Effects of emotion on awareness in memory

Applying the Remember-Know approach to awareness in memory for emotional news stories

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Abstract

This thesis investigates subjective states of awareness in memory for emotional information following Tulving's (1985) dual-memory model in which feelings of 'remembering' (including specific recollection of the encounter with the item) index episodic memory and feelings of 'knowing' (memory but without any specific recollection) index semantic memory. Rajaram's (1996) proposal that distinctiveness of processing increases feelings of 'remembering' while fluency of processing increases feelings of 'knowing' was examined. Seven studies utilising news stories with varying emotional content were conducted following the assumption that emotional content would increase both distinctiveness and fluency of processing (cf. Oschner 2000). If emotional information invokes greater distinctiveness of encoding, this would be expected to result in enhanced episodic encoding and increased 'remembering'; greater fluency of processing would be expected to result in enhanced semantic encoding and increased feelings of 'knowing'. The studies broadly support the hypothesis that emotional news stories increased feelings of 'remembering'; however, emotion did not systematically affect feelings of 'knowing'.

Earlier research using different materials found increased 'remembering' with enhanced distinctive/elaborative processing. Three studies manipulating depth of processing, level of attention at encoding and repeated study trials replicated these effects with both emotional and neutral news stories.

Using news stories as a study material facilitates investigation of the hypothesis that conditions promoting learning (transfer to semantic memory) would lead to increased feelings of 'knowing' (Conway, Gardiner, Perfect, Anderson & Cohen, 1997). This hypothesis was supported for both emotional and neutral stories.

The viability of exploring memory awareness for stories varying in emotional content was demonstrated and the results support the view that emotional distinctiveness increases feelings of remembering. It is argued that feelings of remembering depend on both distinctive and fluent encoding processes. It is suggested that emotional fluency at the encoding stage makes emotional information more readily available for episodic encoding and thereby fosters feelings of remembering.

Chapter 1 Introduction

The information we retrieve from memory – personal memories, knowledge about the world, knowledge about how to do things – can trigger different subjective feelings towards it. For instance, some events are quite vivid in one's mind (e.g. a good party); some pieces of information feel familiar (e.g. a familiar face); and one can feel that some information is just known rather than feeling vivid or familiar (e.g. capital cities). The research on awareness in memory has received an important impetus with Tulving' s (1985) proposal that subjective states of awareness can provide a way to study information represented in different memory systems. The feeling that one remembers some piece of information vividly and the feeling that the information is just familiar or known were suggested to indicate information represented in the episodic memory system and in the semantic memory system respectively. These two feelings of awareness also provide the most common designation for Tulving's (1985) proposal – the remember-know approach.

In twenty years the driving forces in the research conducted aimed mainly at providing empirical evidence for the theoretical claims concerning the association between types of awareness experience and memory systems and between types of awareness and types of processing (e.g., Dunn, 2004; Gardiner & Richardson-Klavehn, 2000). Studies of memory awareness for emotional information within the remember-know framework are very recent (Dewhurst & Parry, 2000; Oschner, 2000), perhaps because the inclusion of emotion in cognitive psychology issues has usually occurred after some maturation of the specific area of research. The general goal of the research described in this thesis was to proceed with the investigation on the effects of emotional information on awareness in memory using the remember-know approach.

This chapter begins by an overview of the study of awareness in memory. The main propositions of the remember-know approach and its relationships with some other approaches in awareness in memory are described first. Secondly, the

processing of emotional information and its connection with the study of memory awareness is characterised and, finally, the main research problems and a brief overview of the empirical studies are presented.

1. Awareness in memory

1.1 Consciousness in memory

The study of awareness in memory stems directly from the attempt to approach consciousness scientifically. At the outset of psychology as a scientific field, consciousness was present as an object of study via the method of introspection (for a short review, see Cohen & Schooler, 1997). However, as consciousness is related to cognition, it disappeared, along with other cognitive issues, from the research focus during the predominance of the behaviourist approach. Cognitive research re-emerged in the 1950s (Mayer, 1981), but the study of consciousness was brought back as a researchable cognitive area only during the 1980s (e.g., Velmans, 1996).

The definition of consciousness, particularly in the psychology field, has not been easy, and much of the research has proceeded without a clear definition of the phenomenon (Moscovitch, 2000). It has included generally three aspects of cognition: (1) awareness of experience (perceptual experiences, the experience of activities, the sense of learning and memory); (2) control of action or of cognitive operations, and (3) organisation of complex representations and new responses, mainly in their requirements of analytical capability, planning or creativity (Johnson & Reeder, 1997; Velmans, 1991). Therefore, consciousness seems to be more than awareness, but the

phenomenological experience of awareness has been the door used to access consciousness (e.g., Velmans, 1991): actually, the term 'consciousness' has often been used as a synonym of 'awareness' in the sense that the contents of consciousness are what one is aware of (Velmans, 1996).

As consciousness has been linked to information represented in the mind, conscious processing has been explored in association with studies in the areas of pre-attentive and attentive processing, memory and learning (e.g., Velmans, 1991). Awareness in memory has been studied both from the point of view of an external observer (a third person approach, which requires the measurement of externally observable criteria) and from the point of view of the subject (a first person approach, where self reports of internal states can serve as data), and these approaches have been defended to produce complementary information (Gardiner, 1996; Velmans, 1991). The third person approaches in memory awareness include the measurement of subjective thresholds in the so-called subliminal perception area (e.g., Schooler & Fiore, 1997) and the research in the Process Dissociation Approach (e.g., Jacoby, 1991). The Process Dissociation Approach aims at estimating the contribution of conscious and unconscious processes to recognition memory, thereby focusing on the type of processing rather than on the subjective experience of awareness. The first person approach more commonly used is the remember-know approach, which was proposed by Tulving in 1985, and that provides the theoretical framework for the research reported here.

1.2 The Remember-Know approach

In his seminal paper, Tulving (1985) considered that the study of consciousness in memory requires the postulation and identification of different kinds of consciousness and, at the empirical level, their measurement as dependent variables via subjective states of awareness towards the information processed. He proposed that information represented in different memory systems gives rise to different types of consciousness: information represented in the episodic, semantic and procedural memory systems is associated, respectively, with autonoetic, noetic and anoetic consciousness. The episodic memory system concerns the representation of personally experienced information; the semantic memory system concerns symbolic representations of knowledge about the world; and, the procedural memory system contains non-declarative knowledge about how to do things and how to perform tasks (e.g., Tulving, 1985). Information about personally experienced events elicits an autonoetic consciousness, which, in experiential terms, is reflected in the feeling of remembering events from one's personal past. Information in the semantic memory system should give rise to a noetic consciousness, that is, to the awareness that one possesses knowledge about objects and events and their relationships. Finally, anoetic consciousness, as implied by the term, does not relate to feelings of having a cognitive representation. Instead, anoetic consciousness is spatially and temporally bound to the current situation as it is closely related to the perceptual and behavioural responses of doing something.

