval level, a consequence of their poor conceptual elaboration may be that they are involuntarily retrieved, having the effect of being triggered unintentionally and automatically, which once again will be a dysphoric experience. At a more fundamental level still, experience preserved within a sensory-perceptual form, might in extreme cases be poorly understood and poorly generalised. A meaning based interpretation of an event, rather than one encoded in terms of superficial sensory-perceptual features, is likely to generate emotional responses on a more appropriate basis because it apprehends the causal significance and sequence of the experiences preserved in memory.

This leads to the suggestion that what in part contributes to failures in emotional processing and what may characterise a poor emotional processing style is a comparative deficit in reducing analogue/sensory-perceptual information to semantic/conceptual form. Unprocessed memories may be intimately associated with unprocessed emotion. The semantic abstractive processing of memories may render them more amenable to symbolic, reflective routes to emotion generation and emotional regulation. Their persistence in sensory-perceptual form may mean they access automatic routes of emotion generation more readily producing responses that are beyond individual control and modification.

These suggestions are of course still speculative and aim principally to integrate an array of research findings drawn from a number of diverse fields. The final section of this review will consider support for these speculations by exploring how inducing conceptual/semantic processing of events and experiences produces protective effects against a number of symptoms typical of poor emotional processing.

#### *1.4 Conceptual Processing and Emotional Processing*

The following section reviews factors and experimental manipulations which appear to facilitate emotional processing, as well as models developed to account for how PTSD symptoms develop. The findings are drawn from studies which aim to reproduce the conditions under which traumatic memories are produced, naturalistic studies into vulnerability factors for PTSD, and more widely, writing studies that investigate how emotional expression brings remedial affective and psychological benefits.

##### *1.4.1 PTSD and Analogue Studies*

The most substantial body of research into emotional processing failures comes from

studies exploring PTSD. Investigations into the development and maintenance of distressing memories and flashbacks frequently adopt the analogue study paradigm. This involves exposing experimental participants to a stimulus, typically a film, which contains highly graphic distressing material (for example the aftermath of a car crash filmed as part of a roadside emergency training video). Participants are then asked to record for a period following exposure the number and nature of recollections they experience from the film. The experiment is designed to mimic, or provide an *analogue* for a traumatic event; intrusive memories are taken as analogous to the flashbacks trauma sufferers experience. Frequently, other indices of emotional processing, such as changes in affect and mood measures are administered. Typically, various manipulations imposed upon experimental participants, in the form of tasks to be performed concurrently with or immediately after viewing the stimulus are intended to investigate by what means PTSD symptoms might be alleviated, and contribute to a greater understanding of the development of the disorder.

Such studies have their origins in Lazarus's (e.g. Lazarus & Alfert, 1964; Lazarus & Opton, 1966) research programme which investigated principally how cognitive orientation might mitigate against the development of severe affective reactions in the face of a stressor. Horowitz (1969, 1975, 1976) extended these studies by specifically investigating how intrusive thoughts and recollection might develop following exposure to a distressing film. Such intrusive thoughts were measured over short intervals and intrusion frequency was investigated as a function of population type, stimulus type and cognitive processing styles, concluding that the experience of intrusive memories was a pervasive phenomenon within cognitive emotional processing and arose in response to both mild and extreme stressors.

The burgeoning interest in PTSD and its hallmark symptoms of flashback memories motivated more contemporary researchers to consider how intrusive memories develop over longer periods after exposure to stressors involving elements associated with trauma, i.e. threatened or actual death, serious harm to oneself or others. This produced the currently administered trauma film paradigm.

Influential cognitive models aiming to elucidate those processes which might palliate against or exacerbate trauma can be, roughly, divided into two camps. The first, inspired by Ehlers and Clark's model (2000) see data-driven processing of a traumatic event as likely to promote and conceptually driven processing as protecting against PTSD development. The second, inspired by Brewin, Dalgleish and Joseph's (1996) model of verbally accessible and situationally accessible memories, sees the restriction of the formation of visuo-spatial memories as protective. These two approaches, sharing much common ground, will be considered in order.

#### *1.4.2 Conceptual versus Data-Driven Processing*

A series of analogue studies (Halligan, Clark & Ehlers 2002; Halligan, Michael, Clark & Ehlers, 2003) contrasted the development of intrusive memories of two groups following exposure to a distressing film. The first group was instructed to immerse themselves in the images and sounds of the film: the second to concentrate on *meaning* elements, such as what was happening in the scene and what might happen next. The first group's instructions attempted to induce a *data-driven* style of processing, the second group a *conceptually-driven* style. This distinction is imported from Roediger's (e.g.1990) episodic memory studies, and was originally devised to explain how the nature of processing of a stimulus could account for differences in implicit and explicit memory task performance (cf. Jacoby, 1983; Roediger, 1979; Roediger & Blaxton, 1987; Weldon & Roediger, 1987).

Halligan, Clark and Ehlers's (2002) study found that the data-driven processing group recalled a smaller proportion of events in the correct order, replicating perhaps the fragmentary recall of trauma memories described in section 1.3.4, and a smaller number of events overall, but did not differ on any of the analogue symptom measures such as the development of intrusive memories. Data-driven processing did however predict the development of later distress associated with the film as well as subsequent avoidance behaviour.

A further study conducted by Halligan et al. (2002) preselected participants who reported responding to stressful life events with a data-driven style of processing and participants who reported a conceptually driven style. Here, following exposure to the same distressing film, it was found that the data-driven processing group reported more memory intrusions although quantity and coherence of recall did not differ from the conceptually driven processing group. Furthermore, the data-driven group exhibited a greater number of analogue symptoms and more evidence of subjectively disorganised memory.

Halligan, Michael, Clark and Ehlers (2003) subsequent study demonstrated that assault survivors with a high level of memory disorganisation experienced peritraumatic dissociation, data-driven processing and a lack of self-reference in the processing of events, with none uniquely predicting memory disorganisation.

More ecologically valid studies conducted by Laposa and Alden (2006) interviewed health workers to explore how they cope with the potentially traumatising scenes encountered through their work. They found that these largely reflected a conceptual

processing style: directing attention to procedural steps of an operation, recalling prior training and applying it to solve medical problems. A follow up study instructed experiment participants to apply these techniques during exposure to a video film of events in a hospital emergency room. After controlling for participants' intelligence, pre-film anxiety, depression and prior traumatic experience, it was found that applying these coping strategies led to fewer intrusions developing than experienced by controls.

A study was carried out in 2009 by Krans, Naring, Holmes and Becker who used a similar trauma film to those previously cited. Here the experimental manipulation involved questioning participants regarding the content of sections of the film found in previous studies to have produced the greatest number of intrusive memories. The effect of questioning was to reduce the number of intrusive memories related to the section. For sections which were not probed by question, there was a significantly greater number of analogue symptoms.

#### *1.4.3 Summary*

These findings suggest that within the experimental paradigm here considered, as well as in a naturalistic study, a processing style which focuses on conceptual rather than perceptual aspects during and following exposure to distressing materials has some protective benefits in measures of mood and affect, as well as in the incidence of intrusive memories.

#### *1.4.4 Constraining memory stores*

In an attempt to replicate the division of attention dissociation was thought to induce, Brewin and Saunders (2001) required participants to carry out a visuo-spatially taxing tapping task whilst concurrently viewing a distressing film. Dissociation is frequently

reported during traumatic experience and has been shown to predict the onset of PTSD symptoms. The experimenters reasoned that the tapping task would, thus, promote the occurrence of intrusive memories. However, contrary to prediction, they found it produced the opposite effect, with the experimental group reporting significantly fewer analogue symptoms than controls.

This finding was explored through further studies which imposed increasingly taxing burdens on the spatio-visual working memory which a tapping task was thought to engage. Such manipulations have been found to reduce the likelihood of intrusive memories by Holmes, Oakley, Stewart & Brewin (2006). Such tasks have exploited a 'conceptual keypad' in which digit sequences can be tapped out during the presentation of traumatic material. By varying systematically the amount of practice participants are allowed, the sequence tapping task can be made variously onerous, with less practice producing less automaticity and consequently a greater strain on visuo-spatial resources. Participants least practiced in this task reported the lowest frequency in the number of intrusive memories.

Similar manipulations have involved requiring participants to model clay objects during film sections, which produced similarly protective effects against analogue symptoms compared to sections where no such tasks were performed (Stuart, Holmes & Brewin, 2006). Post event manipulations have recently involved participants playing a video game (Tetris) thought to tax the verbal spatial system (Holmes, James, Coode-Bate & Deeprose, 2009). This study found a significant reduction in analogue symptoms following presentation of a film.

Attempts to tax verbal processing and memory have produced mixed results (e.g. Brewin & Saunders, 2001). Participants whose verbal processing of a distressing film was disrupted by being required to count backwards in threes were found to experience more intrusions. A 'verbal enhancement' condition implemented in order to encourage the formation of verbal memories, where participants were instructed to describe aloud details whilst viewing a film did not produce any reduction in intrusions. Nonetheless, on subsequent analysis of participants' protocols, it was found that participants had tended to describe superficial aspects of events without focussing on the meaning aspects. Furthermore, the possibility remains that the burden of having to articulate thoughts aloud may have impeded ordinary conceptual processing of the event.

#### *1.4.5 Theories of Flashbacks*

Such results, which broadly implicate the formation of visual memories in the development of extreme failures of emotional processing, and, with more mixed results, point to a protective role for conceptual processing, have contributed to the development of two influential cognitive theories of PTSD and intrusive memory development, which in their information processing bias, address many of the themes developed in the first two sections. These are the cognitive model proposed by Ehlers and Clark (2000) and the dual representation theory of Brewin, Daligliesh and Joseph (1996).

##### *1.4.5.1 Ehlers and Clark.*

Ehlers' and Clark's (2000) cognitive model of PTSD is presented as an attempt to explain the apparent paradox evident within traumatic symptoms, namely the persistence of anxiety regarding a threat which is no longer present. They account for this paradox by means of two processes – first in terms of how the event was processed,

and second in terms of the appraisal of the long-term consequences (sequelae) of the event.

A distinction adumbrated above between perceptually driven and conceptually driven processing is the centrepiece of this model. Their hypothesis is that for a number of reasons individuals most susceptible to the development of traumatic memories and attendant PTSD symptoms will have processed the event in a perceptually driven way, such that sensory features and superficial aspects will have predominated at the event encoding. Furthermore, the event is subsequently poorly elaborated in terms of its deeper meaning structure, and this produces memories which are comparatively difficult to retrieve and integrate. Implicit in this discussion is that such memories persist in this relatively unelaborated form and are cued by triggers encountered after the event which are superficially similar (in terms of their sensory-perceptual aspect) but which do not in any meaningful way bear connection with the event with which they are connected. As such superficially similar environmental cues encountered following the trauma serve as warning signals for the recurrence of the traumatic event, which triggers both the reliving of the event in memory (the flashback) and the panic response prevalent in PTSD symptoms.

Sufferers exhibit poor intentional recall of the event largely because they have processed it perceptually and not semantically: memories are likely to be cued involuntarily at a low perceptual threshold and a persistent sense of threat or alarm experienced coupled with a hypervigilance to future threat. Implicit and explicit memory thus falls into a dysfunctional relationship within PTSD symptomatology. The strong associative priming implicated within PTSD means that sufferers preconsciously

respond to warning signals within their environment which perceptually processed stimuli from the original trauma serve to cue in future situations.

It is further proposed that as a result of poor conceptual processing the memory of the event is not temporally or spatially contextualised within broader autobiographical memory structures where such contextualisation might both facilitate the suppression of trauma memories and their strategic intentional recall. Flashbacks owe their 'here and now' quality to this failure in contextualisation; intentional recall fails because the memory trace has not been given a clearly specified retrieval route.

The distinction between data-driven and conceptually driven processing, though highly suggestive, still requires clarification and greater development. As Brewin and Holmes (2003) point out, whether conceptual processing essentially refers to classification, conceptualisation or an assessment of implications for the self and autobiographical memory structures is yet to be determined.

#### *1.4.5.2 Dual representation theory.*

Brewin, Dalgleish and Joseph's (1996) dual representation theory proposes the existence of two distinct memory systems which form qualitatively distinct memories whose retrieval depends on different types of cues. Whilst both systems ordinarily operate in parallel, highly distressing experience can produce disruptions within the system such that one type of memory dominates at the expense of another at event encoding. This produces the distinctive pattern of memory disorders characteristic of PTSD. The original experimental support for this model was drawn from analogue studies cited above, where it was found that taxing the visuospatial load (originally intended to mimic dissociation) had, contrary to prediction, an inhibitory effect of the formation of

subsequent intrusive memories. It was thus reasoned that this finding, in combination with the fact that traumatic memories are often poorly retrieved by verbal cues, pointed to the existence of two types of memory store: one containing verbally accessible memories, the other situationally accessible memories.

The verbally accessible memory (VAM) system encodes our everyday experiences and integrates these within coherent narratives of our lives. Such memories can be accessed through verbal cues, communicated to others through language, edited in memory and drawn upon selectively. The second system, the situationally accessible memory (SAM) store, encodes features of events not consciously encoded but still forming subliminal traces within memory. This offers a more ample, capacious store than verbally accessible memories, yet resists self-cued, intentional retrieval. Instead situational reminders of the original event cue the memory which is retained in an affectively laden, highly vivid form. This draws experimental support from such phenomena as 'inattention blindness' (Mack and Rock, cited in Brewin et al., 1996) whereby elements of a visual field may be unattended, and not consciously report, but still effect performance on priming tasks and other tests of implicit memory. The stress and anxiety experienced at the time of the traumatic event has the effect of constraining the amount of information that can be registered or attended to at encoding. The traumatic event is presumed to focus attention on the immediate source of threat to such a degree that other elements are only stored unconsciously.

Brewin, Dalgleish and Joseph originally (1996) proposed that within therapy verbally accessible memories combining the original trauma information combined with states of reduced arousal and new understanding of the event need to be formed which block access to the original memories. Brewin's revised (2001b) view is framed within the

terms of feature theory such that information (or features of an original stressor) retained only within the SAM memory system cannot be transferred to VAM structures because of suppression and avoidance behaviours which typify PTSD symptoms. The flashback memory needs to be re-encoded into a format more amenable to general knowledge structures, given a temporal and spatial context, and thereby palliating the sense of threat and alarm which their re-experiencing produces. The quantity of information which the SAM store contains means that a great deal of material needs to be transferred and processed. This calls for often protracted therapeutic treatment.

The trauma reminders encountered within the environment spark a retrieval competition between verbally accessible memories and situationally accessible memories – successful access to the newly formed VAM of the traumatic event will prevent amygdala activation and the re-experiencing of emotions associated with the event. This also means that in the future a suitably specific cue may trigger the original trauma memory, which by no means eradicated. Therapy allows verbally accessible memories to be produced which incorporate features from the situationally accessible memory store and which is preferentially accessed.

#### *1.4 6 Summary*

The studies so far reviewed in this section have suggested that attending to conceptual and meaningful aspects of an experience constraining visual spatial details of an event may have a protective effect against the formation of intrusive memories; further, and relatedly, post event meaning elaboration and verbal processing can reduce the incidence of analogue PTSD symptoms. The models considered have given such processes as conceptual elaboration, or the formation of verbal accounts, a central role in explaining both how PTSD symptoms arise and how they can be prevented. It must

be stressed however, that such findings and models are intended specifically to account for a particular type of traumatic experience and pathological conditions. Furthermore, they, largely adopt a restricted paradigm (the analogue study) intended to replicate to a lesser degree the effects of a highly distressing event. Their chief focus, too, is on the formation of intrusive memories. Thus much of the evidence reviewed is suggestive, rather than specifying precise mechanisms and processes by which a more global account of emotional processing and memory interactions might be described.

Precisely how the mechanisms and models of memory proposed by these theories map on to general understanding of memory, and emotional processing needs to be established. The findings do, helpfully, point to a polarity between sensory and conceptual aspects at encoding and following exposure to materials. This parallels the direction already developed within sections one and two pointing to an association between emotion and sensory memories, and the possibility that a surfeit of sensory encoding might both distort and impede recall.

Certain difficulties persist with the notion of conceptual processing. Within the experimental learning paradigm in which it was originally proposed (Jacoby, 1983; Blaxton, 1989; Roediger, 1990), it was intimately connected with transfer appropriate processing account of memory. When applied to clinical models, it becomes something of a catch-all for a number of processing styles which might be taken in a broad sense to denote top-down processing (Brewin & Holmes, 2003). Yet, these are far from a homogenous group of processes. They might refer to simply labelling elements of an event, to categorisation, to production of narrative, to interpreting an event in terms of its consequences, or to provide higher-level meaning accounts.

They might all, however, suggest that a recoding and 'processing' of bare sensory data has some protective effect, at least in the type of analogue symptoms here reviewed. This resonates with multilevel multi representational theories of emotion, (see section 1.1.6) which predict that emotional desynchronies might arise when representations are retained in an analogue format which enables it to access through associative processes emotional responses automatically. In the following section, these considerations will be extended to more wide ranging interactions between conceptual processing of experience and emotional processing.

### *1.5 Verbalisation and Emotional Processing*

#### *1.5.1 Therapeutic Expression*

That talking about your problems is good for you is, apparently, an axiom of folk wisdom which exhorts us not to 'bottle things up', to 'get things off our chest, to 'vent our feelings'. The compulsion to express and communicate difficulties and feelings seems to be attested within almost every walk of human life where opportunities for confessional and disclosure abound.

Talking, too, is a mainstay of many therapeutic approaches. Humanistic inspired approaches in which contemporary counselling techniques originated, see talking as the chief means of establishing an atmosphere in which dynamic developmental forces within the individual might come to the fore and effect change within the client's life (e.g. Rogers, 1951). Psychodynamically inspired practices see dialogue as a vehicle to achieve some degree of insight into hidden material of one's emotional past, as a means of bringing some rational principle to irrationally motivated behaviour (e.g. Freud, 1940). Cognitive therapies (e.g. Beck, 1976) may enable clients to articulate

preconscious or poorly attended beliefs and values driving behaviour in dysfunctional ways. Each approach, even in this extremely cursory synopsis, presents its own account, and own terminology, and its own psychological model to explain why talking is useful within therapy and how talking helps.

Such views may be counterbalanced by sceptical voices questioning the efficacy of talking therapies. This may have its genesis in Eysenck's (1952) classic and polemical study that found that psychotherapy had no demonstrable benefits in the treatment of 'neurotics'. This critique became refined to the claim that psychological training brought no benefits over those not trained in a counselling environment, (Durlak, 1979, 1981; Strupp & Hadley 1979) and the conclusion that the principle benefit of therapy consisted in talking to a sympathetic individual gained some support (e.g. Berman & Norton, 1985).

Fortunately, this debate does not need here to be pursued. What, for the purposes of this dissertation, is of interest, is that talking appears to bring benefits to psychological distress, and that many of the benefits of counselling or psychotherapy *might* be attributed to the process of talking alone. This of course leads to the question of why this might be the case.

It is possible, indeed likely, that such benefits are multiply determined. Speculatively, this compulsion to report on experience could be rooted in number of possible causes. Developmental emphases may suggest that from infancy the act of disclosure may be associated with consolation and assistance a caregiver provides when a child feels distressed. In cognitive terms, the act and effort required in repressing may be cognitively and affectively costly; traumatic and experience may isolate us, and in

communicating its nature we may feel less solitude as a result of being 'understood'.

Communicating emotional experiences may have benefited the communities in which human development was fostered: by pooling knowledge of threats and rewards, and as such the need to disclose might be understood as a phylogenetically prepared remnant of our psychosocial development.

Such speculations could go on. One of the few rigorous empirical attempts to explore this area emerges from a long series of writing studies monitoring affective, psychological and general performance effects of producing written accounts of traumatic experience within a normal population. This provides some insight into some of the issues raised above as to why precisely expression might be beneficial.

As a whole these studies provide striking evidence for how verbalising distressing emotional experiences can effect emotional processing. This paradigm was first introduced by Pennebaker and Beall in 1986. In its initial form required a sample of college non clinical students to write whilst comparing outcomes with a control group set the task of writing about trivial subjects over an identical period. No feedback on participants' accounts was given, offered or implied; participants were instructed to engage with their deepest emotional responses, perhaps connecting their traumatic experience with other experiences in their lives (Pennebaker & Chung, 2007); beyond that no further constraints were set as to how participants should approach the task. At the end of each session participants were instructed to deposit their essays in a black box. Outcome measures comprised self-reported affective ratings, academic performance, and number of visits to healthcare professionals. The experimental group demonstrated significant improvements in all these areas.

This paradigm has since 1986 been replicated in various forms and has demonstrated robust effects. By 1996 over 150 studies had adopted the basic model (Pennebaker & Chung, 2007). A 1998 meta-analysis by Smyth, reporting on 14 studies, concluded that writing studies produce reliably positive outcomes with an effect size as great as is seen in many clinical interventions. Strongest outcomes tend to be witnessed in psychological and physiological measures, compared to health and other measures of general performance. Males typically benefit more than females and a longer interval between writing sessions effects greater responses. Health benefits have comprised blood pressure decrease, increases in t-helper response to Epstein Barr virus, and decreases in resting pulse. Effects have been found in diverse populations, age groups and social classes and professions, including various educational backgrounds and nationalities.

Numerous manipulations of the basic paradigm have attempted to uncover precisely how traumatic disclosure produces such salutary effects. The mode of expression has been altered to include talking into a tape recorder, rather than writing accounts, and found to be effective (Esterling, Antoni, Fletcher, Margulies & Schneiderman, 1994); oral accounts in a one way interaction have shown comparable effects (Murray, Lamnin & Carver 1989; Donnelly & Murray, 1991). 'Finger writing' (where participants form the shape of words with their fingertips rather than using stationery) has also produced equivalent effects (Pennebaker & Chung, 2007). Similarly, having participants write their accounts on a 'magic pad' where the writing disappears once the page is lifted, produced similar effects to participants writing on actual paper (Czajka, cited in Pennebaker & Chung, 2007).

Pennebaker's own explanation for these effects has evolved since the publication of his first studies; the simple theory of inhibition (i.e. the removal of inhibition through writing and the subsequent freeing up of cognitive resources it effects) found very mixed support (Greenberg & Stone, 1992). Attempts to account for the effects in terms of habituation were similarly discredited (Pennebaker & Chung, 2007). This evolution has culminated in his more cognitively biased A- to-D (analogue to digital) model. This attempts to describe what is presumed to take place when an experience is translated into linguistic form. In essence, Pennebaker stresses how language enables a reduction from highly detailed experience to a more optimal level of specificity. This level allows memory representations to be reduced to a more manageable and amenable scale within the functional demands of the cognitive system. This he likens to the reduction of the data provided by an analogue signal (such as is provided in a skin conductance study) which is over-detailed and shifts on nanosecond to nanosecond basis to a digital signal which converts data numerically on a sampling basis. The analogue signal here, presumably, is intended to refer to emotions and emotional experience: the digital signal intended to describe language. If an experience persists in attention until it is understood or naturally dissipates over time an experience in analogue form cannot be tied to the meaning of the event or conceptually analysed. For this it requires reformulation in language. Too summary or too detailed a description of experience will not enable to sort of conceptual elaboration and processing it requires.

The research appears to suggest that the efficacy of such traumatic disclosure lies not in the *communication* of the experience, as these accounts are not produced to be read either by the experimenter or other participants. Feedback is neither offered nor given, so cannot account for any benefits exhibited. *Expression* per se, has also, to some degree been discounted: Krantz and Pennebaker (1995, cited in Pennebaker, Mayne &

Francis, 1997) explored whether an 'expressive movement' condition whereby participants expressed through some movement or action their representation of a traumatic event and found only short term affective benefits followed compared to a condition where verbal expression was required. Furthermore, studies which have instructed participants to focus exclusively on the emotional response, as opposed to the event which precipitated it report few benefits. Thus expression *per se* may be incidental to some more fundamental factor.

Rather, the research suggests that the benefits derive from the *formation* (rather than *communication*) of a verbal account. This account need not persist in any tangible form, or be communicated, but rather the act of *reviewing and reformulating in language* an experience and feelings associated with it appear to produce a range of surprising and unforeseen benefits, psychological, physiological and behavioural, and appear to accelerate the emotional processing of events that persist in memory. It is hard to understand these effects in terms of the removal of repression: in strict psychoanalytical terms the memories cannot have been repressed as they are at the time of the experiment readily accessible to recall. Furthermore, participants are not selected because they have suffered traumatic experience, but are drawn from a general (often university student) population; although, according to how the experiment is described at recruitment, some degree of self-selection appears wholly possible. Similarly any unnuanced notion of 'expression' as providing a catharsis of pent-up feelings appears, similarly, unlikely to adequately explain the mechanisms at work in producing these effects. Participants are expected to engage with their emotions, but this forms only part of the task requirements. Furthermore, where participants simply express their emotions few benefits are seen. At a broader clinical level, the 'mindless emoting'

Teasdale (1999) discusses is thought to be a symptom of rather than a remedy for many emotional disorders.

### *1.5.2 Additional Experimental Findings*

Further experimental findings drawn from a number of research programmes cast some further light on interactions between language, memory, and affective responses. At a general level, some evidence suggests that describing feelings can have a palliative effect on their felt intensity (Schwarz, 1990) as well as on global measures of mood (Keltner, Locke, & Audrain, 1993) such that describing, after a dysphoric mood induction, how one felt, was found to improve mood globally.

That language may impact on memory trace is suggested by a number of studies demonstrating that memory can be plastic, and susceptible to post-event (linguistic) manipulations. Thus, Loftus's demonstration (1975, 1979) that by manipulating the question cue following exposure to an action sequence, individuals differ in their assessment of basic features of the event. Verbal overshadowing (e.g. Schooler & Engstler-Schooler, 1990) studies suggest that some decrease in sensory-perceptual characteristics of an original memory may occur as a result of the act of description. Experimental participants required to describe a face, are subsequently less able to recognise it (and these studies have been extended beyond simply face recognition to a range of stimuli). This effect has been explained by some (e.g. 'recoding interference': Brandimonte, Schooler & Gabbino, 1997) as an effect of the recoding of the original trace from a visual to a verbal basis.

Yet why should the reduction of sensory/perceptual basis bring affective benefits? Some slender explanatory evidence for this possibility is thrown up by Holmes,

Mackintosh, Mathews and Dalgleish's study (2008) which suggested that visual representations were naturally more productive of affective responses than verbally based ones. Thus, the recoding of memory traces may make them in themselves less emotionally charged, and verbal description may alter the memory trace such that it is less affectively volatile. At a more fundamental level, the sort of conceptual elaboration which verbal description, discussion and writing accounts provide for may alter the accessibility of the trace such that it is principally accessed and retrieved through conceptual/thematic routes (cf. Conway & Pleydell-Pearce's 2000 model of autobiographical memory) rather than on the basis of poorly elaborated superficial cues which bring to mind memories and feelings associated with them on an accidental, poorly controlled basis through external sensory cues.

At a functional level, however, verbal description might be understood as enabling a first attempt at *conceptualising* experience. This, it is argued, is important for any individual attempting mastery and regulation of his/her environment because it enables *significance* to be extracted from experience, and the particularity of an experience to be extended to a more generic basis. This could be understood as making possible a better location of threats and dangers, rewards and incentive, all of which enables an individual to more efficiently avoid harm and pursue benefits within an environment. Poorly understood experience, e.g. one which is predominantly data-based (sensory-perceptual), will not achieve this purpose. It may be in this need to understand experience, and to generalise it to novel future instances, that the compulsion to talk (i.e. to form conceptual/semantic accounts) is grounded. It may be that symptoms of poor emotional processing too are rooted in this unassimilated emotional/experiential material. Essentially, poor cognitive understanding of an experience may closely parallel poor emotional processing of it.

### *1.6 Section Conclusion and Comments*

Findings were reviewed which suggested that certain experimental manipulations during the presentation of distressing images might have protective effects against the development of intrusive memories and analogue PTSD symptoms. These were found to be promoting conceptual processing both during and after an event, and impeding the formation of visuo-spatial memories. These were then discussed in the light of two influential theories of PTSD which proposed that certain symptoms of PTSD were produced by processing style, or the operation of a situationally accessible memory system. The discussion then considered broader phenomena of how writing studies suggest that emotional processing can be facilitated through the formation of verbal accounts of experience.

## Chapter 2: Experimental Rationale and Methods

### *2.1 Rationale*

After considering the nature of the emotions and emotional processing, the foregoing review considered theoretical frameworks which propose that certain emotional dysfunctions might be explained through stimulus and event coding/recoding processes operating within a cognitive-affective system. In attempting to explore how emotional processing and memory interact, the review then considered how this differential coding might be reflected in differences in memory qualities, namely its sensory/perceptual as opposed to its semantic/conceptual basis. In conformity with such a view, evidence suggesting that heightened emotional states promote the retention of sensory, vivid elements within episodic memories was presented. Some evidence to suggest that in cases of extreme emotional arousal sensory elements may proliferate in recollection, maintain affective reactions, and be associated with poor semantic memory contextualisation was considered. We have considered how certain theorists have proposed a causal link between sensory memory formation and the maintenance of emotional disorders; and how others have suggested that conceptual processing of an event may be protective against emotional disruption. Further evidence was reviewed considering how the formation of an account of a distressing experience appears to bring a number of psychological and affective benefits.

In outline, these studies compare poor and effective emotional processors over a range of autobiographical and episodic memory tests. They explore memory performance in terms of groups' tendency to form and retain sensory-perceptual based memories, and in terms of their tendency to conceptually-semantically process such memories. The rationale for this approach is to explore whether an association exists between poorly processed emotions and sensory perceptual memories. This rationale is reflected in the

hypothesis that poor emotional processors will exhibit a greater tendency to form and retain sensory perceptual memories. The support for this rationale has been outlined throughout the literature review and will be expanded in the following section.

The aim of the studies is to explore **if and where** such differences exist. For this reason a gamut of memory types within the overarching category of episodic memories is being surveyed. The potential value of such a finding is to provide independent converging support for the psychotherapeutic contention that conceptually processing experience (through writing, talking, analysing, and forming an alternative perspective) brings remedial emotional benefits. It will also provide support for a model of emotional processing that emphasises the role cognitive processing plays in the generation and maintenance of affective disorders.

The status of sensory perceptual memories in affective disorders in the literature surveyed is somewhat unclear. They may be peculiar products of a particular type of experience, and the processing that results from it; they may be confined to traumatic experience, experimental artefacts, or simply epiphenomenal in nature. Before the status, the causal significance of such memories can be explored, additional triangulatory evidence of their prevalence such as this thesis may offer needs to be established. Accordingly, by discovering their incidence over a broader range of every day memory phenomena, and establishing whether they can reliably be associated with a particular emotional processing style, some step may be made towards establishing their role in the development of emotional processing disruptions.

In brief, if sensory perceptual memories are a persistent feature of poor emotional processors' memories, and if evidence of conceptual-semantic processing can be found within effective emotional processors, then perhaps these two processes are contributing

to the development of emotional processing disruptions. **How** this may happen has already been suggested: **that** it is the case requires further evidence.

A number of assumptions and suggestions have been proposed chiefly to organise and integrate these findings. The fundamental assumption is that a certain sensory-perceptual encoding style is promoted in emotional situations, likely to be phylogenetically primitive and functional to the extent that it retains a high degree of unedited information or raw data regarding an experience of significance to the individual. It becomes dysfunctional, it is suggested, through suppressing semantic/conceptual processing of experience, which latter would render memory, and the information it provides more transferable across cognitive domains, and susceptible to meaning-based emotional responses, greater integration within autobiographical knowledge, enhanced emotional regulation, and more appropriate affective reactions. Comparatively unprocessed memory forms are more resistant to meaning-based appraisal, more liable to produce emotional reactions on an associative basis, and less tractable to cognitive intervention and modification. It was in the introduction argued that one key aspect of poor emotional processing consists in precisely this sense of emotional responses gaining a relative autonomy, opacity, and automaticity for a range of stimuli and events, which to rational inspection appear comparatively innocuous.

Despite their speculative and general nature, such assumptions and suggestions have the advantage of integrating rather disparate research drawn from various clinical and experimental approaches each adopting paradigms and explanatory models specific to their field. They aim to articulate a pattern and to organise findings. It must however be conceded that few of the studies here cited aim to support a general account of how emotional responses become dysfunctional and how memory might be implicated

across all cases of emotional processing. PTSD analogue studies, to select an example that has been particularly prominent in the review, address often the development of a particular symptom of a particular pathological condition. Any attempt to generalise their conclusions to broader level of emotional processing failures encounters a number of difficulties. First, the nature of the precipitating event, a trauma or trauma analogue, makes it difficult to separate the characteristics of the situation from the particular features of the memory representation. Thus, extraneous factors which may disrupt the memory trace such as an individual's fight or flight response, or extraordinary aspects of the particular situation, elements of therapeutic measures, may, to name a few, contribute to formation of certain memory types. This complicates the question of what causal role memory plays in the disruption of emotional processing, as it is possible to see such memories as epiphenomenal to underlying processes of recovery and rehabilitation.

Thus, an alternative to studying how individuals' recollections of emotionally distressing situations differ from ordinary autobiographical memories, would be to compare how the recollections of individuals with poor emotional processing styles differ from normal individuals using non arousing, everyday stimuli and images.

The rationale adopted is to examine how poor emotional processors and effective emotional processors differ in their episodic memory performance. The specific measures adopted aim to gauge sensory-perceptual and semantic/conceptual processing. The studies explore whether poor emotional processing can be associated with a bias towards sensory-perceptual processing. This dissertation attempts to provide the basis for a more global account of the association between memory processes and emotional processing. A central aim is to explore whether mechanisms previously adduced as

active in producing trauma symptoms are continuous with those ordinarily in operation in the everyday assimilation of emotionally disruptive material. The purpose of this approach is thus to triangulate the proposal drawn from previous studies such that differences in conceptual/sensory processing contribute to the genesis of emotional processing disorders, and that these will be reflected in episodic memory representations.

The studies attempt to provide a sample of different types of episodic memory performance by adopting and modifying paradigms frequently encountered in conventional episodic, autobiographical as well memory and emotion studies. Whilst exploratory in nature, such research may suggest at what stage of memory formation, whether comparatively early at encoding or during consolidation, sensory memories are preserved. Furthermore, by varying the valence of the material presented or probed whether such a bias exists independent of arousal can be explored. By varying the complexity of the materials, as well as the personal meaningfulness of the materials, the boundary conditions of this memory bias can also be better investigated.

### *2.1.1. Overview*

After considering the nature of the emotions and emotional processing, the foregoing review considered theoretical frameworks which propose that certain emotional dysfunctions might be explained through stimulus and event coding/recoding processes operating within a cognitive-affective system. In attempting to explore how emotional processing and memory interact, the review then considered how this differential coding might be reflected in differences in memory qualities, namely its sensory/perceptual as opposed to its semantic/conceptual basis. In conformity with such a view, evidence suggesting that heightened emotional states promote the retention of sensory, vivid

elements within episodic memories was presented. Some evidence to suggest that in cases of extreme emotional arousal sensory elements may proliferate in recollection, maintain affective reactions, and be associated with poor semantic memory contextualisation was considered. We have considered how certain theorists have proposed a causal link between sensory memory formation and the maintenance of emotional disorders; and how others have suggested that conceptual processing of an event may be protective against emotional disruption. Further evidence was reviewed considering how the formation of an account of a distressing experience appears to bring a number of psychological and affective benefits.

In outline, these studies compare poor and effective emotional processors over a range of autobiographical and episodic memory tests. They explore memory performance in terms of groups' tendency to form and retain sensory-perceptual based memories, and in terms of their tendency to conceptually-semantically process such memories. The rationale for this approach is to explore whether an association exists between poorly processed emotions and sensory perceptual memories. This rationale is reflected in the hypothesis that poor emotional processors will exhibit a greater tendency to form and retain sensory perceptual memories. The support for this rationale has been outlined throughout the literature review and will be expanded in the following section.

The aim of the studies is to explore **if and where** such differences exist. For this reason a gamut of memory types within the overarching category of episodic memories is being surveyed. The potential value of such a finding is to provide independent converging support for the psychotherapeutic contention that conceptually processing experience (through writing, talking, analysing, and forming an alternative perspective) brings remedial emotional benefits. It will also provide support for a model of emotional

processing that emphasises the role cognitive processing plays in the generation and maintenance of affective disorders.

The status of sensory perceptual memories in affective disorders in the literature surveyed is somewhat unclear. They may be peculiar products of a particular type of experience, and the processing that results from it; they may be confined to traumatic experience, experimental artefacts, or simply epiphenomenal in nature. Before the status, the causal significance of such memories can be explored, additional triangulatory evidence of their prevalence such as this thesis may offer needs to be established. Accordingly, by discovering their incidence over a broader range of every day memory phenomena, and establishing whether they can reliably be associated with a particular emotional processing style, some step may be made towards establishing their role in the development of emotional processing disruptions.

In brief, if sensory perceptual memories are a persistent feature of poor emotional processors' memories, and if evidence of conceptual-semantic processing can be found within effective emotional processors, then perhaps these two processes are contributing to the development of emotional processing disruptions. **How** this may happen has already been suggested: **that** it is the case requires further evidence.

A number of assumptions and suggestions have been proposed chiefly to organise and integrate these findings. The fundamental assumption is that a certain sensory-perceptual encoding style is promoted in emotional situations, likely to be phylogenetically primitive and functional to the extent that it retains a high degree of unedited information or raw data regarding an experience of significance to the individual. It becomes dysfunctional, it is suggested, through suppressing semantic/conceptual processing of experience, which latter would render memory, and the information it provides more transferable across cognitive domains, and susceptible to meaning-based emotional

responses, greater integration within autobiographical knowledge, enhanced emotional regulation, and more appropriate affective reactions. Comparatively unprocessed memory forms are more resistant to meaning-based appraisal, more liable to produce emotional reactions on an associative basis, and less tractable to cognitive intervention and modification. It was in the introduction argued that one key aspect of poor emotional processing consists in precisely this sense of emotional responses gaining a relative autonomy, opacity, and automaticity for a range of stimuli and events, which to rational inspection appear comparatively innocuous.

Despite their speculative and general nature, such assumptions and suggestions have the advantage of integrating rather disparate research drawn from various clinical and experimental approaches each adopting paradigms and explanatory models specific to their field. They aim to articulate a pattern and to organise findings. It must however be conceded that few of the studies here cited aim to support a general account of how emotional responses become dysfunctional and how memory might be implicated across all cases of emotional processing. PTSD analogue studies, to select an example that has been particularly prominent in the review, address often the development of a particular symptom of a particular pathological condition. Any attempt to generalise their conclusions to broader level of emotional processing failures encounters a number of difficulties. First, the nature of the precipitating event, a trauma or trauma analogue, makes it difficult to separate the characteristics of the situation from the particular features of the memory representation. Thus, extraneous factors which may disrupt the memory trace such as an individual's fight or flight response, or extraordinary aspects of the particular situation, elements of therapeutic measures, may, to name a few, contribute to formation of certain memory types. This complicates the question of what causal role memory plays in the disruption of emotional processing, as it is possible to see such memories as epiphenomenal to underlying processes of recovery and rehabilitation.

Thus, an alternative to studying how individuals' recollections of emotionally distressing situations differ from ordinary autobiographical memories, would be to compare how the recollections of individuals with poor emotional processing styles differ from normal individuals using non arousing, everyday stimuli and images.

The rationale adopted is to examine how poor emotional processors and effective emotional processors differ in their episodic memory performance. The specific measures adopted aim to gauge sensory-perceptual and semantic/conceptual processing. The studies explore whether poor emotional processing can be associated with a bias towards sensory-perceptual processing. This dissertation attempts to provide the basis for a more global account of the association between memory processes and emotional processing. A central aim is to explore whether mechanisms previously adduced as active in producing trauma symptoms are continuous with those ordinarily in operation in the everyday assimilation of emotionally disruptive material. The purpose of this approach is thus to triangulate the proposal drawn from previous studies such that differences in conceptual/sensory processing contribute to the genesis of emotional processing disorders, and that these will be reflected in episodic memory representations.

The studies attempt to provide a sample of different types of episodic memory performance by adopting and modifying paradigms frequently encountered in conventional episodic, autobiographical as well memory and emotion studies. Whilst exploratory in nature, such research may suggest at what stage of memory formation, whether comparatively early at encoding or during consolidation, sensory memories are preserved. Furthermore, by varying the valence of the material presented or probed whether such a bias exists independent of arousal can be explored. By varying the complexity of the materials, as well as the personal meaningfulness of the materials, the boundary conditions of this memory bias can also be better investigated.