In the study of awareness in memory, the focus has been on awareness responses that operationalise autonoetic and noetic consciousness, as they accompany the declarative knowledge represented episodically and semantically. These awareness responses have been usually termed 'remember' and 'know' responses (e.g., Tulving, 1985; Gardiner, 1988). The feeling of remembering concerns

the experience of a vivid recollection of the specific learning episode, the experience of reliving situations mentally, and the experience of being sometimes able to have a mental picture of what happened. A 'know' response is provided when one feels that the information presented is familiar and cannot associate it with a recollection of the processing episode or when one feels that the information retrieved is just known (e.g., Gardiner, 1988; Gardiner & Java, 1990; Gardiner & Parkin, 1990; Tulving, 1985). These definitions have been confirmed at the experiential level, as participants use the distinction correctly and without difficulties, as shown by their awareness descriptions which match up with the definitions participants were supplied with (Gardiner, Ramponi & Richardson-Klavehn, 1998; Java, Gregg & Gardiner, 1997; Perfect, Mayes, Downes & Van Eijk, 1996, exp. 5).

Remember and know responses have been most often assessed in recognition memory tasks (yes/no: e.g., Gardiner, 1988; forced choice: Gardiner, Java & Richardson-Klavehn, 1996) and have been studied in a diversity of encoding and retrieval situations and populations. The evidence initially collected showed a pattern of functional dissociations between the two responses, and contributed to supporting the claim that remember and know responses are associated with different memory systems. Early evidence also attempted at characterising the types of processing underlying different states of awareness (e.g., Gardiner, 1988). Both the systems approach and the processing approaches proposed are described in the following sections.

1.2.1. The systems approach in the remember-know approach

1.2.1.1 Convergent evidence for the systems approach

Because remember and know responses are, respectively, operational definitions of awareness experiences towards information in the episodic and in the semantic memory systems, the first research concern was to find convergent dissociations between these two responses. One of the criteria proposed to justify the existence of different memory systems consists of convergent findings from different sources of evidence such as functional dissociations on different cognitive/behavioural tasks alleged to tap different systems, neuropsychological dissociations in studies involving brain-injured patients and a differential physiological functioning (Schacter & Tulving, 1994). Resulting from the initial studies is a pattern of functional and neuropsychological dissociations between remember and know responses, which constitutes strong evidence for these responses as indicators of information in different memory systems. Some variables have led to an increase in one of the responses while not affecting the other, other variables have had opposite effects in the two responses and some others have produced parallel effects (for a short revision, see Gardiner & Richardson-Klavehn, 2000).

Effects on remember responses but not on know responses

Examples of experimental manipulations increasing remember responses but not affecting know responses include variables aimed at enhancing the conceptual processing of the individual items: level of processing (deep vs. shallow; Java et al., 1997, exp. 2; Gardiner, 1988, exp.1; Gardiner, Java & Richardson-Klavehn, 1996, exp. 1), the generation effect (generate a word vs. read a word; Gardiner, 1988, exp.2;

Gardiner, Java & Richardson-Klavehn, 1996, exp. 3), undivided versus divided attention at encoding (Gardiner & Parkin, 1990; Mäntylä & Raudsepp 1996; Parkin, Gardiner & Rosser, 1995), and self-referent judgments of lists of personality traits (vs. semantic tasks low in self-reference; Conway & Dewhurst, 1995b).

Stimuli considered distinctive have also led to higher memory accompanied by feelings of recollection while not affecting memory accompanied by feelings of familiarity in the absence of any specific recollective experience: low-frequency words (vs. high-frequency words; Gardiner & Java, 1990, exp.1), dominant meaning homographs (vs. non-dominant meaning homographs; Rajaram, 1998, exp. 1), famous classical music excerpts (vs. obscure classical music excerpts; Java, Kaminska & Gardiner, 1995), and emotional stimuli (vs. neutral stimuli; Dewhurst & Parry, 2000, exp. 1; Oschsner, 2000; Pesta, Murphy, & Sanders, 2001).

The processing of individual stimuli using more cognitive resources at both perceptual and conceptual levels has also increased remembering while not affecting feelings of knowing/familiarity: vocalization (vs. silent reading of words; Gregg & Gardiner, 1991), repeated study trials with music excerpts from a familiar background (Gardiner, Kaminska, Dixon & Java, 1996; Gardiner & Radomski, 1999), performed actions (vs. watched or imagined actions; Conway & Dewhurst, 1995a), imageability effects (Dewhurst & Conway, 1994), difficulty of study operations such as category decision task for items of low versus high instance frequency (Dewhurst & Hitch, 1999, exp. 1) and anagrams to be solved (vs. anagrams to be read; Dewhurst & Hitch, 1999, exp. 2).

It has also been observed that, in the absence of further processing and in retention intervals shorter than 1 week, observed forgetting is accompanied by a decrease in remember responses, while the level of know responses is not affected (Gardiner, 1988, exp.2; Gardiner & Java, 1991).

In summary, remember responses seem to increase after elaborative or conceptual processing of the individual items. Moreover, they also increase with perceptual processing. Some variables that affect perceptual processing of individual items have been shown to increase feelings of recollection while not affecting feelings of familiarity: same-size objects (vs. different size) and same left-right orientation of objects (vs. different orientation) at study and test (Rajaram, 1996), distinctive orthography (vs. common orthography; Rajaram, 1998, exp. 2), mirror image (vs. same image) for repeated faces (Mäntylä & Cornoldi, 2002).

Effects on know responses but not on remember responses

The level of know responses has been shown to increase with both conceptual and perceptual variables that seem to enhance fluency or ease of processing, while the level of remember responses is not affected: repetition of words from the same semantic category as the target word (vs. repetition of words unrelated to the target; Dewhurst & Anderson, 1999, exp. 2), semantically related test primes (vs. unrelated test primes; Rajaram & Geraci, 2000), repetition priming of the same word at test (vs. unrelated word; Rajaram, 1993, exp. 3), same (vs. different) study and test modalities with a highly perceptual orienting task (Gregg & Gardiner, 1994).

Opposite effects on remember and know responses

Some other variables have shown to lead to opposite effects in remember and know responses. Know responses were shown to increase and remember responses to decrease with variables such as non-words presented at study (vs. words; Gardiner & Java, 1990), non-national folk songs (vs. national folk songs; Gardiner & Radomski, 1999), massed repetition of items within the study list (vs. spaced repetition; Parkin &

Russo, 1993), typical actions in scripts (vs. atypical actions; Lampinen, Faries, Neuchatz & Toglia, 2000), words with low imageability (vs. high-imageability words; Dewhurst & Conway, 1994, exp. 5), old participants (vs. young participants; Perfect, Williams & Anderton-Brown, 1995); and typical faces (vs. distinctive faces; Brandt, Macrae, Schloerscheidt & Milne, 2003).

Double dissociations, that is, when one level of the variable leads to a certain pattern of results while the other level leads to the opposite pattern, have also been reported. A size congruency effect for pictures (higher memory for pictures with the same – rather than different – sizes at study and test) was obtained for remember responses under undivided attention and a deep level of processing at encoding; however, the size congruency effect was only obtained for know responses under divided attention and a shallow level of processing at encoding (Gardiner, Gregg, Mashru & Thaman, 2001). In a directed-forgetting paradigm, longer delays between a word and a cue to learn or to forget it, intended to enhance maintenance rehearsal, and, consequently, know responses, did increase the number of know responses (Gardiner, Gawlik & Richardson-Klavehn, 1994). Similarly, shorter delays between a word and a cue to learn it, which intended to promote elaborative rehearsal and, consequently, remember responses, did produce a greater number of remember responses (Gardiner, Gawlik & Richardson-Klavehn, 1994). Finally, massed repetition of faces increased remember responses, while spaced repetition increased know responses (Parkin, Gardiner & Rosser, 1995, exp. 2).