### 2.1.2 Exploratory Nature of the Research

Given the paucity of research addressing this specific field, and the consequent lack of relevant models and hypotheses licencing specific experimental predictions, this programme of research must be understood as exploratory. It is intended to provide a preliminary overview of group differences in memory performance principally in terms of the comparative incidence of sensory perceptual memories and conceptual-semantic processing. As has been stated, the chief interest of the research is to explore *if* and *where* differences emerge. **If** such differences emerge this would provide, in extremely preliminary but significant form, evidence for the status of sensory perceptual data in emotional processing disruptions. Identifying **where** such differences emerge (in terms of memory type) might better inform speculation as to the mechanisms of the relationship between cognitive and affective processes. Such differences, if found, might provide a basis for more rigorous hypothesis led research. At this stage, the detection and location of differences is the chief preoccupation of the research programme. Furthermore, the exploratory nature of the research, its preliminary status within this particular field, has motivated the decision made to form a preliminary snapshot and survey of different types of episodic/autobiographical memory performance using fairly typical and well-tested paradigms. The research was thus intended as broad in scope, and to generate more specific future research questions.

## *2.2 General Features of the Studies*

### *2.2.1 Design*

These studies in all but one case compare memory performance of individuals grouped according to their emotional processing effectiveness.

### *2.2.2 The Emotional Processing Scale*

The Emotional Processing scale (Baker et al, 2009) is a 25 item tool which aims to measure signs of poor emotional processing. After reflecting on the experiences of the previous week, respondents are presented with 25 statements, and asked to indicate on a ten point rating scale the extent to which the statement is an appropriate description of their affective responses during the previous week, ranging from 0 ('completely disagree') to 9 ('completely agree').

The scale was originally inspired by Baker's (2001) model of emotional processing, itself the product of extensive clinical research as well as a series of factors identified within clinical literature as crucial indicators of poor emotional processing. The current questionnaire reduces the original scale from 38 to 25 items, merging two of the original eight factors into one and introducing a new factor leaving a resulting scale which measures five factors: suppression, unregulated emotion, impoverished emotional experience, signs of unprocessed emotion, and avoidance. Five items measure each factor.

As a 45 item scale, the current 25 item scale's predecessor's concurrent validity was assessed through comparison with related well-established clinical scales probing areas of emotional responsiveness and wellbeing. It achieved high levels of concordance with the Toronto Alexythymia scale ( $r = 0.73$ ), the state of anxiety and depression scale ( $r=0.52$ ) and Courtauld emotional control scale (0.39), with the latter's suppression measure correlating more highly with the emotional processing scale as a whole ( $r =0.61$ ). In terms of reliability, the 45 item scale's internal consistency, indicated through Cronbach's alpha was .89; mean item total correlation was .0.32,; and test-retest scores over a 4-6 week interval with a sample of 17 undergraduates achieved a coefficient for

the total scale of 0.86, with the eight individual factors the 45 item scale measured ranging between .49-.92.

The current 25 item scale, measuring five factors, achieves similar levels of reliability: when assessed with cross cultural samples drawn from UK and Italian populations, internal consistency through Cronbach's alpha achieved 0.9, with mean item total correlation scoring .49. Cronbach's alpha scores for individual factors ranged from .7 to .83. Test-retest reliability over a 4-6 week interval with a sample of 19 participants was .74 for the entire scale, with individual factors ranging from .48 to .84.-

Comparing samples drawn from normal and mental health populations (n 226, and 726 respectively) drawn from Italian and UK, the scale exhibited considerable discriminatory power across all factors (all  $p < .001$ ). (Baker et al., 2007). Based on UK samples percentile norms were established for groups of healthy, pain and mental health individuals. In healthy individuals mean scores across the scale for the 2.2(.55 ), 4.4.(110). for pain 2.8 (70), 5.1,(127.5) 4 (100) and 5.9 (147.5) for mental health groups.

As such, the scale is unique in attempting to provide a global measure of emotional processing style. By using this scale as the principle grouping measure, it is hoped to identify individuals with a discordant relationship with their emotions. By examining how such individuals diverge from normal individuals in their cognitive/mnemonic style, it is hoped that further light can be cast on how in general failures of emotional processing occur and how memory contributes to this.

The total emotional processing score is the sum of responses to all 25 items while the score for each subscale factor is the sum of response to that subscale. Higher scores indicate a higher number of symptoms indicating a poor emotional processing style. Test retest reliability based on a sample of 17 undergraduate students (mean age 25.3,

$SD = 3.2$ ) yielded a coefficient of 0.79 ( $p < .01$ ). As such, the scale is unique in attempting to provide a global measure of emotional processing. By using this scale as the principle grouping measure, it is hoped to identify individuals with a discordant relationship with their emotions. By examining how such individuals diverge from normal individuals in their cognitive/mnemonic style, it is hoped that further light can be cast on how in general failures of emotional processing occur and how memory contributes to this.

### *2.2.3 Grouping Variables*

The studies adopt Baker, Thomas, Thomas, Gower, Santonastaso, & Whittlesea's (2009) Emotional Processing Scale (EPS-25) as a grouping measure, comparing groups achieving high scores, suggestive of a poor emotional processing style, with low scoring groups, suggesting an effective emotional processing style. In order to form the experimental groups used in the studies reported within this dissertation, scores on the emotional processing scale from a large undergraduate population at Bournemouth University ( $N=218$ ; mean age = 22.37 years;  $SD = 6.04$  years;  $F= 156$ ,  $M=62$ ) were obtained through large-scale test administration. These then provided thresholds for group boundaries. Poor emotional processors were defined as those scoring within the highest third of the total range of scores. This was ascertained as 110.67 or above. Effective emotional processors were defined as those scoring within the lowest third of the total range of scores. The threshold here was 80 or below. Thus emotional processing effectiveness was defined in terms of a previously tested sample of a similar population of undergraduate students. Once these boundaries had been established, they were used to assign individuals enrolling to participate within the studies reported in this dissertation to experimental groups and it was on this basis that between group comparisons were made. The threshold established for the effective emotional processing group is comparable to that attained by Baker et al. (2009) for the normal

control group (80 vs. 82.5) whereas the threshold for poor emotional processors (110.67) is somewhat lower than those ascertained for the highest scoring mental health quartile in Baker et al.'s validation study (122.5).

This method of forming experimental groups of course defines poor and effective emotional processors in purely statistical terms based on the distribution of scores across an undergraduate sample. Such a method is susceptible to the objection that it does not accurately identify 'truly' effective or poor emotional processors. Yet, without some independent measure or means of defining an effective or poor emotional processor, it seems hard to understand precisely what, according to such an objection, 'truly' effective or poor means.

It may be that, in future, more extensive sampling reveals that the population parameters to be somewhat different to the levels established within the current sample.

Alternatively, some more advanced psychometric measure of emotional processing may be developed. It may also be that, for some reason, perhaps on the basis of a diagnostic category or a set of symptoms, a linguistic descriptor of a poor or effective emotional processor is preferred as a basis of differentiation. Whilst all of these are possible objections, they do not appear to have a basis in any currently existing research, and the decision to form tercile splits groups appeared the most sensible procedure to adopt.

Nonetheless, to all of these objections, it still might be replied that, however truly effective or poor emotional processing capacity is defined, the method adopted in this study has nonetheless identified *comparatively* poor and effective processors. This is sufficient if we assume a linear relationship between emotional processing capacity and memory performance. That is, the poorer the emotional processor, the greater the tendency to form and retain sensory-perceptual memories. There is no evidence to suggest that this is not the case, or that differences will only emerge with more extreme criterial levels. Of

course, it is perfectly possible that this is the case, but this can only be determined empirically.

Implicit in such objections is the notion that the emotional processing scale is used as a means of identifying independently existing poor and effective emotional processors, a tenable assumption but one that requires further justification. By contrast, within this thesis emotional processing is conceptualised as a linear capacity and that it makes sense to compare comparatively effective emotional processors with comparatively poor when seeking differences in memory performance.

This is not to exclude the possibility that given more extreme levels, say from quartile or quintile splits, differences so slight as to evade detection using the current method might not emerge. Practical difficulties in recruiting sufficient participants to form experimental groups in dictated the method here adopted: groups of participants with more extreme scores could not be found in sufficient numbers.

#### *2.2.4 Stimulus Types*

The studies measure recall and recognition of a number of stimuli and events. The first four studies employ simple pictures and words as stimuli. These are presented as lists of unconnected items. The purpose of such stimulus selection is to investigate whether mnemonic biases emerge spontaneously over simple stimuli which allow little scope for complex meaning based elaboration. As stated, both pictures and words are used in order to establish whether there is a preference for symbolic items over pictorial representations.

The second group of studies consider more complex stimuli, namely laboratory presented and real life events. These represent stimuli of greater temporal duration, and

complexity and allow for some degree of autobiographical elaboration, such that events presented may have significance for experimental participants. The two narratives adopted have neutral and emotional versions to explore the effects emotional arousal may have on the nature of memory encoding. A high degree of stimulus control, in terms of the standardisation of the narrative presented is possible with such materials. In order to provide a greater degree of ecological validity, one study explored how different emotional processors' recall differed for a real life event which was thought to represent a stressful life event, and was recorded in some detail.

The final group of studies consider aspects of autobiographical memory, in which participants largely selected events from their own life and completed questionnaires probing various aspects of the memory quality. These were intended to provide some deeper investigation of how events which had meaning within individuals' lives differed in terms of their phenomenological qualities.

#### *2.2.5 Measures*

The chief measure of interest was in whether participants differed in their propensity to form unreduced, persistent sensory-perceptual representations of events as opposed to reduced semantic/conceptual forms. This hypothesised propensity was explored across a broad range of experimental paradigms investigating various forms of memory. This diversity of methods has meant that no single, consistent measure of a sensory-perceptual style of encoding, or conceptually driven style is applied across studies. Rather, in order to sample a broad spectrum of memory types, measures of this hypothesised tendency are applied which are appropriate to and feasible within the paradigm adopted. An overview of the studies conducted is given in table 2 which lays out how the programme of studies consider a number of variables.

That emotional processing difficulties can be associated with a tendency to encode analogue, sensorily-based information at the cost of conceptual processing, and thus that poor emotional processors will display a greater tendency to encode events in this manner will be explored by comparing the memory features of poor and effective emotional processors across three types of autobiographical memories. Thus a central measure throughout these studies is memory vividness, which is used to reflect the degree of sensory-perceptual information retained from a past experience. This extends a long line of autobiographical memory research, where an interest in vividness of recollective memories is pervasive (Conway, 1990; Pillemer, Rhinehart, & White, 1986; Brown & Kulik, 1977; Heuer & Reisberg, 1990; Neisser & Harsch, 1992; Rubin & Kozin, 1984). Furthermore, vividness is frequently operationalized in terms of the availability and clarity of sensory perceptual details upon recollection. Brown and Kulik (1977) refer to vividness as implying 'photographic recall' of an event; Rubin and Kozin's vividness dimension essentially rates the availability and precision of a mental image (1984); Talarico and Rubin's (2003) questionnaire study requires participants in assessing the vividness of their memory to rate how much they can 'see it' 'hear it' and 'know the setting'. More recently, Talarico, Labar and Rubin, (2004) explicitly equate vividness as the amount of perceptual or sensory detail a memory contains (p.1120) and their autobiographical memory questionnaire merges measures tapping the availability of sensory perceptual detail into a single vividness measure.

If poor emotional processors are comparatively deficient in their ability to reduce complex, sensory- perceptual events and stimuli into coherent, semantically based narratives, then, it is reasoned, such deficiencies will be reflected in phenomenological aspects of those memories, resulting in greater sensory-perceptual detail, and impaired narrative/conceptual coherence. The following three studies explore how groups differ in phenomenological measures of memory vividness and memory coherence, both taken to

reflect the operation of a sensory-perceptual and conceptually driven memory style respectively. Furthermore, as in study 7, the studies include supplementary exploratory measures which tap features known to influence the availability and accuracy of memories which may help to explain differences between groups' memory performance. These measures include emotionality, rehearsal, recency and valence.

#### 2.2.6. *Presentation Order of the Studies*

The large numbers of participants involved, fairly narrow windows in which they would be available for testing, along with logistical and scheduling difficulties meant that the entire series of studies was organised and planned in advance according to a predetermined schedule. As a result, analysis was completed once data for all studies had been gathered. Whilst a more spontaneous approach might have allowed questions thrown up by particular findings to be pursued, study designs to be adapted, and more acute hypotheses to be tested, it was regrettably not possible given such restrictions.

The order of presentation of the studies within this dissertation does not therefore reflect the *chronological* sequence in which they were conducted, but, rather, *the degree of complexity* of the stimuli adopted within the studies. Increasingly more complex, naturally occurring, and authentic materials were adopted in the hope of thereby gaining greater insight into the everyday processing of mundane materials. Thus, studies 1-4 concern recognition of discreet, non-complex, laboratory presented pictures and words. Studies 5-7 present more complex narratively structured events, either experimentally controlled, or, in the case of study 7, a naturally occurring event which was monitored and recorded by the experimenter. Studies 8-10 investigate through questionnaire participants recollections of events drawn from their own lives.

*Table 2 : Overview of studies conducted and reported on within this dissertation*

<i>Experiment</i>	<i>Stimulus type/ manipulation</i>	<i>Stimulus complexity</i>	<i>Arousal level</i>	<i>Control of stimulus</i>	<i>Retention interval</i>
Episodic memory study (1)	Word lists	Simple	Low	Experimentally controlled	Short (45 minutes) to intermediate (1 week)
Verbal/picture memory (2)	Word lists/pictures	Simple	Low	Experimentally controlled	Short (45 minutes) to intermediate (1 week)
Verbal transfer (3)	Picture	Simple	Low	Experimentally controlled	Short (45 minutes) to intermediate (1 week)
Arousal verbal transfer (4)	Picture	Simple	High	Experimentally controlled	Short
Visually induced arousal slide show (5)	Narrated slide show	Complex	High (low in control)	Experimentally controlled	Short (45 minutes) to intermediate (1 week)
Verbally induced arousal slide show (6)	Narrated slide show	Complex	High (low in control)	Experimentally controlled	Short (45 minutes) to intermediate (1 week)
Event memory (7)	Publicly experienced event	Complex	High	Recorded/non controlled event	Long (8 months)
Autobiographical Memory test (8)	Cues: autobiographical memory	Varied	Varied	Experimentally controlled	Varied
Flashbulb memory study (9)	Novel event	Complex	High	Authentic non controlled event	Long (various)
Traumatic memory study (10)	Traumatic event	Complex	High	Authentic non controlled event	Long (various)

As the ecological validity of such stimuli increases, so diminishes the degree of experimental control, as well as the capacity to exclude extraneous factors which might influence memory performance. It was hoped within the first four studies to obtain a relatively 'pure' measure of groups performance albeit over materials unlikely ordinarily to exercise individuals' memory.

An overview of the studies conducted is presented in table 2.

### *2.2.7. Ethical Measures and Participant Screening*

Ethical approval was obtained for all of the studies described. Studies were advertised on a participant recruitment system where an outline of the task type was provided as well as the type of memories likely to be probed. Once participants had registered to participate, they were contacted by email and given further details of the type of task involved, and reminded of their freedom to withdraw from the study, or to withdraw any data they had provided, without having to provide any explanation and without any impairment of their position within the department. This was reiterated at study, where participant consent was obtained. In those studies where emotional material was presented and probed, (4,5,6, 8 & 9) contacts for University counselling service, and experimenter contact information was provided at debriefing.

For study 6 (verbally induced emotional slide show), participants were screened using the Beck Hopelessness Scale (Beck, Weissman, Lester, & Trexler, 1974). This was chosen as the themes of hopelessness and despair regarding the future were precisely those conveyed in the narrative involved in the study, corresponding to those feelings which the Hopelessness scale identifies. The scale correlates moderately with the Beck Depression Inventory, and excludes some of the items measuring physical symptoms and

somatisation markers for which the BDI has been criticized and which impair its validity. As participants for both studies 4 and 5 were drawn from the same pool, the Beck Hopelessness Scale was administered to participants for both studies (although Reisberg's materials in no previous replication have been deemed disturbing enough to merit screening measures). No participants scored above the screening threshold, and thus could be randomly assigned to control or arousal groups.

For study 10, (representations of traumatic memories) participants were advised both before and at study of the nature of the memories being probed, and given repeated opportunities to withdraw from the study. At the study, participants were given a choice to participate or complete a flashbulb memory questionnaire (study 8). The element of self-selection involved amongst participants was thought a price worth paying to ensure no participant felt compelled in any way (although participants were repeatedly advised of their freedom to withdraw) to write about personal traumatic experiences. After the study, participants were given contact information for counseling services, all data was coded and confidentiality of information provided was throughout the study stressed.

## Chapter 3. Studies 1-4: Effects of Emotional Processing Style on Recognition of Words and Images

### *3.1 Studies 1-4: Introduction.*

Many of the effects which emotional events are reported to have on memory quality have been described in section 1.3. Particular features, such as heightened vividness, and a preponderance of sensory-perceptual detail might, it could be argued, arise for reasons extraneous to the event, which have little to do *per se* with how emotion and memory interact. Thus, in general terms, one may argue that emotional events tend to be significant or consequential, with social or personal implications which will promote their likelihood of being rehearsed, or elaborated (Reisberg & Heuer, 2004). Such rehearsal may take a number of forms. Within therapy, patients may be encouraged to revisit and discuss traumatic events. Accidents or crimes may *require* such rehearsal as they are investigated by official bodies. Alternatively, emotional events may be more noteworthy and promote discussion and description. Or, most straightforwardly, it may be that emotional events simply attract more reflection and discussion subsequently (Reisberg and Heuer, 2004). All or more of these factors may combine to ensure that emotional events are better remembered, subjected to more scrutiny, and that sensory-perceptual detail is promoted as a feature of emotional events along with other aspects of recollection. For all of these reasons emotional memories may be more vividly recalled as a result of increased rehearsal and the greater scrutiny given to an event's distinctive features.

Whilst such an account is unsatisfactory for a number of reasons, it, or approaches broadly similar have been employed to argue against both the distinctiveness of flashbulb memories and traumatic memories as a class of recollection (Shobe, &

Kihlstrom, 1997; Porter & Birt, 2001). They do not however address the particular pattern of memory, the predominance of sensory -perceptual detail, which emotional events reportedly produce (Christianson, 1992), nor how certain memories appear inaccessible to conscious retrieval, (Brewin, 2001a) and thus incapable of being extensively rehearsed (Ehlers and Clark, 2000).

An alternative account, and one that has been sketched in the introduction and in section 1.1.6, would see the increased sensory-perceptual features of emotional memories as reflecting the operation of a cognitive-mnemonic system, whose aim is to preserve maximum information regarding situations or sources of high reward or threat (e.g. Brewin, 2001a; Brown and Kulik, 1977; Livingston, 1967). The bases of such a cognitive-mnemonic system are presumably phylogenetically primitive and predate language or sophisticated conceptual understandings of the environment. The disadvantage of such a system are it encodes memories and information regarding sources of threat or reward in a comparatively unsophisticated, superficial way retaining information primarily perceptual in nature. In extreme instances this becomes difficult to retrieve, and to reduce to conceptual/semantic forms, and as a result emotional experiences are poorly integrated within broader knowledge structures of one's environment and life. These may render them resistant to cognitive intervention and impenetrable to reflection. Emotional responses may occur to future stimuli in an inappropriate way, on the basis of superficial similarity, rather than on a more meaningful basis. Such a view has the advantage of explaining many features of poor emotional processing.

The following four studies approach the issue raised by these two rival accounts by considering recognition memory and comparing groups of poor and effective emotional

processors. The four studies explore what memory differences may emerge between groups for relatively simple items, presented over brief exposures, which deliberately preclude the possibility of extensive rehearsal, personal significance, arousal and emotional involvement. These latter factors may complicate the question of why particular aspects of an event – or indeed particular events – are more memorable. Thus the following studies aim to compare emotional processing groups, rather than types of event, in order to explore whether a sensory-perceptual style of memory will emerge at the basic level of simple, laboratory controlled, discreet and thematically unconnected items.

It is hypothesised that poor emotional processors, individuals reporting symptoms or inadequate assimilation of emotional events, are more likely to exhibit a sensory-perceptual style of memory for events. The key features of a sensory-perceptual style of memory are a heightened tendency to retain stimuli in an analogue, sensorily-rich and less cognitively processed form. The corollaries of this are that poor emotional processors will form more vivid memories, prefer sensorily-rich over semantic stimuli, and show less evidence of semantic processing of stimuli. These three aspects are specifically explored within the following studies.

The following studies aim to achieve a high degree of control of the stimulus types, adopting an item-list presentation paradigm, in which words or pictures are presented to participants and their retention tested by recognition measures at intervals of either 45 minutes or one week. Stimuli are briefly and sequentially presented in lists of 100 items; recognition is then assessed through test lists comprising both novel and previously presented items. Participants are given no explicit instructions to memorise items, but instructed simply to pay attention to the stimuli as

they may be asked about them subsequently. The adoption of such simple stimuli with no inter-item connections aims principally to eliminate the extent to which meaningful elaboration of the stimuli might occur; as items are not thematically or narratively linked. To reduce the effects of arousal the stimuli are low-valenced, non-arousing items. The two retention intervals are adopted, at 45 minutes and 1 week, to explore how memory consolidation processes, thought to begin three hours following an event (Dudai, 2004) affect recognition memory.

The particular measures the studies adopt to assess different aspects of a sensory-perceptual memory style will vary according to the paradigm adopted. First by comparing remember and know judgements some measure of memory vividness is explored. Further, by comparing the type of stimuli optimally remembered by different groups, a measure of stimulus preference is considered. Finally by exploring how pictorial stimuli are retained, and accessed by varying cues, how stimuli are processed following encoding is considered.

### *3.2 Study 1: Effects Of Emotional Processing Style On Autonoetic Recognition*

#### *Judgements*

##### *3.2.1 Introduction*

###### *3.2.1.1 Episodic Memory judgements*

The concept of episodic memory originates in Tulving's (e.g. 1972, 1983, 1984, 2002) body of research which originally distinguished two types of memory, semantic and episodic, a distinction which previous theory had to some extent elided. Episodic memory results from personal acts of recollection, enabling 'mental time travel' (2002, p.3) producing memories which comprises a sense of 'pastness', a sense of the self as the experiencing agent, spatio-temporal location, and sensory-perceptual details. Tulving, on the basis of extensive experimental research (for a review see Gardiner & Richardson-Klavehn, 2000; Neely, 1989), neurocognitive evidence (Cabeza & Nyberg 2000; Kapur, Craik, Tulving, Wilson, Houle, & Brown, 1994; Moscovitch, Kapur, Kohler & Houle, 1995; Nyberg 1998; Raichle 1994; Schacter and Tulving, 1994), and clinical dissociations in memory performance (Calabrese et al. 1996, Cermak & O'Connor 1983; Kopelman, Stanhope & Kingsley, 1999; Rousseaux, Godfrey, Cabaret, Bernati & Pruvo, 1997; Squire, 1992), sees the distinction as grounded in two separate 'mind-brain' systems.

Nonetheless, other theorists have come to see this distinction as problematic. Some (e.g. Cohen, 1984) see it as simply descriptive, others as a product of task demands (e.g. Anderson & Ross, 1980; McKoon, Ratcliff & Dell, 1986). One of the most recent and thoughtful reviews of the episodic semantic memory distinction proposes that the

difference between episodic and semantic memory consists principally in how events are processed and abstracted over the course of experience. Conway and Pleydell-Pearce (2000), thus, argue that episodic memory is essentially and initially constructed of sensory-perceptual knowledge of events and experiences captured within a recency timeframe. Ordinarily such information is retained over brief periods before decaying: occasionally such memories attain relative permanence when anchored to broader autobiographical structures and significant events of one's personal past.

The transitoriness of typical sensory-perceptual (episodic) memories is thought to arise from the fact that complex sensorily-rich details of phenomenal experience are largely irrelevant to the broader goals and plans of the individual over the ordinary course of experience and their retention likely to impose an excessive burden on memory resources. The reduction of recollective experience to semantic knowledge (i.e. from remembering to knowing that something happened) has been identified as a typical process occurring in the course of learning (Conway, Gardiner, Perfect, Anderson, & Cohen, 1997; Dewhurst, Conway & Brandt, 2009; Herbert & Burt, 2001). Thus, it has been argued semantic memories are abstractions of episodic memories involving knowledge schematisation rather than products of a particular and distinct memory system.

Accordingly, one may claim that the persistence of recollective experience within auto-noetic memories, may result from a failure to reduce such memories to more compact semantic forms which preserve in a symbolic format (i.e. in language and schemata) representations of events and one's environment.

This failure has, as has been argued in section 1.6 and 2, been implicated within emotional processing deficits. A surfeit of vivid sensory-perceptual details can characterise traumatic recollection of distressing experiences which may take the form of flashbacks and intrusive memories; emotionally arousing events frequently produce vivid recollections. A relative impoverishment of in the semantic processing of distressing events appears to be a hallmark symptom of certain psychopathological conditions.

Thus it has been argued in section two that emotional processing difficulties may be associated with a comparatively poor capacity to recode sensory-perceptual memories to symbolic more abstract formats. Such a view sees sensory-perceptual features encoded at the expense of conceptualisation and semantic processing of experiential data, which inhibits higher level meaningful elaboration of experience, which would enable sense to be made of past experience and the appropriate regulation of future emotional responses. This approach sees sensory-perceptual encoding as causally implicated in the generation of emotional processing difficulties by producing representations of past experience that are more difficult to integrate into autobiographical knowledge structures, poorly understood, difficult to retrieve and which may generate erroneous and inappropriate reactions to future encountered stimuli on the basis of superficial similarities to past experience.

Episodic word list experiments present participants with a series of words and then require them to state from a test list presented after a set interval which of the items they have previously seen, reporting whether they *remember* or simply *know* that an item was presented previously. Thus recollection of ‘miniature episodes’ (Conway, 1991) – discreet items, with no meaningful associations, presented at short durations and tested

over a stipulated interval – is examined, over which a high degree of experimental control is possible.

The distinction between 'remember' and 'know' judgements is thought to probe the operation of episodic or semantic memory respectively (Tulving, 2002). 'Remember' judgements are thought to occur when participants retain vivid (e.g. Rajaram, Hamilton and Bolton, 2002) recollection of the learning episode such that contextual elements of the situation is preserved. 'Know' judgements reflect a far less distinct trace: a feeling of familiarity which does not reflect auto-noetic consciousness. Whilst this distinction relies essentially on phenomenological report, abundant evidence exists to suggest that it is a distinction which is both meaningful to participants and can be successfully reported within experimental tasks (Gardiner, 2001).

The following study compared the relative availability of recollective experience (auto-noetic knowledge) for poor and effective emotional processors following exposure to a list of low frequency, non-valenced words, in order to compare the relative incidence of auto-noetic memories across groups of poor and effective emotional processors. If remember judgements are taken to reflect the persistence of a memory trace in a relatively unprocessed form, it is predicted that poor emotional processors will retain a higher proportion of such memories. These differences may then reflect comparative deficiencies within poor emotional processors to process, reduce and abstract experience such that it takes a semantic and less vivid form.

### *3.2.2.2 Priming effects*

Susceptibility to priming has been specifically implicated in the development of post-traumatic stress disorder. Ehlers and Clark (2000) suggest that during trauma

particularly strong stimulus-stimulus and stimulus-response associations are developed during the events (similar suggestions are made by Foa, Steketee, & Rothbaum, 1989; Keane, Zimering, & Caddell, 1985). Furthermore, it is claimed that heightened perceptual priming for stimuli associated with the event is induced within traumatic experiences. These strong priming effects, it is proposed, result in the various re-experiencing symptoms described in section x when superficially similar environmental cues are encountered following the trauma and the original memory reactivated.

It has been suggested in the previous section that emotional dysregulation and failure to assimilate emotionally disruptive events may be associated with a sensory-perceptual style of memory encoding, and that greater conceptual processing of events may bring certain protective benefits. Priming could be understood as representing an extremely superficial form of processing, such that conscious awareness, and conceptual processing of stimuli are not recruited in the formation of memory representations. As such, if poor emotional processors are predicted to show a sensory-perceptual bias in memory encoding, and if priming effects are implicated in the development of extreme disruptions of emotional processing (e.g. PTSD) the following study also aims to examine whether poor emotional processors are more susceptible to priming effects than effective emotional processors.

The following study aims to explore how individuals with poor emotional processing styles differ in their performance on remember/know and fragment completion study when compared to a normal sample of individuals. The study adopts a word-list paradigm using materials developed by Tulving (1982) requiring participants to state whether they 'know' or 'remember' having seen a particular word at presentation. This

is followed by a word fragment completion task in order to measure priming effects.

The stimuli are words, presented for short periods and tested over short intervals.

### *3.2.2 Method*

#### *3.2.2.1 Participants.*

Participants (N=82; Mean age=22.49 years; *SD*=3.18 years; M=16, F=66) were undergraduates from Bournemouth University, mostly comprising psychology students who took part for course credit, or students from software systems courses participating voluntarily. Data from participants who reported dyslexia or difficulties with reading, or whose first language was not English were not included for analysis.

#### *3.2.2.2 Design.*

Participants viewed wordlists and after a retention interval of either forty five minutes or a week were required to state from a test list which of the items had been presented before, then to complete word fragments half of which were resolved by words previously presented. A 2x2 ANOVA design was used to analyse data for each measure with factors of emotional processing group (effective vs. poor) and retention interval (45 minutes vs. 1 week). There were two dependent variables: Correct know judgements as a percentage of total correct judgements (know and remember combined) and percentage of primed correctly completed fragments as a percentage of total correctly completed fragments.

#### *3.2.2.3 Materials and procedure.*

Participants had previously completed Baker's 25 item emotional processing scale and those scoring within the highest or lowest tercile range (<80, >110 respectively)

selected to participate and randomly assigned to either the short or long retention interval group.

This study used the 192-item list of 7-8 letter nouns Tulving, Schacter and Stark compiled for their 1982 priming study and reused in later studies (e.g. Sloman, Hayman, Ohta, Law & Tulving, 1988; Hintzman & Hartry, 1990). Words in this list occurred with low frequency in English and produced fragments which allow only one legitimate completion. For the present study the list was revised by removing obsolete words, words unique to or more current in American usage and proper nouns. From the original list of 192 words, 160 were retained and forty low frequency nouns of 7 or 8 letters added with similar word frequencies of those items they replaced. Ratings were determined by Birmingham University Titania Corpus word frequency rankings, and arranged into two lists matched for frequency (see appendix A for the two lists used in this study).

Participants viewed one of the two lists, each composed of 100 items taken from the original word bank. Instructions displayed on a computer monitor informed participants that they were about to see a series of words to which they should pay attention as they may be asked about them at a later stage. Each word was then displayed for five seconds. Items were shown in Times New Roman font, size 34, and displayed using a Powerpoint presentation program. Stimuli were presented on a 17-inch computer screen using an HP Compaq dc7900, 2.2 Ghz computer, with a resolution of 1440 x 900 pixels.

Following this, participants then completed a questionnaire not forming part of the study currently being reported which took between 30 and 40 minutes to

complete. Forty-five minutes after presentation, participants were presented with a test list of 80 items. Forty of these items had been viewed at presentation, 40 were novel 7-8 letter nouns taken from the word bank. For each item participants were instructed to provide one of five responses by ticking one of the following:

- a. I remember seeing this item.*
- b. I know that I have seen this item (but don't remember it).*
- c. I think I saw this item.*
- d. The item was not there.*
- e. I don't know.*

Both responses a. and b. identified the dependent variables of interest (remember and know judgements respectively). Response c. was included to ensure that participants did not include under 'know' or 'remember' judgements uncertain or dubious responses, thus allowing 'remember' and 'know' judgements to make relatively pure phenomenological reports. An example was provided to explain the difference between remembering and knowing. Participants could then proceed at their own pace, clicking a mouse to see each new item and recording responses in a booklet.

Printed lists of 40 word fragments were then presented to participants, 20 of which could be completed uniquely by words seen at presentation, 20 of which were fragments of new items taken from the stimulus bank. Word fragments had been devised to allow only one legitimate solution. Participants were given twenty minutes to complete as many fragments as possible.

Examples of the word fragments with their solutions in brackets are shown below:

\_EX\_C\_N → (LEXICON)  
S\_ \_ \_ FF → SHERIFF

BA\_ \_E\_ OR → BACHELOR

HO\_ \_ \_ ON → HORIZON

\_RI\_Y\_ \_ \_ → TRICYCLE

### 3.2.3. Results

#### 3.2.3.1 Remember/know judgements

Incorrect remember and know judgements were subtracted from correct remember and know judgements, a procedure fairly common within this paradigm (e.g. Gardiner & Java, 1993; Gardiner, Gregg & Hampton, 1988). These totals were then combined to form an overall correct response total and the percentage of remember judgements calculated from this total. Descriptive statistics are shown in Table 3.

*Table 3:* Mean percentage of remember responses (and standard deviations) for emotional processing groups across intervals.

<i>Retention Interval</i>	<i>Emotional Processing Group</i>		
	<i>Poor</i>	<i>Effective</i>	<i>Total</i>
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>
<i>45 Minutes</i>	67.92 (7.66)	62.32 (11.75)	64.98(10.29)
<i>1 week</i>	70.07 (12.9)	71.91(13.26)	70.92 (12.93)
<i>Total</i>	69.02 (10.6)	66.63 (13.21)	

A two-way ANOVA with factors emotional processing group (poor vs. effective) and retention interval (45 minutes vs. 1 week) was carried out. The main effect for emotional processing group on percentage of remember judgements was not significant,  $F(1, 78) = 2.85, p = .09$ . A significant main effect for interval was found on percentage of remember judgements,  $F(1, 78) = 15.69, p < .01$ . The interaction between emotional processing group and retention interval on the percentage of remember judgements approached significance,  $F(1, 78) = 3.93, p = .051$ .

### 3.2.3.2 Fragment completion.

To obtain an accurate score of priming susceptibility correctly completed fragments for previously presented words were calculated as percentages of total correct fragments. Descriptive statistics are shown in Table 4.

Table 4: Mean percentage of primed fragments (and standard deviations) from total fragments completed acrossgroups and intervals.

<i>Retention Interval</i>	<i>Emotional Processing Group</i>		
	<i>Poor</i>	<i>Effective</i>	<i>Total</i>
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>
<i>45 Minutes</i>	10.25 (3.75)	6.30(6.21)	
<i>1 week</i>	7.62(5.55)	8.11(5.29)	
<i>Total</i>	8.90(4.89)	7.16(5.79)	

A two-way ANOVA with factors emotional processing group (effective vs. poor) and retention interval (45 minutes vs. 1 week) did not reveal a significant main effect for emotional processing group on percentage of primed fragments completed,  $F(1, 78) = 0.27, p >.05$ . A significant main effect for retention interval was found on percentage of primed fragments completed,  $F(1, 78) = 9.24, p <.05$ . The interaction between emotional processing group and retention interval on the percentage of remember judgements was not significant,  $F(1, 78) = .03, p >.05$ .

### 3.2.4 Discussion

#### 3.2.4.1 Episodic memory

There was evidence of an interaction closely approaching statistical significance, such that, over short intervals, individuals with a poor emotional processing style reported a higher percentage of remember judgements than know judgements.

Following Conway (2001), we may conceptualise episodic memory as comprising detail rich experience near records of experience. The ordinary fate of such memories is to decay unless elaborated and anchored to significant life events, or reduced to semantic memory forms. As such, the increased percentage of know judgements over longer intervals may be seen as confirming Conway's view: vivid, sensory-rich memories are expected to persist over periods of minutes and hours: know judgements might be expected to increase in percentage terms.

Whilst the interaction observed merely approached significance, it may be suggestive of a tendency amongst poor emotional processors to form more vivid memories, accompanied with more attendant details and auto-noetic knowledge. This retention of sensory-perceptual and irrelevant details may suggest a comparative deficiency in reducing memories, or to recode memories to semantically based formats. As these differences only emerged over short intervals, before presumed periods of consolidation occur, they may point to a relative automaticity in the reduction of memories amongst efficient emotional processors.

If, as has been argued above, we understand emotional processing difficulties as partly associated with a failure to reduce sensory-perceptual experience to a more abstractive reduced basis, then there appears to be some slight suggestive evidence of a processing difference between groups which would support this assumption.

Yet why were such differences not observed over longer intervals? It seems reasonable to assume that most of the material ordinarily encoded in memory does not persist in vivid auto-noetic forms producing 'remember' rather than 'know' judgements.

Rather, the transference of episodic to semantic knowledge is seen by some as typical of mnemonic processing (Gardiner, 1988; Gardiner & Java, 1991; Hockley & Consoli, 1999) with evidence existing that remember responses transfer to know responses over one week retention intervals with a concomitant loss in specific episodic information (Knowlton & Squire, 1995). The persistence of such rich memory forms would presumably take up an inordinate amount of storage and processing capacity; thus, from an efficiency point of view one might expect such a decline, particularly for the type of materials adopted in this study, i.e. disconnected discrete words with little personal significance or coherence.

There seems no *a priori* reason to assume that any of the factors typically seen to promote remember over know judgements would have been adopted by poor and not efficient emotional processors: greater depth of processing was to some extent precluded by the short duration of item presentation, and the quantity of stimuli presented. The possibility that poor emotional processors were more emotionally aroused by the study situation, could, in part account for differences observed, but would not explain the decline in remember judgements over longer intervals. Furthermore, there is no necessary connection between emotional arousal and having a poor emotional processing style, so there is no reason to assume the contribution of emotional arousal. The possibility that poor emotional processors were simply trying harder, and paying more attention to the stimuli is further not predictable from the literature. Such a pattern of behaviour might be expected from repressors, and other populations scoring high on social desirability measures, but cannot be expected of poor emotional processors as a group.

The stimuli used, adapted from Tulving, Schacter and Stark (1982), had the virtue of being low frequency items, comparatively rare, and thus likely to be distinctive. As such, it was presumed they would have a greater likelihood of producing episodic memories, which more frequent and commonly encountered materials might not have created. This, it was hoped, would reduce the possibility of interference from other sources and enable the formation of distinct remember judgements. Their second virtue was to enable unique fragments for the fragment completion task.

#### *3.2.4.2. Fragment completion.*

Whilst there was evidence that over longer testing intervals the effects of priming diminished significantly, there was no evidence to suggest any main effect of group or interaction between group and interval upon the completion of word fragments resolving previously presented words. Priming is a notoriously polysemous construct (Tulving, 2000) and the tests adopted to measure priming effects equally diverse. The assumptions within the present study were that previous exposure to a word would facilitate subsequent completion of a fragment. Across groups, there appeared to be evidence of such facilitation although poor emotional processors were not especially facilitated when compared to effective emotional processors. The possibility that priming induces an unconscious alteration in behaviour on the basis of information poorly represented at a conscious level seems particularly applicable to failures in emotional processing. Nonetheless, no evidence was found for such effects within the paradigm adopted.

### 3.3 Study 2: *Effects of Emotional Processing Style on Recognition of Verbal and Pictorial Items*

#### 3.3.1 *Introduction*

Strong associations between imagery and the affective responses have been established through recent studies within psychopathological and emotions research (Mathews & MacLeod, 2002; Holmes & Mathews, 2005; Holmes, Geddes, Colom & Goodwin, 2008). Holmes and Mathews (2010) speculate that affective mechanisms may be particularly responsive to imagery than other, later evolving representational systems, which have abstractive, symbolic bases (similar suggestions are made by Mathews & MacLeod, 2002, and Ohman and Mineka, 2001).

*Prima facie*. images seem to have more in common with objects ordinarily encountered within the environment than words. They comprise analogue rather than symbolic representations of objects, and contain more sensory-perceptual detail than words. Images, too, may require greater elaboration to be reduced into symbolic format than word forms which can be more easily read and converted into phonological code. Images thus seem more likely to leave vivid memories than words by exploiting a broader range of coding types (Paivio, 1986).

The following study considered whether poor compared to effective emotional processors display a preference in recognition memory for previously presented images over previously presented words. The rationale behind this investigation comes from a number of sources. First, emotional memories tend to be vividly recalled displaying a preference for sensorily based details than semantic, verbally based information

(Christianson, 1992). Second, research exploring how emotional events affect memory suggest dissociations in recall and recognition between verbal and visual elements (Reisberg, 2004). Third, the much discussed distinction between perceptual and conceptual processing suggests that some facilitatory benefits derive from individuals conceptually processing events and allow them to be more effectively processed. One rudimentary way in which this may occur is through some verbalisation, labelling, or categorisation of experience, however rudimentary or conscious this may be. If this is deficient in poor emotional processors, then words, whose recall is thought to be enhanced by phonological rehearsal, would presumably be less memorable for poor emotional processors than effective emotional processors. Fourth, a number of theories of emotion reviewed in section 1.1.6 see sensorily based, analogue representations derived from experience and preserved in memory as directly productive of emotional responses which are frequently implicated within pathological conditions of emotion dysregulation. To the extent that emotional processing difficulties can be understood as resulting from the automatic generation of emotion which bypasses voluntary control, and that this is achieved through sensorily based analogue representations of events, it may be surmised that individuals poor at emotional processing retain analogue representations (e.g. pictures) in preference to conceptual ones (e.g. words).