Dissociations for subject variables

Dissociations between remember and know responses have also been obtained for subject variables such as age (old vs. young adults; e.g., Mäntylä, 1993, exp. 1). Developmental studies have shown that remember responses increase with age in

child and teenage participants (e.g., participants from 8 to 19 years old; Billingsley, Smith & McAndrews, 2002; for a review see Wheeler, 2000). Remember responses decline for older adults (vs. young adults; Clarys, Isingrini & Gana, 2002; Mäntylä, 1993; Perfect, Williams & Anderton-Brown, 1995). Meanwhile, know responses were not affected by age in these studies.

Remember and know responses have also been used to characterise memory awareness in different clinical groups. For instance, schizophrenia has been found to impair feelings of recollection but not to affect feelings of familiarity/knowing (e.g., Danion, Kazes, Huron & Karchouni, 2003; Huron & Danion, 2002; Huron, Danion, Rizzo, Killofer & Damiens, 2003; Sonntag, Gokalsing, Olivier, Robert, Burglen, Kauffmann-Muller, Huron, Salame & Danion, 2003); patients with left temporal lobe epilepsy gave more know responses than remember responses for visuospatial materials while patients with right temporal lobe epilepsy showed the opposite pattern (Blaxton & Theodore, 1997); adults with Asperger's syndrome showed impaired recollection and increased knowing in comparison to controls (Bowler, Gardiner, Grice & Saavalainen, 2000; Bowler, Gardiner & Grice, 2000; Gardiner, Bowler & Grice, 2003).

Neuropsychological and physiological dissociations

Neuropsychological and physiological dissociations have also been obtained for remember and know responses (for a short review, see Gardiner & Richardson-Klavehn, 2000). Measures of event-related potentials at encoding and at retrieval for memory accompanied by remember and know awareness responses have shown differences for both the temporal pattern of the electric activity of the brain and for the brain area where the electrical wave originates from (Duarte, Ranganath, Winward, Hayward & Knight, 2004; Düzel, 2000, for a review; Mangels, Picton & Craik, 2001).

Evidence from studies with brain injured patients have also suggested that remember and know responses involve different areas of the brain. For instance, injuries centred in the frontal lobes undermined remember responses and did not affect know responses, and injuries localised in the dorsolateral prefrontal cortex did not affect awareness in memory (Wheeler & Stuss, 2003). In comparison to controls, amnesic patients have also shown impairment in remembering, while feelings of knowing/familiarity can either be impaired (e.g., Knowlton & Squire, 1995) or not (e.g, Verfaellie, Cook & Keane, 2003).

Psychopharmacological studies have also produced different patterns of awareness in memory. For instance, benzodiazepines such as lorezepam and diazepam impaired recognition accompanied by remember responses (Huron & Danion, 2002; Huron, Servais & Danion, 2001).

Parallel effects on remember and know responses

Differing effects on remember and know responses have not always been observed. Parallel effects have also been found: both responses increase with longer response deadlines (Gardiner, Ramponi & Richardson-Klavehn, 1999; Konstantinou & Gardiner, in press) and with repeated study trials for unfamiliar material (Gardiner, Kaminska, et al., 1996; Gardiner & Radomski, 1999) and they decrease with retention intervals longer than a week (Gardiner & Java, 1991).

Parallel effects do not provide evidence for a systems view, as they are associations between the responses rather than dissociations. Nonetheless, they do contribute to the characterisation of the relationship between remember and know responses. The fourfold relationship between remember and know responses – some variables affect one response but not the other, some other variables lead to opposite

effects, and some others have similar effects on both responses – shows, according to Gardiner (2000), that these responses are more than dissociated responses; rather, they are functionally independent.

In summary, the converging pattern of functional and neuropsychological dissociations just described constitutes a necessary condition for the postulation of independent memory systems (Schacter & Tulving, 1994). Therefore, the proposal that feelings of remembering index information represented in the episodic memory system and feelings of knowing/familiarity index information represented in the semantic memory system is supported.

1.2.1.2 Two distinguishable awareness experiences associated to the semantic memory system

From a systems point of view, the interpretation of remember responses both empirically and theoretically is consensual across researchers. At the theoretical level, information in an episodic memory system gives rise to an autonoetic consciousness. This autonoetic consciousness leads to a subjective state of awareness in which the individual can re-experience the encoding situation, that is, he/she can mentally travel back in time and recollect vividly specific events, including sensorial and emotional experiences. At the empirical level, it is the occurrence of such awareness experience that is measured via the provision of remember responses.

The definition of know responses used in most studies includes two distinguishable awareness experiences: a transient feeling of familiarity in the absence of any specific recollective experience and the awareness that the information presented is just known (e.g., Conway, Gardiner, Perfect, Anderson & Cohen, 1997). The former definition – a feeling of familiarity – is the one used or emphasised in most of the studies. Familiarity responses have been associated with a noetic consciousness, as they reflect awareness in memory in the absence of remembering (Gardiner & Conway, 1999). At the experiential level, familiarity towards processed information clearly seems to be experienced as a subjective state of awareness, as

participants do not have difficulties grasping the meaning of familiarity and using it when describing their awareness in memory as shown by Gardiner et al. (1998).

However, at a theoretical level, it is not enough to associate the representation of semantic knowledge and the noetic consciousness that comes with it to a transient feeling of familiarity that the information was experienced recently. Even at the experiential level, quite established knowledge seems to be experienced in a way that is not attributional, that is, people feel that they just know some piece of information and this feeling is not attributed to knowledge acquired in a specific situation or a moment in time (Gardiner & Conway, 1999). Therefore, a subjective awareness experience of just knowing seems to be a necessary complement to the operational definition of noetic consciousness.

This distinction between familiarity and just knowing is necessary when awareness associated with knowledge acquisition or with transfer or re-encoding of information between memory systems is the focus of research. There are only a few studies measuring the 'just know' state of awareness (e.g., Conway et al., 1997; Herbert & Burt, 2001, 2003, 2004), maybe because it requires a bigger effort for researchers to manipulate or promote knowledge acquisition.

1.2.1.3 Guess responses – a methodological addition

Guess responses were introduced as a response alternative to remember and know responses with the aim of removing possible guessing from know responses (e.g., Gardiner, Java & Richardson-Klavehn, 1996; Gardiner, Kaminska, et al., 1996, exp. 3; Gardiner & Conway, 1999). Participants have been asked to use a guess response when they suspect that the test item was present in the study list but they are not sure about it.

One common feature between guess and know responses is that both of them are attributional, in the sense that the awareness of a recent encounter with the stimuli or its guessing is attributed to the experimental study situation (Gardiner & Conway, 1999). Guess responses have been shown to be discontinuous in relation to know responses at the empirical level – when guesses are reported, they usually show an inverse relationship to remember responses (e.g., Gardiner, Java & Richardson-Klavehn, 1996) and, sometimes, to know responses too (e.g., Gardiner, Kaminska, et al., 1996, exp. 3). Consequently, when guess responses are included, know responses no longer tend to show an inverse relationship with remember responses, supporting the view that remember and know responses are functionally independent. Furthermore, guess responses do not show memory for the studied information in laboratory settings using non-naturalistic material such as lists of words, that is, the level of guess responses is similar to studied and to unstudied items (Gardiner & Conway, 1999). Even at the experiential level, guess responses are discontinuous with know responses, as participants characterise these awareness experiences differently (Gardiner et al., 1998).

According to Gardiner and Conway (1999), if there is a response opportunity for guessing (e.g., moderate levels of remembering) and possibly a more lenient response criterion, guessing can be higher for unstudied than for studied items (e.g., Gardiner, Kaminska, et al., 1996, exp. 3). The opposite pattern, higher level of guesses responses to studied than to unstudied items, has also been found in more naturalistic studies (e.g., Conway et al., 1997). The counterbalancing of studied and non-studied items is not possible in these studies because the incorrect response options can be plausible and be conceptually related to the target information. In this situation people can use an informed guessing strategy based on their background knowledge to decide which response options are more and less plausible (Conway et al., 1997).

1.2.2 The processing approach – relationship between memory awareness states and underlying cognitive processes

In the remember-know approach, the systems view has been complemented with the proposal of different types of processing underlying remember and know responses. The initial proposal within the remember-know approach was that remembering increased with conceptual processing and that knowing increased with perceptual processing (Gardiner, 1988). It was followed by the proposal that remembering increased with distinctive processing, either conceptual or perceptual, and knowing increased with conceptual or perceptual fluency of processing (Rajaram, 1996, 1998).

Both proposals assumed implicitly that remember and know responses were rather process-pure (i.e., only one psychological process was involved in each awareness response). This assumption of process-purity in awareness responses was also present when these responses were related to other dual-processing approaches such as Mandler' s (1980) account of recognition memory processes in terms of elaboration and integration processes and the Process Dissociation Approach (PDA; e.g., Jacoby, 1991). It was even more explicit when remember and know responses were proposed to vary in a single continuous dimension of memory strength described by a signal-detection model (Donaldson, 1996; Hirshman & Master, 1997; Inoue & Bellezza, 1998).

The distinctiveness-fluency approach is used in this thesis to investigate awareness in memory for emotional information. It is therefore described in some detail. The other approaches (conceptual vs. perceptual processing; integration and elaboration processes; PDA, and the signal-detection model) are described briefly in order to provide a view on the connection of the remember-know approach to other theoretical approaches in the study of memory.

1.2.2.1 Conceptual versus perceptual processing

The transfer appropriate processing account, used in explicit/implicit memory research, was the first one used to explain the processing associated with memory awareness responses (Gardiner et al., 1994). This principle states that if the same study processing conditions are re-instated at test, then memory performance will be enhanced – conceptual (or perceptual) processing at study will enhance memory if memory is tested by a task tapping on conceptual (or perceptual) processes.

The first published study after Tulving's (1985) proposal of the remember-know approach suggested that remembering was positively affected by conceptual processing, whereas know responses were positively affected by perceptual processing (Gardiner, 1988). Variables that enhanced conceptual processing such as level of processing (deep vs. shallow; Gardiner, 1988, exp.1), generation effect (generate a word vs. read a word; Gardiner, 1988, exp.2) and undivided attention at encoding (vs. divided attention; Gardiner & Parkin, 1990) increased remember responses and did not affect significantly know responses. On the other hand, variables that promoted perceptual processing – repetition priming of the same word at test (vs. repetition priming by an unrelated word; Rajaram, 1993, exp. 3); same (vs. different) study and test modalities with a highly perceptual orienting task (Gregg & Gardiner, 1994) – increased feelings of familiarity/knowing towards the stimuli processed, while not affecting feelings of remembering.

However, later findings such as an increase in remembering after perceptual processing (Rajaram, 1996) could not be accounted for by the conceptual-perceptual processing hypothesis in awareness in memory. Another processing hypothesis was then proposed – the distinctiveness-fluency of processing approach (Rajaram, 1996, 1998).

1.2.2.2 Distinctiveness versus fluency of processing

The distinctiveness-fluency of processing approach suggests that remember responses accompany memory enhanced by distinctiveness of processing and know responses accompany memory enhanced by fluency of processing (Rajaram, 1996). The relationship between conceptual-perceptual processing and distinctiveness-fluency of processing is proposed to be orthogonal, as both distinctiveness of processing and fluency of processing can include conceptual or perceptual processing or both.

The distinctiveness of processing component was derived from research on distinctiveness in memory (e.g., Schmidt, 1991). Rajaram (1996) considered that distinctiveness of processing encompasses situations in which individual stimuli stand out or are salient in relation to background stimuli and situations in which stimuli are unique or uncommon. This distinction parallels Schmidt's (1991) definitions of primary and secondary distinctiveness, respectively. In primary distinctiveness, items are distinctive because they are dissimilar in relation to the overall structure of the stimuli that compose the immediate processing context and, maybe, dissimilar to the active set of features in working memory. This definition implies that a stimulus, regardless of being a very frequent occurrence, can be rendered distinctive if it does not share common features with the background items (e.g., a picture of a dog in a list of pictures of monuments). Secondary distinctiveness refers to stimuli that are uncommon or atypical in relation to information stored in long-term memory (e.g., bizarre sentences or bizarre imagery such as someone wearing a swimsuit in a lecture). A stimulus is distinctive when it is an atypical or peripheral member of a conceptual class or a description of semantic relations atypical of the constituent concepts (e.g., applying a rock-concert script to attending a classical music concert).

The fluency of processing component was based on the attribution approach to memory (e.g., Jacoby, 1988; Jacoby, Kelley & Dywan, 1989). In Jacoby et al.'s

approach, fluency of processing is defined as the ease of processing and the readiness of information coming to mind. This approach also suggests that processing information fluently leads directly to an attribution of familiarity towards that information. Moreover, attribution of familiarity is influenced by the subjects' goals and contexts. For instance, if the goal is retrieving information, subjects will attribute fluency to the past (e.g., "if this item just popped out in my mind, then I must have seen it before"); if the goal is other than a memory goal (e.g., judging temporal duration or the difficulty of a problem), then fluency resulting from the past is likely to be misattributed to goal-relevant aspects of the situation (e.g., "if this item just popped out, then it was shown for a longer duration than the others"). Furthermore, people do not seem to discriminate between familiarity due to the presentation of items in the experimental context and familiarity due to the activation of schema related general knowledge. However, in the distinctiveness-fluency hypothesis, the main idea taken from the attribution approach to memory is that fluency of processing influences familiarity directly, that is, feelings of familiarity towards the information processed are attributed when the information is felt as being fluently processed.

Some general predictions derived from the distinctiveness-fluency of processing hypothesis have been confirmed. The claim that feelings of remembering increase after distinctive conceptual processing is supported by previous evidence obtained in the remember-know approach. Variables that elicit elaboration of processing of individual items such as level of processing and full versus divided attention (Gardiner, 1988; Gardiner & Parkin, 1990) have fostered levels of remembering while not affecting feelings of familiarity/knowing.

The claim that remember responses increase with distinctiveness of perceptual processing has also been supported: increased remembering is associated with a picture superiority effect, with memory for the same size and same orientation of

objects at study and at test, Rajaram, 1996; and with memory for orthographic distinctive words; Rajaram, 1998, exp. 2).

Prior to the development of the distinctiveness-fluency of processing hypothesis, know responses had already been shown to increase with fluency of perceptual processing (Gregg & Gardiner, 1994; Rajaram, 1993, exp. 3). They were also shown to increase with fluency of conceptual processing (repetition of words from the same semantic category of the target words, Dewhurst & Anderson, 1999, exp. 2; words primed with related primes, Rajaram & Geraci, 2000).