It was hypothesised that poor emotional processors might show a greater tendency to encode and retain images over words, exhibited in a greater recognition bias for images over words. The following study continued the basic item list paradigm adopted in the previous study yet altered the presentation stimuli to include both images and words.

### 3.3.2 Method

#### 3.3.2.1 Participants.

Participants (N=86; mean age = 23.9 years;  $SD = 8.2$  years; M=24, F=62) were undergraduates from Bournemouth university, mostly comprised of psychology students who took part for course credit. Participants had been preselected for scoring high or low on Baker's (2009) Emotional Processing Scale. Data from participants who reported dyslexia or reading difficulties or whose first language was not English were excluded from analysis.

#### 3.3.2.2 Design.

Participants viewed a mixed list of images and words. Independent variables were emotional processing scores; dependent measures were percentage of correctly recalled images out of total of correct items. A 2-way ANOVA with factors interval (45 minutes vs. 1 week) and emotional processing group (effective vs. poor) was used.

#### 3.3.2.3 Materials and procedure

*Stimuli.* The first two hundred nouns denoting concrete objects for which pictures with a high degree of fit could be found were drawn from the Titania Frequency word bank corpus (University of Birmingham, 2009). These formed the image and word bank from which lists were drawn (see appendix B).

Pictures depicting these nouns were found and tested within a pilot study (N=12, mean Age: 35.4 years;  $SD = 7.2$  years) where they were presented to participants who were required to name the object they depicted. Pictures which were ambiguous or required more than 2 seconds to name correctly were eliminated from the image bank. Nouns

which could not be easily or unambiguously depicted pictorially were also eliminated. Thus, by selecting high frequency nouns, and images which readily depicted them, it was intended to ensure that words were neither obscure, difficult to retrieve and that there was a high degree of fit between image and noun.

*Presentation.* Participants were informed through instructions on a computer monitor that they were about to see a series of items to which they should pay attention as they might be asked about them later. Participants were presented with one of four stimulus lists. Stimulus Lists were matched for frequency and consisted of fifty words and fifty images, each depicting or naming a different item drawn from the original two hundred noun list. Pictures alternated with words and each item was displayed for five seconds using PowerPoint software on computer monitors with a resolution of 1440 x 900 pixels. Words were displayed in capitals, Times New Roman font size 34. Images were displayed at sizes between 13cm and 10.67cm and 15cm by 12.3cm. Participants then completed a writing task not forming part of the current study which lasted approximately 35 minutes. After forty five minutes, participants viewed a test list comprising 100 items. These consisted of fifty images and fifty words, half of which had been presented at study, and half of which were novel, all taken from the original word/image bank. For each item participants were instructed to indicate whether they had seen the image or word presented, by marking *yes*, *no*, or *don't know*. Participants could then proceed at their own pace, clicking a mouse to see each new item and recording responses in a booklet.

### *3.3.3 Results*

Correctly recognised pictures and correctly recognised words were totalled together for each participant to arrive at a total correct score. False positives were subtracted as in

study one. The percentage of total correctly recognised pictures was calculated from the total correct score and compared across groups and intervals. Descriptive statistics are shown in Table 5.

*Table 5: Mean correctly recognised pictures (and standard deviations) as a percentage of total items across intervals and emotional processing groups*

<i>Retention Interval</i>	<i>Emotional Processing Group</i>		
	<i>Poor</i>	<i>Effective</i>	<i>Total</i>
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>
<i>45 Minutes</i>	67.92 (7.66)	62.32 (11.75)	64.98(10.29)
<i>1 week</i>	70.07 (12.9)	71.91(13.26)	70.92 (12.93)
	69.02 (10.6)	66.63 (13.21)	

A two-way ANOVA with factors emotional processing group (high vs. low) and retention interval (45 minutes vs. 1 week) was conducted on percentage of pictures from total items correctly recognised. A significant main effect was found for retention interval  $F(1, 77) = 5.18, p <.05$ . No significant main effect was found for group,  $F(1, 77) = 0.53, p >.05$ , nor was any interaction between group and retention interval detected,  $F(1, 77) = 2.08, p >.05$ .

Adopting an alternative method of calculating encoding preference for pictures overwords, by subtracting totals of words from totals of pictures, no main effects of group or interval were found,  $F(1, 75) = 2.11, 0.12$ ) respectively,  $p >.05$ ; although the interaction did approach significance,  $F(1, 75) = 3.48, p =.64$

### *3.3.4 Discussion*

The higher percentage of pictures remembered by poor emotional processors compared to effective emotional processors (67.92 compared to 62.32) did not achieve statistical significance and was not apparent over longer intervals. A picture superiority effect (Paivio, 1986), such that words were recognised less effectively than pictures, was apparent for both groups at both intervals, and over one week retention interval there

was a significant increase in the percentage of pictures recalled out of total correct judgements. Descriptive statistics are shown in Table 6.

*Table 6: Mean scores (and standard deviations) for words subtracted from pictures across groups and retention intervals*

<i>Retention Interval</i>	<i>Emotional Processing Group</i>		
	<i>Poor</i>	<i>Effective</i>	<i>Total</i>
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>
<i>45 Minutes</i>	10.25 (3.75)	6.30(6.21)	
<i>1 week</i>	7.62(5.55)	8.11(5.29)	
<i>Total</i>	8.90(4.89)	7.16(5.79)	

### *3.3.4 Discussion*

The assumption that poor emotional processors would display a mnemonic bias towards pictures over words was thus not borne out. This hypothesis rested on the assumptions that by producing richer memory traces which would not be reduced to a more abstracted basis, pictures would compete for memory resources with verbal items and leave stronger traces which would result in a lower percentage of correctly recognised words. It was also assumed that verbal items were more likely to produce phonological encoding repetition to assist memory formation, to be recalled and that this would be less ion evidence within poor emotional processors.

Nonetheless picture superiority effects may have overwhelmed and masked any processing differences between groups and thus obscured between group differences. It is also possible that, if effective emotional processors are processing visual stimuli more than poor emotional processors, then by articulating, labelling or somehow conceptually processing pictures, a superiority of recognition for both pictures and words might be expected, which would undermine any group differences. Furthermore, the small differences observed over shorter retention intervals which, without achieving statistical significance, supported the prediction, may become more marked if items were displayed for shorter periods (five seconds was chosen somewhat arbitrarily) and in

greater number. The five second presentation period may have enabled intentional encoding strategies to be used by participants. This may have meant the study misrepresented how participants ordinarily encode features of their environment.

### *3.4 Study 3: Effects of Emotional Processing Style on Verbal Encoding of Pictorial Stimuli*

#### *3.4.1 Introduction*

Whilst the previous study aimed to probe a processing of stimuli in a rather indirect manner, arguing that verbal cues could be encoded and retained only if pictorial stimuli were effectively reduced and that competition between verbal and pictorial stimuli would result in phonological encoding enabling effective emotional processors to retain a greater number of words than poor emotional processors, the following study aims to explore more directly this process of reduction and stimulus processing.

Emotional processing difficulties may arise from a relative inability to reduce analogue sensory forms to symbolic codes (e.g. Bucci, 1997; Barnard & Teasdale, 1991; Power & Dalgiesh, 1997; Teasdale, 1993, 1999; Teasdale & Barnard, 1993). This may result in comparatively enduring vivid sensory-perceptual memories, which retain a high degree of detail in a relatively unprocessed and unelaborated form. A distinction between conceptually driven and perceptually driven processing pervades much research into the development of emotional disorders following traumatic experience. The concept, originating in episodic memory and priming studies to explain dissociations in performance, has been imported to clinical traumatology theory where it was used to account for differences in susceptibility to PTSD symptoms. Ehlers and Clark (2000) claim that flashbacks and intrusive memories are most likely to develop in individuals with a data-driven processing style; the precise ways in which these concepts were operationalised in trauma analogue studies or investigated through correlational studies have been rather varied; similarly the construct of conceptually driven processing suffers some ambiguity (e.g. Brewin & Holmes, 2003). Ambiguities in the construct of

semantic/conceptual processing were previously noted, such that it may be taken to denote a comparatively low-level process occurring relatively early within stimulus processing, or may, alternatively, refer to higher-level elaborative processes whereby stimuli are associated with broader constructs or given meaning in relation to self.

This study aims to explore how images are differentially processed by poor and effective emotional processors. It adopts an item presentation paradigm using discreet, unrelated images of ordinary objects, and tested recall through three distinct measures. It was reasoned that individuals retaining veridical, sensorily-rich, analogue representations of previously presented images would be less likely to believe or affirm that a similar but not identical image had been previously presented. If, by contrast, an image is reduced to a semantic/conceptual code then such errors are more likely. Furthermore, verbal cues, where one is asked whether one has seen an item of a certain class, are likely to be facilitated by semantic/conceptual processing and comparatively less effective with a sensory/perceptual style. Participants with a sensory-perceptual processing bias would be more likely to retain faithful recollections of stimuli, less likely to mistake these for similar but not identical images, and less likely to process these semantically.

The following study probes verbal encoding of visual stimuli (pictures) by testing recognition of previously presented images through a mixture of pictorial and verbal cues. Pictorial cues may be identical images to ones already seen; entirely different images; or images which depict the same *class* of object but are not identical to pictures already seen (such cues will be referred to as lures). The success of a *verbal* cue in eliciting a memory of a *pictorial* stimulus is taken to be an indication of the amount of verbal processing such stimuli receive. The success of a *lure* to elicit a (false) positive

recall judgement may also reflect the reduction of a *pictorial* stimulus to a verbal/conceptual trace. The success of a pictorial cue to elicit a memory of a pictorial stimulus is taken to indicate the formation of persistent visual memories of pictorial stimuli.

As individuals with poor emotional processing styles are hypothesised to form stronger sensory memories and perform poorer conceptual processing of stimuli, the following study will consider whether this group of individuals recall a higher proportion of images whilst responding *correctly* to a lower proportion of verbal cues, and *incorrectly* to a lower proportion of lures.

### 3.4.2 Method

#### 3.4.2.1 Participants.

Participants (N=90; mean age = 21.81 years; *SD* =4.39 years; M=24, F=66) were undergraduates from Bournemouth University, mostly comprised of psychology students who took part for course credit. Participants had been preselected for scoring high or low on Baker's (2009) Emotional Processing Scale. Data from participants who reported dyslexia or reading difficulties or whose first language was not English were excluded from the following analyses.

#### 3.4.2.2 Materials and Procedure

*Stimuli.* The first two hundred nouns denoting concrete objects for which pictures with a high degree of fit could be found were drawn from the University of Birmingham Titania Frequency word bank corpus (see appendix C). Two pictures for each of these

nouns were found and piloted to ensure they immediately elicited the noun they were presumed to depict (see study 2 for piloting method).

*Presentation.* Participants had already completed copy of the Emotional Processing Scale (Baker et al., 2009). Participants were informed through instructions on a computer monitor that they were about to see a series of items to which they should pay attention as they might be asked about them later. Participants were presented with one of four stimulus lists. Stimulus lists were matched for frequency and consisted of 100 images, each depicting a different noun drawn from the original four hundred noun list. Each picture was displayed for five seconds on computer monitors using PowerPoint software. Stimuli were presented on an 18-inch computer screen using an HP Compaq dc 7900, 2.2 Ghz computer, with a resolution of 1440 x900 pixels. Images were displayed at sizes between 13cm by 10.67cm and 15cm by 12.3cm. Participants then completed a writing study which lasted approximately 35 minutes.

After forty-five minutes, participants viewed test lists which comprised 60 images, twenty of which had been seen at presentation, twenty of which were lures, and twenty of which were novel images taken from the picture bank. For each item participants were instructed to provide one of three responses by ticking the appropriate box in their booklet:

*a. The item was there*

*b. The item was not there*

*c. I don't know*

Participants could then proceed at their own pace, clicking a mouse to see each new item and recording responses in a booklet. Once the 60 images had been viewed, a series of 40 words were presented. Twenty words denoted objects which had been seen

at presentation, and twenty words denoted novel objects drawn from the original word list. Participants were required to select from the same range of responses as before and proceeded at their own pace.

### 3.4.3 Results

As each of the measures reflected hypothetically distinct processing tendencies, 3 separate two-way ANOVAs was carried out for each of the measures as reported below.

#### 3.4.3.1 Pictures.

False positives (previously unrepresented pictures which participants claimed to have seen) were subtracted from correct positives to form a true picture score. Data are depicted in Table 7.

Table 7: Mean totals of pictures correctly recognised across emotional processing groups and retention intervals

<i>Retention Interval</i>	<i>Emotional Processing Group</i>		<i>Total</i>
	<i>Poor</i>	<i>Effective</i>	
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>
<i>45 Minutes</i>	15.76 (3.82)	12.41 (7.12)	13.88(6.09)
<i>1 week</i>	6.55 (4.42)	7.35 (4.68)	6.93 (4.51)
<i>Total</i>	11.05 (6.2)	10.26 (6.64)	

A two-way ANOVA with factors emotional processing group (effective vs. poor) and retention interval (45 minutes vs. 1 week) revealed a significant main effect of interval  $F(1,89) = 39.93, p < .05$ . No significant main effect of group was found  $F(1,89) = 1.27, p > .05$ . However, the group x interval interaction approached significance:  $F(1,89) = 3.39, p = .069$ .

#### 3.4.3.2 Lures.

Similar but non-identical pictures participants stated they had previously seen were

calculated and compared across groups and intervals. Data are depicted in Table 8.

Table 8: Mean number of lures participants stated having seen (and standard deviations) across emotional processing groups and intervals

<i>Retention Interval</i>	Emotional Processing Group		
	Poor	Effective	Total
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>
<i>45 Minutes</i>	1.57 (1.96)	3.33 (3.47)	2.56(3.02)
<i>1 week</i>	4.05 (3.02)	5.45 (2.46)	4.71 (2.82)
<i>Total</i>	2.84 (2.82)	4.23 (3.23)	

A two-way ANOVA with factors emotional processing group (effective vs. poor) and retention interval (45 minutes vs. 1 week) revealed a significant main effect of interval  $F(1, 89) = 14.44, p < .01$ . Furthermore, a significant main effect of group was found  $F(1, 89) = 6.87, p < .05$ . Group interval interaction was not significant,  $F(1, 89) = 0.09, p > .05$ .

#### 3.4.3.3 Words.

Correct responses to word cues were calculated for each group, subtracting false positives as for pictures. Data are depicted in Table 9.

Table 9: Mean number of pictures correctly recognised (and standard deviations) in response to verbal retrieval cues

<i>Retention Interval</i>	Emotional Processing Group		
	Poor	Effective	Total
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>
<i>45 Minutes</i>	8.38 (5.68)	9.26 (3.11)	8.88(4.39)
<i>1 week</i>	3.5 (2.15)	5.9 (4.13)	4.64 (3.43)
<i>Total</i>	5.88 (4.88)	7.83 (3.91)	

A two-way ANOVA with factors emotional processing group and retention interval revealed a significant main effect of interval,  $F(1,89) = 24.61, p < .05$ . There was no

significant interaction between group and interval,  $F(1, 89) = 0.84$ ,  $p > .05$ . The main effect of group approached significance,  $F(1, 89) = 3.89$ ,  $p = .052$ .

#### *3.4.4 Discussion*

The study aimed to explore differences in how pictorial stimuli were processed between groups. Both lure and picture measure were designed to gauge the extent to which participants retained analogue representations of stimuli, whilst verbal cues were intended to probe verbal/semantic processing of stimuli. The results may be taken to suggest that poor emotional processors exhibit a sensory-perceptual memory style over shorter periods which was not apparent over a week long testing interval: effective emotional processors appeared over a longer retention interval to have more persistent semantic records of stimuli.

Over short retention intervals, poor emotional processors showed stronger recognition memory for previously presented pictures, and were less susceptible to lures. Over longer retention intervals effective emotional processors were more likely to correctly recognise items in response to a verbal cue.

One possible interpretation of these findings is that effective emotional processors more rapidly reduce sensory-perceptual details, showing inferior picture recognition and an increased susceptibility to be lured by similar but not identical images into asserting that these have previously appeared. This may be mediated by some verbal/conceptual processing of stimuli such that images are not retained in an identical format against which test stimuli can be compared, but rather in some reduced or abstracted form. Such differences were apparent over short periods, suggesting that such reduction may have occurred in a fairly automatic manner or at least with greater speed than with poor emotional processors.

That verbal cue elicited more correct responses from effective emotional processors than poor only over longer testing intervals points to the effects of memory consolidation. It appears that semantic processing may confer longer terms recognition benefits and that, perhaps, effective emotional processors by processing experience at a deeper more semantic level may develop more organised and more easily retrieved representations of past events.

### *3.5 Study 4: Effects of Arousal on Verbal Processing of Pictorial Information*

#### *3.5.1 Introduction*

The following study aims to consider the impact of arousal upon the verbal processing of pictorial stimuli. This was principally to examine whether the differences that emerged between emotional processing groups might be replicated by subjecting participants to arousal, and thus whether arousal might be the principle determinant in producing the particular pattern of sensory-perceptual memory discovered previously.

Specifically, one objection that might be raised to the previously reported findings is that poor emotional processors experience more arousal generally across situations which in some way facilitates their recognition at subsequent test. Furthermore, as many of the findings upon which this dissertation are based consider how memory disruptions occur within particularly arousing situations, it was thought to be of interest to consider how an arousing situation might affect recognition over non-complex stimuli presented within a highly controlled environment.

#### *3.5.2 Method*

##### *3.5.2.1 Participants.*

Participants (N=80; mean age = 24.36 years,  $SD=8.7$  years; M=28, F=52) were undergraduates from Bournemouth University, mostly comprised of psychology students who took part for course credit. Unlike in previous studies, participants were recruited who were intended to represent a 'normal' (i.e. neither poor nor particularly effective) emotional processing style. Accordingly, participants within this study had been preselected as scoring within the medium third of Baker et al.'s (2009) Emotional

Processing Scale (scoring between 80 and 110). Data from participants who reported dyslexia or reading difficulties or whose first language was not English were excluded from analysis.

### *3.5.2.2 Materials and Procedure.*

Stimuli were identical to those used in study 3. An identical procedure for study 3 was used, except for the experimental group in the 'arousal' condition, who before presentation were informed they were about to view images that may be extremely distressing, graphic or distasteful. All participants were tested after an interval of 45 minutes only. Consent forms were distributed and participants were given a further opportunity not to participate in the study by ticking a box indicating that they preferred to participate in an alternative study which could be conducted there and then which would attract equal credits. Seven out of the total recruits chose not to participate. Once the experiment was completed participants were debriefed as to the nature and purpose of the deception used and given the opportunity to ask questions regarding the study.

*Manipulation control.* The procedure used to raise arousal levels within the experimental group had been previously piloted by presenting participants with an identical warning regarding the content of images they were about to view (N=28, mean age = 22.4 years, *SD* = 3.2 years). Heart rate was taken immediately following the presentation of the warning and compared to heart rate levels of a control group presented with a non-arousing information regarding the experimental procedure. Mean increases in heart rate of heart rate calculated as a percentage increase from baseline heart rate. This intervention proved effective, producing net mean increases in heart

beat compared to a non-aroused control group (3.54% versus -.47%) which proved significant ( $t(26) = 3.82, p < .01$ ).

### 3.5.3 Results

#### 3.5.3.1 Recognition of images.

This was calculated as in study 3: false positives (previously presented pictures of entirely novel nouns which participants claimed to have seen) were subtracted from correct positives to form a corrected total picture score.

#### 3.5.3.2 Lures.

Participants in the experimental group were more susceptible to lures, incorrectly stating on average that 4.43 ( $SD = 2.5$ ) similar but non-identical pictures had been previously presented, compared to 2.7 ( $SD = 2.75$ ) for the neutral condition.

*Table 10: Mean responses (and standard deviations) according to cue across arousal and control groups*

<i>Group</i>	<i>Picture</i>	<i>Lure</i>	<i>Word</i>
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>
<i>Arousal</i>	14.75 (4.17)	4.43 (2.5)	10.68 (5.34)
<i>Control</i>	13.25(6.63)	2.7 (2.75)	8.63 (4.69)

#### 3.5.3.3 Words.

As in study 3, correct responses to word cues were calculated for arousal and non-arousal groups by subtracting false positives from correctly recognised pictures to arrive at a corrected total which were compared across groups. Independent sample two-tailed t-tests revealed significant differences only for lures:  $t(78) = 2.33, p < .05$ . For pictures, no significant differences emerged:  $t(78) = -1.21, p > .05$ . For words the difference approached significance:  $t(78) = -1.82, p = .072$ .

#### 3.5.4 Discussion

Interestingly, whilst the effects of arousal were to generally promote recognition over all measures, it also had the effect of increasing participants' susceptibility to be lured

by similar but not identical images. Indeed, the only measure that achieved significance was the lure measure. If the effects of arousal are to induce participants to pay closer attention, or to devote increased cognitive resources to the stimuli presented, then whilst it may be argued it is possible that *anticipation* of unpleasant images affected how the neutral images were processed serving as a sort of distractor which disrupted the ordinary perceptual processing of the non-arousing images participants viewed.

The arousal manipulation had been piloted and found to be effective producing mean increases in heartbeat. Heart rate recordings were also taken from 10 of the 40 participants in the arousal condition and found on average that the anticipation of seeing unpleasant images raised heartrate. For the purposes of the present research programme, it is of interest that the results do not replicate the tendencies encountered within study 3, where poor emotional processors displayed heightened pictorial recognition, diminished susceptibility to lures, and inferior verbal recognition. This may be taken as evidence against the proposition that poor emotional processors approach stimuli in a global fashion with heightened arousal which alone can account for differences in recognition memory.

### 3.6 Studies 1-4: General Discussion

#### 3.6.1 Evidence for a sensory – perceptual memory style

The studies in section one found some support for the hypothesis that poor emotional processors exhibit what has been loosely termed a sensory-perceptual style. Elements of a sensory-perceptual style are the formation of analogue representations of events, and a comparatively deficient reduction of such events to conceptual/semantic forms and a preference for sensorily-rich pictures over words. This was reflected over short retention interval where a comparatively higher percentage of know over remember judgements was achieved by poor emotional processors, suggesting that they develop more vivid representations of events, before they are reduced to semantic form. It was further reflected in verbal processing of pictorial stimuli, such that poor emotional processors, it was reasoned, retained more analogue sensory-perceptual memories of stimuli, yet were, over longer intervals, apparently less likely to have reduced these to semantic forms elicited by verbal cues. At a descriptive level, there appeared to be a preference for pictures over words (study 2) although this result, whilst conforming with the prediction, did not achieve statistical significance.

As a general pattern, there appeared to be some support for a sensory-perceptual memory style within poor emotional processors particularly over short intervals.

Effective processors superior semantic processing of stimuli emerged only over longer testing intervals.

The effects of arousal *per se* did not replicate these findings. Arousal appeared to increase attention and improved performance over all aspects of items displayed but not with the specific pattern of findings discovered within poor and efficient emotional

processors. This may reflect greater attention being devoted to stimuli rather than the effects of a specific memory style.

Whilst such results must be treated as extremely preliminary and can only be taken as suggestive of processing tendencies, it is interesting to note this distinction between shorter and longer intervals in terms of the emerging results. The two testing intervals had been introduced to examine the effects of consolidation on memory processes. The fact that poor emotional processors apparently formed more detailed memories of events (including auto-noetic knowledge) at short intervals may suggest differences in how events are encoded. Such encoding differences may have consequences for how events are later accessed over longer intervals, in that effective emotional processors showed superior recognition when memory was probed by verbal cues.

That no reliable differences emerged for percentage of auto-noetic judgements, picture retention, or pictorial cues over longer intervals may be explained by the relatively unmemorable and insignificant nature of the stimuli adopted. It would be expected that such materials would be forgotten or decay, both because experimental instructions made no explicit demands on participants to memorise materials, and because many of the event features known to enhance recall (depth of processing, arousal, personal significance, and thematic unity) were deliberately excluded from the experimental design.

The intriguing possibility, here tentatively posed, that processing differences enabled effective emotional processors to better retrieve events over longer intervals, finds some, albeit slight, support from Study 4, in which verbal cues elicited more successfully correct recognition judgements than was the case with poor emotional

processors. In other words, if semantic reduction does occur more automatically within effective emotional processors, this may confer benefits over long term recognition and memory retrieval.

This could be seen as broadly consonant with findings from PTSD literature and analogue studies (e.g. Halligan, Clark and Ehlers, 2002; Hellowell and Brewin, 2002; Holmes, Brewin and Hennessy, 2004) such that data-driven processing of events tends to result in a higher incidence of flashbacks and intrusive memories. If effective emotional processors process events more conceptually, then it might be suggested that events are more conceptually assimilated, retrieved in a more organised fashion, and more compatible with the broader autobiographical knowledge structures by which knowledge of one's environment is preserved.

At a still speculative level, if poor emotional processors retain in greater detail during event presentation, this may result in demands being made on processing and memory which have an ultimately distorting effect on event memory. Retention may occur at the expense of organisation and semantic reduction assuming limited processing capacity. It should be reiterated that such speculations are made on very slight evidence.

Evidently, what implications differences in recognition performance for picture and word lists have for a broader understanding of how emotional processing and memory interact requires far greater exploration. The studies used briefly presented unconnected stimuli with little personal significance narrative or thematic connection allowing very little scope for personal elaboration or schematisation. As such, their significance for the understanding and recollection of the types of events individuals ordinarily

encounter remains unclear. If however it is assumed on the basic level evidence presented in these studies, the poor emotional processors retain an inordinate amount of sensory-perceptual detail, which is not automatically reduced to semantic forms, then such patterns compounded over longer sequences of events and exacerbated in highly emotional situations an aggregate effect might be the production of memories and representations of events which were less conceptually processed, less assimilated and more volatile.

The general purpose of these studies was to explore whether poor emotional processors exhibited a type of sensory-perceptual memory style which is often implicated in the development of pathological memory disorders. It was hoped to explore to what extent this memory style might be in evidence in the absence of event features which typically characterise traumatic or distressing situations, thus to explore the extent to which individuals, rather than features or demands of an event, contribute to the development of degraded or distorted memory formats. As such some evidence has been attained for such a possibility. Nonetheless, in an attempt to better explore the specific impact of emotional events on poor emotional processors, it might be of interest to examine how participants respond to valenced materials, either arousing words or images.

Furthermore, manipulating stimulus exposure times might provide a better reflection of how individuals process events in real life. In these studies, fairly extended exposure times (five seconds) were allowed. This may have encouraged poor emotional processors to articulate or verbally process items in ways that may not reflect their ordinary processing style, particularly if they suspected they would be later tested for their recognition or recollection of events, as articulation or verbal processing of stimuli is frequently adopted as a strategy to aid memorisation.

Whilst the studies so far reported have aimed at a high degree of control over stimulus type with the explicit aim of reducing complexity, arousal, thematic unity, and scope for personal elaboration, the studies in the following section explore differences between emotional processing groups with more complex temporally extended stimuli, presented in various modalities. As such, participants' capacity to organise and process extended, complex events is explored.

## Chapter 4: Effective and Poor Emotional Processors' Recall of Narrative

### *4.1 Studies 5-7: General Introduction*

The investigation of how experimentally presented narratives are recollected can be seen as originating within Bartlett's (1932) studies which demonstrated how auditors' reconstructed and edited exotic and anomalous stories in line with their own cultural expectations. The impact of such research in emphasising the constructive over reproductive nature of memory was profound (Johnson, Foley, Suengas & Raye, 1988; Moscovitch, 1995; Norman & Schacter, 1996; Conway & Pleydell-Pearce 2000; Neisser, 1981). How top-down, interpretative schemas facilitate, condense and at times distort the interpretation and recollection of complex events, situations and behaviours is a theme exhaustively explored throughout memory studies. Script and schema theories (Schank & Abelson, 1977; Rumelhart & Norman, 1978) have been particularly influential in modelling how diachronous sequences of action and complex situations can be assimilated with great cognitive economy within generic knowledge structures.

That narrative constitutes a distinct form of information processing is a view most intriguingly elaborated by Bruner whose 1991 position argues that narratives can be viewed as one of the fundamental cultural products through which reality is interpreted, constructed and communicated. Related research has considered how cognitive processes tend to reduce narrative complexes in line with certain canonical expectations. Thus story grammar approaches elucidate those features of a story which tend to be constitutive of the genre (and most worthy of retelling and remembering). Researchers within the field (Mandler & Johnson, 1977, Stein and Glenn, 1979) have found that that story settings, protagonists' goals and consequences of their actions tend to be best recalled from narratives, suggesting that reconstructive memory processes tend to pare down plot irrelevant details upon recounting (Schank, 1975), and are thus less

accessible to memory (Black & Bower, 1980; Trabasso, Secco, & van den Broek, 1985; Warren, Nicholas, & Trabasso, 1979).

That such 'narrative processing' might apply equally to humans' recounting and encoding of their own experience is a possibility explored by numerous researchers of autobiographical memory (Gergen & Gergen, 1988; McAdams, 1985). Singer (1995, 1996, 2004) has considered how the 'storied' aspect to human memories helps individuals negotiate the conflicts and challenges presented through life and how autobiographical narratives are organised around fundamental cognitive, affective and motivational themes, to constitute the various 'Me-selves' through which individuals both conceptualise themselves, and derive guidance for future action.

At a functional level, narrative processing has presumed benefits not only in the communicative terms, by facilitating the recounting of past experience, but, presumably in enabling guidance and a repertory of past experience which may inform future endeavours (Cohen, 1998; Pillemer, 1998; Robinson & Swanson, 1990). In order to effectively learn from experience, for our accounts to sensitively reproduce what we have undergone, and how we have achieved or avoided particular outcomes, two complementary processes, the retention of data, and its effective reduction need to be presupposed. The effectiveness of our narratives in generalising to future instances will depend upon our capacity to reproduce and maintain in memory significant features of our experience, but also to bring causal order and sequence to the proliferation of data received within ordinary perception and experience. Such processes have broad parallels with how episodic and semantic memory are proposed to interact (Cermak, 1972, 1984; Conway et al, 1997; Herbert & Burt, 2001), and depend upon the complementary perceptually based and conceptually based processing of experience.

Thus sufficient detail must be retained to ensure our accounts are accurate, and sufficient understanding brought to bear on such detail to ensure our accounts are effective. Indeed, that narratives represent a cognitively economical means of reducing complex events to those details significant to an individual's future agency, appears to be supported by story grammar research showing initiating events, goals, and consequences are found to be consistently best recalled from story features (e.g., Mandler & Johnson, 1977; Stein & Glenn, 1979).

Establishing coherent narratives of our own life story appears to have therapeutic benefits, and is a recurrent principle of psychoanalytical, humanistic and narrative schools of therapy (for a review, see Meier, 2004). Within psychotherapeutic contexts the negotiation of an autobiographical narrative between client and therapist has been a persistent feature of therapeutic goals; ample empirical research supporting the benefits of developing narratives of traumatic events is available (Pennebaker, 1998; Smyth, 1998). Narrative coherence deteriorates in certain pathological conditions (Foa & Kozak, 1993; Foa et al., 1995; van der Kolk and van der Hart, 1991; van der Kolk & Fislser, 1995; Halligan et al., 2003; Murray, Ehlers, & Mayou, 2002). Sufferers of post-traumatic stress disorder exhibit poor intentional recollection of traumatic events, incoherent and fragmentary accounts of their experiences (Brewin, 2001a; Ehlers & Clark, 2000) in which evidence of logical sequentiality is absent and insignificant details may predominate (Conway, 2001). This may be reflected both in the nature of the traumatic memory, as well as in the hypervigilant and overgeneral defence mechanisms which emerge from the traumatic encounter (Richter–Levin, 1998; Yehuda, 2002). Similarly, the construction of coherent self-narratives has been frequently seen as the goal of therapeutic practice. Ehlers and Clark (2000) for example compare traumatic memory to '*a cupboard in which many things have been thrown in*

*quickly and in a disorganised fashion, so it is impossible to fully close the door and things fall out at unpredictable times'* (p. 337). Furthermore, this pattern of memory disruption may appear, in a more attenuated form, within tunnel memory phenomena, where recollection follows a highly selective focus of an array (Christianson, 1992). Experimental dissociations between verbal and visual elements have also been reported (Burke, Heuer & Reisberg, 1992; Reisberg & Heuer, 2004), and arousing elements within an event appear to have the effect of monopolising and distorting subsequent recollection (Intraub & Berkowits, 1996; Pickel, 1998; Loftus, Loftus & Messo, 1987).

The following studies aim to explore evidence for a sensory-perceptual style of memory encoding within poor emotional processors, by introducing measures intended to specifically gauge elements of this style. If poor emotional processors exhibit a more sensory-perceptual style of memory encoding, in which unreduced sensory elements predominate over conceptual semantic aspects of an event, it is reasoned that their recollection will be reflect more sensory-perceptual features, in particular pictures and images conveyed within a narrative, rather than semantic aspects of a narrative. A further dimension explored is the degree to which central (gist) elements of a narrative or display or detail is retained. If effective emotional processors are more efficient at reducing a complex experience to its significant elements, then it is assumed this will be reflected in a comparatively greater ability to respond correctly to gist questions from an event. A more disordered recollection of events will be reflected, according to this hypothesis, in poor emotional processors relatively greater retention of visual or verbal detail at the expense of gist elements.

Whilst studies 1-4 considered emotional processing groups' comparative performance of recognition for simple, discreet, stimuli briefly presented within a single modality, i.e.

visually, studies 5-7 explore stimuli of greater complexity. Thus the following studies are chiefly concerned with narrative representations of events, participants' recollections and reductions of previously presented complex stimuli, and the extent to which poor and effective emotional processors' recollections of past events reflect different styles of stimulus processing. Such differences, it is predicted, will be evident in the type of features encoded following an event and subsequent performance in recall and recognition. The fundamental division between sensory and semantic aspects of an event which informs many of the measures adopted in the following studies and is intended to explore the extent to which a sensory-perceptual style is evident within poor emotional processors.

It is assumed that a high degree of sensory material available within a recollection, denoting broadly visual aspects of stimuli, reflects a comparatively low degree of stimulus processing. It is further assumed that a greater availability of semantic aspects – narrative, coherence and meaning giving features – reflects a greater ability to abstract meaning from an event, and the spontaneous application of narrative processing.

Thus studies 5 and 6 compare groups' recollection of extended narratives presented both auditorily and visually, combining pictorial and verbal elements, with multiple actors, and thematic connection between pictures. Study 7 explores how poor and effective emotional processors differ in their recollection of a publicly experienced naturally occurring event probing recollection following a longer retention interval than has previously been adopted. Whilst aiming for greater ecological validity in terms of the types of stimuli and complexity individuals ordinarily encounter, the following studies still aim to retain a high degree of experimental control or monitoring over the types of stimuli tested.

## *4.2 Study 5: The Effects of Emotional Processing Style on Recall of Visually Arousing Events*

### *4.2.1 Introduction*

One of the seminal and most influential studies on tunnel memories and mnemonic distortions following emotional arousal comes from Heuer and Reisberg's (1990) slide show study which found that compared to recall of a neutral narrative, participants who had viewed an arousing narrative demonstrated uneven recall with central details predominating at the expense of peripheral elements. This was originally taken by the authors as experimental evidence for weapon-focus effects and Easterbrook's (1959) hypothesis. Nevertheless, at a more general level, the particular effects of emotional stimuli in producing uneven memories of events may be crucial in understanding the particular syndrome of behaviours and dysregulated emotional responses characteristic of any number of emotional processing failures. In short, it is thought that by producing defective memories and reconstructions of events, inappropriate emotional responses to trivial stimuli may be maintained.

The following study replicates Heuer and Reisberg's study and aims to explore poor and effective emotional processors patterns of recall over narrative events. The advantages of such materials are their comparative simplicity. They comprise 12 slides with an audio accompaniment of a simple story narrating the visit of a mother and son to their father's work place. There are 12 accompanying sentences using unsophisticated vocabulary and syntax; the inclusion of an arousal condition also enables the exploration of relative susceptibility to weapon focus effects and the relative impact of arousal upon recall. The total text is 110 words, with mean slide word count 8.2 words.

By comparing performance of poor and effective emotional processors in recall of both neutral and arousing versions of the stimulus set enabled some exploration of the differential effects of arousal on the two populations. Furthermore, it was intended that, by administering recall and recognition tests at two retention intervals, 45 minutes and 1 week, the effects of memory consolidation processes could be explored.

#### *4.2.2 Method*

##### *4.2.2.1 Participants.*

Participants (N= 187; mean age = 22.64, *SD* = 6.51 years; M = 49, F = 138) were undergraduate students at Bournemouth University participating for course credit or on a voluntary basis. Participants had been preselected as scoring high or low on Baker et al.'s Emotional Processing Scale.

##### *4.2.2.2 Design.*

Participants were presented with a slide-show and accompanying aural narrative. Participants were shown either the arousal or neutral version of the slide show. Participants' recognition memory was tested at either 45 minutes or 1 week following presentation of the slide show, with approximately equal numbers of poor and effective emotional processors assigned to each condition. Questions testing recall probed memory for verbal detail, verbal gist, visual detail and visual gist. The independent variable was emotional processing group, and the dependent variable recognition according to question type. Thus a 2 (emotional processing group: high versus low) x 2 (slide show version: arousing versus neutral) x 2 (testing interval: 45 minutes versus 1 week) x 4 (question type: verbal gist versus verbal detail versus visual gist versus visual detail) factorial design was employed.

#### *4.2.2.3 Materials and procedure.*

Participants had been recruited to participate in a study that would ‘involve the presentation of visual or recorded material that may be pleasant, unpleasant or have an erotic tinge’. Participants were shown either an arousing or neutral narrative slide show with participants being randomly assigned to each slide show. The slide show was presented on an 18-inch computer screen using an HP Compaq dc7900, 2.2 Ghz computer, with a resolution of 1440x900 pixels.

After viewing the slide show, participants were asked to rate on a scale of 1-9 the extent to which they felt it related an emotional tale and the extent to which they felt emotionally engaged. According to the testing-interval group to which they had been assigned either after forty-five minutes or one week, participants were given a surprise memory test which probed their recall of the narrative slide show.

*Slide show narratives.* The slide show narratives used in this study were developed by originally by Heuer and Reisberg (1990) to examine the effects of arousal upon memory (see appendix D). There were two conditions: arousal and neutral. Each consisted of 12 slides with an accompanying recorded narrative which was for the present study adapted in three minor details to remove instances regarded as non-standard British English. These were presented on a PC monitor. Slides were presented for 6 seconds each with a 2 second interval between slides.

The stimulus set related a simple story involving a mother and her son visiting father at his work place, and watching him carry out a simple procedure at work, after which the mother leaves. In the neutral version, father works as a mechanic and carries out a

procedure to repair a car that has been towed in. In the arousal version, father is a surgeon operating on a victim of an accident. Visual and auditory aspects were matched as closely as possible and both versions used identical images and narratives for the first three and identical images and similar narratives for the final four slides.

In both conditions slides 1-3 represented a mother leaving home with her child, crossing a road and walking along a pavement. Slide 4 represented father's workplace: in the arousal condition this was a hospital, for the neutral condition a garage. Slide 5 in the arousal condition showed the scene of a traffic accident, whereas for the neutral condition showed a car that had broken down. Slide 6 in the arousal condition, intended to generate an emotional response, depicted a team of surgeons working over a patient whose viscera were clearly visible. Slide 7 showed an image of badly bruised legs after an operation. Slides 5, 6 and 7 in the neutral stimulus set contained a team of mechanics working over an open car engine hood; the car part which has been removed; and finally the father washing his hands after performing the repair. The final section of the slide shows (slides 9-12) comprised images identical for both conditions. In the arousal condition mother is presented as upset after seeing the operation, calling her boss to get the day off from work, and catching a bus home. In the neutral condition, she leaves father's place of work, calls her boss to apologise for being late, and catches a bus home.

The recognition memory test for the slide show was identical to that employed by Heuer and Reisberg (1990). There were 120 multiple choice questions with four possible choices for each question. Questions for the recognition test were designed to probe memory of four categories of information presented within the slide show. These were

visual gist, visual detail, verbal gist and verbal detail. Examples of these are given below.

1. (visual gist) When we first see mother and son they are?... (answer) Outside their house
2. (visual detail) The colour of the house roof is ?.... (answer) Brown
3. (verbal gist) Mother and son are going to visit? .... (answer) Father
4. (verbal detail) The name of father's job is? .... (answer) Chief surgeon

As can be seen from the examples above, gist questions for both verbal and visual categories referred in broad terms to the unfolding of the story with verbal gist probing memory for the overall story as communicated in the narrative and visual gist questions concerning in a general fashion the content and layout of the photographs. Verbal detail questions targeted memory for details largely irrelevant to the central events and plot. Visual detail questions focused on finer details of the slides and visual features irrelevant to the plot.

Equal numbers of questions were generated for each category across each condition although given the nature of these categories (gist naturally producing fewer questions than details) equal numbers for each were not produced for each category overall. The majority of questions and answers in all categories were identical for arousal and neutral groups. Different questions were necessarily used in the second stage of the slide show (slides 5-8) where the arousal inducing element was introduced. Here most questions were identical in the wording they used yet had different answers across conditions. A few remaining questions which were different yet were matched as closely as possible for question length and complexity of language. In terms of total questions for each

question type, there were 24 reflecting visual gist, 60 visual detail, 12 verbal gist and 24 verbal detail.

#### 4.2.3 Results

For each participant, a *total correct* score was calculated and then the percentage of the total constituted by each category of question type (verbal gist, verbal detail, visual gist and visual detail), as what was of interest for the purposes of comparison between groups was not overall memory performance, but the relative composition, in terms of the types of details available, of emotional processing groups' recall of the narrative. Results for both conditions (arousal and neutral story) and intervals (one week and forty-five minutes) are shown according to category of question type (verbal and visual gist, verbal and visual peripheral) in table 11.

Participants' recognition on the memory test was examined using a mixed 2x2x2x4 ANOVA with between-subjects factors of emotional processing group (effective vs. poor) and retention interval (45 minutes vs. 1 week) and story version (arousal vs. neutral) and within-subjects factor of question type (verbal gist vs. verbal detail vs. visual gist vs. visual detail).

This analysis revealed a significant interaction between interval and question type,  $F(3, 537) = 36.15, p < .01$ , suggesting that over greater retention intervals the type of information retained by all participants altered. There was, further, a significant interaction between condition and question type,  $F(3, 537) = 8.51, p < .01$ , suggesting that an emotionally arousing story promoted the recall of different types of information than a non-arousing story.

Nonetheless, of critical interest within this study was how poor and effective emotional processing groups differed in the type of information they retained of the narrative slideshows and the relative compositions of their total recollection of the narrative. As such, analysis focussed on interactions between question type and emotional processing group. In no analysis of interaction in which emotional group figured was there any evidence of a significant effect. Thus group x question type interaction ( $F(3, 537) = 8.17, p > .05$ ), group x condition x question type interaction ( $F(3, 537) = 6.23, p > .05$ ), group x interval x question type ( $F(3, 537) = 33.6, p > .05$ ), group x interval x condition x question type, ( $F(3, 537) = 18.83, p > .05$ ) all failed to achieve significance, suggesting that emotional processing style did not affect the type of information retained by participants even when the effects of retention interval and story type were taken into account.

*Table 11: Mean percentage (and standard deviations) of total recall constituted by different question type for story versions, emotional processing groups and retention intervals.*

<u>Testing Interval</u>	<u>Narrative version</u>	<u>Emotional Processing Group</u>	<u>Verbal gist</u>	<u>Verbal Details</u>	<u>Visual Gist</u>	<u>Visual Detail</u>
45 minutes	Neutral	Poor	13.08(1.87)	24.6(2.64)	21.62(3.14)	40.7(3.37)
		Effective	13.29(1.92)	24.72(2.77)	22.54(1.69)	39.45 (3.39)
	Arousal	Poor	14.21(1.4)	26.46(2.12)	22.94(2.49)	36.39(4.45)
		Effective	14.34(1.08)	24.55(1.69)	25.2(2.32)	35.9(3.07)
1 week	Neutral	Poor	11.84(2.05)	24.06(2.27)	19.5(3.59)	44.6(5.93)
		Effective	11.85(2.71)	24.85(2.77)	19.86(3.97)	43.45(5.61)
	Arousal	Poor	12.05(2.17)	23.6(3.32)	21.68(2.83)	42.67(6.48)
		Effective	12.76(3.01)	25.08(5.05)	19.37(3.93)	43.23(5.55)

#### *4.2.4 Discussion*

The study failed to find any significant interactions between emotional processing type and type of question, suggesting no reliable differences could be found in terms of the type of memories different emotional processors formed from the slide narrative shows employed. The arousal condition appeared to be effective in promoting memory and in affecting the types of memories participants formed and testing interval also appear to have a similar impact. Nonetheless, between groups of poor and effective emotional processors no reliable differences emerged.

It is perhaps worth noting that the materials employed within this study were originally designed to explore the impact the interposition of an emotionally arousing element would have on memory, by comparing recollection across groups exposed to different versions of an essentially similar narrative. The designers of the materials were further interested in how story stage (before, during or after) the presence of a visually arousing stimulus would modify aspects of recognition and recollection memory.

Within the current study, the chief independent variable of interest was emotional processing group. What was of interest was groups' comparative facility at reducing information to essential and non-essential details, as well as comparative tendencies to retain visual or verbally based information, and only as a subsidiary question how an arousing element impacted upon this. Within this area, it may be that materials and measures sensitive enough to detect the impact of a visually arousing stimulus when compared to a somewhat neutral narrative, fail to detect subtler and more elusive differences in how different emotional processing groups process and retain environmental and narrative information.

Both versions of the narrative comprised rather uncomplicated and simplistic stimuli recounting a story which involved minimal details and a rather straightforward plot. It seems plausible that differences between groups' capacity to extract meaning and organise information will only emerge when their retentive capacities are taxed by more complex and challenging material. Study 6 aims to increase the complexity, and to examine the effects of a non-visual arousal source upon recognition measures where emotional intensity is produced through narrative rather than visual sources.

### 4.3 Study 6: Effects of Emotional Processing Style on Recall of Thematically Arousing Events

#### 4.3.1 Introduction

Whilst experimentally controlled studies exploring the effects of emotional arousal upon recall typically adopt visually arresting, shocking or disgusting images to elicit arousal, some research suggests that this is untypical of sources of emotional arousal experienced within real life, Laney, Heuer and Reisberg, (2003) for example, found within a naturalistic study that respondents reported emotional arousal as most often likely to be experienced from *thematic* sources, which represents information relevant to our lives goals and values. This acknowledges that complex meanings and their appraisals are more frequently productive of emotional responses than lurid scenes. Accordingly Laney, Campbell, Heuer and Reisberg (2004) devised a series of slide shows which aimed to produce emotional arousal through identification with central characters goals and aspirations and a verbally mediated narrative which relied for its effects upon thematically aroused emotion, rather than visually arresting stimuli.

The following study adopts Laney's (2004) materials and explores how a complex, verbally mediated narrative produces differential effects on recognition and recall measures within poor and effective emotional processors. The stimuli are considerably more complex than was the case in the previous study. Multiple actors are involved, as well as a greater number of slides (33), and a rather more complex narrative with a greater total word length (759 words compared to 110 in the previous study) and a more sophisticated thematic development (see appendix E for materials).

### *4.3.2 Method*

#### *4.3.2.1 Participants.*

Participants (N = 168; mean age = 22.98, *SD* = 6.79 years; M = 46, F = 122) were undergraduate students at Bournemouth University participating for course credit or on a voluntary basis.

#### *4.3.2.2 Design.*

The study reproduced the design used in study 5, with a 2 (emotional processing group: high versus low) x 2 (slide show version: arousing versus neutral) x 2 (testing interval: 45 minutes versus 1 week) x 4 (question type: verbal gist versus verbal detail versus visual gist versus visual detail) factorial design implemented.

#### *4.3.2.3 Materials & procedure.*

Participants attended two sessions separated by a one-week interval. In the first session they completed the Beck Hopelessness Scale (Beck, Weismann, Lester, & Trexler, 1974) administered to screen candidates likely to be vulnerable to the themes of hopelessness and despair portrayed in the arousal version of the slide show. No participants scored above the threshold for non-participation.

Once the Beck Hopelessness Scale was completed, participants were shown either an arousing or neutral narrative slide show with participants being randomly assigned to each slide show. Stimuli were presented on an 18-inch computer screen using an HP Compaq dc7900, 2.2 Ghz computer, with a resolution of 1440 x 900 pixels.

Participants listened to the narrative through headphones. After viewing the slideshow

participants were asked to rate on a scale of 1-9 the extent to which they felt it recounted an emotional tale and the extent to which they felt emotionally engaged. In the second session, either 45 minutes or a week later, participants were given a surprise memory test which evaluated their recall of the narrative slide show.

*Slide show narratives.* The slide show narratives used in this study were developed to examine the effects of verbally induced arousal on recall and recognition memory. For the present study they were adapted in three places to remove instances of American English likely to be unclear to British participants. The slide show narratives depicted a short period in the life of a university student. The neutral version portrayed the student protagonist leading a generally happy life performing well in academic areas, with a happy relationship and looking forward to celebrating her birthday. In the arousal version the same student was depressed, having failed an important examination and likely to drop out of her course, and subsequently contemplating suicide.

The slide show narratives comprised 33 images, identical for both versions, where each image was accompanied by a recorded narrative which diverged across conditions. The narratives were matched as closely as possible with regard to language and content, in terms of complexity, familiarity, and phrasing. Each slide was presented for 10 seconds with a two second interval between slides. Throughout the narratives participants were addressed in the second person and asked to imagine that Megan, the female protagonist of the slide shows, was a friend and neighbour in a hall of residence. Slides 1–9 of the narrative depict Megan, a student, joining ‘you’ the participant for lunch in the university canteen. Over the course of conversation she discusses her life which, in the neutral version, is portrayed as reasonably contented: in the arousal condition, however, she describes her academic failure and distress in her emotional life. Slides 10-13

recount walking back to the dormitory with Megan and Megan's announcement, in the neutral version, that the following day is her birthday, whereas in the arousal version she explains how she has recently split up with her boyfriend. Slides 14-23 take place the following morning and the participant sees him/herself dropping by Megan's room. In the neutral version the participant wishes her a happy birthday and discovers that she is hungover; in the arousal version, the participant is concerned about her well-being and discovers that she is extremely distressed and threatening suicide. The final section of slides (24 –33) show in the neutral version dormitory neighbours congregating in Megan's room to celebrate her birthday. The arousal version depicts these same individuals trying to console her and encourage her to contact her family.

*Memory test.* The recognition test for the slide show was identical to that employed by Laney (2004) and comprised 64 multiple choice questions with four possible choices for each question (for a full list of questions please see appendix E). Questions for the recognition test were designed to probe memory of four categories of information. These were visual gist, visual detail, verbal gist and verbal detail examples of which are given below:

1. (visual gist) When you first meet the residential assistant he is?... (answer) in the corridor
2. (visual detail) The residential assistant has?... (answer) a goatee beard
3. (verbal gist) Meghan is feeling? .... (answer) upset
4. (verbal detail) Meghan's boyfriend is called? .... (answer) Steve

As can be seen from the examples above, gist questions for both verbal and visual categories referred in broad terms to the unfolding of the story with verbal gist probing

memory for the overall story as communicated in the narrative and visual gist questions concerning in a general fashion the content and layout of the photographs.

Verbal detail questions targeted memory for details largely irrelevant to the central events and plot. Visual detail questions focused on finer details of the slides and visual features irrelevant to the plot. Equal numbers of questions were generated for each category across each condition although given the nature of these categories (gist naturally producing fewer questions than details) equal numbers for each were not produced for each category overall. The majority of questions and answers in all categories were identical for arousal and neutral groups. Some questions were identical in the wording they used yet had different answers across conditions. A few remaining questions which were different yet were matched as closely as possible for question length and complexity of language. Per category there were 10 questions relating to visual gist information, 29 to visual detail, 8 to verbal gist and 17 to verbal detail.

### *4.3.3 Results*

#### *4.3.3.1 Manipulation check.*

The materials had previously been tested for their effectiveness at eliciting arousal (Laney, Campbell, Heuer & Reisberg, 2004) and the arousal version found to be significantly more emotionally engaging than the neutral version (ratings 4.38 ( $SD = 1.02$ ) vs. 2.84 ( $SD = 1.19$ ) on a 1-5 rating scale). Similar differences in how emotionally engaging participants found the narrative to be were found within the current study with the arousal version rated 4.24 ( $SD = 1.87$ ) versus 2.23 ( $SD = 1.66$ ),  $t(167)$ ,  $p < .01$ ) on a seven-point rating scale.

#### 4.3.3.2 Recognition performance.

Correct answers for any category (verbal gist, verbal detail, visual detail and visual gist) were calculated as percentages of total correct scores and compared across groups.

These data are depicted in table 12.

Participants' recognition on the memory test was examined using a mixed 2x2x2x4 ANOVA with between-subjects factors of emotional processing group (effective vs. poor) and retention interval (45 minutes vs. 1 week) and story version (arousal vs. neutral) and within-subjects factor of question type (verbal gist vs. verbal detail vs. visual gist vs. visual detail). Once again of principal interest within this analysis was the question of whether the relative composition of emotional processing groups' memories of the story differed according to question type. Accordingly, interactions between group, interval, story version and the within-subjects' factor question type were considered. None of these proved to be significant. Thus, interactions between emotional processing group x question type,  $F(3, 480) = 1.34, p > .05$ , emotional processing group x question type x interval,  $F(3, 480) = .62, p > .05$ , emotional processing group x question type x version,  $F(3, 480) = .68, p > .05$ , and emotional processing group x question type x version x interval,  $F(3, 480) = .72, p > .05$ , all failed to achieve statistical significance, suggesting that emotional processing group had little influence on the type of information participants recalled regardless of story version, or testing interval. Once again, across emotional processing groups, there were significant interactions between question type and the version of the story presented,  $F(3, 480) = 6.49, p < .01$ , and question type and testing interval,  $F(3, 480) = 8.93, p < .01$ , suggesting that for all participants the type of information successfully recalled was influenced by the version of the story presented, as well as by the duration of testing interval.

*Table 12:* Mean percentages (and standard deviations) of total recall constituted by different question type for story versions, emotional processing groups and retention intervals.

Testing Interval	Narrative version	Emotional Processing Group	<i>Verbal gist</i>	<i>Verbal Details</i>	<i>Visual Gist</i>	<i>Visual Detail</i>
45 minutes	Neutral	Poor	18.21(1.64)	30.67(4.36)	15.94(2.44)	35.17(4.31)
		Effective	18.44(2.14)	30.44(7.06)	16.48(1.98)	34.63(7.21)
	Arousal	Poor	18.61(2.63)	33.01(4.03)	16.81(2.01)	31.56(6.95)
		Effective	18.28(2.29)	32.98(3.63)	17.68(2.76)	31.05(6.73)
1 week	Neutral	Poor	19.28(3.38)	35.73(4.58)	11.35(3.94)	33.62(4.11)
		Effective	21.17(2.46)	35.99(3.89)	12.32(3.92)	30.50(5.95)
	Arousal	Poor	18.97(2.52)	32.78(2.69)	16.07(1.99)	32.17(5.10)
		Effective	20.34(2.86)	30.78(3.48)	16.33(2.29)	32.54(5.65)

#### *4.3.4 Discussion*

There was once again no evidence of an interaction between emotional processing group and question type. Thus it appears that emotional processing style, over these more complex stimuli, which in their emotionally arousing version relied for their effects on thematically induced arousal and empathy with the protagonist, did not predict the type of memory formed. Poor emotional processors did not, apparently, show evidence of a more sensory-based memory style and showed preference comparable to effective emotional processors for semantic as well as sensory-perceptual aspects. The materials employed in study 6 differed from those used in study 7 in a number of respects. First, the quantity of detail presented was greatly increased, both in terms of the number of slides used, and the amount of verbal detail accompanying them. Second, within arousal versions of the narrative, the nature of arousal was elicited through more sophisticated, meaningful strategies, namely through the relation of a story involving the gradually unfolding fortunes of a young student, rather than the presentation of a lurid visual image intended to elicit disgust or shock. The source of arousal was thus thematically based (Laney, Heuer & Reisberg, 2003) and thought to better replicate the types of emotional situations and emotional involvement individuals ordinarily encounter. Furthermore, the nature of the story in both versions was perhaps more sophisticated and verisimilar, echoing the concerns and routines of the experimental participants, rather than the grossly simplistic, generic narrative adopted within study 5.

All of these factors were intended to better replicate the quotidian nature of emotional engagement participants were thought to experience within their own lives.

Nonetheless, the greater sophistication and verisimilitude of the materials did not

produce significant between- group differences, in terms of the variable of interest, namely the relative constitution of participants' memories.

Evidently, and inevitably, the materials used in both studies 6 and 7 *diverge* from ordinary experience in significant ways. Ordinary experience does not have a narrative commentary, nor is it segmented into discrete audio-visual slides. Furthermore, our recollection of experience is not typically cued by detailed multiple-choice questions. All of these factors may have had the effect of structuring, editing and giving coherence to 'the experience' in ways atypical of the types of events we ordinarily undergo. They may have the effect, not only of facilitating recall by providing detail retrieval cues, but, further, of presenting an exogenous structure to an experience which life typically lacks. It may be at precisely this, higher level, of conceptually organising a temporally extended experience that poor and emotional processors can be differentiated. This possibility is explored in the following study.

#### *4.4 Study 7: Effects of Emotional Processing Style on Recall of a Naturally Occurring Event*

##### *4.4.1 Introduction*

It was speculated that three factors apparent within studies 5 and 6 may have led to ceiling effects in performance, such that little discrimination between emotional processing groups was possible. These may have been the artificial nature of the stimuli offering little ecological validity, the nature of the questions, which adopted multiple choice measures and were essentially a gauge of recognition memory, and finally the rather brief retention intervals between presentation and test, such that participants may have performed equally well over all the variables of interest, and natural tendencies to reduce or preserve aspects of an event may not accurately have been captured by the procedure adopted.

In terms of arousal, the limitations of the previous two studies are that, for the purposes of experimental control of materials, the type of arousal they induce are typically visually induced (study 5) or rely upon empathetic identification with a protagonist (study 6). The particular events for which recall is test are highly contrived and are unlikely to induce arousal or emotional responses homologous to those experienced in ordinary life. These fictional representations depend upon an imaginative identification with rather thinly drawn characters over a briefly presented story within an artificial setting.

Some of these difficulties may be addressed by comparing individuals' recall of a real-life event during and before which some stress and arousal was thought to be experienced, namely an examination in statistical methods taken at the end of an

experimental methods and statistical analysis module which was a course requirement for first year psychology undergraduates at Bournemouth University. Given, however, that it was a real-life event, the same degree of stimulus control was obviously not possible as had been in the previous two studies. Nonetheless detailed records and recordings were made of the examination, and on this basis questions were formed which aimed to replicate the categories adopted in the previous studies. Measures was sought for participants' capacity to reduce their memories of the event, for their retention of 'plot-irrelevant' peripheral details, as well as some measure of the sensory/perceptual *vis a vis* semantic/conceptual recollections.

Accordingly, the study here reported probed memory for a publicly experienced event which, in order to test long-term memory development, was assessed eight months after its occurrence, using a greater proportion of open questions than had been the case in the previous two studies.

#### *4.4.2 Method*

##### *4.4.2.1 Participants.*

Undergraduate psychology (N= 82; mean age = 24.9, *SD* = 8.07 years; M = 31, F = 51) were students at Bournemouth University who had taken a first year statistics examination were recruited for this study. They participated for course credit.

##### *4.4.2.2 Materials and procedure.*

The study took place 8 months after the examination. Participants had been invited to participate in a study concerning an event they had experienced in the recent past. Upon arrival, the subject of the memory test was explained and informed consent obtained.

Participants undertook the study in small groups working at computers with instructions

and questions appearing on the screen. Before questions were viewed, participants were instructed to try to remember back to the examination and given 90 seconds in silence to do this. Questions were then shown for between 30 and 50 seconds, depending on the amount of material they contained. Participants recorded their responses in booklets, and questions were projected on computer screens. A 100 item questionnaire was developed specifically for this study. The questionnaire was designed to probe recall and recognition for a number of elements occurring within the examination (see appendix F).

As in experiments 5 and 6, four categories of questions were developed inspired by laboratory based studies into the effects of arousal upon memory. These categories were visual gist, verbal gist, visual detail, verbal detail. Visual referred to physical elements of the situation i.e. the layout of the examination hall, what a lecturer was wearing, where seats were arranged. Verbal referred to information communicated orally or in print. Gist denoted broad elements of the event and location approximately described. Verbal gist referred to the general sense of what was said, whereas visual gist referred to gross features of the visual array. Detail referred to one off events, specific comments, words used, or finer details of the visual array.

To further explore differences between emotional processing groups memory style, certain supplementary tests were included within the study. These measured dimensions known to influence the accuracy of memory, all of which might account for discrepancies in memory performance. Thus, the first section of questions (10) aimed to establish levels of arousal before and during the examination as well as probe rehearsal/discussion of the event since. Questions asked participants to state how they felt, and to assess the intensity of this feeling before and after the examination, their

expectations of how they would perform, and how often since they had thought about or discussed the examination.

A final category of semantic facts about the examination were employed. These comprised broadly information about the event, either publicly known or announced information regarding the examination or semantic facts relating to it, known to candidates beforehand and providing contextual and content information regarding the examination. Finally, there were two 10- item 4 -alternative fixed choice recognition sections. The first required participants to select from four similarly worded alternatives the precise statements lecturers had made whilst addressing the students. The second required participants to select from four similarly worded alternatives the questions they had seen in the examination.

*Table 13 : Constitution of recall test according to question category*

<i>Category</i>	<i>No. of questions</i>	<i>Example</i>
<b><i>Semantic</i></b>	5	<i>What day was the examination on?</i>
<b><i>Visual gist</i></b>	10	<i>How many lecturers were there at the beginning? How full was the hall</i>
<b><i>Visual detail</i></b>	20	<i>What colour was the curtain hanging over the door</i>
<b><i>Verbal gist</i></b>	10	<i>What did lecturer x speak to you about before the exam?</i>
<b><i>Verbal detail</i></b>	20	<i>For what specific reason was it likely you would fail if you copied?</i>
<b><i>Recognition aural</i></b>	10	<i>which of the following did lecturer y say.....</i>
<b><i>Recognition verbal</i></b>	10	<i>Which of these questions do you recognise from the test itself.....</i>
<b><i>Memory quality</i></b>	5	<i>how vivid would you say your recollection of the exam is?(on 7 point rating scale)</i>
<b><i>Arousal/rehearsal</i></b>	10	<i>How stressed were you feeling before the exam (on 7 point rating scale)</i> <i>How often have you thought about the exam since (on 7 point rating scale)</i>

#### 4.4.3 Results

##### 4.4.3.1 Question type.

The chief variable of interest, the type of information emotional processing groups recalled following the event, was measured by assessing what proportion of total correct responses were constituted by each question type. Means scores were calculated and compared across groups. Descriptive statistics are shown in table 14.

Table 14: Mean percentage (and standard deviations) of correct responses according to question type for emotional processing groups

Question Type	Emotional Processing Group		
	Poor	Effective	Total
Verbal gist	21.43 (8.57)	27.37 (11.25)	24.47 (10.36)
Verbal detail	19.26 (9.88)	21.86 (10.56)	20.59 (10.21)
Visual gist	28.17 (8.78)	25.04 (10.09)	26.55 (9.50)
Visual detail	31.19 (12.9)	25.72 (8.31)	28.41 (11.03)

A 2x4 mixed ANOVA with between-subjects factor emotional processing group (effective vs. poor) and within-subjects factor question type (verbal gist vs. verbal detail vs. visual gist vs. visual detail) was conducted. Once again the chief variable of interest was expressed through the interaction between emotional processing group and question type. There was, predictably, a significant main effect of question type,  $F(3, 135) = 3.94, p < .05$ . There was no significant interaction between group and question type although this approached significance ( $F(3,135) = 2.32, p = .078$ ).

##### 4.4.3.2 Other exploratory measures

A series of t-tests were conducted on a number of supplementary exploratory measures also included within the study to examine further dimensions on which poor and effective emotional processors may have differed and which may have served as

potential confounds of the data. These were total correct scores, recognition measures of questions presented in the original examination, subjective ratings of vividness, levels of stress associated with the event, and finally a 'semantic' memory measure, which tested participants' recall of certain 'facts' regarding and associated with the examination.

*Total correct.* Mean total correct scores for the recall test (60 questions concerning verbal and visual gist and detail) were 14.11 ( $SD = 3.89$ ), which represents just under 25 per cent correct. There were no differences between groups on this measure,  $t(45) = .33, p > .05$ .

*Recognition measures.* Neither groups performed significantly better than chance level for multiple choice section testing recognition for actual test items, and statements made during the examination with poor emotional processors achieving mean scores of 27.2 per cent correct, and effective 24.9 per cent correct. Accordingly these measures were not analysed further as they provided no basis for differentiation between groups.

*Subjective measures of vividness.* Memory quality measures of arousal and memory quality were analysed and revealed no significant group differences. Overall, across groups ratings suggested that the event was recalled rather indistinctly ( $M = 1.82, (SD = 1.22$  on a seven-point rating scale), with no differences emerging between groups,  $t(45) = 1.43, p > .05$ . Groups did not differ on levels of reported arousal for the examination with mean scores of 2.72 ( $SD = .16$ ) for poor and 3.01 ( $SD = .94$ ) for effective emotional processors, a difference which did not achieve statistical significance  $t(45) = 1.43, p > .05$ . Similarly, for levels of rehearsal, no differences were detected,  $t(45) = 1.43, p > .05$ , with mean scores of 2.98 ( $SD = .12$ ) for effective

emotional processors and 3 ( $SD = .69$ ) for poor emotional processors.

Thus poor and effective emotional processors reported no reliable differences in either affective measures of stress or anxiety before or after the exam, nor were there any reliable differences in phenomenological measures of vividness.

*Semantic memory.* An independent samples t test conducted on semantic memory of the event revealed significant differences between groups, with poor emotional processors correctly responding to fewer semantic questions ( $M = 2.87$ ,  $SD = 1.97$ ) than effective emotional processors ( $M = 4.04$ ,  $SD = 2.03$ ),  $t(45) = 2.01$ ,  $p = .05$ .

#### 4.4.4 Discussion

The only statistically significant difference found within this study was in the semantic memory category, where effective emotional processors displayed a greater accuracy in responding to questions concerning facts about the test. These were intended to probe the extent to which different groups retain contextual, semantically based information regarding an experience.

In terms of the chief measure of interest, question type, which sought to probe the availability of *types* of memory regarding an event, the tendency, at a descriptive level, seems to suggest a preference amongst effective emotional processors for verbal elements (aurally communicated) over visual, although this interaction merely approached statistical significance. Poor emotional processors performed better in visual measures, comprising visual gist, and visual detail.

The findings suggest that poor emotional processors may display some tendency, as

outlined in the introduction, towards a sensory-perceptual style in event encoding to the extent that this is expressed through a preference for visual rather than verbal features of a complex event. This was not expressed through measures that sought to assess how effective emotional processing groups retained significant details of an event, namely central over peripheral (or gist over detail as it was here operationalised), suggesting that, to the extent that it was measured within this study, there is little difference for greater *abstractive* tendencies within effective emotional processors, or *indiscriminate* event encoding amongst poor. It should be noted that of the sixty questions analysed according to question type and intended to assess relative memory composition across groups, total correct responses across groups were fairly low, at approximately 25 per cent correct for both groups. This is perhaps to be expected given the interval between testing and encoding (8 months) and the inherent difficulty of some of the questions, which were recall, rather than recognition measures, and, particularly in the detail category of question, were particularly challenging. Nonetheless, it does point to the possibility of floor effects emerging, which may obscure differences between groups.

#### 4.5 Studies 5-7: General Discussion

Studies 5 and 6, which used computer presented slide shows and tested participants using multiple choice questions after retention intervals of 45 minutes and 1 week, failed to discern any reliable differences in the kind of memories different emotional processors retain of events. It had been hypothesised that poor emotional processors would show inferior ability to abstract gist, central elements as well as to retain verbal information regarding an event. Yet no supporting evidence was found for this hypothesis.

Clearly there is some discrepancy between the findings here reported and those reported within studies 1-3 which suggested that poor emotional processors tended to retain analogue, unreduced sensorily-based representations. The extension of the sensory-perceptual processing styles, would, it was hypothesised, be reflected in poor emotional processors encoding comparatively *indiscriminately* such that gist and central elements would not be prioritised (Burke, Heuer & Reisberg, 1992), and that this groups' memory for the events would more replicate the pattern of vividness, and retention of sensory-perceptual detail typical of witnesses of highly arousing emotional situations or experiences (Christianson & Loftus, 1987, 1990). There was no preference for visual over verbal materials either, which further confirmed the pattern found in study 3.

The materials used within studies 5 and 6 were originally designed to study the effect the interpolation of a visually or thematically arousing element would have when compared to a similar neutral narrative, a method adopted by many studies within this field (Clifford & Scott, 1978; Heuer & Reisberg, 1990; Hosch, Leippe, Marchioni, &

Cooper, 1984; Loftus & Burns, 1982; Reid, Yuille, & Tollestrup, 1992). They were thus intended as experimental reproductions of how stress responses might impact upon memory in order to further explore weapon focus effects and attention cueing hypotheses might be borne out within experimental settings. As such, their original intention was to compare experimental groups' performance using subtly different stimulus sets, rather than differences in the memory performance of populations defined by trait, in the way they were applied within this study. It seems that perhaps experimental materials more sensitive to the presumably more subtle differences between populations here investigated may need to be developed as the materials here adopted represented fairly poor replications of the processing demands and affective involvements which naturally occurring situations and events might place on people.

There are evidently limitations to the extent to which the fairly simplistic narratives presented within a laboratory can replicate those individuals encounter within their own lives (Laney, Heuer, & Reisberg, 2003). Within studies 5 and 6, aural narratives provided a distinct and unambiguous commentary of the actions, what was significant to action, and the simplicity of the images enabled a high degree of attentional focus on what from an array to attend to and what may be significant. This leaves open the question of whether within more complex and personally involving events that characterise one's own life, differences between groups might emerge. Thus it may have been unchallenging for participants to extract meaning, gist and causal-motivational significance from these highly simplified analogues of real life experience. Whilst enabling a high degree of stimulus control, the obvious disadvantage to this is that it poorly reflects the complex, 'uninterpreted' stream of events and stimuli which characterise ordinary life. If poor emotional processors are inferior at abstracting from

experience, and semantically processing events, then perhaps such stimuli perhaps provide a relatively superficial means of exploring such deficits.

Furthermore, in terms of the amount of data provided, the stimulus sets comprised comparatively short texts with a small number of slides, which, once again poorly reflects the degree of complexity and detail individuals confront in their ordinary lives. To some extent, particularly over brief retention intervals and for gist and central measures (which by their nature could only yield a limited number of questions) ceiling effects may have emerged for both groups the information provided within the narratives may have failed to tax participants memories sufficiently to reveal processing preferences for a particular type of information. By virtue of this simplicity, these stories may have constituted tests of *retention* rather than *interpretation and reconstruction* of complex events. This former question is naturally an interesting one to pursue, but an alternative approach that might be pursued could be to examine how complex, detail-rich, unnarrated stimulus sequences are subsequently processed by different groups and what differences emerge in their relative capacity to spontaneously provide meaning to an otherwise unstructured stimulus set.

A more interesting, and theoretically significant aspect of why emotional processing groups could not be differentiated on memory performance comes to light when we consider the *nature* of the memory test administered. The paradigm adopted used multiple choice question format which presented participants with four possible responses, in common with similar studies (Burke, Heuer & Reisberg; Loftus; Reid, Yuille & Tollestrup, 1992; Christianson, 1984). These in themselves may have constituted fairly detailed retrieval cues for participants. Thus when, say, given the option of four colours for a character's item of clothing from the slide show, there is the possibility that the question itself prompted the formation of a retrieval cue and memory

facilitation effects have occurred. These externally initiated recollections of events may not have reflected how participants might have spontaneously represented the events to themselves, and thus been insensitive to automatic processing differences between groups.

This introduces the question of the effect post-encoding elaboration can have on modulating the original memory trace. Post-event verbalisation plays a central role in dual representation theory's account (Brewin, Dalgleish & Joseph, 1996; Brewin, 2001b) of how emotionally processing of highly distressing experiences are assimilated. It suggests that through the elaboration of a verbally accessible memory, either distressing features of the original event become incorporated and stabilised within a newly formed, verbally cued memory, or that the original intrusive memory becomes suppressed through a preferentially accessed verbally based trace.

Further post-event manipulations have found that the act of interrogating participants on sections of an aversive, experimentally presented film had the effect of reducing intrusive memories for that section of the film (Krans, Naring, Holmes & Becker, 2009). This, according to the experimenters, occurred because the memory trace was recoded to a verbal semantic basis which had the consequence of etiolating its sensory-perceptual content, and, presumably its affective potency. Further studies, by taxing, post-event, the operations of visuo-spatial memory have been able to inhibit the formation of intrusive memories within an analogue PTSD studies (Stuart, Holmes & Brewin, 2006). Relatedly, verbal overshadowing effects (e.g, Brandimonte, Schooler & Gabbino, 1997; Schooler & Engstler-Schooler, 1990) also report that the visual basis of a representation can be attenuated following the production of a semantically based

account of a percept: by requiring experimental participants to describe a face they have seen, they are less able to subsequently identify it.

To contextualise these findings within current study, the suggestion is that complex, verbally based retrieval cues may have represented an exogenous source of memory consolidation which undermined naturally occurring differences between groups, and facilitated retrieval. Participants within both groups may have been able to retrieve features and elements of the slide-show narratives given a detailed enough cue: this may not, however, have reflected their spontaneous representations of the stimuli in the absence of such facilitation.

What may be the case is that it is in groups' spontaneous, unassisted ability to order event sequences meaningfully as well as their recollection, rather than their recognition of past events, genuine differences emerge in their capacity to conceptually process experience. The possibility that exogenous cues, structures and scaffolding can provide a source of conceptual processing which eliminates differences between groups in their typical representations of events is one which requires greater exploration.

The final set of studies aims to pursue the greater ecological validity which the final study allowed. This naturally comes at the cost of a certain degree of experimental and stimulus control, but may provide some insight into how different groups of emotional processors retain memories of events in long term memory.

## Chapter 5: Autobiographical Memory Studies of Poor and Effective Emotional Processors

### 5.1 Studies 8-10: General Introduction

Autobiographical memory denotes our long-term memory for life events (Rubin, 1988). The concept suffers a certain degree of ambiguity within the academic literature such that its boundaries are sometimes taken to encompass any long-term memory of events an individual has experienced (Nelson & Fivush, 2004); other researchers, by contrast, stress that for a memory to be autobiographical it must be *significant* to the individual's sense of self (Wang & Brockmeier, 2002); whilst others characterise autobiographical memory as memory for any information *related* to the self (Brewer, 1988; Robinson, 1992).

Empirical investigation into autobiographical memory, was pioneered by Galton (1879, cited in Baddeley, 1997) who developed a word-cue technique which required experimental participants to provide specific memories in responses to generic word-cues. This paradigm was revisited by Crovitz and Schiffman (1974) and subsequently adopted and refined as a tool for many researchers investigating how long-term representations of life events are organised within the human memory system (Robinson 1976; Rubin, 1992; Conway & Bekerian, 1987; Pillemer, 1990).

Whilst certain researchers have advocated and restricted themselves to essentially taxonomical, descriptive accounts of the types and qualities of such memories (e.g. Brewer, 1986), others have attempted to develop functional models of the purposes of autobiographical memory. Thus certain theorists in the field (e.g. Nelson, 1993; Nelson & Fivush, 2004) have emphasised the social interactive value of autobiographical memories in that it allows us to produce narratives and accounts of our past experience,

and adduce developmental evidence in support of such a view to the effect that the origins of autobiographical memory are intimately bound up with the onset of language; others (e.g. Barclay, 1986; Barsalou, 1988, 2002, 2008) have stressed the role autobiographical memory plays as a means of processing information about the environment, and see episodic memories as interacting with and supporting abstract, schema based representations of the world. Still others see autobiographical memory (ABM) as facilitating important goal attainment through the course of one's life (Pillemer, 1992, 2004; Bluck, 2003).

One of the most recent and certainly most influential models of autobiographical memory (Conway & Pleydell-Pearce, 2000) sees such memories as transitory constructions functionally ancillary to maintaining and supporting an individual's self-concept. The model sees access to memories for particular events and experiences as achieved through highly ordered, hierarchically organised structures, where event specific memories are preserved within partonomic relations to temporal and life themes. Implicit within this and other researchers' (Barsalou, 1988; Conway & Bekerian, 1987) view is the claim that, rather than haphazardly stored within memory, such recollections are subject to a high degree of processing and organisation, and acutely responsive to novel encounters and demands, symbolic and semantic cues, and thematic similarities across situations.

The possibility that memory interacts in highly versatile and adaptive ways with currently experienced environment, that memory is organised thematically and can readily incorporate and respond to new environmental information has resonance within many other information processing accounts of human memory (Kolodner, 1983; Schank, 1982; Schank & Abelson, 1977) as well as with the speculations introduced

within section 1.3.5. Briefly, it was suggested that in situations of reward or threat a heightened tendency to encode sensory-perceptual detail may be manifest in order to maximise the retention of valuable information. Such a tendency may become problematic where it disrupts the conceptual organisation and processing of experience.

The final three studies here reported consider how emotional processing style may be associated with particular features of long-term memory representations. Whilst storage based views of memories, and concomitant distinctions between short and long term memory have become increasingly problematic in recent years (Neath & Surprenant, 2005), questions of how individuals represent and retain past experiences is a fertile field for much research and, in the view of many, of greater significance than studying memory performance in closely controlled laboratory situations (Neisser, 1978; Gathercole & Collins, 1992; Conway, 1991). Thus, in order to explore how poor and effective emotional processors differ in the representations of personally significant events, the degree of stimulus control, and experimental manipulation exercised in the previous studies is here to some extent relinquished. Instead, the final three studies here reported adopt research procedures widely used in the study of three well researched long-term memory phenomena: autobiographical memories cued by generic word cues, flashbulb and personally significant memories, and representations of traumatic events. All three studies consider naturally occurring events drawn from participants own lives, and allow some scope for exploration into how differing emotional processing style influences the representation of past experience.

Evidently the methods used to investigate such memories frequently depend upon individuals' phenomenological reports of memory features, relying upon self-rating questionnaires and recall measures to a greater extent than has previously been the case

in this dissertation. Whilst foregoing an element of experimental control such studies afford an opportunity to gather a greater wealth of data, provide greater ecological validity and a more holistic view of how events experienced as personally meaningful are encoded and retained. Thus the final studies here reported explore how emotional processing style might be associated with particular features of long-term memory representations.

That emotional processing difficulties can be associated with a tendency to encode analogue, sensorily-based information at the cost of conceptual processing, and thus that poor emotional processors will display a greater tendency to encode events in this manner will be explored by comparing the memory features of poor and effective emotional processors across three types of autobiographical memories. Thus a central measure throughout these studies is *memory vividness*, which is used to reflect the degree of sensory-perceptual information retained from a past experience. If poor emotional processors are comparatively deficient in their ability to reduce complex, sensory- perceptual events and stimuli into coherent, semantically based narratives, then, it is reasoned, such deficiencies will be reflected in phenomenological aspects of those memories, resulting in greater sensory-perceptual detail, and impaired narrative/conceptual coherence. The following three studies explore how groups differ in phenomenological measures of memory vividness and memory coherence, both taken to reflect the operation of a sensory-perceptual and conceptually driven memory style respectively.

Furthermore, as in study 7, the studies include supplementary exploratory measures which tap features known to influence the availability and accuracy of memories which

may help to explain differences between groups' memory performance. These measures include emotionality, rehearsal, recency and valence.

## *5.2 Study 8: Effect of Emotional Processing Style on Recall of Autobiographical*

### *Memory*

#### *5.2.1 Introduction*

The concept of autobiographical memory appears to exhibit some of the fluidity typical of a construct comparatively new to contemporary research. It is clearly located within the superordinate field of episodic memory yet its boundaries, contents, function and structure have all been theoretically contested (Brewer, 1986). This is reflected not least within the profusion of terminology adopted by researchers: what Robinson (1976), Rubin (1976), Waagenar (1986), Barclay (1986) referred to as autobiographical memory ranges from 'episodic memory' (Crovitz and Schiffman, 1974) to 'memory for real world events' (Linton, 1975), personal memory (Franklins and Holding, 1977), 'memory for unique personal events' (Thompson, 1982) 'memory for personal events (White, 1982), 'personal memory' Brewer and Pani, 1983; Nigro & Neisser, 1983). Indeed speculation regarding the function and purpose of autobiographical memory is similarly diffuse: Nelson & Fivush, 2004) see it as enabling a shared social world, Conway prefers to see it as critical in organising a sense of self; Reeser 2002 emphasises its roles in mediating social factors in early development; Bruner (1997) and Singer and Bluck (2001) stress its significance in realising a narrative self; whilst Rubin (2006) prefers a basic systems model seeing autobiographical memory as essentially recollective memory whose achievement depends on the coordination of a number of memory systems.