Limitations and criticisms of the distinctiveness-fluency approach

Despite the evidence supporting the distinctiveness-fluency approach, a main empirical limitation and a main criticism can be raised. The empirical limitation concerns the vagueness in the characterisation of the conditions promoting distinctiveness of processing and fluency of processing. This approach has inherited a theoretical problem that affects the research on distinctiveness of processing: research has not produced yet a set of predictors about which types of information will be distinctively processed and which ones will not (Schmidt, 1991, 1996). For instance, from a theoretical point of view, as atypical category members are considered to be more distinctive than typical members of the same category, they should lead to higher memory than typical instances (Schmidt, 1996). However, Schmidt (1996, exp. 1-5) obtained the inverse finding: memory increased with typicality of category membership.

Furthermore, some definitions of distinctiveness of processing seem to include aspects of fluency of processing. For instance, Rajaram (1998, exp. 1) claimed that the dominant meanings of homographic words were more salient or distinctive than non-dominant meanings because, among other reasons, they were more easily

accessed and activated than non-dominant meanings. However, ease of access and ease of activation have been suggested to characterise fluency of processing (e.g., Jacoby et al., 1989). Schmidt (1991) also mentioned evidence linking distinctive stimuli and orienting responses, which include a fast initial attentional processing of the stimuli.

The proposal that distinctiveness of processing entails an initial more fluent processing raises the possibility that feelings of recollection could also be affected by both distinctiveness and fluency of processing. A size congruency effect and an orientation effect, in which the study conditions led to higher recognition and higher remembering when the study conditions were replicated at test was considered by Rajaram (1996) to provide evidence that remembering was affected by perceptual distinctiveness. However, the same perceptual conditions at study and at test could be considered to reflect a more fluent processing rather than a more distinctive processing. This position is supported by Jolicoeur's (1987) finding that patterns with the same size at study and at test were not only more accurately recognised but their recognition times were also faster in comparison with recognition for visual shapes differing in size between study and test. In this line of reasoning, remembering is affected by fluency of processing, either conceptual or perceptual. Anyway, it is possible that these same processing conditions, somehow, provided the opportunity for further elaboration of the individual stimuli, but this assumption is not theoretically clear in Rajaram's (1996) study.

The concept of fluency of processing has also been vaguely defined. It can refer to fast processing (e.g., Rajaram & Geraci, 2000), but it can also mean a spread of activation along the cognitive representations without the need to assume processing speed. For instance, Dewhurst & Anderson (1999, exp. 2) found that, after relational processing of the information, both true and false memories were accompanied by an increase in feelings of familiarity/knowing. Relational processing activates general

knowledge structures, which can lead to inference of information and, therefore, increase both true and false memories. In the remember-know approach, fluency of processing has been manipulated mainly by repetition of stimuli (Dewhurst & Anderson, 1999, exp. 2) and priming tasks (Rajaram, 1993, exp. 3; Rajaram & Geraci, 2000) in order to promote ease of processing or information coming to mind. However, Dewhurst (2001, July) found that other variables supposed to affect fluency of processing such as the duration of stimuli presentation, the discriminability in terms of stimuli visibility and semantic priming did not produce changes in the pattern of remember and know responses.

In the research reported in this thesis, the distinctiveness-fluency approach is applied to the processing of emotional information, particularly to the effect of emotional distinctiveness on awareness in memory.

1.2.2.3 Integration and elaboration processes in recognition memory

As remember and know responses have been used mostly with recognition memory, it was initially proposed that these two awareness responses could be related to Mandler' s (1980) dual-processing approach in recognition memory (Gardiner, 1988). This model postulates two separate processes that contribute to recognition memory performance – elaboration and integration. The elaboration component acts by establishing new relationships among the information processed and by reactivating previously formed relationships; the integration component promotes further strengthening of the internal organization of the information processed (Graf & Mandler, 1984).

The integration component was also suggested to involve the activation of representations such as word representations, therefore explaining priming effects in non-semantic and perceptual indirect memory tests (e.g., Graf & Mandler, 1984). Gardiner (1988) proposed that know responses could be a measure of the integration component because they were found to increase after perceptual processing. He also suggested that know responses could show a pattern of results similar to the one found in other perceptual indirect memory tests. Remember responses were found to increase after conceptual processing, which led to the proposal that feelings of remembering reflected conceptual or elaborative processing (Gardiner, 1988).

However, there is no straightforward convergence of results between the elaboration-integration approach and the remember-know approach (e.g., Gardiner & Java, 1990). Furthermore, at a theoretical level, know responses cannot be compared to the performance in indirect memory tests – know responses are by definition experienced consciously, whereas implicit memory encompasses processes whose outputs are not always experienced consciously (Richardson-Klavehn, Gardiner & Java, 1996).

1.2.2.4 The Process Dissociation Approach

Another processing approach in the study of awareness in memory is the Process Dissociation Approach, developed by Jacoby and collaborators (e.g., Jacoby, 1991; Jacoby, Lindsay & Toth, 1992). Remember and know responses have also been proposed to be similar to the processes of recollection and familiarity, respectively, in the process dissociation approach (e.g., Yonelinas & Jacoby, 1995). Recollection has been considered a controlled cognitive process while familiarity has been described as an automatic process. The process dissociation approach was originally aimed at estimating the separate contributions of the recollection and familiarity processes to

recognition memory, but now it proposes to estimate the contribution of conscious and unconscious processes to perception and memory (Jacoby et al., 1992).

The general procedure is called the opposition method as it places conscious influences and unconscious influences in opposition. In stem-completion tasks, participants are first presented with a list of items and, afterwards, they have to complete stems under inclusion and exclusion instructions (e.g., Jacoby et al., 1992). Under inclusion instructions, participants are instructed that they should complete the stem with the first word coming to mind, regardless of its previous presence in the study list. Under exclusion instructions, the stem should be completed with words not presented in the study list, that is, participants should complete the stem with the first word coming to mind but, if they realise that this word belonged to the study list, they should exclude it and look for another word to complete the stem. Therefore, if a studied word is produced in the exclusion condition, it will be due to unconscious influences. In the inclusion condition, both conscious and unconscious processes influence the completion of the task.

The calculation of the estimates for the contributions of conscious and unconscious processes follows different formula according to the assumption regarding the nature of the relationship between these processes. Three different assumptions have been discussed in the literature: the independence assumption, in which conscious and unconscious influences have independent effects on performance, that is, they can co-occur or operate alone; the redundancy assumption, in which conscious influences are always accompanied by unconscious influences, but unconscious influences can operate alone; and the exclusivity assumption, in which conscious and unconscious influences can never co-occur (e.g., Jones, 1987; Joordens & Merickle, 1993; Richardson-Klavehn et al., 1996). The debate about the type of relationship between conscious and unconscious processes in the process dissociation procedure has been centred mostly on the independency assumption (Jacoby, Toth & Yonelinas,

1993) and on the redundancy assumption (Joordens & Merickle, 1993). Other authors have defended the approach by arguing that both assumptions of independence and redundancy do not produce distinguishable patterns of estimates of recollection and familiarity, so the choice between them cannot be made at the empirical level (Humphreys, Dennis, Chalmers & Finnigan, 2000).