The field appears to lack a definitive model, compelling evidence which might unveil the construct's underlying psychological reality, or unanimously agreed definition by which rival accounts, claims and stipulations regarding the 'true' nature of autobiographical memory might be adjudicated. Accordingly, it is unclear on what basis one might

privilege a particular type of memory as more representative of its kind than another and thus more worthy of investigation. Given this absence of scholarly consensus and the many theoretical divergences, a theoretically neutral, minimal definition is offered by Williams (2002) as ‘the aspect of memory that is concerned with the recollection of personally experienced past events’.

With this minimal definition in mind, and conscious that the methods adopted to explore autobiographical memory will be determined by our understanding of what autobiographical memory is, arguably the singly most replicated paradigm in autobiographical research, along with diary methods, is the cueing technique which has been used since the inception of autobiographical memory as an object of scientific research and continues to the present to be remarkably widespread.

Briefly, the test presents participants with a series of word cues, and requires participants to retrieve a specific memory of an event or experience of short duration drawn from their own lives, and then to rate particular characteristics of the memory, such as vividness, emotionality or valence. The time taken to retrieve the memory, the retrieval latency is seen as reflecting the accessibility of the memory, and is often a variable of interest, and has been investigated to explore the structure of autobiographical memory by several researchers within the field. (e.g. Arntz, Meeren & Wessel, 2002; Anderson & Conway 1993; Conway & Berkerian, 1984; Reiser, Black & Abelson, 1985; Robinson, 1976).

This method has its origins in Galton’s seminal research (1879) which adopted words as cues, and recorded reactions times to produce memories. In the seventies this technique was revived by Crovitz and Schiffman (1974) and has since been used to provide exploratory samples of the nature of autobiographical memory performance (Robinson;

Fitzgerald; Fitzgerald), to explore the frequency of episodic memories as a function of age (Crovitz and Schiffman, 1974; Franklin & Holding, 1977; Holding, Noonan, Pfau, & Holding, 1986; Hyland & Ackerman, 1988; Jansari & Parkin, 1996); the relative accessibility of memory in response to different types of cues (Anderson & Conway, 1993; Barsalou, 1988; Conway & Berkerian, 1987). Indeed the chief researchers of the field have adopted this paradigm, or data it has produced, and to form the foundation for some of the most well established models of autobiographical memory. (Barsalou, 1988; Conway & Pleydell-Pearce, 2001; Rubin, 2005)

Within clinical areas, too, the autobiographical memory test has been adopted to explore and establish differences mnemonic differences between clinical and normal populations. This capacity to retrieve specific memories appears impaired within certain affective disorders. Pathological states such as depression (Wessel, Meerern, Peeters, Arntz, & Merckelbach, 2001), parasuicide (Williams & Broadbent, 1986), acute stress disorder (Harvey, Bryant & Dang, 1998), post-traumatic stress disorder, (McNally, Lasko, Macklin, & Pitman, 1995) and behavioural disorders (Dalgleish, Tchanturia, Serpen, Ehms, Yend, De Silva, 2003; Nandrino, Doba, Lesne, Christophe & Perzard, 2006) have been shown to slow response time in the autobiographical memory test, as well as to induce a tendency to produce generic 'categoric' memories (Williams, 1996) reflecting experiences collated from repeated occasions, rather than specific temporally located events the autobiographical memory test requires of its participants. This 'overgeneral memory effect' consisting of slowed response times and a tendency to produce generic rather than specific memories has been thought to reflect the comparative difficulty of accessing and retrieving particular episodic memories. It has been typically explained as the effects of a particular cognitive mode (Watkins & Teasdale, 2001, 2004), impaired executive memory control (Dalgleish, Rolfe, Golden, Dunn & Barnard, 2008) or a protective suppressive strategy blocking access to specific

memories in an attempt to prevent access to distressing materials stored within long-term memory (Williams et al 2007; Conway & Pleydell-Pearce, 2000; Phillippot, Schaefer & Herbette, 2003).

The following study aims to probe the structure of autobiographical memory through the use of the autobiographical memory test, comparing retrieval time to produce memories in response to verbal cues for participants with high and low emotional processing scores. The autobiographical memory test, the paradigm adopted within this study, has the benefit of being extensively used within autobiographical memory studies, and of having established a basis of findings within which current results can be interpreted (e.g. Williams & Broadbent, 1986; Conway, 1984; Conway & Bekerian, 1987; Robinson, 1976; Kuyken & Dalgleish, 1995; Pollock and Williams, 2001).

Whilst clearly the autobiographical memory test may have certain drawbacks in its capacity to provide a rich profile of individuals' memories, the current purpose of this research is to produce a sample of group differences in line with the general framework established previously. As such, it serves the exploratory goals of the research particularly well by providing a welter of data likely to be indicative of directions for further study. Here, using standardised cues, a number of measures can be implemented to obtain a profile of phenomenological differences, recency data, and retrieval times for a considerable number of memories. Similarly, through standardised instructions prescribing the type of memory to be reported on, the key sense of autobiographical memory, that is recollective experience involving the participant stored in long-term memory can be preserved and such memories investigated.

Prominent theories of autobiographical memory (Conway & Pleydell-Pearce, 2000; Schank, 1982) see within it a high degree of thematic organisation, structured in a

hierarchical manner, which enables access to self-knowledge according to currently activated goals and plans. This presupposes that the human memory system depends for its optimal functioning upon the critical processing of events and experiences in order to subserve current system demands, superordinate goals and currently undertaken activities. Specific autobiographical memories may serve as repositories of valuable information relating to the world or self, which can be accessed to facilitate the individual in pursuing current projects. Critically, for the purposes of this programme of studies the test provides a measure of verbal indexing (Conway, 2000 ; Conway and Pleydell Pearce, 2001). Clearly, at the heart of the autobiographical memory test is the capacity of symbolic, conceptual cues (words) to elicit sensorily based, event specific representations (episodic memories). The nature of this interaction depends, it is assumed, on how effectively a memory is indexed. It is apparent that human memory is ordinarily highly versatile and responsive to verbal cues and questions. It appears to be a prerequisite of human dialogue and thought that we can respond rapidly to an infinite range of novel questions probing long-term experiences, and a functional benefit of memory is that it can so readily be recruited to produce information about past experience in response to current challenges and demands.

Furthermore, the type of word cue can also influence response time. Thus, words denoting emotions are typically poor at eliciting autobiographical memories (Robinson, 1976; Conway & Bekerian, 1987) as are abstract word cues. Nouns denoting concrete items, by contrast, have been found to be more effective. The capacity to label and describe emotions is viewed as a central component of models of emotional literacy (Mayer & Salovey, 1997; Taylor & Bagby, 2000), hypothesised to be a key component of emotional intelligence, and this meta-affective awareness likely to be crucial in regulating one's own emotional responses. Such higher level meta-affective abilities may be deficient in poor emotional processors, i.e. in the regulation, analysis and

understanding of affective states. If, as has been assumed, poor emotional processors are less effective at conceptualising events and experiences, then this deficit may be particularly marked in retrieving events which exemplify certain feeling states.

Thus latency to produce autobiographical memories has been found to increase within certain affective pathological conditions, and such retrieval latency may be a reflection of how effectively memories are verbally indexed, and thus semantically processed.

This suggests that poor emotional processors, who, it is reasoned, may be comparatively deficient at the semantic processing of events, may exhibit greater latency in the retrieval of memories in with autobiographical memory test. Furthermore, in order to explore how the type of word cue may differentially affect latency between groups this is varied in the following study, by adopting a mixture of emotion adjectives employed within previous research (e.g. Williams & Broadbent, 1986), and concrete nouns.

Thus, by measuring latency to respond, and assessing participants' subjective ratings of the memories they produce for a range of cues denoting both emotional states and concrete nouns, the following study aims to explore differences in both the conceptual/semantic processing of autobiographical memories, as operationalized through their responsiveness to verbal cues, and the sensory-perceptual contents of such memories (vividness). Furthermore, by providing rating scales for such memories, other mnemonic features can be compared across groups. Phenomenological self-rating measures regarding the emotionality, valence and frequency of discussion and thought are included to provide further exploratory measures of between-group differences.

## *5.2.2 Method*

### *5.2.2.1 Design*

The study compared emotional processing groups' autobiographical representations on

two principle measures. The first, thought to correspond to a key aspect of conceptual memory processing, was the latency to produce memories in response to word cues. The second, corresponding to sensory aspects of memory processing, was the reported vividness of the memory. To examine the effects that the type of word cue would have on memory quality and retrieval latency, words cues were varied to include adjectives denoting emotions and concrete objects. Thus, two separate mixed 2x2 ANOVAs with factors emotional processing group (poor vs. effective) and word cue type (adjectives vs. concrete nouns) were conducted with latency and vividness serving as dependent variables. To further explore between group differences, a series of separate t-tests were conducted on groups' ratings of emotionality, valence, frequency of rehearsal and temporal proximity of the reported-on memories.

#### *5.2.2.2 Participants.*

Participants (N = 52; mean age = 21.69; *SD* = 3.7 years; M = 11, F = 41) were undergraduate students from Bournemouth University who took part either on a voluntary basis or to receive course credit.

#### *5.2.2.3 Materials & apparatus.*

*The Autobiographical Memory test* (from Williams & Broadbent, 1986). Twenty words served as memory cues. Of these, ten were adjectives describing emotional states (happy, relieved, successful, interest, safe, clumsy, lonely, sorry, hurt, angry) used in multiple replications of Williams and Broadbent's study (e.g. Kuyken & Brewin, 1995; McNally et al., 1995; Dalgleish et al., 2003; Arntz et al., 2003). A further ten common nouns were added to this list (table, fish, train, garden, music, holiday, gift, mother, examination, hospital). These nouns had been selected on the basis of pilot research where 100 common nouns had been rated for their likelihood to produce emotional memories. Three were selected (table, fish, train) as consistently receiving low ratings,

( $M = 1.4$ ,  $SD. = 0.4$ ). Four (garden, music, holiday, gift) as they had consistently received intermediate ratings ( $M = 5.1$ ,  $SD. = 0.8$ ) and three (hospital, mother, examination) which had consistently received high ratings ( $M = 9.1$ ,  $SD = 0.8$ ). Order of item presentation was randomised. Stimuli were presented on an 18-inch computer screen using an HP Compaq dc7900, 2.2 Ghz computer, with a resolution of 1440 x 900 pixels. A program using C# under Win32 Environment was developed to present the word cues, to time latency to response and to record the ratings responses provided by participants regarding the memories they had produced.

#### 5.2.2.4 Procedure.

Participants were given ninety seconds to retrieve a specific autobiographical memory cued by the word. Once they had thought of a memory they were to click a button on the computer mouse, which prompted a text box to appear on the screen. Time was recorded from presentation of cue, to clicking the mouse button, to provide a *latency* score. Participants were then required to write a brief description of the memory to ensure that a specific memory was being reported on and to provide a series of ratings for the nature of the memory. These ratings were for vividness (1-7 for 'not at all' to 'completely'); emotionality (1-7 for 'not at all emotional' to 'completely emotional'); valence (1-9 ranging from 'extremely negative' to 'extremely positive'); frequency of thinking about the event (1-9 for 'never' to 'almost all the time'); and frequency of talking about the event (1-9 for 'never' to 'almost all the time'). Finally, participants stated when the memory occurred (1-8 ranging from 'this week' to 'five or more years ago').

Participants were tested in small groups of between 4 and 9 participants, who recorded responses on a computer. Participants had already completed Baker et al's (2009)

emotional processing scale prior to taking part in the study and preselected as belonging to a low or high group. Once informed consent had been obtained, instructions were given to participants, first in printed form, then orally, regarding the procedure of the study, and the type of memory being probed. It was explained that participants were to produce specific memories from their own lives that had taken place over a short period (not longer than a day) and not representing general, extended or repeated events or periods. These memories could have happened at any time, and could be important or trivial. Two examples of this type of memory were provided. These were '*I remember one morning when I was very young eating strawberries in my kitchen lounge when the electricity in the house went off and my mother had to try to fix it*' (in response to cue: strawberries) and '*Last week when I was driving to the shops in the afternoon another driver took my place in the parking lot outside the supermarket and I was so angry I shouted at him*' (in response to cue: angry). To familiarise participants with the computer program, an example cue was worked through, to which participants produced memories on the computer which were checked by the experimenter to ensure they met the criteria for autobiographical memories. Participants were then allowed to proceed at their own pace. If they were unable to produce a specific autobiographical memory, once ninety seconds had elapsed a new cue word appeared.

### 5.2.3 Results

#### 5.2.3.1 Latency.

Mean latency to produce a memory was calculated for adjective and nouns and compared across emotional processing group. These are depicted in Table 15.

A 2x2 mixed ANOVA with between-subjects-factor emotional processing group (effective vs. poor) and within-subjects factors word type (adjective vs. noun) revealed

no significant main effect of group,  $F(1,50) = 1.23, p > .05$ . Word type did appear to have a significant effect :  $F(1,50) = 19.35, p < .01$ . There was no interaction between factors.

*Table 15: Mean latency (and standard deviations) in seconds to respond to word cues across emotional processing groups.*

<i>Word type</i>	Emotional Processing Group		
	Poor	Effective	Total
Adjectives	17.43 (17.51)	12.71 (10.32)	15.16 (14.59)
Nouns	10.33 (8.87)	8.46 (6.60)	9.43 (7.84)
Total	13.88 (8.79)	10.58 (7.75)	

Given the high standard deviations for latency for both emotional processing groups, two outliers were removed from analysis. Whilst substantially lowering the mean latency for poor emotional processors (9.29 seconds and 14.63 seconds for nouns and adjectives respectively) and effective emotional processors (7.67 seconds and 11.95 seconds for nouns and adjectives respectively), no main effect of group, ( $F(1, 48) = 0.99, p > .05$ ), or interaction between emotional processing group and word type was revealed ( $F(1, 48) = 0.32, p > .05$ ).

In order to further explore whether emotionality of word stimulus impacted differentially upon latency to retrieve, a mixed 2 x 4 ANOVA with between-subjects factor emotional processing group (effective vs. poor) and within-subjects factor emotionality of word (adjectives vs. high emotion nouns vs. mid emotion nouns vs. low emotion nouns) was conducted. This revealed once again no main effect of emotional processing group on latency ( $F(1, 50) = 0.97, p > .05$ ), nor a significant interaction between emotional processing group and word type ( $F(3, 150) = 1.08, p > .05$ ). There

was a significant main effect of word type,  $F(3, 150) = 8.03, p > .05$ .

### 5.2.3.2 Vividness.

Mean ratings for vividness of memories were calculated for each word group according to word type. These are given in table 16.

*Table 16:* Mean vividness ratings (and standard deviations) of autobiographical memories formed in response to word cues across emotional processing groups.

<i>Word type</i>	Emotional Processing Group		
	Poor	Effective	Total
Adjectives	5.01 (0.57)	4.39 (0.88)	4.73 (0.79)
Nouns	5.00 (0.45)	4.38 (0.87)	4.71 (0.75)
Total	5.01 (0.45)	4.38 (0.81)	

A 2x2 mixed ANOVA with between-subjects factor emotional processing group (effective vs. poor) and within-subjects factors word type (adjective vs. noun) revealed a significant main effect of group,  $F(1,50) = 12.96, p < .01$ . There was no significant main effect of word type,  $F(1,50) = 0.02, p > .05$ ., nor group x word-type interaction  $F(1,50) = 0.08, p > .05$ .

### 5.2.3.3 Further exploratory measures.

Data for rehearsal (frequency of discussion and thought of the event), valence, emotionality and date of memory are depicted in table 17. A series of independent samples t-tests comparing groups for each particular measure was conducted. In no measure was there an effect of group, suggesting that, as a whole, poor emotional processors did not differ from effective in terms of the

pleasantness or aversiveness of memories reported on ( $t(50) = 0.39, p > .05$ ), how frequently they thought about or discussed such memories ( $t(50) = 0.32, p > .05$ ), the recency of such memories ( $t(50) = 0.21, p > .05$ ) and, most interestingly perhaps, how emotional the events were experienced as ( $t(50) = 0.33, p > .05$ ). Thus poor emotional processors could not be differentiated from effective processors on any of the additional exploratory measures.

*Table 17: Mean ratings (and standard deviations) of emotional processing groups for memory valence, rehearsal, recency and emotionality.*

<i>Measure</i>	<i>Emotional processing group</i>		
	<i>Poor</i>	<i>Effective</i>	<i>Total</i>
Valence	5.28 (0.62)	5.35 (0.51)	5.31 (0.56)
Rehearsal	3.27 (0.66)	3.22 (0.58)	3.24 (0.61)
Recency	4.69 (1.01)	4.63 (0.97)	4.66 (0.98)
Emotionality	3.45 (0.90)	3.21 (0.84)	3.33 (0.87)

#### *5.2.4 Discussion*

In terms of vividness, it appears that, in line with the experimental prediction, poor emotional processors do retain long-term memories of past experiences more vividly. Whilst remaining mindful of the methodological difficulties in comparing self-rating measures of vividness across participants (c.f. Baddeley & Andrade, 2000; Rubin, 1988), it is nonetheless interesting to note that such differences in vividness occur across word-type and thus appear to be a widespread systematic tendency in poor emotional processors long-term memory retention. This finding is particularly noteworthy because studies 1 and 3 suggested a greater tendency of poor emotional processors to form vivid memories across a range of experimental measures. It is interesting to note that, on the exploratory measures applied of frequency of rehearsal or discussion, valence, date of event and emotionality of event, no differences emerged between the groups. This suggests poor emotional processors, on the general audit of

autobiographical memories the autobiographical test allows, were not more susceptible to factors likely to increase or diminish memory vividness, such as repeatedly thinking about or discussing events, or reporting more recent events, or most interestingly retaining more emotional representations of events. This provides some support for the possibility that it is encoding style that is responsible for differences between groups: in particular that poor emotional processors retain more sensory- perceptual elements of an event, rather than react or respond to events with heightened emotional reactivity. Of course, this relationship was not directly measured within this study, and the results reported are at best suggestive of this difference. Generally, however, it does argue for a difference in encoding style rather than temporary state factors that in some way enhance or distort encoding operations, such as heightened emotional reactivity.

The study failed to detect any reliable difference between how long it took poor and effective emotional processors to retrieve autobiographical memories in response to generic verbal cues. It had been reasoned that, if poor emotional processors are comparatively deficient in conceptually processing memories then such memories will be less accessible to verbal cues, less semantically organised, and thus slower to retrieve. This prediction on the basis of the method adopted, found little support.

Whilst findings of greater latency amongst pathological groups is a well-supported phenomenon (see Williams et al, 2007 for a review), of course there is no reason to conceptualise poor emotional processing as a clinically diagnostic category, and thus to assume overt similarities between poor emotional processors and, say, parasuicide populations is unwarranted. Rather, poor verbal indexing of autobiographical memories was, here, postulated as a probable source of increased latency to retrieve specific memories. No support for this prediction was found.

It might be argued that the type of cues used, which were high frequency nouns and

adjective, provided a poor basis of discrimination between groups, as such nouns are likely to be comparatively rich in the number of memories associated with them and thus productive of a great number of memories, which did not reveal difference between the conceptual processing of complex events. Furthermore, whilst latency probed verbal indexing, this may be seen as a rather superficial form of conceptual processing, not reflecting meaningful reflection upon or conceptualisation of experience, which may be precisely the area in which poor emotional processors show deficits. Indeed, basic verbal indexing appears so fundamental a capacity for language and autobiographical memory to interact that any deficits in this area would be an extreme hindrance to communication and organisation within the cognitive-mnemonic system. It is quite possible, and apparently suggested by the results here reported, that within this fundamental sense of conceptual processing few differences between groups exist. Rather, it is in the more abstractive, reflective processes whereby experience is understood thematically and in terms of its consequences for self that differences between groups may emerge and poor emotional processors prove comparatively deficient. Accordingly, an innovation on the paradigm used here that might be adopted by further studies could be to present more complex abstract cues which test participants' indexing of memories in more sophisticated meaningful ways.

Whilst suggesting the operation of a sensory-perceptual memory style in poor emotional processors, it must be conceded that little evidence here points to superior conceptual-semantic processing amongst effective emotional processors as retrieval time between groups did not differ significantly. It may be pointed out that both conceptual-semantic and sensory-perceptual processing were assessed through single measures, either response latency or a single rating of memory vividness which may not

have provided a sufficiently thorough operationalization of the constructs as, in line with previous studies, given the amount of data participants have to produce and the number of word cues to which they must retrieve memories, it is thought that extensive measures of vividness would induce fatigue and possible non-compliance. A more detailed measure of vividness will be employed within the following study.

### 5.3. Study 9: Effects of Emotional Processing Style on Flashbulb Memory and Significant Personal Event Representations

#### 5.3.1. Introduction

That memory for particular events can be preserved within long-term memory with an apparently high degree of detail and veracity is well established both within research literature and popular belief (Brown & Kulik, 1977; Conway et al., 1994; Neisser et al., 1996; Pillemer, 1984, 1990; Reisberg, Heuer, McLean, O'Shaughnessy, 1988). One particularly prominent subset of such recollections, flashbulb memories, enjoys a distinctly controversial and contentious history within autobiographical memory research. Originally characterised as memories of 'indiscriminate illusion and brevity' and accounted for in terms of Livingston's (1967) 'now print' mechanism, the welter of studies Brown and Kulik's original research (Christianson, 1989; Pillemer, 1984; Winograd and Killinger, 1983; Bohannon, 1988; Wright, 1993; Christianson and Engelberg, 1999) engendered have led subsequent theorists within the field to questioning the accuracy of such memories (e.g., Neisser and Harsh, 1992), their distinctness from ordinary memories (McCloskey, Cynthia, Wible & Cohen, 1988), as well as the existence of dedicated neurocognitive circuits exclusively subserving them (Davidson & Glisky, 2002).

Such debates can be seen as originating within conflicting models of memory. Those who tend to envision memory as *reconstructive* more readily stress the possibility of inaccuracies arising within memories, for contamination through top-down processes, arising through source monitoring, suggestion, schematisation and other reconstructive processes (e.g. Bartlett, 1932; Neisser & Harsh, 1992; Conway, 2008). Others, by contrast, arguing from a view of memory as *reproductive* may more strongly advocate

'now-print' mechanisms, a photographic model of memory (Brown & Kulik, 1977; Finkenauer et al., 1998; Livingston, 1967) for the veridical recording of experiences, and events, such that original event features are preserved and accessible over longer periods of time. Of course, one may speculate that such models could be reconciled by postulating complementary reconstructive and reproductive processes and in memory retrieval operating alternately, separately or synergistically.

That flashbulb memories constitute a distinct class of memories (in anything other than their definition) rather than a subset of long-term vivid memories, would seem a particularly difficult proposition to defend. That memory for public events (frequently associated with figures of renown) which are of high consequence, social or national importance, and that are registered with a sense of surprise monopolize a distinct form of memory processing seems a priori somewhat improbable. The popularity of flashbulb memory studies may in part arise from methodological convenience: studying recollections of such well-documented, publicly disseminated events may bring research benefits, in terms of ensuring large sample sizes, stimulus standardisation, and a presumed uniformity in participants' reaction.

Pillemer, mindful of these concerns, maintains that considerable evidence exists for 'robust personal memories' and argues for a redefinition of flashbulb memories as 'memory of personal circumstances' (1990), but sees such memories as continuous with a range of memories for momentous events which he labels 'personal event memories' (2001) which may exhibit comparable clarity, accuracy and detail. He sees the flashbulb memory as a 'suggestive metaphor' provisional by nature and emblematic of an array of long-term memory phenomena.

Yet what, for the purposes of this dissertation, is most noteworthy of such memories is that, in common with flashbacks and memories of traumatic events, they include in unreduced sensory-perceptual form, details irrelevant to the event itself. The retention of data regarding the reception context, one's feelings and thoughts at the time of learning of the event, and so forth suggests indiscriminate, and apparently dysfunctional retention of excessive detail.

The purposes of such memories is rather enigmatic: certain theorists have suggested that they are by-products of processes ordinarily responsible for encoding short-term memories (Cohen, McCloskey and Wible, 1988), whilst others see them as fulfilling goals of retaining environmental information within situations of threat or reward (e.g. Brewin, 2001a; Brown & Kulik, 1977; Livingston 1967) are retained in unreduced form because they cannot be categorised within generic self-knowledge structures (Conway, 2000) or form prototypes for particular classes of subsequent experiences (Barclay, 1990).

If, as has been argued within the introduction, the retention of sensory-perceptual detail can be understood as reflecting a failure to satisfactorily reduce and conceptualise experience and if this is implicated in failures of emotional processing, then such differences are likely to be manifest in the qualities of poor emotional processors' long term memories. Whilst, within the previous study, such a failure to reduce and conceptualise experience was not reflected within increased latency to retrieve autobiographical memories, it is arguable that such differences may be expressed through a comparatively poor narrative ordering of memories such that they are comparatively less coherent, sequential and verbally based and cohesive within

participants life story and knowledge of themselves (Conway & Pleydell-Pearce, 2001; Ehlers and Clark, 2000; van der Kolk & Fisler, 1995).

The following study aimed, by exploring memories of a naturally occurring and personally significant event, to attain some profile of phenomenological differences in memory between groups of poor and effective emotional processors. It adopted a questionnaire study using self-ratings measures for event of both public significance and consequentiality, as well as personally significant events. Whereas previously, vividness has been operationalised in terms of sensory-perceptual details correctly recalled (studies 5-7), or a simple rating scales, the following study adopts a far more thorough operationalization of memory vividness, developed by Talarico, and Rubin, (2003) requiring participants to provide 8 separate ratings of vividness using subscales which assess key aspects of the vividness construct through tapping the availability of sensory detail, a phenomenological sense of returning to the time and experience itself as well as strength of belief in the event's occurrence. All of these features have been argued to be central to the construct of vividness (Brewer, 1995; Conway, 1995; Rubin, 1995; Rubin & Kozin, 1984) and provide a richer profile of between-group differences beyond the simple rating of memory vividness.

Furthermore, conceptual processing of memory is gauged by 5 sub ratings. Thereby, it is intended that a more reliable of these key dimensions of the research programme can be obtained. Thus by enabling participants to report on more aspects of the conceptual processing of their memory it was intended to acquire more robust data which may reveal differences between groups. In order to circumvent some of the difficulties outlined above regarding the conceptual distinctness of flashbulb from significant

private memories, memories for events of both public significance, and private significance are considered.

### 5.3.2. Method

#### 5.3.2.1 Participants.

Participants (N= 102; mean age = 22.1 years, *SD* = 3.42 years; M = 24, F = 78) were undergraduate psychology students at Bournemouth University who received course credit for participation, and volunteers from other faculties.

#### 5.3.2.2 Materials and procedure.

Participants had originally been recruited to participate in a study that concerned emotional experiences taken from their own lives. They were given the choice to participate in the current study or study 10. They were asked to complete two sets of identical questionnaires concerning an event of great significance from their own life, and a public event which was shocking or unexpected. First, a brief explanation of what a flashbulb memory was given. They were then asked to choose from a set of options for both questionnaires the event for which they had the clearest memory. For the personal event, these were (a) receiving A level results (b) being accepted into university (c) passing their driving test. For the public event, these were (a) Michael Jackson's death (b) the London bombings (c) the award of Olympics games to London.

*Questionnaire.* The questionnaire consisted of two sections. The first, taken from Talarico and Rubin (2003) comprised six open ended questions that probed for memory of the context of the event disclosure. These were intended to ensure that flashbulb memories were in fact being reported on, by probing the availability of *canonical details* within recollection, namely details regarding the reception context to ensure that

such memories satisfy the definitional criteria of flashbulb memories (Rubin & Kozin, 1984; Talarico, 2009). These questions were “*Who or what first told you the information?*” “*When did you first hear the news?*” “*Where were you when you first heard the news?*” “*Were there others present, and if so, who?*” “*What were you doing immediately before you first heard the news?*” and “*Are there any other distinctive details from the event?*”. Each question was followed by five blank lines for participants to record responses (see appendix G).

The second section comprised the Autobiographical Memory Questionnaire (Talarico & Rubin, 2003) which employs rating-scales to assess various phenomenological aspects of an autobiographical memory. These consisted of statements with which participants were asked to state their degree of agreement on seven point rating scales. Statements were designed to test four categories of information. *Vividness* questions comprised subcategories of *belief* and *recollection* and *sensory detail* measures. In total there were eight questions probing vividness. *Belief* items probed participants’ belief in the veracity of their memories (example questions: ‘*I believe the event in my memory really occurred in the way I remember it*’; ‘*I could be persuaded that my memory of the event was wrong*’). *Recollection* measures referred to the quality of recollection and contained questions such as ‘*I feel as though I am reliving the experience*’ and ‘*while remembering the event now, I feel that I travel back to the time that it happened*’; sensory detail measures directly addressed the availability of sensory detail by requiring participants to state whether they could recall *aspects of the setting*, whether they could *hear or see* the event in their mind.

*Emotion* questions tapped a variety of emotional aspects of the participants' memories. Ratings were given for emotional intensity of the memory, whether participants on

recollection felt emotions as strongly now as at the time of the event, whether the same emotions were now as at the time of the event.

The *valence* of the memory was also rated by participants but did not form part of the emotion scale as this latter probed quality of emotion (pleasantness) rather than intensity directly. Participants were asked to state the kind of emotions their memory involved from 100% negative.

*Narrative scales* asked participants to rate the narrative coherence and structure of their event recollection. Five questions probed this measure. Examples statements: '*the memory comes as a coherent story or episode and not as an isolated fact, observation or scene*'; '*the memory comes in pieces with missing bit*'; '*the memory comes in words*'; (all rated from 1, '*not at all*', to 7 '*completely*').

*Rehearsal* was measured by asking participants if how often they discussed or thought about the event since its occurrence. Finally *vantage point* denoting the perspective participants 'saw' the event from in memory, namely a first person perspective, bird's eye/observer perspective, or mixed was reported on. More emotional memories, which have not been reconstructed conceptually tend to be viewed through one's own eyes (D'Argembeau et al. 2003; Nigro & Neisser, 1983; Talarico & Rubin, 2003); thus, by requiring participants to report on the perspective from which they relived the memory, it was hoped some insight into the degree of conceptual processing might be attained.

### 5.3.3 Results

The majority of participants selected the same event in both sections of the questionnaire. These were for the personal event receiving news of A level results (N =

86; mean age = 22.51,  $SD = 3.21$  years;  $M = 19$ ,  $F = 40$ ); and for the public event the death of Michael Jackson ( $N = 59$ , mean age = 21.4,  $SD = 3.74$  years;  $M = 17$ ,  $F = 69$ ). In order to retain uniformity of stimulus, analysis was thus restricted to these participants. A series of independent samples t-tests were conducted to examine between group differences for vividness, narrative coherence measures, emotionality, rehearsal, and valence ratings. Chi – square analysis was used to examine differences in memory perspective.

### 5.3.3.1 Personally significant events.

Scores for vividness ratings were combined to form an overall vividness measure as were narrative coherence measures, and together with valence, rehearsal and emotion are presented in table 18. A series of independent samples t-tests were conducted comparing emotional processing groups ratings of features. Poor emotional processors rated recollections as significantly more vivid,  $t(84) = 2.46, p < .05$ . For narrative coherence, no significant differences between groups emerged,  $t(84) = 1.15, p > 0.05$ . The same applied for emotionality:  $t(84) = 1.05, p > .05$ ); and rehearsal,  $t(84) = 1.51, p > .05$ .

*Table 18* : Mean ratings (and standard deviations) of memory vividness, narrative coherence, valence and rehearsal for personally significant memory across emotional processing groups.

<i>Memory characteristic</i>	Emotional Processing Group		
	Poor	Effective	Total
<i>Vividness</i>	5.65(0.79)	5.24(0.74)	5.4 (0.76)
<i>Narrative coherence</i>	4.8(0.88)	4.6(0.96)	4.7 (0.93)
<i>Emotionality</i>	5.43(1.58)	5.07(1.60)	5.26 (1.59)
<i>Rehearsal</i>	3.75(1.74)	4.26(1.36)	4.01 (1.55)

The valence of the memory did not differ significantly between groups with mean ratings of 5.74 for poor emotional processors, and 5.57 for effective, suggesting that both groups tended to see the event reported on as pleasant with little difference between groups,  $t(84) = 0.5, p > .05$ ).

Chi-square analysis on memory perspective, assessed through requiring participants to report on the vantage point of the memory, did not differ significantly between groups ( $\chi^2(2, N = 86) = 1.24, p > .05$ ). Frequencies are given in table 19.

A series of independent samples t-tests were conducted comparing emotional processing groups ratings of features. Poor emotional processors rated recollections as significantly more vivid,  $t(84) = 2.46, p < .05$ . For narrative coherence, no significant differences between groups emerged,  $t(84) = 1.15, p > 0.05$ ). The same applied for emotionality:  $t(84) = 1.05, p > .05$ ); and rehearsal,  $t(84) = 1.51, p > .05$ ).

The valence of the memory did not differ significantly between groups with mean ratings of 5.74 for poor emotional processors, and 5.57 for effective, suggesting that both groups tended to see the event reported on as pleasant with little difference between groups,  $t(84) = 0.5, p > .05$ ).

Chi-square analysis on memory perspective, assessed through requiring participants to report on the vantage point of the memory, did not differ significantly between groups ( $\chi^2(2, N = 86) = 1.24, p > .05$ ). Frequencies are given in table 19.

Table 19: Frequency of memory perspective reported for personally significant event.

Emotional Processing Group	Memory Perspective			
	First person	Bird's eye	Mixture	Total
Effective	24	13	5	42
Poor	29	9	6	31
Total	53	22	11	86

*Recall measures:* All participants whose responses were used for this study provided sufficient canonical details regarding the reception event to satisfy criteria used by Talarico (2009) to assess whether memories reported on genuine flashbulb memories. Thus participants in all cases were able to report on details of the reception context of the event, e.g. how they learnt of the event, their location, others present and so forth, details which comprised the definitional criteria of flashbulb memories (Brown & Kulik, 1977). Written responses were further analysed for the number of sensory details as a proportion of total details provided. Following, Talarico and Rubin (2003), a detail consisted of a noun, verb phrase or unique modifier. Details referring to sensory information were then calculated as a percentage of total details.

Poor emotional processors tended to report a higher percentage of sensory details than effective emotional processors. This proved to be a reliable difference,  $t(84) = 10.83$ ,  $p < .05$ .

### 5.3.3.2 Event of public significance

Scores for vividness, and narrative coherence emotionality and rehearsal are presented in table 20. A series of independent samples t-tests comparing emotional processing groups

ratings showed no significant difference between groups for vividness,  $t(57) = 0.14, p > .05$ , narrative coherence,  $t(57) = 0.68, p > .05$ , emotionality,  $t(57) = 1.05, p > 0.05$ , or rehearsal  $t(57) = 0.85, p > 0.05$ . The valence of the memory did not differ significantly between groups with mean ratings of 2.9 ( $SD = .20$ ) for poor emotional processors and 2.86 ( $SD = .21$ ) for effective, suggesting that both groups tended to see the event reported on as aversive with little difference between groups,  $t(57) = 0.16, p > 0.05$ . A chi-square analysis on memory perspective, assessed as in the first section of the study, did not differ significantly between groups ( $\chi^2(2, N=59) = 1.96, p > .05$ ).

*Table 20: Mean ratings (and standard deviations) of memory vividness, narrative coherence, valence and rehearsal for publicly significant events across emotional processing groups.*

	Emotional Processing Group		
	Poor	Effective	Total
<b><i>Vividness</i></b>	4.64 (1.27)	4.69 (1.38)	4.68 (1.31)
<b><i>Narrative coherence</i></b>	4.46 (0.86)	4.32 (0.66)	4.39 (0.77)
<b><i>Emotionality</i></b>	3.74 (1.79)	4.25 (1.91)	3.98 (1.85)
<b><i>Rehearsal</i></b>	3.48 (1.73)	3.57 (1.81)	3.52 (1.78)

A series of independent samples t-tests comparing emotional processing groups ratings showed no significant difference between groups for vividness,  $t(57) = 0.14, p > .05$ , narrative coherence,  $t(57) = 0.68, p > .05$ , emotionality,  $t(57) = 1.05, p > 0.05$ , or rehearsal  $t(57) = 0.85, p > 0.05$ .

The valence of the memory did not differ significantly between groups with mean ratings of 2.9 ( $SD = .20$ ) for poor emotional processors and 2.86 ( $SD = .21$ ) for effective, suggesting that both groups tended to see the event reported on as aversive

with little difference between groups,  $t(57) = 0.16, p > 0.05$ ).

Chi-square analysis on memory perspective, assessed as in the first section of the study, did not differ significantly between groups ( $\chi^2(2, N=59) = 1.96, p > .05$ ).

*Table 21:* Frequency of memory perspective reported for publicly significant event.

Emotional Processing Group	Memory Perspective			Total
	First person	Bird's eye	Mixture	
Effective	17	10	4	31
Poor	11	10	7	28
Total	28	20	11	59

*Recall measures* Once again all participants' responses provided sufficient canonical details to qualify as flashbulb memories. Written responses analysed as in the first section of the study to quantify the number of sensory details as a proportion of total details provided. By contrast with personally significant memories, poor emotional processors and effective emotional processors demonstrated few differences in the quantity of sensory detail provided. Poor emotional processors produced an average of 7.35 per cent ( $SD = 2.86$ ) sensory details as a total of details provided, whereas effective emotional processors reported an average 7.16 per cent ( $SD = 2.87$ ). This was not statistically significant ( $t(38) = 0.07, p > .05$ ).

#### 5.3.4. Discussion

The study considered differences in poor and effective emotional processors' recollections for events of either public or private significance for which it was assumed vivid, long term memories would be formed. In both sections, participants were asked to discuss events for which they had the clearest memories. The analysis focussed on participants reporting memories of learning of Michael Jackson's death and receiving A

level results, as these attracted the greatest number of responses. From the many measures assessed, significant differences only emerged between groups for the vividness ratings that were reported for personally significant events, as well as the number of sensory details reported for this recollection. This appears consistent with findings from study 6, and studies 1 and 3, all of which suggested in various ways, poor emotional processors exhibited tendencies to retain more vivid recollections, with a greater quantity of sensory-perceptual detail. Thus, the tendency detected at a microcosmic level within chapter 3 may be continuous with these phenomenological reports of memories for events which have greater significance within individuals' lives and are retained over greater durations.

Yet, within the event of public significance, such differences in vividness were absent. Methodological aspects may account for these null findings. One difficulty, endemic within many such questionnaire studies into flashbulb memory, is ensuring that the event canvassed is of sufficient importance to respondents to represent an event which was truly surprising or consequential. Public events attracted mean emotionality ratings of 3.53 on a seven-point rating scale which may be seen as rather low. Of course emotionality is not the central criterion of flashbulb memories, but may be seen as some index of the significance of the event for respondents and it is questionable whether, for the public event condition, participants were actually reporting on flashbulb memories. Participants were required to report on memories for which they had the most vivid memories, yet this requirement alone may not have guaranteed that the memories satisfied the *phenomenological* criteria Brown and Kulik originally stipulated. The further measures of memory quality (ensuring all participants could provide canonical details), represented a rather liberal criterion (adopted by Talarico, 2009) and analysing participants' responses informally led to an impression of great diversity in the

specificity and quantity of details presented. It may be arguable that some of those participants who were able to recall (or reconstruct) aspects of the reception context were, nevertheless, still not reporting on genuinely vivid, flashbulb memories, and a more stringent criterion might perhaps be more effectively applied in future studies. Simply put, the fact that an event is consequential, surprising and significant (as may have been the case with Michael Jackson's death) and that details of the reception context could be recalled may all have been necessary but not sufficient to guarantee the formation of flashbulb memories. Of course there is no obvious reason why such caveats may have distorted results systematically in favour of either emotional processing group and to some extent of course, these difficulties are beside the point if the study is regarded as simply an investigation of differences in long-term memory between emotional processing groups.

In terms of coherence of narrative there were no reliable differences detected. This measure had been intended to assess the extent to which participants conceptually process their experiences into coherent, semantically sequenced forms with the expectation that poor emotional processors would be comparatively deficient at this. There was no evidence that poor emotional processors were less capable of processing the events into semantic, conceptual forms. Of course, the events discussed score relatively moderately on valence and relatively low on emotionality, thus were unlikely to disrupt individuals processing of event in the way more traumatic events might, but if emotional reactivity is not the central factor in explaining why differences in memory types arise, then some other explanation needs to be provided for the null result.

It seems certainly true that for both event types, although most markedly for events of

public significance, that they are far more likely to attract discussion, media coverage, and publicly disseminated narrative and commentary which may contaminate or distort memory of the original event. More pertinently such subsequent discussion and commentary may represent precisely the type of conceptual processing of the original event, which poor emotional processors are hypothesised to be deficient in, and as such may offer an exogenous source of memory processing, which may have elided differences between groups.

Indeed, if conceptual processing is understood as altering the nature of memory representations and to some extent transforming and overwriting sensory-perceptual representations then differences in vividness would be most expected where greater conceptualisation, narrative, discussion and commentary would occur, which one may surmise would be the case with events of public significance rather than private. Thus one might expect such exogenous sources of conceptual processing, an area where poor emotional processors are likely to be deficient, to result in reductions in sensory-perceptual representations (i.e.) vividness, and increases in ratings on narrative scales, to the extent that difference between groups may have levelled out. Of course, such post hoc accounts must be understood as extremely tentative.

## 5.4 Study 10: Effects of Emotional Processing Style on Traumatic Memory Representations

### 5.4.1 Introduction

Debate concerning the status of traumatic memories has been polarized between claims that traumas produced a distinct form of memory (e.g. Brewin, Dalgleish & Joseph, 1996; Freud, 1922; van der Kolk; & Fislser, 1995) which tends to be inaccessible, volatile and incompatible with the workings of the ordinary system; and others claiming that traumatic events produce vivid, easily retrieved and content rich memories (e.g. Wagenaar and Groeneweg, 1990; Yuille and Cutshall, 1986). Relatedly, debates persist as to whether traumatic memories need to be accounted for in terms of distinctive cognitive mechanisms, or can be better conceptualized as products of processes ordinarily operating within memory (Loftus et al., 1998; see Reisberg & Heuer, 2004, for a review).

It is possible to reconcile such views by seeing arousal or emotional intensity as enhancing memory qualities up to a certain point, beyond which increases in vividness and intensity occur at the expense of narrative coherence, conceptual order and in extreme cases accessibility to verbal cues and ordinary retrieval processes. Such a possibility has been outlined in chapter 2, and indeed the fundamental binary which has informed much of the research conducted within this dissertation, between conceptual (narratively coherent, semantically structured) processing and sensory-perceptual (data rich comparatively disorganised) processing of events, derives from traumatology research (see section 1.3.4), and a suggestion that poor emotional processing can in part be associated with a particular sensory-perceptual style.

The following final study extends investigation of memory for naturally occurring events pursued in this section, by considering how poor and effective emotional processors differ in phenomenological reports of memories for traumatic events whereas within the previous studies less emotionally extreme events were considered. The obvious limitations of such a study are that it allows no experimental control over the type of event, its temporal proximity, emotional intensity or extension in time. As such, in order to establish contrasts between groups, it relies upon a range of subjective ratings of memory quality which provide measures by which between group comparisons can be made, as well as certain objective measures of the written descriptions of the events which participants produced. Nonetheless, the study allows consideration of memory differences between emotional processing groups for events which are highly significant, highly emotionally charged, and likely to be strongly preserved within long-term memory storage.

The study in part replicates Porter and Birt's (2001) exploration of traumatic memory, which aimed to establish differences between extremely positive and extremely negative memories and to consider whether traumatic memories were in some way distinct. Within that study the scale had been intended specifically to explore whether traumatic memories are qualitatively distinct from ordinary memories. Thus this questionnaire was seen as particularly well-suited for exploring the between-group differences that this dissertation aims to examine. Porter and Birt's questionnaire was also seen as preferable to more extensive flashbulb memory questionnaires for ethical reasons. It invites participants to write a complete account of their experience, but does not probe participants to respond to as many predetermined questions as is the case in Talarico and Rubin's questionnaire used in Study 9. Given the delicate nature of the subject matter it was thought important to allow participants scope to determine their degree of

participation and disclosure within this study. Methodologically, too, by prioritising spontaneous recollection over responses to predetermined questions, it was thought that a more sensitive portrait would be acquired of the memory as it is spontaneously retrieved by participants. A large number of questions interrogating the memory may have had the unintended effect of serving as retrieval cues, which may have distorted the ordinary recollection of the event. Here, by contrast, emotional processing groups' recollection of a single traumatic event is compared. It was of particular interest to discover whether the types of sensorily-based vivid memories poor emotional processors manifested for ordinary as well as exceptional, novel events would also be manifest within the experience of extremely aversive, possibly life threatening situations. The degree of memory quality, in terms of the coherence and narrative structure of the event, was also of particular interest in examining whether groups differed in their capacity to narratively structure authentic, naturally occurring events which lacked the degree of narration and organisation the experimental materials adopted in studies 5 & 6 enjoyed.

#### *5.4.2. Method*

##### *5.4.2.1 Participants.*

Participants (N= 40; mean age = 23.4; *SD* =3.8 years; F= 31, M = 9) were undergraduate psychology students at Bournemouth University who took part in exchange for course credit.

##### *5.4.2.2 Materials and procedure.*

Participants had registered to participate in a study involving responding to questions about emotional experiences taken from their own lives. After they had registered, the

participants were contacted by email and reminded of their rights to withdraw from participation at any time and informed that one of the studies may inquire about distressing or highly positive events from their own life and that they would have a choice to participate in this study or not.

At the experimental session printed instructions outlined that the following task would require students to write about their most traumatic experience. Below this participants were informed that they did not have to complete this task and could gain full study credit by completing an alternative study (i.e. Study 9). Those who chose to complete the traumatic study task were given the following printed instructions (taken from Porter and Birt, 2001):

*Please take a moment and think back to the most traumatic event you have ever experienced. Choose a specific event as opposed to a series of events or a drawn out traumatic period. Take your time and report everything you can remember. Start at the beginning and give a complete account.*

This was a self-paced activity taking on average between 30 and 45 minutes. Once they had finished writing their reports, a series of printed questions was presented using scales developed by Porter and Birt (2001) to explore traumatic memories (see appendix H). These assessed various aspects concerning the quality of the memory by requiring participants to assess on seven point scales various phenomenological features of the memory. Participants reported the *general vividness* which the memory had on recollection. A further assessment of sensory basis of the memory was attained by requesting participants to record *how many sensory modalities* (auditory, visual, olfactory, tactile and so forth) were involved in their recollection of the experience.

Participants assessed the *level of stress* they associated with the memory using a seven-point scale. As a measure of narrative coherence, participants were asked to rate the overall *narrative quality* of the memory, and this was explained in terms of whether the memory was fragmentary, had a clear story, or contained elements which were difficult to explain or cohere within a narrative structure. Participants were asked to judge *how often they thought and talked about the event* on two separate scales, once again rated 1-7. Finally, *vantage point* for the memory was assessed. As in study 9, this was of interest because of research suggesting highly emotional memories are more likely to be remembered from a first person perspective, and that the adoption of a bird's eye, third person perspective within memory suggests a degree of conceptual reconstruction of the memory.

Participants' written reports of their accounts were subjected to textual analysis first by counting the number of details provided. Following Porter, Yuille and Lehman's (1999) Memory Assessment Procedure, a detail counted as a distinctive piece of information and scored one point. *Sensory details* designated specific reference to sensory modality included within these descriptions either referring to verbs denoting sensory processes and sensory descriptions (largely adjectives of colour, odour, texture or somatic reactions) were calculated from descriptions. These were then calculated as a percentage of total details. T-tests were finally conducted to compare these scores across groups.

#### *5.4.3 Results*

Mean scores for poor and effective emotional processors were calculated for all measures. A series of t-tests were performed on vividness, stress associated with the

event, sensory components of the recollection, memory quality, frequency of thought, frequency of discussion, and percentage of sensory details within the written accounts. This data is summarised within table 22.

#### *5.4.3.1 Memory vividness.*

Differences in ratings of vividness, the chief variable of interest did not achieve statistical significance,  $t(38) = 1.57, p > .05$ . A supplementary measure, the number of senses involved in the recollection yielded identical means across groups.

#### *5.4.3.2 Stress.*

There was no statistical difference between groups' reports of the amount of stress associated with the event. Poor emotional processors reported ratings of 5.65 ( $SD = 1.27$ ), compared with effective emotional processors' 5.6 ( $SD = 1.19$ ). This was again not statistically significant  $t(38) = 0.13, p > 0.05$ .

#### *5.4.3.3 Memory quality.*

This measure sought to assess the coherence and consistency of the memory, and was originally intended as a means of assessing the degree of conceptual processing the memory had received, in opposition to the fragmentariness that traumatic memories are often reported to exhibit. Groups displayed few differences on this dimension with poor emotional processors achieving ratings of 5.65 ( $SD = 1.39$ ), and effective emotional processors achieving 5.15 ( $SD = 1.31$ ). No significant differences between groups emerged :  $t(38) = 1.17, p > .05$ .

Table 22: Comparison of qualities of traumatic memories for poor and effective emotional processors: means (and standard deviations)

Memory Features	Emotional processing group			<i>t</i> (38)	p.
	Poor	Effective	Total		
Vividness of the memory	6.15(1.23)	5.5 (1.4)	5.83(1.34)	1.57	0.13
Stress associated with event	5.65 (1.27)	5.6 (1.19)	5.62(1.21)	0.13	0.90
Senses involved in the memory	2.50 (1.15)	2.50 (0.76)	2.50 (0.97)	0	1
Quality of the memory	5.65 (1.39)	5.15 (1.31)	5.4(1.35)	1.17	0.25
Frequency of discussion	3.20 (2.12)	3.30 (1.95)	3.25(2)	0.16	0.88
Frequency of thinking about the event	5.30(2.3)	4.60 (1.98)	4.98(2.15)	1.1	0.28
Number of details	34.90 (17.71)	36.45 (24.25)	35.67 (20.98)	0.23	0.82
Percentage of sensory details	19.53 (11.64)	19.76 (10.15)	19.65 (10.92)	0.66	0.95

#### 5.4.3.4 Memory perspective.

Chi-square analysis on memory perspective (probing whether participants experienced the memory from a first person, third person or mixed vantage point showed no significant differences in proportions of emotional processing groups report on the perspective of their experience ( $\chi^2 (2, N=40) = 0.21, p > .05$ ).

Table 23: Frequency of memory perspective reported across groups for traumatic memory

Emotional Processing Group	Memory Perspective			Total
	First person	Bird's eye	Mixture	
Effective	4	6	10	20
Poor	5	5	10	20
Total	9	11	20	40

#### 5.4.3.5 Rehearsal measures.

Given the nature of the subject matter, it was thought more appropriate to treat frequency of thinking about the event separately from frequency of talking about the event, and not to merge scores as had been done previously. Poor and effective emotional processors produced very similar ratings for frequency of discussion (3.2 ( $SD = 2.12$ ) and 3.3 ( $SD = 1.95$ ) respectively. Frequency of thinking about the event saw poor emotional processors reporting slightly higher ratings (5.3,  $SD = 2.3$ ) than effective emotional processors (4.6,  $SD = 1.98$ ). None of these differences achieved statistical significance (frequency of discussion:  $t(38) = 0.16, p > .05$ ; frequency of thought:  $t(38) = 1.10, p > .05$ ).

#### 5.4.3.6 Free recall measures.

The study invited participants to provide detailed and extensive accounts of their traumatic experiences. The range of response length varied greatly across participants, although in no systematic way according to emotional processing group. Number of details was calculated from the written responses and from these the number of details involving a sensory component computed. Poor emotional processors produced a mean number of 34.9 details ( $SD = 17.7$ ) with sensory details averaging 7.45 ( $SD = 7.32$ ). Effective emotional processors produced a mean of 36.45 details ( $SD = 24.25$ ) with sensory details averaging 6.25 ( $SD = 3.64$ ). Neither difference between groups achieved statistical significance (total details:  $t(38) = 2.31, p > .05$ ; sensory details:  $t(38) = .043, p > .05$ ). Nor were any reliable differences found when sensory details were calculated as a percentage of total details,  $t(38) = 0.66, p > .05$ .

#### 5.4.4. Discussion

Differences in group ratings of memory vividness, along with all other measures adopted in this study, did not achieve statistical significance.

At a theoretical level one may provide some account for why, over extremely distressing events, no differences emerged between groups. Speculatively, it seems quite possible that style of processing which *ordinarily* characterise poor emotional processors memories become active within effective emotional processors when extremely aversive events are experienced. As a result, what differences were detected within previous studies tend to level out in the field of traumatic experiences. Thus, a sensory-perceptual memory style, whilst routine and global for poor emotional processors and resulting in more vivid and sensorily-rich memories, becomes typical for all or most individuals in situations experienced as extremely aversive.

Indeed, much of the rationale behind positing a distinctive, trait-like, memory style for poor emotional processors, derives from a range of studies considering how participants in particular conditions or undergoing particular experiences tend to develop certain forms of vivid, affectively- laden, sensorily-based memories (Brewin & Andrews, 1998; Brewin, 2001b; Brown & Kulik, 1977; Christianson & Loftus, 1990; Davies & Clarke, 1998; Deffenbacher, 1983, 1994). Thus, there is an extrapolation from an encoding style that apparently arises within certain states, to a trait like tendency amongst certain groups of individuals. Within extreme circumstances, it seems quite plausible that what serves as a particular encoding tendency within a subset of individuals becomes a general tendency across all, resulting in uniformly vivid, less narratively coherent memory representations. It must be reiterated that such remarks and interpretations can only be extremely tentative given the limitations of the study.

In methodological terms there were certain limitations to this study, indeed to any study that relies upon self-rating measures for recollections of non-standardised events, which became particularly acute given the sensitivity of the subject matter and the measures compelled by ethical considerations: participants effectively self-selected, choosing to participate either in this study or in study 9. Accordingly, there was a rather small sample size which precluded certain statistical analyses and possibly reduced the effect size. One may here only speculate, but this may have constrained the sample characteristics in a number of ways. Potential participants may have been reluctant to disclose truly traumatic experiences (this was explicitly stated by one participant who opted instead for study 9) or may simply have felt they had little to report, having had generally untraumatic lives. Thus, in common with the study upon which it was modelled (Porter and Birt, 2001) the study relied upon a descriptive label 'the most

traumatic experience you have ever had' and relied upon participants themselves to judge whether their own experiences were suitable objects of investigation. Naturally, given the nature of the subject matter, there could be no independent measures of the impact or significance of the event although the self-reported measure, (5.6), suggested that most participants assessed the intensity of their experience as high. One may object that truly traumatic experiences should have been rated at the extreme of the seven point scale and that some of the participants were reporting events that were less severe in their impact and that this may have adulterated findings to some extent, Porter and Birt (2001) using a larger sample size and more targeted recruitment of participants found higher levels of stress associated with the event (6.3 compared to 5.6) which, whilst statistical comparison between samples is not possible, may suggest that their participants were reporting on events experienced as marginally more traumatic. Other studies (e.g. Taghavi, et al., 2003; Wessel, Merckelbach & Dekkers, 2002; Elsesser & Sartory, 2007) comparing memory performance between groups have exploited independent assessments of severity of trauma to provide some safeguard that participants responded to events that could genuinely be labelled as traumatic. Whilst within the present study recruitment processes would have precluded such an approach, it might have produced data which could more confidently have been regarded as trauma related.

### *5.5 Studies 8-10: General Discussion*

Studies 8-10 considered differences in emotional processing groups' long term memory representations of personally experienced events. These, by and large, probed memories for which there was little experimental control and which participants themselves elected to describe, and gathered data primarily through the use of self-reported measures. One interesting finding was that poor emotional processors reported more vivid memories than effective emotional processors. This finding achieved statistical significance in study 8 (which considered a broad sample of autobiographical memories) and study 9a. In studies 9b and 10 this was not found, where it was suggested, that features of the events reported on may have, either through benefiting from greater exogenous conceptual processing, or constituting extremely aversive experiences, evened out differences between groups in terms of memory vividness. Thus, with more extreme or publicly disseminated events fewer differences in memory vividness were apparent. Alternatively, within extremely aversive experiences, it seems quite plausible that what between groups differences existed over more mundane phenomena levelled out.

Here, once again, there appears some moderate support for the hypothesis that poor emotional processors retain more sensory detail from events, producing more vivid recollection of events, and that such differences persist over long periods. This may be taken as to some extent supporting the possibility that poor emotional processors exhibit a sensory-perceptual style of memory encoding, although its obverse, conceptual - semantic processing has no support in the studies here reported.

The suggestion that more remote memories tend to be of a semantic form and recent memories episodic (Cermak, 1984) is supported by empirical studies showing that it is typical for vividness of recollections to decline with the passage of time (Robinson & Swanson, 1993; Conway et al. 1997); furthermore, as individuals age it appears that a process of semanticisation of memory occurs, such that sensory-perceptual details are substituted by factual, semantically based knowledge of one's life events (Piolino, Desgranges, Benali, & Eustache, 2002; Levine et al. 2002). This has been explained in functional terms as reflecting a tendency to abstract significant information from repeated encounters with similar events or phenomena (e.g. Barclay & Wellman, 1986). Thus experiments within associative learning fields have found a reduced recollection of sensory aspects of a display over repeated exposure (Schanks, 1995); studies of naturally occurring phenomena suggest a shift from episodic to semantic forms (Conway, 1990), and many of the studies exploring prototype formation report a decline in the vivid perceptual quality of memories (Barclay, 1984). Interestingly too, episodic memories (Neisser, 1981) suggest the existence of intermediary memory forms representing amalgams of repeated episodic experiences.

Thus the persistence of vivid recollections appears to be something of an anomaly within ordinary consolidation processes. Flashbulb memories, recollections of momentous events and emotionally distressing experiences all appear to promote vividness. If in accordance with Nelson (1993), episodic memories are seen as 'holding stores' preliminary to prototype formation, why might poor emotional processors tend to retain more episodic like, sensorily based memories, particularly over the range of comparatively every day autobiographical memories canvassed in study 8 where differences were most apparent? The account developed within the introduction would suggest, in broad terms, that their *retentive* capacities, and tendencies to store veridical

perceptual like records of experiences, exceeds that of effective emotional processors if self-rated vividness is accepted as a valid measure.

It is interesting to note that, on further measures here representing possible confound of the data, most commonly associated stress or emotionality, the groups showed little divergence. This, once again, provides some support for the notion that difference between groups consists not in their emotional reactions before or during the events, but rather in how they tend to process such events, and how such difference in processing is reflected in memory representations. If such differences are not accounted for in terms of arousal at the time of encoding, and there is little evidence of poor emotional processors being more aroused, or emotionally reactive to such events, then there is the suggestion of differences in information processing styles of the two groups, supporting what has, loosely been termed a sensory-perceptual encoding style.

Conceptual-semantic processing of events was investigated in a number of ways. Some measure of verbal indexing was sought in study 8 (through measuring latency to produce autobiographical memories), yet reliable evidence of between group differences was not established. Self-report measures of narrative coherence in studies 9 a and b provided little support for effective emotional processors' superiority. Furthermore effective emotional processors did not report superior memory quality in terms of its narrative coherence and integrity in study 10. Beyond the reasons already suggested for why this may have been the case, such findings do raise questions as to the construct's validity and appropriate operationalization within experimental paradigms. Conceptual processing appears to be a rather nebulous concept and its assessment through phenomenological measures rather elusive. Whereas a data-driven or sensorily-based processing style might most obviously be manifest within detailed, vivid recollections and the availability of sensory details, what the phenomenological correlate of a

conceptual processing style is rather less clear. Broader questions regarding the status of conceptual processing, its degree of automaticity and conscious awareness, and whether it can be induced by intentional strategies of stimulus categorisation and reflection upon events will be considered in the final discussion.

## Chapter 6: Concluding Remarks

### *6.1 Introduction*

The studies reported within this thesis sought to explore the hypothesis that poor emotional processing style is associated with what has been loosely termed a 'sensory-perceptual' encoding style. Characteristic of such an encoding style is a tendency to retain sensory-perceptual aspects of events and stimuli in analogue-like representations of the past, at the expense of conceptual-semantic processing of data which ordinarily serve to categorise, order, and provide a meaningful conceptual basis to experience. The rationale behind such a hypothesis was drawn from a number of sources. First, multilevel models of emotions (Leventhal, 1979; Barnard & Teasdale, 1991; Teasdale & Barnard, 1993; Power & Dalgleish, 1997) which stress discrepancies between coding formats within the cognitive-mnemonic system as a likely source of emotional disruptions and cognitive impenetrability (Teasdale 2005; Bucci, 1997); second, theories of post-traumatic stress and coping which emphasise the fragmentary sensory based and affectively laden nature of traumatic memories and their aetiological significance in maintaining psychopathological conditions (e.g. Hellowell & Brewin, 2002; Janoff-Bullman, 1992; van der Kolk & van der Hart, 1991); finally, a range of naturalistic and theoretical studies within the fields of episodic and autobiographical memory which explore how emotional states impact upon the phenomenological features of memories, in particular by strengthening their sensory perceptual basis (Arntz, de Groot, & Kindt, 2005; Bohannon, 1988; Brown & Kulik, 1977; Buckhout, 1974; Christianson & Loftus, 1990; Conway, 1990).

The research drew its impetus from Rachman's (1980, 2001) formulation of emotional processing which stressed the need for an explanatory account of the intrapsychic

processes by which aversive emotional events are overcome and assimilated. This was originally applied within a clinical setting of psychopathological disruptions although its avowed intention was integrative in spirit, seeking to develop a framework within which a host of psychological phenomena, from the quotidian to the extreme, might be explained. Research inspired by this formulation (Foa and Kozak, 1986; Rauch & Foa, 2006; Coughlin della Selva, 2006; Hunt, 1988; Teasdale, 1999) similarly sought to provide an underlying explanation for a full range of affective disorders within a unifying explanatory construct.

This integrative spirit of Rachman's original agenda is reflected within this thesis in its eclecticism. It has considered a number of memory types and performances by applying various experimental paradigms and exploratory measures. Its chief assumption was that emotional processing as a construct might be effectively investigated by considering differences between populations, namely effective and poor emotional processors, in order to isolate and better consider the contribution the individual cognitive-mnemonic system makes to the development of emotional processing disruptions, without the further complicating factors of considering event features, and psychosocial factors. Thus the emphasis has been upon endogenous, intra-psychic, information processing tendencies (Brewin & Holmes, 2003) which vary between individuals, rather than event features primarily.

In essence this thesis has explored whether poor emotional processors tend to retain veridical, sensorily based, analogue representations of events. It has assumed that such a tendency is rooted within an instinct to preserve information regarding sources of threat or reward. It has further assumed that the development of emotional processing failures is a consequence of, or strongly associated with, a failure to reduce perceptual

codes (Knowlton & Squires, 1985; Barnard & Teasdale, 1991) to symbolic ones the medium of reflective consciousness (e.g. Rolls, 2005), which failure impedes the construction of effective models of our environment, the efficient prediction and negotiation of sources of threat and reward, and the integration of memories of particular experiences within broader knowledge structures (Conway & Pleydell-Pearce, 2000). Thus an implicit relationship between cognitive processing and emotional processing has pervaded the research rationale.

## *6.2 Conclusions*

### *6.2.1 Support for a Sensory-Perceptual Style*

#### *6.2.1.1 Retention of analogue data.*

Both studies 1 and 3 indicated differences between groups in line with experimental predictions. There appeared to be a statistically significant or marginally significant increased tendency within poor emotional processors to retain analogue representations of events when compared to effective. By considering recognition of previously presented, non-complex discrete words and images with no meaningful interrelation and thus restricted scope for top-down, interpretative interference, ('miniature events', Conway, 1991) these studies were intended to provide relatively 'pure' measures of processing tendencies.

Thus, study 1 saw poor emotional processors exhibit a marginally significant tendency ( $p = 0.051$ ) to retain 'episodic' rather than 'semantic' knowledge states (Gardiner, 1988) over brief testing intervals. This was interpreted as indicating a comparatively retarded 'remember to know' shift (Dewhurst, Conway & Brandt, 2009) such that sensorily based, 'irrelevant' contextual detail of an event is maintained in memory. This finding

may reflect the comparative durability of sensory coding, which is apparently more resistant amongst this population to the sort of abstractive processes (Knowlton & Squires, 1985) necessary for the integration of environmental knowledge within schematic forms (Cermak, 1972, 1984; Herbert & Burt, 2001).

In study 3 a more direct gauge of groups' spontaneous processing tendencies of visual images was attained and again, in line with experimental predictions, poor emotional processors exhibited greater picture recognition and a greater resistance to lures, suggesting the retention of veridical, detailed sensorily based representations against which new stimuli could be matched. Interestingly too, at marginal levels ( $p=.052$ ) poor emotional processors showed a poor sensitivity to verbal cues, suggesting that percepts were not processed semantically to the extent that appeared to be the case with effective emotional processors.

Evidently for encoded experience to be retrievable by verbal cues some form of semantic processing needs to be assumed: that poor emotional processors were comparatively deficient at this, may suggest, in microcosm, how the types of desynchronies (Lang, 1979; Marks, 1987) between sensorily based experience and perception and conceptually based understanding develop. Indeed the notion of recoding is at the heart of multi-level theories of cognition – emotion relationships. These propose that 'cognitive impenetrabilities' (Teasdale, 1999), central to failures of emotional processing (Teasdale, 2005), arise because environmental and event information is stored in heterogeneous formats and retrieved by a variety of environmental cues. The SPAARS model (Power & Dalgliesh, 1997) suggests that at an associative level, reactions and apparently irrational emotional responses can be provoked by stimuli which bear only a sensory-perceptual similarity to previous

stressors, suggesting how rational, reflective processes by which responses might be moderated can be circumvented. A similar suggestion of Ehlers and Clark (2000) in the case of PTSD sufferers is that this population is particularly sensitive to associative priming, often encoded at a subliminal, unreflective level.

#### *6.2.1.2 Increased phenomenological report of vividness.*

A sensory-perceptual style of processing is assumed to be reflected in long-term memories' heightened vividness (Livingston, 1967; Pillemer, 1984, 1988). A fairly consistent finding throughout this thesis is that poor emotional processors tended to report more vivid memories when assessing their own autobiographical memories. This tendency was statistically significant in study 8 using the autobiographical memory test, as well as in study 9a which considered memory for privately significant events. When events of public significance, or self rated traumatic events were considered (Study 9b and 10) differences only emerged descriptively, and considering the nature of the subject matter (participants' most traumatic experience) it was speculated that differences between groups narrowed, and sensory-perceptual style of processing became characteristic across groups, as would be suggested by models of post-traumatic stress disorder (e.g. Ehlers & Clark, 2000; Murray, Ehlers & Mayou, 2002).

Heightened vividness is a feature of significant, emotional events (flashbulb and personally significant memories (Pillemer, 1984; Conway, Collins, Gathercole & Anderson, 1996) and interpreted in terms of increased arousal (Finkenauer, et al, 1998), prototype formation (Barclay, 1986), or more deep rooted evolutionary tendencies (Brown & Kulik, 1967). Poor emotional processors' greater vividness of personal memories, even as cued by relatively banal word stimuli (used in study 8) suggests this tendency may be more global, rooted in a processing bias, rather than, as is typically the

account provided for flashbulb memories (Conway et al., 1994), the specific features of the event, or post event processing (Johnson & Chalfonte, 1994; Neisser, 1982; Rubin & Kozin, 1984) that may explain the distinctive characteristics of such memory, i.e. the availability of sensory-perceptual detail, retention of spatial detail of reception context or the persistence of apparently irrelevant details.

Within these studies, some evidence was found to suggest that the micro-level processing differences between groups encountered within studies 8 and 9, may be consolidated within the formation of long-term memories for emotionally significant events. At heart is the same hypothetical tendency of poor emotional processors failing to reduce complex events to more schematised (Barclay, 1986), generic forms (e.g. Neisser's episodic memory, 1981; Barsalou's extended events, 1988). The aetiological consequences of such a deficit in pathological development are suggested by Conway and Pleydell-Pearce (2000) whose model of autobiographical memory suggests sensory-perceptual details are ordinarily quick to decay, and the long-term vivid autobiographical memories are fairly anomalous within the ordinary workings of a cognitive mnemonic system. Traumatic memories persist in comparatively unstable, sensorily and affectively laden forms because they cannot be indexed or subordinated within the generic, thematic knowledge structures that organise our self-knowledge. Nelson (1996) for example envisages the episodic memory store as a 'holding-bay' preliminary to semanticisation. If such processes of reduction are operative within ordinary memory, (Cermak, 1984; Herbert & Burt, 2001) then the increased tendency to form vivid memories suggests that such abstractive facilities may be comparatively deficient within poor emotional processors, which may reflect a processing style productive of poor assimilation of emotional experiences.

### *6.2.1.3 Encoding preference for images over symbolic items.*

An encoding preference for images over symbolic items (i.e. pictures over words) was not well-supported. Within study 2, comparing recognition of pictures and words, poor emotional processors, over brief retention intervals, recognised a higher percentage of words than effective, although this interaction was not statistically significant ( $p = .064$ ). Similarly, within studies 5 and 6, which tested memory for visual over verbal information presented through a slide narrative, differences did not emerge between groups. Study 7, exploring a naturally occurring event, saw a tendency for poor emotional processors to recollect more visually based than verbally based information, although this did not achieve significance.

The assumption that emotional processors would be particularly sensitive to images and imagery was drawn from a repeated suggestion within psychopathological and emotional research (Mathews and Macleod, 2002; Ohman and Mineka, 2001; Mineka, 1992; Holmes, Mathews, Mackintosh & Dalgleish, 2008; Holmes & Mathews, 2005) that the emotional system may be more sensitive to images over other representational systems such as language or other symbolic codes, as these latter are, in phylogenetic terms, comparatively late developing. Indeed some experimental research demonstrates (Holmes, Mathews, Mackintosh & Dalgleish, 2008; Holmes & Mathews, 2005) the widely held assumption that imagery and visual representations are more productive of emotional states than verbal representations. It was thought that such a difference in memory performance might be significant because verbal information is more often a vehicle of meaning than gross perceptual data and failure to extract meaning from experience was thought to be central to disruptions in emotional processing. Yet the

three studies which considered differences between groups encoding preferences could not support this prediction.

#### *6.2.1.4 Summary.*

Thus in general for autobiographical memories, poor emotional processors' recollections of events appears to be characterised by a heightened sense of vividness. Further, there is evidence from the original more experimentally controlled studies that poor emotional processors may retain representations in a comparatively unreduced, analogue sensorily based form. A sensory perceptual style was not apparent in a preference for images over words in nor poor emotional processors' relative capacity to reduce complex narratives, although this latter capacity may have been insufficiently taxed by the (comparatively simple) narratives used within the studies to draw out group differences.

#### *6.2.2 Support for a Conceptually Driven Processing Style*

##### *6.2.2.3 Verbal encoding of perceptual stimuli.*

The closest confirmatory evidence that effective emotional processors tend to process conceptually/semantically events and stimuli to a greater degree than poor emotional processors detected in study 3, where effective emotional processors appeared more likely to reduce pictorial stimuli to semantic forms, as evidenced by greater recognition performance when cued by verbal prompts, and greater susceptibility to lures. In essence it appeared within this study that effective emotional processors were more sensitive to verbal cues than were poor emotional processors.

Furthermore, within study 1, effective emotional processors apparently exhibited, over brief retention intervals, a greater tendency to report 'know; rather than 'remember;

judgements when compared to poor emotional processors. This is simply the obverse of processing tendencies exhibited by poor emotional processors and attests to a greater reduction of perceptual stimuli and a semantic processing of visual events.

This, once again at a microcosmic level, was taken to suggest an association between conceptual processing of experience, and more efficient resolution of emotional disruptions (Teasdale & Barnard, 1993; Bucci, 1997). Effective emotional processors were apparently more efficient at eliminating irrelevant sensory perceptual information and thus consolidating memories into semantic forms. By enabling memories to be more accessible to semantically based retrieval cues, and more readily assimilated within general symbolically based knowledge structures (Conway & Pleydell-Pearce, 2000) it is possible that experiences becomes more tractable and more amenable to rational control and modification. Thus, they may more readily form the basis of schematisations of sources of threat and reward, which allow greater cognitive understanding of the environment, and its more efficient navigation. This is of course considerable extrapolation on the basis of limited research findings: nevertheless, at this level of miniature events exploring the spontaneous processing of experimentally presented stimuli it fell in line with the general direction of hypothetical predictions.

#### *6.2.2.4 Discrimination of significant details. Verbal indexing of memories*

##### *Narrative coherence.*

Nonetheless, more elaborate measures of long-term, conceptually-driven processing adopted in studies 5-10, found little support for between-group differences. Thus very little evidence was found to suggest effective emotional processors show greater semantic processing, more coherent or verbally indexed memories, or a deeper conceptualisation or reflection upon experience. Studies 5 & 6 explored groups'

capacity to reduce complex events to their narrative core, speculating that a sensory-perceptual style might be expressed through an uncritical, indiscriminate retention of detail which subsequently complicate the effective discernment of factors and causal sequences of an event and culminating in overgeneralised emotional reactions. This was not supported through the paradigms adopted which were experimentally presented audio-visual narratives or recollection of a naturally occurring event. This was explained in terms of ceiling effects, as the simplicity of the narratives used in studies 5 and 6 may have provided little challenge to participants and thus a poor basis of discrimination between groups. Furthermore, study 7 which tested recognition and recall of a naturally occurring event some eight months after its taking place, showed effective emotional processors distinguished from poor only on the basis of semantic memory measures, namely facts regarding the event, rather than on, as had been expected, visual and peripheral information. Study 8 which considered how effectively verbal cues indexed autobiographical memories which was assumed to indicate semantic processing of memory found no differences between groups. Studies 9 and 10 also attempted some gauge of memory quality, chiefly representations of narrative coherence.

Thus while studies 1-3 suggested differences in line with experimental predictions for both poor and effective emotional processors, and whilst in studies 5-10 these differences were found continuity with poor emotional processors' reports of greater vividness, there was no evident expression of a conceptual-semantic driven processing style within effective emotional processors over these longer-term autobiographical memories.

Whilst, of course, such results may simply point to the fact that no such differences exist, they are also of theoretical interest in suggesting possible difficulties with the construct of conceptual process which might fruitfully be addressed in future research. These will be considered in the following section.

#### *6.2.2.5 Difficulties operationalizing conceptual processing.*

The original impetus for exploring conceptual processing came from empirical research (Halligan, Clark & Ehlers, 2002; Halligan et al. 2003; Holmes, Brewin & Hennessy, 2004; Pennebaker, 1997), psychotherapeutic models (Brewin, 2001a; Ehlers & Clark, 2000; Foa & Riggs, 1995; van der Kolk & Fisler, 1995), and models of cognitive-emotional interactions (Barnard & Teasdale, 1991; Leventhal, 1979; Power & Dalgleish, 1997; Teasdale & Barnard, 1993) where the particular suggestion that in various ways, the act of semantically processing events facilitates recovery or protects against the adverse affective reactions. It was speculated that this assists an individual to more optimally and veridically represent environment information regarding sources of threats and reward and, further, that poor emotional processors would be deficient in this area. Yet it must be recognised that conceptual processing represents something of a hybrid of many diverse types of processing ranging from focussing on semantic aspects of a word (e.g. Roediger, 1990) the simple labelling of percepts (Halligan et al. 2003) , to vocalising narratives (Brewin & Saunders, 2001) to responding to a question regarding an event (Krans et al.2009), to discerning meaning (Laposa & Alden, 2006), and ultimately to reflecting upon the significance of complex episodes for the self (Pennebaker & Beall, 1986). As such, conceptual processing appears to denote a far more eclectic subset of psychological phenomena than sensory processing. The simple binary established between conceptual and sensorily based processing which had clear reference and meaning within the context of its original development (Roediger &

Blaxton, 1987; Roediger & McDermott, 1993) may suggest that both have comparable status either as competing or complementary processes in memory. Yet when transferred to the more variegated of humans with complex histories interacting with their environment over extended intervals this binary model may be far too simplistic. That conceptual processing is likely a spectrum of processing operations conducted to varying degrees of depth, and to various ends, and at various stages during and after event encoding appears more likely. What role endogenous and exogenous factors, be it group discussion, public analysis, media dissemination, or therapeutic analysis, may come into play in achieving some form of conceptual processing remains an open question (Brewin & Holmes, 2003, p.365). This ambiguity is reflected within much of the research interval where the diversity of operationalisations of conceptual processing is apparent.

Interestingly, some of the most impressive results drawn from analogue studies (Holmes et al., 2004, 2009; Krans et al, 2009; Stuart, Holmes & Brewin, 2006) suggest that it is not the induction of conceptual/semantic processing per se that mitigates against aversive symptoms and unpleasant recollections following exposure to an experimentally presented traumatic scene. Rather, it is by disrupting the operation of visuo-spatial memory that such therapeutic benefits are gained. Such results led Brewin, Dalgleish & Joseph, (1996) and Brewin (2001b) to postulate that flashbacks could be explained in terms of the formation of a distinct form of memory, situationally accessible memories, which could be suppressed through the subsequent development of verbally accessible memories, perhaps within the course of therapy. Similarly, within the PTSD research arena, attempts to operationalise a form of conceptual processing met with somewhat mixed results in terms of reducing negative affect or the formation of distressing memories (Ehlers and Clark, 2000; Halligan et al. 2002).

Within the narrow field of these studies, a legitimate inference may in concordance with Brewin (2001b) be that it is an excess of sensorily based processing, rather than an absence of conceptually based processing that is most associated the development of emotional processing difficulties.

Of course such findings are drawn from a specific paradigm devoted to the investigation of a particular subset of emotional processing failures. Other work suggests broadly that some form of attempts to organise and semanticise memory does have therapeutic effects (Laposa & Alden, 2006; Pennebaker & Seagall, 1999; Smyth, 1998). Yet at the very least there appears to be a need for far greater specification regarding what conceptual processing is, or what type is implied, as well as ingenuity in devising measures sensitive enough to assess it.

Of course only one study (10) dealt with a genuinely distressing event, although studies five and six attempted some replication of a distressing narrative. This reflected the rationale that sought to detect differences between groups ordinary style of processing ordinary events. Yet it is quite possible that, for a range of distressing or even simply upsetting events individuals ordinarily experience, differences in the conceptual processing of memories might emerge far more distinctly between groups. It may be that for events which genuinely matter and have implications for their life, the retention of excessive sensorily based information in some way interfere with their resolution and emotional processing and that it is here, within aversive emotional experience, that such differences emerge. Of course these questions can only be addressed once a more rigorous definition of what conceptual processing is is arrived at, which may allow its more thorough operationalization within experimental designs.

## 6.3 Implications

### 6.3.1 General practical and theoretical implications

It must be acknowledged that, given the many non-significant findings, the thesis does not by any means offer confirmation *in toto* of the sort of model of emotional processing, and theoretical underpinning presented in section 1 which originally motivated the research. Fortunately, however, the exploratory objectives of this research programme were to examine *if* and *where* differences in memory performance between groups might emerge in terms of their sensorily perceptual/semantic conceptual processing of memory. As such, the research results' null findings might be seen as equally informative as positive ones. Practically, this research has found some support for the proposition that poor emotional processors retain sensorily based, analogue, unreduced traces of stimuli particularly with simple stimuli over short testing periods. There is some extension of this tendency within two of the studies of autobiographical memory, with poor emotional processors tending to report more vivid memories for a subset of autobiographical memories. Whether these two sets of results are expressions of the same processing tendency cannot at this preliminary stage be determined: nonetheless they do point to an association between memory performance and emotional processing style which might be fertile theoretical ground in probing why emotional processing deficits arise.

Clearly, the implications of such an association, if it can be more thoroughly substantiated within subsequent research, would be to suggest that information processing mechanisms within memory formation are associated with the development of emotional processing difficulties. It would suggest that the status of sensory perceptual memories is something more than epiphenomenal, peculiar to a particular type of highly

emotional, or traumatic experience, and, within a certain group of the population, those typically who have difficulties assimilating aversive experience, are a more pervasive phenomenon than had, hitherto, been thought. Such preliminary, exploratory research as has been reported within this thesis cannot of course hope to provide extensive demonstration of the type of complex processes required to explain the interaction between memory and emotional processing, but some of the findings may at least indicate that this represents a fruitful area for further exploration, and that in brief the association between sensory perceptual memory retention and emotional processing warrants further consideration.