The relationship between the remember-know approach and the process dissociation approach has produced a strong debate and an extensive literature (see Richardson-Klavehn et al., 1996, for a detailed discussion). Overall, there is no systematic convergence of results between the two approaches either correcting or not for independence between remember and know responses (Gardiner & Richardson-Klavehn, 2000). Due to the methodology used, remember and know responses have been used in an exclusive way in most studies, as the participant has either to choose a remember or a know awareness response after recognising an item or response option (see Higham & Vokey, 2004, as an exception). Furthermore, Gardiner and Richardson-Klavehn (2000) argued that remembering cannot be equated with the source monitoring required in exclusion tasks and with conscious control. Briefly, some information remembered can be irrelevant to the exclusion task, leading to unsuccessful performance. In this situation remembered information is not included in estimates of recollection but is included in the estimates of familiarity, making familiarity estimates not equivalent to unconscious processes in memory.

From a theoretical point of view, subjective states of awareness and hypothetical information processes are concepts from different levels of description and the assumption that awareness states are process pure does not seem to hold (Richardson-Klavehn et al., 1996). The position defended in the remember-know approach is that subjective states of awareness, which are conscious, are outputs of psychological cognitive processes, which are not necessarily accompanied by

conscious awareness and, therefore, cannot be equated with underlying familiarity and recollection processes (e.g., Richardson-Klavehn et al., 1996).

Recently, the process-purity assumption has been challenged in the process dissociation approach. Jacoby, Jones & Dolan (1998) have argued that the processes of recollection and familiarity can contribute jointly to feelings of familiarity/knowing. They suggested that feelings of familiarity/knowing and exclusion errors in the process dissociation procedure behaved similarly, and that exclusion errors depended on both recollection and familiarity.

1.2.2.5 A single process approach – the signal detection model

The attempt to relate the remember-know approach with the dual-processing approaches to memory just mentioned focused on the claim that remember and know awareness responses were enhanced by qualitatively different cognitive processes. However, some authors have defended the approach by arguing that remember and know responses can be alternatively interpreted in a single continuous dimension of memory strength – a signal-detection model (Donaldson, 1996; Hirshman & Master, 1997; Inoue & Bellezza, 1998).

The signal-detection model takes into account both memory and the decision process when memory is assessed using a yes-no recognition memory test (see Donaldson, 1996). This model uses two dimensions: sensitivity in the discrimination between old and new items (d' or A') and the subject's criterion of familiarity (more liberal versus more conservative criterions in deciding whether an item has been presented before or not). Recognition memory and subsequent remember and know responses are described along a continuum of mnemonic information with two criteria

established by the participant. The first criterion addresses 'yes' and 'no' responses to information presented at the memory test. Information placed above a recognition criterion is given a 'yes' response. Above this recognition criterion lies the second criterion, which divides recognition responses into remember and know responses – items lying above this second criterion are given a remember response, and are considered more conservative 'yes' responses, while the items placed below the criterion are given a know response, and are considered weaker or less confident recognition responses. If the criterion becomes more lenient, both hit rates and false alarms will increase, but statistics such as A' and d' in the signal-detection model provide criterion-free estimates of trace strength (Donaldson, 1996). The inclusion of guess responses in remember-know studies was tackled by the single-process approaches by including a new response criterion for guess responses above the yes-criterion (e.g., Hirshman, 1998).

According to the model, a main prediction is that A' or d' should be similar when calculated on remember responses or when calculated on overall recognition 'yes' responses, since there is only one underlying memory trace or set of memory traces (Donaldson, 1996; Gardiner, Ramponi & Richardson-Klavehn, 2002). If estimates of trace strength based on overall recognition (remember plus know responses) were higher than estimates based only on remember responses, then there would be another source of memory in the overall recognition performance, and the signal-detection model would not be supported. A second prediction is that the amount of know responses depends on the placement of the yes-criterion, that is, the frequency of know responses will increase with a more liberal yes-criterion and will decrease with a more conservative yes-criterion (Donaldson, 1996; Gardiner et al., 2002).

Gardiner and collaborators have tried to refute the statistical arguments used in the signal-detection model. They have concluded that the signal-detection approach can model part of the results, but that it lacks the tools for making predictions and for

accommodating converging evidence from different areas of research such as age differences (as stated by Donaldson, 1996) and neuropsychological studies (Gardiner et al., 1998). For instance, Gardiner et al. (2002) conducted a meta-analysis of yes-no recognition memory studies with accompanying remember, know and guess responses using a signal-detection statistical procedure. They found that estimates of memory trace strength were higher for overall recognition (adding up remember, know and guess responses) than estimates for remember alone and that estimates for overall recognition were lower than estimates for remember and know responses, which showed that know responses indexed a source of memory different from the one in remember responses. The second prediction of the signal-detection model – the correlation between the amount of know responses and overall recognition performance, was not supported as Gardiner et al. (2002) found that know responses were not affected by response criteria and that guess responses were the ones strongly correlated with response criteria. The finding that know responses are not affected by response criteria when guess responses are included is illustrated by the following two studies. Strack and Förster (1995, exp. 1) presented participants with a list of words followed by base rate information about the occurrence of targets and lures in the recognition test. The results of the recognition memory test showed that know responses, and not remember responses, were affected by base rate information and by the number of items to be identified from a list, that is, know responses were influenced by judgmental strategies not related to memory processes. However, in a replication of Strack and Förster' s study including guess responses as a response option, it was guesses that increased with a more lenient response criteria (Gardiner, Richardson-Klavehn & Ramponi, 1997).

The signal-detection model portrays remember and know awareness responses as if they were measures of confidence in memory. However, several studies have compared remember and know responses with confidence judgements and have

reported that awareness and confidence in memory are empirically dissociated (e.g., Gardiner & Conway, 1999; Gardiner & Java, 1990; Perfect et al., 1995, exp. 1; Rajaram, 1993).

Another argument against the validity of the signal-detection model concerns the observation that similar recognition performances can be accompanied by different amounts of remembering and knowing (see Gardiner et al., 2002). The overall pattern of converging functional dissociations and physiological and neurological evidence of different indices of brain function, described previously, rules out trace strength and levels of subjective confidence explanations and provides support for a dual-systems view (e.g., Gardiner & Gregg, 1997). Nonetheless, the debate goes on. For instance, Dunn (2004) explores some arguments against the signal-detection model and argues that the data from a set of studies is not inconsistent with a single-trace interpretation.

Researchers have recently become aware that conscious experience is not process-pure. Different feelings of awareness can depend on both conceptual and perceptual processes, may depend on both recollective and familiarity processes and on both conscious and unconscious processes, and, as it will be argued later in this thesis, may depend on both distinctiveness and fluency of processing. Even considering that awareness states and cognitive processes are concepts in different levels of theoretical description, the characterisation of the cognitive processes underlying subjective states of awareness has not been neglected by researchers. In conclusion, the issue of the underlying processes in states of awareness is an essential part of theory building in the area and therefore constitutes an unavoidable issue in cognitive psychology.

2. Memory and awareness for emotional information

The general observation that emotional events in our lives are recalled more vividly than other events is familiar to most of us and it has been confirmed by research (Heuer & Reisberg, 1992). This observation raises the possibility of differences in memory awareness in relation to the emotional qualities of the information processed. However, there are not many published studies about the effects of emotional information on awareness in memory (e.g., Dewhurst & Parry, 2000; Ochsner, 2000; Pesta et al., 2001). This state of affairs could be justified by the youth of the study of awareness in memory and because the inclusion of emotion in cognitive issues has usually occurred after some maturation of the specific area of research.

2.1 Overview of the research problems in memory and emotion

In psychology, the study of the influence of emotional information on memory has been addressed since, at least, the end of the 19th century (see Guy & Cahill, 1999; Reber, Perrig, Flammer & Walther, 1994). Nonetheless, more systematic research on this topic has only begun during the late 1970s and 1980s, and it has focused on factors mediating the impact of emotion and the impact of emotional real life events on memory. One of the most studied mediating factors in the relationship between emotion and memory is the influence of mood on memory for both emotional and neutral information, leading to the well documented effects of mood-dependent memory and mood-congruent memory (e.g., Blaney, 1986, for a review).

The impact of emotional information as an independent variable was studied in more naturalistic studies using real life events (e.g., flashbulb memories) and in

laboratory simulation studies in the area of eyewitness testimony, which implied that the emotional information used was of a more traumatic or violent nature (Christianson, 1992). Only in the 1990s has research using less extreme emotional materials taken place (Reber et al., 1994).

Some of the most common research questions being explored in the literature are (e.g., Ochsner, 2000): whether memory for emotional information is more accurate than memory for neutral information; whether emotional information either enhances or undermines memory; whether emotional information enhances memory for central or peripheral details; whether memory for emotional information is more resistant to forgetting than neutral information, and whether memory for emotional information is more affected by emotional valence or arousal. Awareness in memory for emotional information is not one of these issues and it was fifteen years after Tulving's (1985) article that the first studies on memory awareness for emotional information were published (Dewhurst & Parry, 2000; Ochsner, 2000).

2.2 The subjective experience of emotion

Affect, emotion, and mood are terms usually found in the emotion research literature and they have been defined in order to enhance different aspects of the emotional experience. Using Forgas (1991) distinction, affect is a more global term and it encompasses mood and emotion experiences. Emotion refers to a more intense and brief affective state, which has a more obvious cause and clear cognitive content (e.g., feeling satisfied with something, feeling distressed with an event), whereas mood concerns a low intensity and longer lasting affective state, with no clear or salient cause and with little cognitive content (e.g., feeling in a good or bad mood, feeling well).

Emotional experiences have been described along two main dimensions: emotional valence and emotional arousal. These dimensions are at the core of Russell' s (1980) circumplex model of affect, which aims at describing the structure of affective experience as assessed through self-report. This model comprises two main orthogonal bipolar factors: pleasure-displeasure (or emotional valence) and degree of arousal. Emotional valence concerns the pleasantness or the hedonic quality of an affective experience (e.g., Barrett & Fossum, 2001). It is associated with two bipolar dimensions in self-reported mood: positive affect associated with pleasure and negative affect associated with displeasure (e.g., Watson & Tellegen, 1985). Self-reported arousal concerns the physiological and psychological activation felt in association with an affective experience.

2.3 Memory for emotional information

Overall superiority in memory for moderate emotional information has been found quite consistently across studies. Nonetheless, there are more mixed results in laboratory studies than in naturalistic studies about memory for real life events, which can be explained by the higher opportunities in the laboratory to control for possible intervening factors (e.g., Christianson, 1992). The memory enhancement for emotional information has been considered to be due to the inherent distinctiveness of emotional stimuli (e.g., Christianson, 1992; Schmidt, 1991), and it has been explained in different levels of analysis: evolutionary, cognitive, physiological, and neuropsychological.

Emotions have been claimed to have an important role in evolution and adaptation (Izard, 1993; Öhman, 1988). For instance, to have feelings before thinking (e.g., danger, pain) can allow faster action behaviours, and lead to a higher survival chance of the individual.

At the cognitive level, emotional distinctiveness seems to rely on cognitive factors such as increased attention, increased rehearsal and increased elaboration (e.g., Hamann, 2001; Ochsner, 2000). At early stages of processing, which are more perceptual, emotional information has been suggested to be processed automatically by pre-attentive mechanisms and also to trigger a higher level of attention (e.g., Christianson, 1992; Öhman, 1988). At later stages of processing, which are more conceptual, emotional information seems to be submitted to a higher level of elaboration and rehearsal at encoding and to be processed faster than neutral information (e.g., Christianson, 1992; Christianson & Loftus, 1991).

Memory performance for moderate emotional information does not seem to be affected by an important subject variable – sex of the participants. For instance, Buchanan et al., (2001) did not find an overall effect of sex on free recall of emotional material (emotional versus neutral pictures accompanied by verbal narratives). For emotionally extreme material, some gender differences have been reported for studies using recall, not recognition, for violent and non-violent news (Gunter & Furnham, 1986).

Besides involving a differential cognitive processing, emotional information has also been shown to engage specific neural and hormonal mechanisms, that is, emotional information has been shown to be processed by mechanisms that are not involved in the processing of emotionally neutral information and that contribute to the memory enhancement associated with emotional stimuli (e.g., Buchanan & Lovallo, 2001; Hamann, 2001; LeDoux, 1994; Phelps, LaBar, Anderson, O' Connor, Fulbright & Spencer, 1998).

At the neural level, neuroimaging studies using techniques such as event-related potentials (ERP), positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), and neuropsychological studies with patients with brain

lesions have identified a key brain structure in the encoding, consolidation and retrieval of emotional information – the amygdala (e.g., Adolphs, Cahill, Schul & Babinsky, 1997; Adolphs, Tranel & Denburg, 2000; Buchanan, Denburg, Tranel & Adolphs, 2001). In the presence of amygdala damage, the person shows impaired memory for emotional information but he or she is still able to react adequately to emotional stimuli; in the presence of hippocampus damage, a brain structure involved in declarative memory, and intact amygdala, emotionally arousing information still leads to better memory performance (Hamman, 2001). The amygdala has been suggested to be more important in memory for emotional verbal information than in memory for emotional pictorial information (e.g., Hamman, 2001). The amygdala also seems to be more involved in the processing of arousing information, regardless of its emotional valence, than in the processing of information with positive and negative emotional valences (LeDoux, 1994; Phelps et al., 1998).

Emotional information also seems to engage valence specific processes that are not determined by the amygdala (Phelps et al., 1998). Using fMRI and awareness and memory measures for emotional words (arousing/valenced words, non-arousing/valenced words), Kensinger and Corkin (2004) suggested that there are distinct neural processes for emotional valence and emotional arousal: higher memory for negative non-arousing words seems to depend on the additional engagement of the same type of processes used for neutral words, which are supported by a pre-frontal cortex-hippocampal network, whereas higher memory for arousing words is supported by an amygdalar-hippocampal network.

Physiologically, the processing of emotionally arousing information stimulates the noradrenergic system, triggering the release of stress hormones such as corticosteroids and epinephrine (e.g., Buchanan & Lovallo, 2001; O' Carroll, Cahill, Shajahan & Ebmeier, 1999). These hormones, in turn, interact with the amygdala (Hamman, 2001). Physiological studies that have examined the relative impact of

arousal and emotional valence in memory have obtained mixed results. For instance, Buchanan and Lovallo (2001) found that memory for pictures was enhanced not only by the intake of cortisol (a stress hormone) but also with pictures rated as arousing and emotionally positive and negative (vs. pictures rated as emotionally neutral).

These results are consistent with the idea that emotional information seems to be encoded both more distinctively and more fluently than neutral information. Arguably, emotional information is processed more distinctively than neutral information as it engages specific neural and hormonal mechanisms and it triggers an enlarged use of cognitive resources such as increased attention, increased rehearsal and increased elaboration. It also seems to be processed rather automatically at a pre-attentive stage, allowing a more fluent processing, especially for negative stimuli.