The aetiological significance of this potential association can only be investigated through better specified models of interactions between memory and affect and more targeted research hypotheses. One interpretation and how such an interaction might be conceptualised has been outlined within section 1.6. Crucially, such an account places great emphasis in explaining emotional processing failures on the *recoding* of experience from sensory perceptual forms to more conceptually-semantically based ones. In unprocessed form, so the argument would suggest, memory is less amenable to form the basis of veridical, lawlike, conceptually based generalisations about the location of threat and danger which allow individuals to negotiate their environment in a functional manner. It is also less amenable to reflection, analysis and the extraction of meaning. Rather, such unprocessed memory is more susceptible to form the basis of associative routes to emotional responses, rather than meaning/appraisal based routes, (see section 1.1.6). Cues and environmental triggers based on superficial (i.e. non-veridical) similarities to previous stressors may elicit dysfunctional, and opaque emotional responses ( cf Sloman's (1996) 'The Empirical Case for two Systems of Reasoning'). In short, emotional difficulties persist because they resist conceptual processing, and the integration of aversive events within broader autobiographical structures (cf Conway

2001). Emotional responses, lacking a basis in meaning, are opaque and intractable to the individual experiencing them. This corresponds a central sense of poor emotional processing (Rachman, 1980).

Thus, such findings could be interpreted as a small step towards a view that emotional processing difficulties, as suggested in outline by multi-level theories of emotion (section 1.1.6), can be understood as emerging through information processing factors, the recoding and integration of environmental information into forms which enable individuals to more functionally respond to their world. Emotional responses will persist dysfunctionally until their causes have been understood. What behaviourists refer to as 'overgeneralisation' whereby an aversive encounters with a stressor engenders an ongoing stress/panic response to all members of the stressor's class, might thus be underpinned by a more cognitively specified account.

Practically of course, the psychotherapeutic implications of such findings, or the understanding towards which they represent a small step, would be to better identify the causes of emotional disruptions, to locate psychopathological conditions within a cognitive mnemonic style, and to tailor therapy to address this deficit. This is, in embryo, already implicit within the much of the research surveyed in section 1: in the many analogue studies which suggest that the proliferation of sensory perceptual detail during a traumatic encounter play a central role in maintaining PTSD symptoms, in comparable research finding that a conceptually driven style of processing can be protective against aversive memories ; it is, too, manifest within the many varieties of talking cure which hope to bring sense and narrative coherence to upsetting and often harrowing experiences.

This is of course an ambitious reading of what were rather slight differences using artificial stimuli that did not very well reflect the types of complex events and

phenomena that are the object of ordinary mnemonic processes. The actual, rather than possible, implications of such differences, that is their effects within the cognitive affective system, need to be explored before any understanding can be established of how these further affect the processing of emotional difficulties.

Clearly, if differences in memory performance are implicated in emotional processing difficulties, one would expect this to be reflected in personal recollective memory of more complex kinds. The question, thus, persists as to why such differences did not also emerge over the tests of more authentic memory phenomena explored in studies 5-8. A tentative line of explanation has been advanced throughout the discussions of these sections: namely that while some differences did emerge between groups over the relatively pure measures adopted within studies 1-4, in those studies which offered exogenous sources of conceptual processing, either through detailed retrieval cues offered in questions, highly stylised and contrived experimental stimuli (studies 5, 6) or through surveying events which received a great deal of public coverage (study 7b) differences in the memory were in fact suppressed.

Whilst this may, partially, account for many of the null findings, a further question remains as to the failure to detect evidence of superior conceptual processing in effective emotional processors, beyond study four's finding of effective emotional processors heightened tendency to recall pictorial stimuli through verbal cues. The methodological and conceptual difficulties inherent in the construct of conceptual processing are addressed in the following section. As is discussed in section 6.2.2.5, conceptual-semantic processing may designate a host of associated processes by which raw sensory perceptual memories become integrated in verbal narrative form within the is indexed, retrievable and amenable within the broader structures of autobiographical memory.

Such processes may be enacted at various stages either subsequent to or concurrent with event encoding.

One potential line of interpretation would be to see emotional processing difficulties as principally attributable to an excess of sensory perceptual details, rather than a deficits in the capacity to conceptually process. These latter may only arise as a result of this sensory-perceptual surfeit, and may only become problematic, i.e. productive of genuine emotional processing failures, within the more complex and engaging experiences of real life.

It may be that effective emotional processors simply retain fewer sensory perceptual details, and this tendency, over authentic and genuinely emotional experiences, enables information to be more effectively processed. Such a suggestion would be consonant with the stance taken by Brewin, whose variant models of PTSD symptoms suggests that it is by restricting the formation of sensorily based memories that trauma symptoms are inhibited, and conceptual processing principally beneficial following traumatic experience in order to recode memories into more accessible formats within an autobiographical memory system.

Applying such a process to the more banal setting of ordinary emotional processing, we could see that poor emotional processors tendency to generate a sensory perceptual surfeit only becomes affectively significant when a 'backlog' of sensory perceptual information obstruct the process, which could take an unspecifiable amount of time to be completed, of making sense, ordering and bringing meaning to events. If this is the case, then the pursuit of differences in terms of superior conceptual semantic processing will need to be far more sensitive to its actual nature and timecourse, and to be more greatly informed by specific experimental models.

As is expanded in section 6.3.3 and 6.2.2.5, this implicit binary between sensory-perceptual processing and conceptual processing that may be misleading. By conceptualising the latter as a unitary, competing, complementary or essentially concurrent process to sensory-perceptual processing may represent its nature. It may not be conceptual processing per se that is deficient but rather that the range of processes denoted by conceptual processing which may be protective against the development of dysfunctional responses that are impeded by an excessive tendency to generate and retain sensory perceptual information.

### *6.3.2 Arousal as Explanatory Construct*

What appears to be confirmed within these studies is that poor emotional processors tend to retain more information of a non-verbal/semantic form. It is inferred that this may be because such information is less semantically/conceptual processed amongst this population. This was most apparent within the comparatively 'spontaneous' measures of memory, namely within the first three studies which adopted discrete disconnected briefly presented stimuli and found differences chiefly over brief retention intervals; then further within phenomenological reports of memory vividness surveyed over longer term autobiographical memories. Thus the thesis does provide a set of findings which appear to suggest that the features characteristic of highly emotional and emotionally distressing events may be best understood as products of a processing style. These findings as was originally intended, are, principally proposed as triangulating research drawn from PTSD studies and models of emotion predicting that the encoding of events, and the recoding of memory information could be seen as critical in the maintenance of emotional disruptions.

The design of the studies means that such results are best interpreted as confirming a

processing tendency amongst a certain population, rather than establishing aetiological connection between that processing style and the development of emotional processing difficulties. This broadly supports theoretical models that posit the formation of distinct representations in themselves incompatible or at least hard to assimilate within the broader workings of a cognitive-mnemonic system (Conway & Pleydell-Pearce, 2000), and which aggravate emotional processing of events (Brewin, 2001a; Foa & Rothbaum, 1988; Foa & Riggs, 1993; Terr, 1994; van der Kolk & van der Hart, 1991). This argues against, or at least deemphasises accounts of the development of pathologies which stress as critical factors arousal per se (Horowitz, 1976, 1986), or psycho-social consequences of trauma (Janoff-Bullman, 1992; Bolton & Hill, 1996), the specific nature of rehearsal following a trauma, or any other peculiar feature of the trauma or aversive event which distinguish it from ordinary events. As such, by considering how poor emotional processors process ordinary stimuli within memory, it supports *information processing accounts* of psychopathological reactions (Brewin and Holmes, 2003, p.349; Foa, Steketee, & Rothbaum, 1989; Litz & Keane, 1989) by suggesting that a processing bias itself may generate protracted affective difficulties. This furthers an understanding of emotional processing difficulties in a more global sense and opens the way to a more general account, by suggesting an underlying mechanism that may contribute to their production (Rachman, 1980, 2001).

The precise mechanisms by which emotional processing difficulties arise can only be sketched within the ambit of this discussion and is clearly in need of far greater specification and empirical support. A consequence, however, of stressing encoding processes as critical factors within accounts of emotional processing is that, to some extent, the specific role that arousal plays may be de-emphasised. This is, arguably, a benefit for a number of reasons. An undifferentiated notion of arousal is frequently

used as a catch-all explanation of why differences in memory and emotional reactivity emerge within aversive situations. Without rehearsing the debate on the validity of arousal as a construct within psychological accounts (Anderson, 1990; Cattell, 1972; Neiss, 1988; Venables, 1984), even within the specific field of emotional memory difficulties have arisen. Deffenbacher (1983) notes the importance of differentiating between arousal caused by the to be remembered stimulus, and that caused by extraneous factors, suggesting that much previous research has elided this distinction and led to a mixed and confusing pattern of findings. More broadly, Levine & Pizarro (2004) censure the unnuanced arousal based view of emotional memory which pervades much research and argued instead for a closer discrimination of the causes of arousal in producing distinctive patterns of memory. Certain studies (Strange, Hurleman & Dolan, 2003; Libkuman, Griffith, Nichols-Whitehead & Thomas, 1999) which have considered the effects of physiological arousal, either induced by exercise or pharmacological means, have failed to reproduce the distinctive pattern of memory for emotional events, suggesting that emotional arousal, however that is defined, needs to be carefully distinguished from other forms. More generally, defined physiologically, arousal may not differentiate between sources and qualitative kinds of arousal. More descriptive psychological accounts appear far too simplistically descriptive and once again fail to account for why such mnemonic distortions and characteristics develop within emotional memories. As Neiss (1990) states *'By focusing on the elevated physiology and ignoring its psychological context, the construct of arousal lumps together grossly disparate states (e.g., joy, grief, anger), resulting in a breadth that explains nothing'* (p.110).

Of course, it would be expected that within situations of extreme threat or reward, arousal would be heightened as evidenced by an augmented tendency to act, the

devotion of psychological resources to the source of threat or attraction (LeDoux, 1986). Yet this is merely to concede that psychological and physiological arousal are consequences of situations or reward or threat. What role arousal plays in the specific pattern of memory encoding and consolidation needs to be carefully elucidated and supported. Thus, at a theoretical level, emphasising the processing shift that situations of danger or reward elicit rather than attempting an explanation in terms of arousal per se may allow more fine-grained predictions and understandings to emerge of how emotion and memory interact.

Significantly, on many gross measures of arousal adopted within these studies, particularly on ratings of emotionality for events, poor and effective emotional processors showed no differences. Whilst of course representing very approximate measures, these may suggest that it is not that groups differ in their initial response to events or situations, nor that poor emotional processing is a result of excessive, or comparatively higher levels of arousal. Instead, a difference in how events are encoded may result in them subsequently being registered as arousing, or specifically of sources of past and future threat. Thus poor emotional processing may be understood as fundamentally rooted in a processing rather than affective tendency. Naturally, such a proposal needs far greater confirmation from more rigidly controlled studies exploring and isolating the differential effects of encoding style from levels of arousal. Nonetheless, the potential significance of such an approach in understanding precisely how emotional processing and memory interact is considerable for clinical applications.

### *6.3.3 Issues with the Construct of Conceptual Processing*

In those cases where no differences emerged between groups in terms of their tendency to process and recollect events in a manner suggestive of a conceptually based style, it has at times been suggested that the nature of the stimuli, and the probes used to test

recall and recognition may have provided some form of exogenous conceptual processing, which itself helped to reduce the sensory basis of representations, akin to how within the verbal overshadowing effect (Schooler & Engstler-Schooler, 1990) the production of verbal descriptions apparently facilitates the reduction of visual detail, or how, within therapeutic contexts the encouragement of verbally based memories of traumatic events can help attenuate their vivid, affectively laden nature (Krans et al, 2009; Brewin, Dalgliesh & Joseph, 1996). This type of semantic/conceptual ‘scaffolding’ appears more likely within publicly broadcast, widely discussed events, which might help to explain why no differences were found, in the autobiographical memory studies, for public, flashbulb type events, or for the studies involving laboratory presented narratives which were highly artificial, verbally narrated and comprised the presentation of simple slides and easily discernible causal-motivational sequences. How convincing one finds such explanations of course depends on what one holds conceptual processing to be. Thus a significant implication of this research is the need for greater elucidation of the construct of conceptual processing, around which a number of issues might be raised.

The first issue is definitional: to what extent is conceptual processing a unitary construct? Are the forms of conceptual processing (labelling, categorising, narrating, causally ordering, reflecting upon consequences, or evaluating) instances of the same underlying process, or can they only *nominally* be grouped together within the same category? If the latter is true, then the question of which particular form of conceptual processing brings protective benefits in emotionally distressing situations becomes particularly pressing. Part of the motivation in grouping such sundry psychological processes beneath a single category was inspired both by the diverse schools of research whose findings were originally reviewed in section 1.4 & 1.5 (Arntz, de Groot & Kindt,

2005; Ehlers & Clark, 2000; Holmes et al. 2009; Krans et al., 2009; Laposa & Alden, 2006; Murray, Ehlers & Mayou, 2002; Mathews & McLeod, 2002; Pennebaker, & Chung, 2007; Pennebaker & Beal, 1986), but also behind a theoretical model which saw individuals attempting to devise law-like conceptually based rules about their environment. This process assumes various stages of conceptual processing, where basic semantic labelling facilitates more complex conceptual processing such as narrative coherence, causal-motivational ascription, and the generalisation/localisation of threats, or implications to self. Yet, at an empirical level, whether this model holds is open to challenge; furthermore, it appears open to empirical investigation which aspects of such processing facilitate emotional processing.

Second, the degree of automaticity and conscious awareness underlying such processes needs to be addressed. Although the type of verbal indexing which our ordinary experience undergoes to render it accessible to retrieval cues must be largely automatic, certain aspects of conceptual processing can of course be intentionally performed.

Whether groups differ in the automaticity of such processes, and whether intentional strategies can compensate for such differences remains an open question. This pertains to the issue of whether conceptual processing can be *induced* or intentionally undertaken and ultimately to its value within clinical/therapeutic settings. The studies reported within this dissertation merely explore features thought to reflect spontaneously arising differences between groups and do not address whether such tendencies can be learnt or deliberately instated; by contrast, researchers within PTSD fields have encouraged participants to process events in a particular style, thus exogenously inducing such protective benefits, with mixed results. Holmes, Mathews, Dalgleish, & Mackintosh (2006), for example, discuss the possibility of a 'cognitive vaccine' intended through focussing upon semantic aspects of aversive events to

facilitate their subsequent assimilation; whether, and over what range of phenomena, such interventional strategies are effective, as well as the longevity of such benefits, crucially depends on whether conceptual processing can be intentionally induced. Relatedly, it seems critical to understand at what stage, during or after event presentation such conceptual processing *in its therapeutically significant sense* occurs. Clearly it is an assumption of many forms of psychotherapy that post- event reconstructions of distressing experiences can be beneficial for recovery; Pennebaker and Chung (2007) for example describe global affective, humoral and physiological benefits accruing from writing of experiences which may have taken place many years prior to the intervention. At the opposite extreme are studies such as Laposa & Alden (2006), and Halligan, Clark & Ehlers (2002), where participants are induced to process events and stimuli in an instantaneous simultaneous fashion, suggesting benefits may accrue from the 'online' application of such processing strategies. Of course whether the two models are equally beneficial is an open empirical question, and whether they are beneficial because they address the same sort of underlying psychological process needs further investigation.

#### 6.4 Summary

In summary, the implications of the results reported within this thesis are twofold. First, by exploring and presenting evidence for a sensory encoding preference within poor emotional processors, it appears that a tendency to encode and retain sensory aspects of an event can be reliably associated with the development of emotional processing difficulties. This triangulates research data considered throughout this dissertation which sees in the deficient top-down processing of information within extremely aversive situations as impeding their subsequent assimilation. By conceptualising emotional processing difficulties as the result of a distinctive *encoding style*, occurring

over a range of non-arousing stimuli and events and typical in a trait like manner across a population, one implication for future research may be to look beyond undifferentiated arousal-based views of how psychopathological disruptions of memory arise, to more

specified accounts considering the specific nature of deficits and processing surfeits which tend to accompany and result from arousing situations. Problems with the arousal construct to some extent be circumvented by an information-processing perspective which emphasises and explores the aetiological significance of processing tendencies and deficits within the development of emotional processing difficulties.

A second implication of this thesis has been to problematize the status of conceptual processing. A consequence of the mixed nature of the results regarding conceptual processing tendencies amongst the populations here considered, is to suggest that, in order for a fully specified model to be developed that can elucidate how, precisely, emotional processing difficulties are sustained by mnemonic processes, more differentiated and robust definitions of conceptually driven processing need to be established. This will allow for the construct's more efficient operationalization within empirical studies, its experimental examination and ultimately the identification of therapeutically beneficial forms of conceptually based processing.

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## Appendices

### *Appendix A: Word Lists Used In Study One*

Presentation List A (with frequency ratings taken from Titania Wordbank (University of Birmingham, 2000), / and difficulty ratings for fragments (as determined by Erickson, Gaffney & Heath, 1987. List A mean frequency rating 314.04 ( $SD = 632.73$ ); List B mean frequency rating = 333.65 ( $SD = 663.33$ ).  $t(198) = -.214, p = 0.831$

List A mean fragment completion difficulty rating = 5.35 ( $SD = 1.77$ ); List B mean fragment completion difficulty rating = 5.41 ( $SD = 1.73$ )  $t(158) = -.219, p = 0.83$ .

#### List A

1. AIRSPACE (118/6.7)	35. GANGRENE (53/6.6)	69. ANTIQUE (830/6.78)
2. WAVELET (5/1.92)	36. TEQUILA (55/6.86)	70. SURGEON (1046/6.95)
3. CROUPIER (10/1.22)	37. CALENDAR (1086)	71. BLADDER (997/6.78)
4. HAYLOFT (12/6.86)	38. CREVICE (58/5.86)	72. RHETORIC (954/4.75)
5. LAGGARD (13/1.28)	39. KEROSENE (60/6.76)	73. MYSTERY (2208/6.92)
6. INSOMNIA (115/6.63)	40. ABATTOIR (67/1.05)	74. BOYHOOD (144/6.95)
7. PETUNIA (15/6.61)	41. STOCKING (581)	75. MASCARA (153/6.73)
8. KEEPSAKE (35)	42. LEPROSY (70/5.78)	76. HYACINTH (163/3.63)
9. EXPONENT (216/6.45)	43. DECIBEL (45)	77. OCTOPUS (172/6.9)
10. SPROCKET (16/5.78)	44. ANTENNA (74/6.9)	78. BOROUGH (1902/4.62)
11. FLANNEL (194/6.85)	45. LECTERN (80/2.94)	79. ANTIDOTE (187/6.55)
12. CHIPMUNK (20/6.68)	46. ELLIPSE (82/5.55)	80. JAVELIN (72)
13. SEXTANT (20/4.07)	47. CUTLERY (307/5.13)	81. NIRVANA (207/1.3)
14. RHOMBUS (22/3.87)	48. GAZELLE (84/5.75)	82. CAULDRON (154)
15. PAGEANT (190)	49. BULLOCK (213/2.14)	83. OVERLORD (99)
16. BROCCOLI (132/6.92)	50. BASSOON (89/5.53)	84. PIGMENT (223/6.58)
17. ESPRESSO (27/4.23)	51. SPITTLE (91/3.17)	85. STILLETTO (45)
18. COPYCAT (33/6.76)	52. DAYLIGHT (957)	86. CLARINET (240/6.78)
19. ARCHDUKE (35/5.15)	53. URETHRA (92/5.25)	87. CESSPIT (14)
20. ISTHMUS (37/3.67)	54. HAIRLINE (90)	88. YOGHURT (287/6.48)
21. HEIRESS (185)	55. GONDOLA (94/6.1)	89. ASBESTOS (297/6.23)
22. REPARTEE (39/1.88)	56. THEOREM (362/5.28)	90. TADPOLE (127)
23. MONOGRAM (43/6.75)	57. COBBLER (96/6.48)	91. CABARET (319/5.8)
24. OUTSIDER (581/6.88)	58. EMISSARY (104/3.24)	92. APRICOT (324/6.92)
25. VERMOUTH (25/5.06)	59. UKULELE (11)	93. LINEAGE (330/5.15)
26. CLIMATE (2782/6.83)	60. PLANKTON (110/5.16)	94. CHOLERA (371/4.93)
27. MONOCLE (45)	61. RHUBARB (119/6.55)	95. BACHELOR (424/7)
28. ANYBODY (4760/7)	62. DUODENUM (124/3.3)	96. ANALOGUE (470/3.48)
29. HIBISCUS (47/4.6)	63. SCIMITAR (14/1.39)	97. VAGABOND (33)
30. SEDATIVE (68)	64. BANDANNA (4/6.95)	98. CURATOR (489/4.33)
31. BITUMEN (71)	65. CHIMNEY (632/6.95)	99. CAVALRY (520/6.75)
32. JAMBOREE (48/6.2/0)	66. INFERNO (128/6.86)	100. LEXICON (557/1.85)
33. OPERETTA (52/4.32)	67. ELECTRON (943/6.55)	
34. STOPCOCK (43)	68. LANOLIN (17/5.68)	

## ListB

1. CONIFER (120/2.42)
2. PHARAOH (126/6.26)
3. NEONATE (211/1.24)
4. UTHIUM (77/3.3)
5. MARJORAM (47/1.6)
6. BAYONET (83/6.51)
7. BOURBON (131/6.82)
8. PEROXIDE (143/6.71)
9. LACROSSE (27/4.63)
10. ORATION (30/3.7)
11. THYROID (150/6.28)
12. LOZENGE (55/5.23)
13. BAZOOKA (15/6.8)
14. SAPPHIRE (156/6.86)
43. CHUTNEY (52/1.8)
44. FLAMINGO (81/6.78)
45. AGNOSTIC: (RR Q)
46. MENTHOL (10/6.53)
47. NOCTURNE (37/3.07)
48. TRICYCLE (41n)
49. BASILICA (168/1.87)
50. OSTRICH (129)
51. MIGRAINE (175/6.75)
52. HAMMOCK (53)
53. STRAINER (26)
54. REPUBUC (4245)
55. ANATOMY (4GG/G.SG)
56. WARRAITY (483/6.92)
57. SENATOR (669)
58. KEYHOLE (125)
59. DEACON (273)
60. VAGABOND (33)
61. TWIUGHT (367/6.85)
62. LETTUCE (383n)
15. RUFFIAN (204.8)
16. GIZZARD (17/6.61)
17. COCKATOO (195/7.8)
18. VICEROY (91/4.87)
19. CYANIDE (94/4.86)
20. BEESWAX (62/6.41)
21. FILTRATE (95/2.7)
22. BEGONIA (234/5.6)
23. OBEUSK (54/1.55)
24. INKWELL (12/6.48)
25. ALMANAC (34/6.5)
26. HEXAGON (59/6.31)
27. ATROCITY (105/4.53)
28. HYDRANT (14/6.78)
63. PENDULUM (221/6.65)
64. VICARAGE (223/1.95)
65. THEOLOGY (207/1)
66. UNIVERSE (250/6n)
67. APPROVAL (3873n)
68. JAWBONE (17)
69. SHERIFF (945/2)
70. RAINBOW (967/6.98)
71. DEMOCRAT (988/6.86)
72. ADVOCATE (851)
73. PHOENIX (558/5.92)
74. SIUCON (597/5.63)
75. FASCISM (G59/SG3)
76. IGNITION (258)
77. CELESTERY (732)
78. JEWELLER (145)
79. STIRRUP (71)
80. HORIZON (1308/6.95)
81. PARAFFIN (253/5.51)
82. DAFFODIL (109)
29. VENDETTA (89/5.03)
30. AARDVARK (16/6.21)
31. SPATULA (36/6.73)
32. EPITAPH (116/4.76)
33. BRAVADO (118/3.83)
34. DEURIUM (101/5.55)
35. ROTUNDA (53/4.98)
36. INCISION (70/6.76)
37. GRANARY (72/2.45)
38. CASHMERE (111/6.13)
39. IMBIBER (2/1.42)
40. CUPCAKE (3/6.98)
41. SORGHUM (45/3.17)
42. AVOCADO (95/6.95)
83. PAINTBOX (21)
84. PADDOCK (26)
85. CHASSIS (104/1)
86. GAZETTE (330/6.28)
87. INERTIA (345/5.08)
88. ALLEGORY (183/3.72)
89. CINNAMON (203n)
90. QUARTET (511/6.61)
91. ESTUARY (524/1.53)
92. PARANOIA (207/6.2)
93. CROQUET (213/6.08)
94. TAILSPIN (11)
95. HACKSAW (73)
96. MEMBRANE (882/6.7)
97. DINOSAUR (296/6.98)
98. TABLOID (396)
99. ASSASSIN (303/6.61)
100. COCONUT (318/6.98)

Appendix B: Stimulus Lists Used in Study 2

List 1

TONGUE		CHEESE		PASSPORT		TENT		TAP	
FENCE		SKIRT		CHAIN		MUD		CROWN	
LAMP		DESERT		TRUNK		KNEE		TAXI	
PIPE		POTATOES		WATCH		GRAVE		FLOWERS	
SEA		HAT		ROAD		STAIRS		PATH	
CARD		DOCTOR		EGGS		MATCH		BAG	
HEART		BUTTON		SHEEP		BED		SALT	
CAT		CUP		CAR		DOLL		DOOR	
COMPUTER		MOON		DRESS		LEAVES		HORSE	
BOX		NOSE		BATH		MONEY		ICE	
TOWER		BRAIN							

List 2

	HAND		BRIDGE		BIRDS		CROSS		RING
	MEAT		BOTTLE		LETTER		STONE		SQUARE
	JUDGE		CHICKEN		BONES		ROPE		BOAT
	GLASS		GUN		CLOUD		PLANE		FOOTBALL
	POOL		EAR		ROOF		BASKET		SUN
	WINDOW		TEETH		NUTS		BLANKET		TELEPHONE
	LEGS		BELLY		BEANS		RIVER		BELL
	PAPER		CHAIR		CORN		FUR		KNIFE
	COW		ORANGE		FLAG		TROUSERS		SHELL
	RUBBER		PIANO		RICE		BELT		WIRE
	TRAY								

List 3

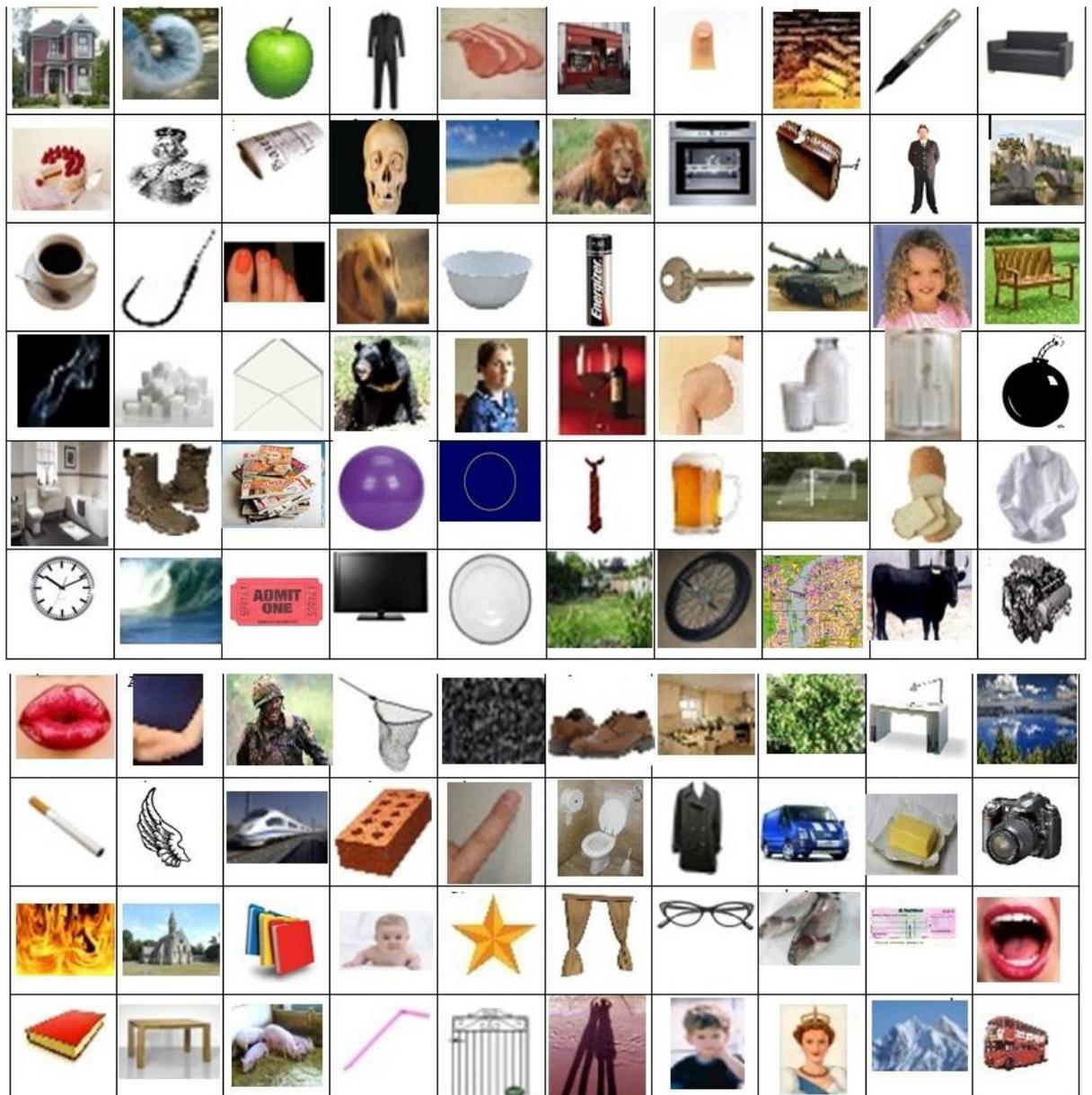
CLOCK		TICKET		PLATE		WHEEL		BULL	
LIPS		SOLDIER		COAL		KITCHEN		DESK	
CIGARETTE		TRAIN		FINGER		COAT		BUTTER	
FIRE		FILE		STAR		GLASSES		CHEQUE	
BOOK		PIG		GATE		BOY		MOUNTAIN	
HOUSE		APPLE		BACON		THUMB		PEN	
CAKE		NEWSPAPER		BEACH		OVEN		POLICEMAN	
COFFEE		TOES		BOWL		KEY		GIRL	
SMOKE		ENVELOPE		NURSE		SHOULDER		SHOWER	
BATHROOM		MAGAZINE		CIRCLE		BEER		BREAD	

List 4

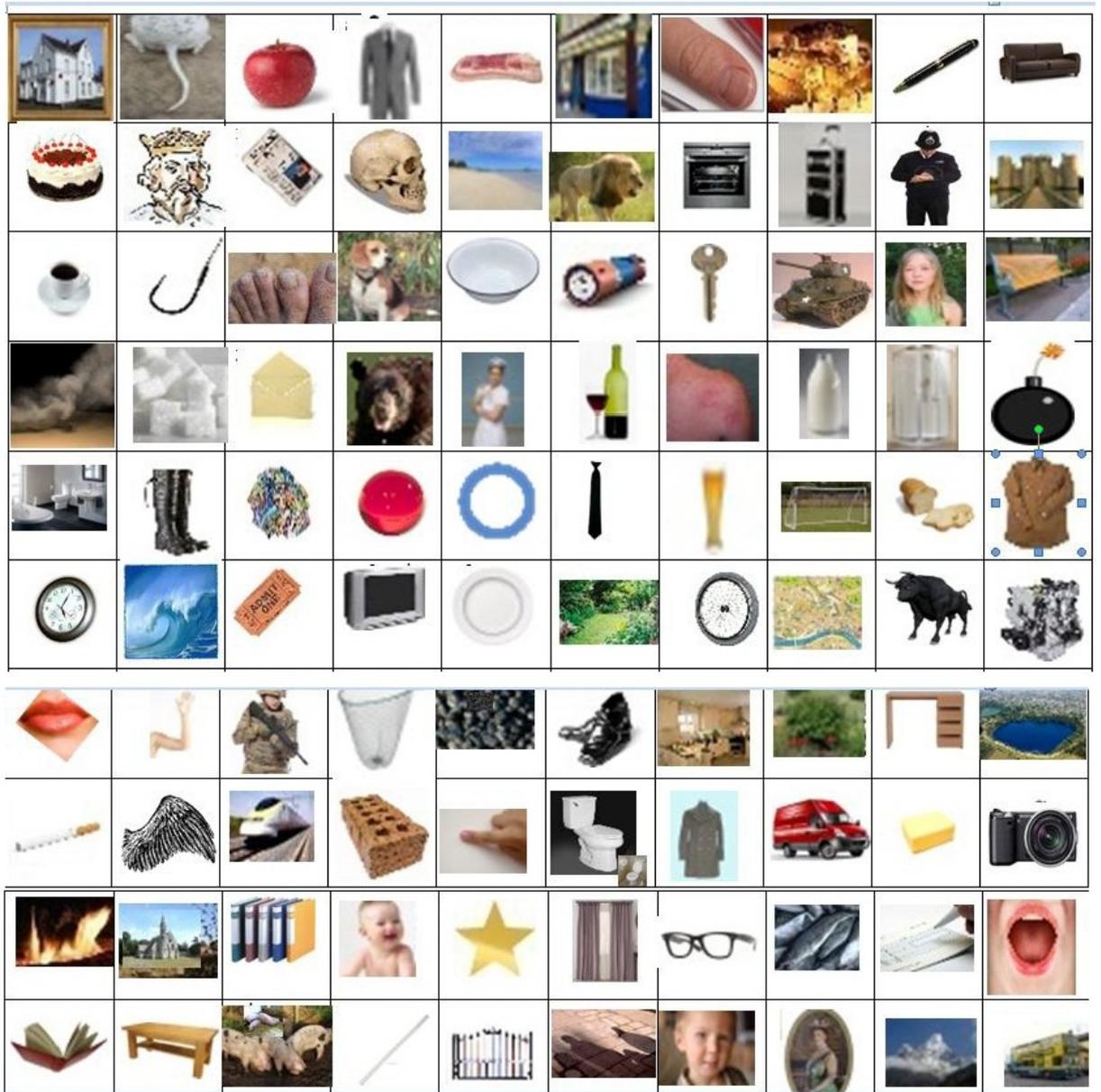
	TAIL		SUIT		SHOP		GOLD		SOFA
	KING		SKULL		LION		CASE		CASTLE
	HOOK		DOG		BATTERY		TANK		BENCH
	SUGAR		BEAR		WINE		MILK		BOMB
	BOOTS		BALL		TIE		GOAL		SHIRT
	WAVE		TELEVISION		GARDEN		MAP		ENGINE
	ARM		NET		SHOES		BUSH		LAKE
	WING		BRICK		TOILET		VAN		CAMERA
	CHURCH		BABY		CURTAINS		FISH		MOUTH
	TABLE		STRAW		SHADOWS		QUEEN		BUS

Appendix C: Stimulus Lists Used For Studies 3 And 4.

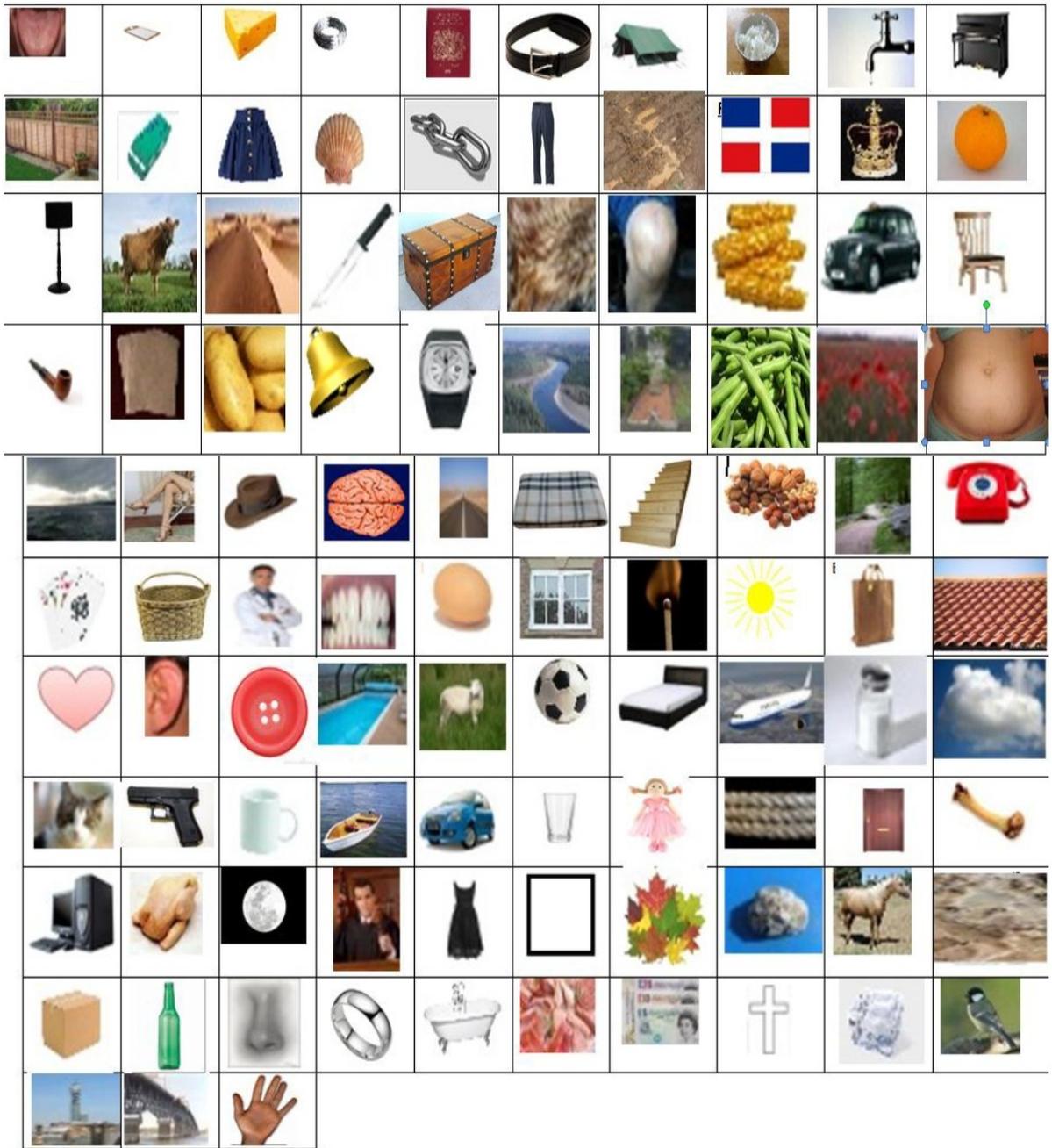
List 1.



List 2



List 3



List 4



*Appendix D: Slide Show And Texts Used In Study 5*

*Arousal Version*

Mother and son are leaving home in the morning



*Neutral Version*

Mother and son are leaving home in the morning



They make sure that crossing park road is safe



They make sure that crossing park road is safe



She is taking him to visit his dad at work



She is taking him to visit his dad at work



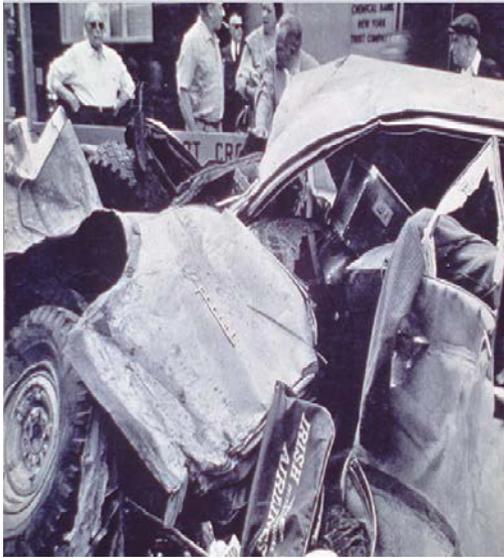
Father is chief surgeon at the nearby hospital



Father is head mechanic at the nearby garage



Earlier in the day there was a terrible accident



Earlier in the day this car had to be towed in



the surgical team has been fighting to save the victims



The garage crew has been trying to locate the problem



Father was able to restore the severed limbs



He is pleased that his son watched the surgery



Father was able to find the broken connection



He is pleased that his son watched the repair



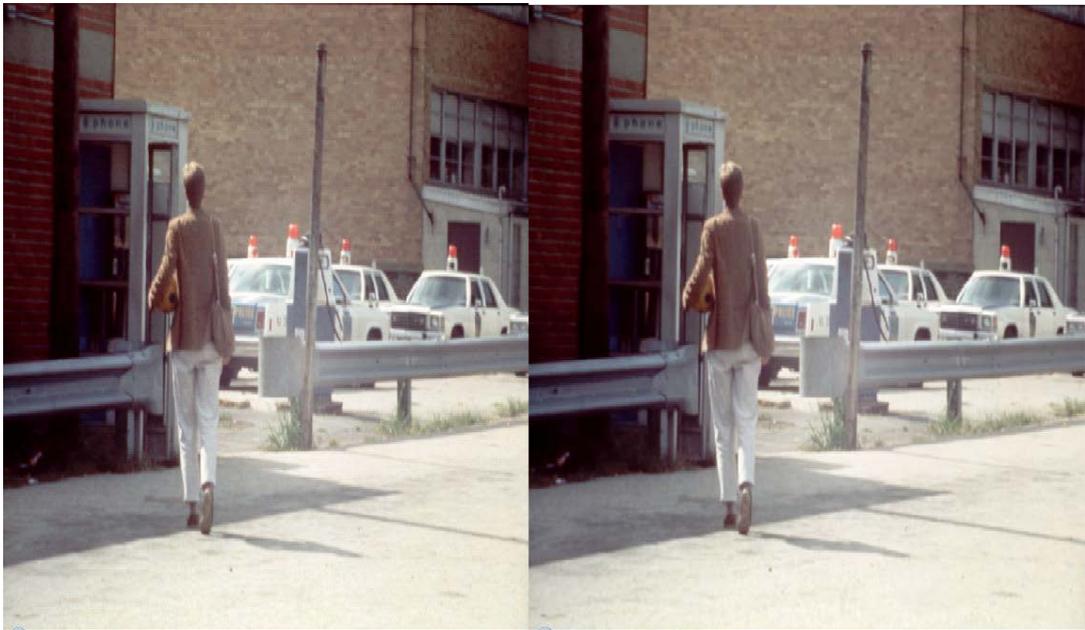
Mother leaves the garage upset by what she saw

Mother leaves the garage being late for her job

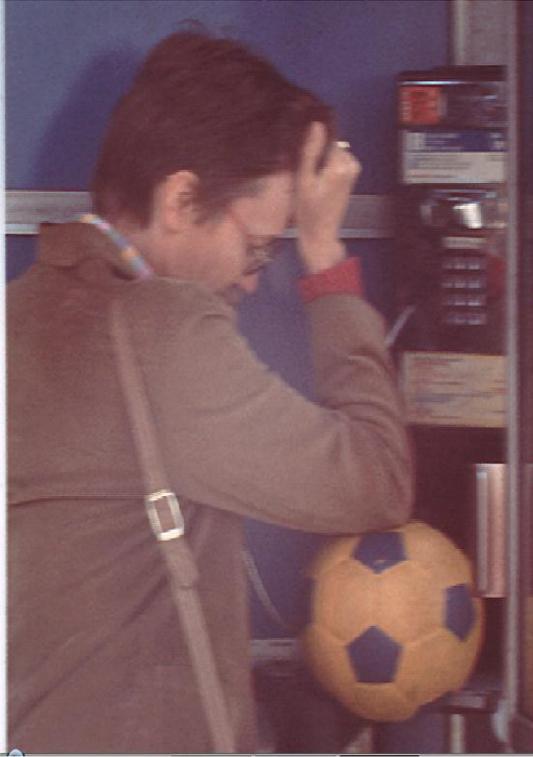


Heading to call work she passes a police station

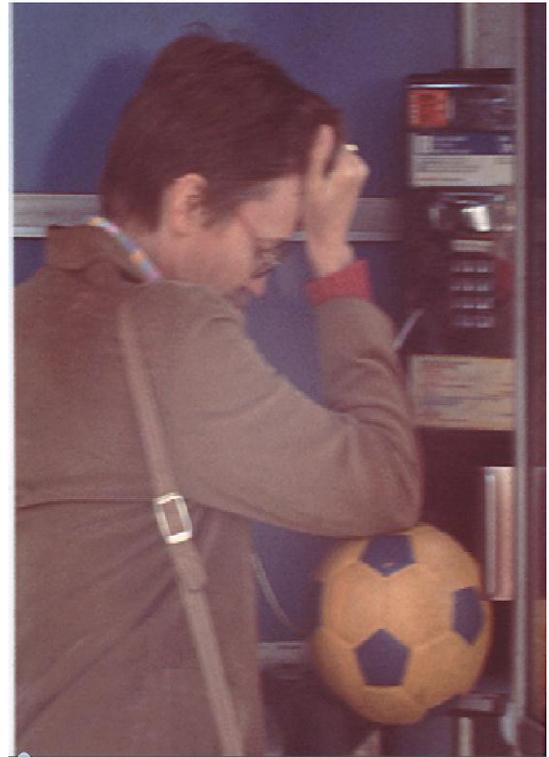
Heading to call work she passes a police station



Mother asks her boss to get the day off



Mother apologises for her delay to her boss



She tries to hail a cab home at the number 3 bus stop



She tries to hail a cab downtown at the number 3 bus stop



## Appendix E: Materials Used In Study 6

### Slide show



### Texts

#### Neutral version

- 1) Imagine that you are sitting alone in the dining hall at lunch. The friends that you normally eat with had other commitments today so you are alone.
- 2) A friend of yours from your hall of residence, Megan, spots you sitting by yourself and asks to join you. You agree and she sits down.
- 3) You comment that she looks quite tired and you ask her how her classes are going. She tells you that her classes are going fine.
- 4) She says she just stayed up too late last night trying to finish an English essay. She will try to get to bed earlier tonight and then she'll be fine.
- 5) You tell Megan that you have piles of reading to do but you are not particularly concerned
- 6) Megan looks down as you ask her about her boyfriend Steve. You comment that you have seen them together a lot lately.
- 7) While absent-mindedly stabbing at her pineapple chunks, she tells you that she wishes they could spend even more time together.
- 8) Megan says that she wishes that 'Bon Appetit', the university canteen, had better choices of salad dressing.

- 9) When you have both finished your lunch you decide to walk back to the hall of residence together.
- 10) Megan tells you that tomorrow is her birthday and you make a mental note to say 'Happy Birthday' to her if you see her.
- 11) You ask Megan how old she will be. She reluctantly tells you that she will be 20.
- 12) She says that 20 seems pretty old to her.
- 13) As you leave Megan, you tell her it was nice catching up with her and you hope that she has a nice birthday.
- 14) The next morning is a Saturday, so you get up late and then decide to run a few errands. You throw on some clothes and then head to the bathroom on your way out the door.
- 15) On the way, you pass by Megan's door and are reminded that it is her birthday. You decide to stop and wish her a happy birthday.
- 16) You knock quietly and hear a feeble 'Come in' from the other side.
- 17) You enter the room and find Megan looking ill. You ask what's wrong, and she tells you she has a migraine. You say 'Happy Birthday' anyway.
- 18) She tells you that she and Steve made cocktails at midnight to celebrate her birthday. As she talks, she winces in pain.
- 19) You suggest that she might not have a migraine – the word 'hangover' seems to fit the bill better. She admits that you are probably right.
- 20) Megan shakes a painkiller out into her hand, and then looks around for something to take it with.
- 21) Because she looks so pathetic, you offer to get her a glass of water, but before you have the chance the phone rings.
- 22) Megan reaches for the phone and you wait.
- 23) It is apparently Megan's mother on the other end of the line calling to wish Megan a happy birthday. You leave her alone and go to get that glass of water.
- 24) You leave the room and see the dormitory assistant at the other end of the hall. You walk past him on the way to the kitchen and casually say 'hello'.
- 25) When you get to the kitchen, you find Mark, a good friend of Megan's. You fill a glass with water and chat with him.
- 26) When you run out of things to say, you say 'goodbye' to Mark and head back towards Megan's room to see if she's off the phone.
- 27) Back at Megan's room you find people gathering to wish her a happy birthday. Julie, Megan's neighbour, tells you they are meeting now because Julie will be out later.
- 28) You find the dormitory assistant in the room with Megan. Mark shows up too after a minute. Megan tells everyone about her evening plans.
- 29) The dormitory assistant suggests that you all sing 'Happy Birthday' to Megan. You all clear your throats and sing.
- 30) Megan looks mildly embarrassed by the fuss. She thanks everyone for the song and birthday wishes.
- 31) Megan is sorry that Steve won't arrive until later. The phone rings again.
- 32) This time Megan greets Steve on the other end of the line. She talks for a minute and then everyone else in the room gets embarrassed for being there.
- 33) One at a time you all get up and sneak quietly out of the room so that Megan can talk without an audience.

*Arousal version*

- 1) Imagine that you are sitting alone in the dining hall at lunch. The friends that you normally eat with had other commitments today so you are alone.
- 2) A friend of yours from your hall of residence, Megan, spots you sitting by yourself and asks to join you. You agree and she sits down.

- 3) You comment that Megan looks quite tired and you ask her how her classes are going. She says that she thinks she may fail biology.
- 4) She says that her parents have threatened to stop paying for her education if she fails any more classes.
- 5) You decide that it is perhaps best to change the subject because Megan looks like she might start crying.
- 6) Megan looks down as you ask her about her boyfriend, Steve. Megan informs you that Steve just dumped her.
- 7) Megan tells you, as she stabs violently at her pineapple chunks, all of the unfortunate details of her split with Steve.
- 8) Megan stares at her food and says that she doesn't really feel like eating.
- 9) When you have both finished your lunch you decide to walk back to the hall of residence together.
- 10) She is clearly quite upset about the break-up. She says that he dumped her suddenly after several years and on her birthday.
- 11) She asks you if you can believe that anyone could do that to her.
- 12) You don't know how to respond but you tell her that you are sorry.
- 13) As you leave Megan, you are worried about how desperate she seems so you suggest that she should see a counsellor.
- 14) The next morning is a Saturday, so you get up late and then decide to run a few errands. You throw on some clothes and then head to the bathroom on your way out the door.
- 15) On the way you pass by Megan's door and are reminded that she was very upset at lunch. You decide to stop and check on her.
- 16) You knock on the door but she doesn't answer. You get worried and try the door.
- 17) You enter the room and find Megan alone looking like hell. She says she has a migraine. The air smells of alcohol.
- 18) You ask what's going on. She tells you she can't take the pressure. Her life is simply not worth living anymore.
- 19) She tells you that she asked about her grades and found out that they were even worse than she expected. You try to comfort her but don't know how.
- 20) It doesn't seem to matter what you say anyway. Megan takes a bottle of pills and pours them all into her hand.
- 21) You try to figure out what to do and then remember that the student health centre has a phone number for emergencies.
- 22) You look up the number for Megan and plead with her to make the call. She finally agrees.
- 23) When Megan is safely on the phone, you rush out to find additional people to help
- 24) You leave the room and see the dormitory assistant at the end of the hall. You run to him and tell him about Megan. He calls the dormitory manager and tells you to find Megan's good friend, Mark.
- 25) You find Mark in the kitchen. You tell him that Megan is threatening suicide. He drops the dish he's washing.
- 26) Mark swears, quickly shakes the water off his hands, and follows you hurriedly towards Megan's room.
- 27) Julie, Megan's neighbour, is standing outside wanting to know what's going on. You and Mark rush into the room. The dormitory assistant is already there talking to Megan.
- 28) Mark tells Megan that he heard what happened and wants to make sure that she is ok. Megan tells him about what's going on.

- 29) Mark asks if she has even talked to her parents lately and told them how bad she is feeling . She admits that she has not.
- 30) The dormitory assistant suggests that she call right now. She looks sceptical but with further coaxing she agrees to call her mother.
- 31) She can't figure out what she might possibly say to her mother.
- 32) Megan asks everyone to stay while she makes the call. She calls her mother and you all hear her side of the conversation. She seems to be telling her the truth.
- 33) In time Megan looks somewhat reassured and slowly one at a time you leave the room to give her some privacy all promising to check on her later.

## Questions

### Neutral Version

#### **1. You are eating alone because**

- a. you had an argument with your friends      b. you were late for lunch  
c. your friends don't like the food in the dining hall      d. your friends have other commitments

#### **2. the dining hall looks**

- a. mostly empty      b. totally empty  
c. half empty      d. mostly full

#### **3 the chairs in the dining hall are**

- a. light brown      b. plastic  
c. wood      d. steel

#### **4 the girl who sits with you is called**

- a. Mary      b. Marianne  
c. Anne      d. Megan

#### **5 when you first see her she is carrying**

- a. a cup of coffee      b. a bottle of water  
c. her books in her arms      d. a tray with food on it

#### **6 she is wearing**

- a. gold earrings      b. a silver necklace  
c. beads      d. a crucifix

#### **7 she is feeling**

- a. sick      b. angry  
c. irritated      d. upset

#### **8 she is feeling this way because**

- a. she was up late doing university work      b. she had to get up early for a lecture  
c. she has been to the gym      d. she was out late last night

**9 when you ask her about her classes**

- a. she says they are going fine      b. she says they are going very well  
c. she says they are going terribly      d. she says they are going quite badly

**10 you tell her you have**

- a. lots of reading to do      b. an essay to write  
c. an exam next week      d. a project to plan

**11 on the table you can see a**

- a banana      b pear  
c orange      d apple

**12 Megan is wearing**

- a dark trousers      b a long blue skirt  
c. light blue jeans      d. track suit bottoms

**13 Megan is wearing a**

- a. blue sweater      b. white shirt  
c. yellow t shirt      d. black track suit top

**14 Megan is wearing**

- a. square metal framed glasses      b plastic rimmed glasses  
c. no glasses      d. oval shaped spectacles

**15 at lunch Megan eats**

- a. pizza      b. pineapple  
c. a banana      d. yoghurt

**16 after lunch you decide to walk with her**

- a. to the busstop      b. to the shop  
c. to the dormitory      d. to the library

**17 walking back you cross**

- a. through a small wood      b. a park  
c. a busy road      d. a bridge

**18 she tells you it is her boyfriend tomorrow and she will be**

- a. 21      b. 19  
c. 20      d. 22

**19 she is carrying a**

- a. grey rucksack      b. red sports bag  
c. blue shopping bag      d. leather handbag

**20 her boyfriend is called**

- a. Steve      b. Pete  
c. Mark      d. Matt



**34 she tells you**

- a. she has a migraine
- b. she has a stomach ache
- c. she feels nauseous
- d. she has tooth ache

**35 she says**

- a. she and her boyfriend drank alcohol last night
- b. she and her boyfriend went to the cinema last night
- c. she was speaking to her boyfriend on the phone till late last night
- d. she went clubbing last night

**36 above her bed you can see a**

- a. blue poster
- b. crucifix
- c. picture of her boyfriend
- d. picture of a rock band

**37 her bedspread is**

- a. beige
- b. black and green
- c. purple with white spots
- d. pink

**38 she is wearing**

- a. toy slippers
- b. pink socks
- c. sandals
- d. trainers

**39 in her arms she has a**

- a. letter
- b. pillow.
- c. handkerchief
- d. teddy bear

**40 under her bed there are**

- a. boxes
- b. sports items
- c. shoes
- d. clothes

**41 on the table next to her bed there is a**

- a. bottle of wine
- b. empty can of beer
- c. bottle of pills
- d. bottle of vodka

**42 you suggest that she**

- a. has a hangover
- b. has food poisoning
- c. hasn't slept enough
- d. is lovesick

**43 you leave her room to**

- a. to get her a drink
- b. call an ambulance
- c. to get some help
- d. to use the bathroom

**44 when you see the residential assistant in the hall he is**

- a. painting a wall
- b. carrying shopping bags
- c. tying his laces
- d. locking his door

**45 the residential assistant has**

- a. a beard
- b. a moustache
- c. long sideburns
- d. a goatee

**46 when you see him you**

- a. ask him if he knows it is Megan's birthday
- b. say you haven't seen him for a long time
- c. say hello
- d. say his new hairstyle looks nice

**47 When you first see her good friend mark he is**

- a. in Megan's room
- b. in the corridor
- c. in the kitchen
- d. in his own room

**48 He is**

- a. eating lunch
- b. washing up
- c. cooking
- d. making a drink

**49 He is wearing a**

- a. striped jumper
- b. thick sweater
- c. t shirt
- d. hooded sports top

**50 On the sports top you can see**

- a. an insignia
- b. stripes
- c. a picture
- d. large letters

**51 On the fridge there is**

- a. a birthdays list
- b. a shopping list
- c. a picture of a girl in a bikini
- d. a no smoking sign

**52 In the kitchen you can see**

- a. full bin bags
- b. a bicycle
- c. a rug on the floor
- d. a sofa

**53 Through the kitchen doors you can**

- a. a high red brick wall
- b. a parked car
- c. the garden
- d. a clothes line on the patio

**54 When you see Mark you**

- a. introduce yourself
- b. chat with him for a while
- c. ask him to fill a glass of water
- d. ask him about college work

**55 Back in Megan's room**

- a. the door is open and she has gone
- b. she is alone
- c. she is making a call and the rd is there
- d. other people are there

**56 On the shelf in Megan's there is**

- a. a television
- b. cds
- c. a computer screen
- d. a stereo

**57 Her neighbour is called**

- a. Elizabeth
- b. Sarah
- c. Simone
- d. Stephanie

**58 When you first see Megan's neighbour she is**

- a. walking along the corridor
- b. in her own room
- c. inside the room leaning against Megan's bed
- d. waiting outside the room

**59 She is there because**

- a. she heard a lot of noise
- b. she was just passing
- c. she has news for Megan
- d. she wants to wish Megan happy birthday

**60 She tells you they are meeting now because**

- a. she will be going out later
- b. they are all going to lunch together
- c. she says she called her last night
- d. she says she hasn't

**61 When the residential assistant suggests you all sing 'happy birthday' ,**

- a. Megan says there is no need
- b. everyone looks embarrassed
- c. you think of an excuse to leave
- d. you clear your throats and sing

**62 the phone rings and it is**

- a. her best friend
- b. her boyfriend
- c. her mother
- d. her father

**63 You leave her room**

- a. to give her some privacy
- b. to get ready to go out
- c. to make some lunch
- d. when you remember you have to meet someone

**64 You all promise**

- a. to check on her later
- b. to bring her some food
- c. take her out to help her forget about everything
- d. help her with her studies

*Questions to arousal condition*

**1. You are eating alone because**

- a. you had an argument with your friends
- b. you were late for lunch
- c. your friends don't like the food in the dining hall
- d. your friends have other commitments

**2. the dining hall looks**

- a. mostly empty
- b. totally empty
- c. half empty
- d. mostly full

**3 the chairs in the dining hall are**

- a. light brown
- b. plastic
- c. wood
- d. steel

**4 the girl who sits with you is called**

- a. Mary
- b. Marianne

- c. Anne  
d. Megan

**5 when you first see her she is carrying**

- a. a cup of coffee  
b. a bottle of water  
c. her books in her arms  
d. a tray with food on it

**6 she is wearing**

- a. gold earrings  
b. a silver necklace  
c. beads  
d. a crucifix

**7 she is feeling**

- a. sick  
b. angry  
c. irritated  
d. upset

**8 she is feeling this way because**

- a. her parents don't like her boyfriend  
b. her parents don't approve of her subject choice  
c. her parents might stop paying for her education  
d. her parents are ill

**9 when you ask her about her classes**

- a. she says they are going fine  
b. she says they are going very well  
c. she says they are going terribly  
d. she says they are going quite badly

**10 she tells you she is going to fail**

- a. biology  
b. mathematics  
c. chemistry  
d. psychology

**11 on the table you can see a**

- a. banana  
b. pear  
c. orange  
d. apple

**12 Megan is wearing**

- a. dark trousers  
b. a long blue skirt  
c. light blue jeans  
d. track suit bottoms

**13 Megan is wearing a**

- a. blue sweater  
b. white shirt  
c. yellow t shirt  
d. black track suit top

**14 Megan is wearing**

- a. square metal framed glasses  
b. plastic rimmed glasses  
c. no glasses  
d. oval shaped spectacles

**15 at lunch Megan eats**

- a. pizza  
b. pineapple  
c. a banana  
d. yoghurt

**16 after lunch you decide to walk with her**

- a. to the busstop  
b. to the shop  
c. to the dormitory  
d. to the library

**17 walking back you cross**

- a. through a small wood
- b. a park
- c. a busy road
- d. a bridge

**18 she tells you her boyfriend**

- a. can't come to visit her
- b. was unfaithful to her
- c. had an accident
- d. split up with her

**19 she is carrying a**

- a. grey rucksack
- b. red sports bag
- c. blue shopping bag
- d. leather handbag

**20 her boyfriend is called**

- a. Steve
- b. Pete
- c. Mark
- d. Matt

**21 your dormitory building is**

- a red brick
- b yellow
- c grey
- d white

**22 you would describe the weather as**

- a. overcast
- b raining
- c. it has snowed
- d. sunny

**23 the next morning it is**

- a. Saturday
- b. Sunday
- c. Friday
- d. a holiday

**24 you decide to**

- a. call home
- b. go for a run
- c. run some errands
- d. go to the library

**25 you decide to call on Megan**

- a. because you hear crying
- b. to see if she is alright
- c. to return a book
- d. to wish her happy birthday

**26 in the corridor you can see a**

- a. drinks machine
- b. vacuum cleaner
- c. step ladder
- d. bicycle

**27 the walls of the corridor are painted**

- a. green
- b. light blue
- c. yellow
- d. white

**28 on her door Megan's name is written on a**

- a. pink card
- b. white card
- c. yellow card
- d. blue card

**29 on her door there is also**

- a. a no smoking sign
- b. a postcard showing a mountain
- c. a picture of a film star
- d. 'in' sign

**30 when you knock on the door**

- a. there is no answer
- b. a voice tells you to go away
- c. a voice says 'come in'
- d. a voice asks who it is

**31 when you enter the room the air smells of**

- a. alcohol
- b. sick
- c. air freshener
- d. cigarettes

**32 Megan is**

- a. sitting on the floor
- b. sitting on her bed
- c. lying on her bed
- d. sitting on a chair

**33 she seems**

- a. sleepy
- b. angry
- c. very nervous
- d. suicidal

**34 she tells you**

- a. her tutor wants to see her about her exams
- b. she will get her exam results that day
- c. she has to retake an exam
- d. her exam grades are worse than she expected

**35 she says**

- a. she hates her boyfriend
- b. she is going to quit university
- c. she cannot take the pressure
- d. she hates her mother

**36 above her bed you can see a**

- a. blue poster
- b. crucifix
- c. picture of her boyfriend
- d. picture of a rock band

**37 her bedspread is**

- a. beige
- b. black and green
- c. purple with white spots
- d. pink

**38 she is wearing**

- a. toy slippers
- b. pink socks
- c. sandals
- d. trainers

**39 in her arms she has a**

- a. letter
- b. pillow.
- c. handkerchief
- d. teddy bear

**40 under her bed there are**

- a. boxes
- b. sports items
- c. shoes
- d. clothes

**41 on the table next to her bed there is a**

- a. bottle of wine
- b. empty can of beer
- c. bottle of pills
- d. bottle of vodka

**42 you persuade her to telephone**

- a. her tutor
- b. the counselling service
- c. her good friend
- d. her boyfriend

**43 you leave her room to**

- a. to get her a drink
- b. call an ambulance
- c. to get some help
- d. to use the bathroom

**44 when you see the residential assistant in the hall he is**

- a. painting a wall
- b. carrying shopping bags
- c. tying his laces
- d. locking his door

**45 the residential assistant has**

- a. a beard
- b. a moustache
- c. long sideburns
- d. a goatee

**46 when you see him you**

- a. ask him if he knows it is Megan's birthday
- b. say you haven't seen him for a long time
- c. say hello
- d. say his new hairstyle looks nice

**47 When you first see her good friend mark he is**

- a. in Megan's room
- b. in the corridor
- c. in the kitchen
- d. in his own room

**48 He is**

- a. eating lunch
- b. washing up
- c. cooking
- d. making a drink

**49 He is wearing a**

- a. striped jumper
- b. thick sweater
- c. t shirt
- d. hooded sports top

**50 On the sports top you can see**

- a. an insignia
- b. stripes
- c. a picture
- d. large letters

**51 On the fridge there is**

- a. a birthdays list
- b. a shopping list
- c. a picture of a girl in a bikini
- d. a no smoking sign

**52 In the kitchen you can see**

- a. full bin bags
- b. a bicycle
- c. a rug on the floor
- d. a sofa

**53 Through the kitchen doors you can**

- a. a high red brick wall
- b. a parked car
- c. the garden
- d. a clothes line on the patio

**54 When you see Mark you**

- a. introduce yourself
- b. chat with him for a while
- c. ask him to fill a glass of water
- d. ask him about college work

**55 Back in Megan's room**

- a. the door is open and she has gone
- b. she is alone
- c. she is making a call and the rd is there
- d. other people are there

**56 On the shelf in Megan's there is**

- a. a television
- b. cds
- c. a computer screen
- d. a stereo

**57 Her neighbour is called**

- a. Elizabeth
- b. Sarah
- c. Simone
- d. Stephanie

**58 When you first see Megan's neighbour she is**

- a. walking along the corridor
- b. in her own room
- c. inside the room leaning against Megan's bed
- d. waiting outside the room

**59 She is there because**

- a. she heard a lot of noise
- b. she was just passing
- c. she has news for Megan
- d. she wants to wish Megan happy birthday

**60 She tells you they are meeting now because**

- a. she will be going out later
- b. they are all going to lunch together
- c. she says she called her last night
- d. she says she hasn't

**61 When the residential assistant suggests you all sing 'happy birthday' ,**

- a. Megan says there is no need
- b. everyone looks embarrassed
- c. you think of an excuse to leave
- d. you clear your throats and sing

**62 the phone rings and it is**

- a. her best friend
- b. her boyfriend
- c. her mother
- d. her father

**63 You leave her room**

- a. to give her some privacy
- b. to get ready to go out
- c. to make some lunch
- d. when you remember you have to meet someone

**64 You all promise**

- a. to check on her later
- b. to bring her some food
- c. take her out to help her forget about everything
- d. help her with her studies

*Appendix F: Questions Used In Study 7*

1. What day was the examination on?
2. What was the date?
3. Where was the test?
4. What time was the test?
5. What module was the test connected to?
6. How was the weather outside just as you entered?
7. Were people waiting outside the lecture hall at the beginning or could you go straight in?
8. How many lecturers (not including Glen Howells the teaching assistant) were present?
9. Which lecturers were present?
10. Was the room full?
11. Were all the lights on in the lecture hall – was the room well lit?
12. Were there any people sitting on the front stage?
13. Were the curtains drawn at the front of the stage?
14. Why couldn't you leave through the back exit?
15. Where were the examination questions written?
16. What was the projector showing at the beginning of the exam?
17. Some people were sitting on chairs at the front. What colour were the chairs?
18. What did people do with their bags and coats?
19. What colour was trousers was Lecturer Y wearing?
20. What colour shirt was lecturer wearing?
21. What colour jacket was Lecturer Y wearing?
22. What colour shirt was Lecturer X wearing?
23. What colour trousers was Lecturer X wearing?
24. What colour cardigan was Lecturer X wearing?
25. What was the picture on the left wall showing
26. What did the sign on the door say
27. What colour was the curtain over the door?
28. What was resting on the lectern?
29. Were all the lecturers there for all the examination i.e. at the beginning and end?
30. Did students leave the hall by the back exit?
31. What did the projector show at the end of the exam
32. What poster was on the entrance door?
33. What was hanging on the back of the seat on the stage?
34. How were pencils and stationery returned at the end of the exam
35. Where were the chairs positioned along the aisles?
36. What did lecturer X speak to you about before the exam?
37. What did lecturer y talk about?
38. What did I speak to you about?
39. Someone came in at the end of the exam. What did he speak to you about?
40. Who warned you about copying?
41. Did the lecturers speak at the end of the exam or did you leave as soon as you had finished?
42. How were you told to collect your results
43. How was seating arranged?
44. Why did you have to leave a space at the back?
45. What were you told about resitting the exam?
46. For what specific reason was it likely you would fail if you copied?
47. Who had asked lecturer X to speak to you about experimental participation?

48. Were there any questions while the lecturers were explaining the exam format?
49. Where did Lecturer Y ask you to write your answers?
50. What did he remind you to write on the last sheet?
51. When was he going to tell you how much time there was left?
52. Lecturer X told you to keep your papers in a certain position when they were handed out. What was this?
53. Lecturer X then spoke to you about something not connected to the test, what was it?
54. IT was about sona participation. Who had asked her to speak to you about this?
55. How many first years had got their full credits?
56. What did she say would be the implications of this?
57. She invited you to send her an email concerning what?
58. What did she then offer to do if people sent her emails?
59. Why did she say participating in the experiments would be better than not i.e. What were the benefits of participating over writing an essay?
60. What could you do if you finished the test early?
61. Lecturer X also mentioned you would be completing something else soon. What was this?
62. It was the student unit evaluation. What did she mention you could refer to?
63. What could happen if this was referred to?
64. At the end of the test, what did you have to do with your papers?
65. A student asked about something at the end of the test. What was this?
66. Which of these sentences did Lecturer Y use?
  - a. We said in class last week that you would get half an hour for thirty questions
  - b. You were already informed you'll have have an hour to complete 30 questions
  - c. I told you last week already there's gonna be 30 questions in 30 minute
  - d. I informed you the length of the test would be 30 minutes for 30 questions
67. Which of these sentences did Lecturer Y use?
  - a. this will be identical to the practice test
  - b. the format of this test is the same as you did last week
  - c. it's gonna be exactly the same as the practice test
  - d. this is very similar to the practice test
68. Which of these sentences did Lecturer Y use?
  - a. we have multiple versions of the test
  - b. there are several versions of the test
  - c. we made various versions of the exam
  - d. we are giving out different versions of the same test
69. Which of these sentences did Lecturer Y use?
  - a. you're definitely gonna fail if you start copying your neighbour's answers
  - b. anyone looking at their neighbour's work will probably fail the test
  - c. copying the person next to you means you'll probably fail
  - d. if you look at your neighbour it's rather likely that you're gonna fail
70. Which of these sentences did Lecturer X use?
  - a. Ben asked me to speak to you because we're not sure that you realise the implications of not completing your participation
  - b. I was asked by Ben to remind you of the consequences of not completing SONA participation
  - c. Ben requested that I make you all aware of what will happen if you don't complete your participation
  - d. Ben told me to let you know what the consequences will be if you don't complete your sona credits

71. Which of these sentences did Lecturer X use?
- if you haven't done all of your participation by the end of this term then you're going to be writing an extra essay
  - an extra assessment will be given to anyone who hasn't done all their participation by the end of term
  - you need to do all of your participation by the end of term – otherwise you get an extra essay
  - if you haven't completed all your credits by the end of this term an additional essay will be set for you
72. Which of these sentences did Lecturer X use?
- At the end of the test, please stay in your seat
  - The test lasts thirty minutes – if you finish early stay in your seat
  - Anyone finishing early can stay in their seat – it's only a thirty minute test
  - It's only thirty minutes so if you finish early can you just sit there quietly
73. Which of these sentences did Lecturer X use?
- No more talking you've got your papers now it'll be classed as cheating
  - Please stop talking as soon as you get your papers
  - If anyone is talking when they get their papers, it will be regarded as cheating
  - You shouldn't be talking when you get your paper
74. Which of these sentences did Lecturer y use
- Don't talk until your papers are handed in
  - No speaking until all the papers are handed in
  - Please do not discuss the test until examinations are handed in
  - It is not allowed to talk before you hand in your papers
75. Which of these sentences did lecturer x use?
- If it gets too cold in here please let me know.
  - If anyone feels too cold please put your hand up.
  - If it feels too cold let one of us know.
  - If you're feeling cold just mention it to one of the lecturers.
76. Which of these questions do you recognise from the test?
- The Mann Whitney U Test is used for
  - The Mann Whitney U Test is suitable for a
  - The Mann Whitney U Test can be used when
  - The Mann Whitney U Test is intended for
77. Which of these questions do you recognise from the test?
- The ranks for this group of data (4,2,3,7,6,4,5,2) are
  - The set of data are ranked accordingly (4,2,3,7,6,4,5,2)
  - The ranks for the following data set (4,2,3,7,6,4,5,2) are
  - (4,2,3,7,6,4,5,2) are the ranks for the following data set
78. Which of these questions do you recognise from the test?
- Peoples measured IQs and their estimated IQs are related?
  - Peoples measured height and their estimated weight are related?
  - Peoples measured wealth and their estimated IQs are related?
  - Peoples measured education and their estimated IQs are related?
79. Which of these questions do you recognise from the test?
- Assume you record horn honking behaviour
  - Assume you measure horn honking behaviour
  - Assume you count horn honking behaviour
  - Assume you note horn honking behaviour
80. Which of these questions do you recognise from the test?

- a) Which of the following is NOT a drawback of the mean?
  - b) Which of the following is NOT a problem with the mean?
  - c) Which of the following is NOT a disadvantage of the mean?
  - d) Which of the following is NOT a difficulty with the mean?
81. Which of these questions do you recognise from the test?
- a) Degrees of Freedom denotes:
  - b) Degrees of Freedom refers to:
  - c) Degrees of Freedom means:
  - d) Degrees of Freedom represents:
82. Which of these questions do you recognise from the test?
- a) Which is the best measure of dispersion to use with categorical data?
  - b) Which is the appropriate measure of dispersion to apply to categorical data?
  - c) Which is the most suitable measure of dispersion when using categorical data?
  - d) Which is the most effective measure of dispersion for cases of categorical data?
83. Which of these questions do you recognise from the test?
- a) We must not divide by N when ascertaining the value of the standard deviation because:
  - b) We should not divide by N when checking the value of the standard deviation because:
  - c) We do not divide by N when obtaining the value of the standard deviation because:
  - d) We never divide by N when establishing the value of the standard deviation because:
84. Which of these questions do you recognise from the test?
- a) If you were comparing the scores of two unrelated groups on a statistics test you would carry out:
  - b) If you were comparing the performance of two unrelated groups on a statistics test you would perform:
  - c) If you were comparing the attainment of two unrelated groups on a statistics test you would conduct:
  - d) If you were comparing the grades of two unrelated groups on a statistics test you would use:
85. Which of these questions do you recognise from the test?
- a) Levene's test is consulted to check which of the following requirements of the data for a t-test to be interpretable?
  - b) Levene's test is applied to assess which of the following requirements of the data for a t-test to be interpretable?
  - c) Levene's test is employed to examine which of the following requirements of the data for a t-test to be interpretable?
  - d) Levene's test is used to test which of the following requirements of the data for a t-test to be interpretable?

*Appendix G: Autobiographical Memory Questionnaire (Adapted From Talarico, & Ruben, 2003 Used In Study 9a & 9b)*

1. Who or what first told you the information?
2. When did you first hear the news?
3. Where were you when you first heard the news?
4. Were there others present, and if so, who?
5. What were you doing immediately before you first heard the news?
6. Are there any other distinctive details from when you first heard the news?

*(Items 7-25 were scored on seven point scales with completely disagree at 1, and completely agree at 7, unless otherwise indicated)*

7. While remembering the event, I feel as though I am reliving it
8. While remembering the event, I feel that I travel back to the time when it happened.
9. While remembering the event I can see it in my mind
10. While remembering the event, I can hear it in my mind
11. While remembering the event, I know the setting where it occurred
12. As I think about the event I can actually remember it rather than just knowing that it happened.
13. I believe the event in my memory really occurred the way I remember it and that I have not imagined or fabricated anything that did not occur(1 = 100% imaginary; 7 = 100% real).
14. I Could be persuaded that my memory of the event was wrong
15. I remember the event as emotionally intense
16. As I remember the event, I can feel now the emotional intensity that I felt then.
17. As I remember the event, I can feel now the emotions that I felt then.
18. My memory of the event is fragmented into specific details with missing bits.(RC)
19. The memory comes as a coherent story or episode and not as an isolated fact, observation or scene.
20. The memory comes in words.
21. My memory of the event has a personal coherence: it fits easily into a story I would tell about that part of my life.
22. My memory is based on details specific to my life not on general knowledge that I would expect most people to have.
23. Since it happened, I have thought or talked about this event (1 = not at all; 7 = as often as any event in my life).
24. As I remember the event, I imagine it again through my own eyes seeing what I would have seen then, or as an observer from a different perspective than the one I had (1 = own eyes; 2 = observer; 3 = mixture).
25. Please rate the kinds of emotions it involves (1 = 100% negative, 7 = 100% positive).



EMOTIONAL PROCESSING SCALE

INSTRUCTIONS

**Name:**

**Today's date:**

**Gender:**

**Date of birth:**

**Code:** *Please write your mother's initials and the day of your birthdate. Eg. If your mother's name is Joan Smith (JS) and your birthdate 12 May 1989 (12), write JS12*

**Email address:**

**Mobile/contact number:**

The idea of this questionnaire is to try to understand something about your emotions and feelings. In order to fill this in, you will need to **fix the last week firmly in your mind.**

Could you first spend a few minutes thinking back over what you have been doing in the last week. Starting from one week ago today, try to think about where you were, what you were doing, who you met, anything you may remember. If you have a diary, check for any appointments or reminders of each day.

With **last week** in mind what would you say was the *strongest* negative or unpleasant emotion that you felt?

*This questionnaire lists different descriptions of how you may have felt or acted **last week**. Each description has got a sliding scale under it. The scale moves from '**completely disagree**' (0) to '**completely agree**' (9). After reading each description, show how much it applies to you last week by putting a circle around one of the numbers on the sliding scale*

**EXAMPLES**

**I kept my feelings to myself**

0	1	2	3	4	5	6	7	8	9
Completely disagree	-----disagree-----		in between-----			agree-----		completely agree	

*If you circled 6, this would mean that you mildly agree that you kept your feelings to yourself' last week. If this had fully described the way you were last week then you would circle 9.*

**I felt bitter about things**

0	1	2	3	4	5	6	7	8	9
Completely disagree	-----disagree-----		in between-----			agree-----		completely agree	

This would mean that you completely disagree with this description of your feelings last week

Now please fill in your answers based on **last week**

**LAST WEEK...**

**1. I smothered my feelings.**

0	1	2	3	4	5	6	7	8	9
Completely disagree	-----disagree-----		-----in between-----			-----agree-----		completely agree	

**2. Unwanted feelings kept intruding.**

0	1	2	3	4	5	6	7	8	9
Completely disagree	-----disagree-----		-----in between-----			-----agree-----		completely agree	

**3. When upset or angry, it was difficult to control what I said.**

0	1	2	3	4	5	6	7	8	9
Completely disagree	-----disagree-----		-----in between-----			-----agree-----		completely agree	

**4. I avoided looking at unpleasant things (e.g. on TV/ in magazines).**

0	1	2	3	4	5	6	7	8	9
Completely disagree	-----disagree-----		-----in between-----			-----agree-----		completely agree	

**5. My emotions felt blunt/dull.**

0	1	2	3	4	5	6	7	8	9
Completely disagree	-----disagree-----		-----in between-----			-----agree-----		completely agree	

**6. I could not express my feelings.**

0	1	2	3	4	5	6	7	8	9
Completely disagree	-----disagree-----		-----in between-----			-----agree-----		completely agree	

**7. My emotional reactions lasted for more than a day.**

0	1	2	3	4	5	6	7	8	9
Completely disagree		disagree		in between		agree		completely agree	

**8. I reacted too much to what people said or did.**

0	1	2	3	4	5	6	7	8	9
Completely disagree		disagree		in between		agree		completely agree	

**9. Talking about negative feelings seems to make them worse.**

0	1	2	3	4	5	6	7	8	9
Completely disagree		disagree		in between		agree		completely agree	

**10. My feelings did not seem belong to me.**

0	1	2	3	4	5	6	7	8	9
Completely disagree		disagree		in between		agree		completely agree	

**11. I kept quiet about my feelings.**

0	1	2	3	4	5	6	7	8	9
Completely disagree		disagree		in between		agree		completely agree	

**12. I tended to repeatedly experience the same emotion.**

0	1	2	3	4	5	6	7	8	9
Completely disagree		disagree		in between		agree		completely agree	

**13. I wanted to get my own back on someone.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**14. I tried to talk only about pleasant things.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**15. It was hard to work out if I felt ill or emotional.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**16. I bottled up my emotions.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**17. I felt overwhelmed by my emotions.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**18. I felt the urge to smash something.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**19. I could not tolerate unpleasant feelings.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**20. There seemed to be a big blank in my feelings.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**21. I tried not to show my feelings to others.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**22. I kept thinking about the same emotional situation again and again.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**23. It was hard for me to wind down.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**24. I tried very hard to avoid things that might make me upset.**

0	1	2	3	4	5	6	7	8	9
Completely-----disagree-----in between-----agree-----completely disagree agree									

**25. Sometimes I had strong feelings but I'm not sure if they were emotions.**

0	1	2	3	4	5	6	7	8	9
Completely		disagree		in between		agree		completely	
disagree								agree	

**Are there any other important things that you would like to add?**