2.4 Awareness in memory for emotional information

If emotional information is encoded more distinctively and more fluently than neutral information, and considering that distinctiveness of processing can entail an initial more fluent processing as suggested in section 1.2.2.2, then the prediction that follows from the distinctiveness-fluency hypothesis in memory awareness is that distinctiveness of emotional information would increase feelings of recollection.

Another prediction is that fluency of processing at test increases feelings of familiarity/knowing. Not much is known about the retrieval of emotional information, but there are some results suggesting that it can be affected by fluency of processing. For instance, Talmi and Moscovitch (2004) suggested that organisational processes at encoding contribute to the higher levels of memory for emotional information. They asked participants to encode lists of emotional words, lists of categorised neutral words

equivalent in semantic relatedness and lists of neutral words with low semantic relatedness (exp. 1 and 2) and mixed lists of words containing words from all the conditions (exp. 3). They found that free recall was similar for emotional words and semantically related words, which was higher than memory for non-semantically related neutral words. The effect of organisation of the information at encoding (repetition of words from the same semantic category) has been found to increase feelings of familiarity/knowing and has been suggested to be due to the activation of the memory representation (Dewhurst & Anderson, 1999, exp. 2). Therefore, maybe the organisation induced by emotional information at encoding could lead to increased feelings of familiarity/knowing.

However, the evidence obtained so far has only confirmed the first prediction. The overall pattern of evidence for awareness in memory for emotional information has been consistent: emotional information, both negative and positive, fosters feelings of recollection, but it either does not affect feelings of familiarity/knowing significantly or it increases feelings of familiarity/knowing for neutral and positive stimuli. This pattern has been obtained for lists of words (Dewhurst & Parry, 2000; Kesinger & Corkin, 2003, for negatively valenced words and arousing words; Pesta et al., 2001) and for lists of photos (Ochsner, 2000).

Enhanced memory and increased remembering for emotional information have been explained by the distinctiveness of processing emotional information. Only Ochsner (2000) applied both the distinctiveness and fluency components of the distinctiveness-fluency hypothesis to predict the possible effect of emotional information on memory awareness. He hypothesised that (a) emotionally negative stimuli would be more distinctive than both emotionally positive and neutral stimuli, leading to a higher level of remembering; and (b) that emotional stimuli, especially negative stimuli, would be processed more fluently than neutral stimuli, which should lead to a higher level of familiarity responses towards emotional information, especially

towards negative information. Using a set of photos varying in emotional valence and emotional arousal, Oschner asked participants to rate the photos in dimensions pertaining to emotional valence, arousal and visual complexity (exp. 1), to perform a distance encoding task in terms of approach/withdrawal (exp. 2), and to judge the subjective brightness of the photos under time pressure (encoding conditions in which attention is directed away from the affective properties of the stimuli; exp. 3). Two weeks after the study phase, there was an old/new recognition memory test with remember and know responses for items classified as old. Guess responses were not included in these studies. As predicted, remembering was higher for emotionally negative items, and to a less extent, for positive items. Know responses did not vary consistently in terms of statistical significance, but they tended to be higher for positive and neutral photos. Therefore, the results for know responses went in the opposite direction of the prediction, that is, the supposedly higher fluency of processing for negative information did not lead to a higher level of know responses. On the contrary, according to the distinctiveness-fluency hypothesis, emotionally positive and neutral stimuli seem to be more fluently processed than emotionally negative information. However, Oschner found that estimates of the familiarity process (calculated by using the estimates proposed by Yonelinas, Kroll, Dobbins, Lazzars & Knight, 1998) increased but only marginally for both emotionally negative and arousing photos. In conclusion, the possible contribution of emotional fluency of processing at retrieval does not seem to be robust enough to affect feelings of familiarity/knowing systematically.

Tulving' s (1995) proposal that encoding in the memory systems is serial, particularly from the semantic system to the episodic system can shed some light on Oschner' s (2000) results. If information is first encoded semantically, and if no further episodic encoding is pursued, the representations of the information will mainly give rise to feelings of familiarity/knowing at retrieval. If information is further encoded

episodically, then its memory should also be accompanied by awareness feelings of remembering. In Oschner' s (2000) studies, information from negative photos, after being encoded semantically, could have been encoded episodically deeper than positive and neutral information, giving rise to more feelings of remembering than positive and neutral photos. On the contrary, positive photos and neutral photos sometimes led to higher feelings of familiarity/knowing than negative photos, maybe because information from positive and neutral photos was initially more encoded semantically than negative information.

In conclusion, memory for emotional information is consistently accompanied by feelings of remembering, but not by feelings of familiarity, which does not support the predictions from the distinctiveness-fluency hypothesis. This issue will be further explored in this thesis using complex verbal materials such as news stories.

3. Research aims

The aim of the research for this PhD was to extend the study of the effects of emotional information on awareness in memory by exploring awareness states for complex verbal material (news stories) and by exploring awareness states accompanying knowledge acquisition.

If emotional informational is more distinctively processed, if it leads generally to better and more vivid memory, then it should be subjected to a significant episodic encoding and be accompanied by more awareness feelings of remembering than neutral events. Higher fluency of processing emotional information at encoding could

also mean that emotional information is available for episodic encoding in higher amounts and maybe sooner than neutral information. This interpretation also fits Oschner' s (2000) results, as described in the previous section. This hypothesis would be tested for more complex verbal material – news stories.

While being able to extend previous findings obtained with lists of words and lists of photos would be an interesting result, this is not the main research goal behind the choice of complex verbal material. Nowadays, one of the central research problems in the remember-know approach concerns the awareness accompanying knowledge acquisition. As already mentioned, with a few exceptions (Conway et al., 1997; Herbert & Burt, 2001, 2003, 2004), the studies have focused on awareness accompanying memory after processing the information in one moment. However, awareness accompanying semantic information should not only be studied after the initial encoding of information. It should also be mapped after conditions promoting learning and possible schematisation of the information take place. This procedure would allow the operationalisation of awareness indexing information represented in the semantic memory system by measuring separately feelings of familiarity and feelings of knowing. Some specific research questions that will be addressed are: How would repetition of information either at encoding or at retrieval affect transfer of information between memory systems and its accompanying awareness? Would emotional and neutral information be differently affected? Would the acquisition of knowledge from emotional information be less prone to be schematised that the knowledge from neutral information as emotional information is so distinctively processed?

In the following chapters, I present the seven studies conducted. They are organised in four papers. These papers are written in a submission format, as they are intended for publication. The first paper began the focus on the effects of repeated processing in memory awareness for emotional news stories. Its first study explores the effect of repeated testing over a time period of days, whereas the second study

tests the course of forgetting over a long time period too. The second paper reports two studies that intended to map the memory awareness for emotional information using classical encoding variables such as depth of processing and divided attention and to compare the pattern of results for emotional text with those obtained for simpler and emotionally neutral materials. The third paper extends the study of the effects of repetition of processing on encoding, including a study with a consecutive study trials manipulation and a study in which learning takes place over a time period of a few weeks. Finally, the last paper explored the issue of distinctiveness being linked to the study context. It includes one study that tested whether the pattern of results obtained with the presentation of mixed lists of emotional and neutral news stories could also be obtained with emotionally homogeneous lists. Afterwards, I will present an overall discussion and conclusion, also pointing future areas of development for my research.

Chapter 2 Effects of emotion and retrieval on awareness in memory

Running head: Emotion and retrieval on awareness in memory

Effects of emotion and retrieval on awareness in memory

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Abstract

Two studies investigated the effect of emotional negative information on awareness in memory using the remember-know paradigm. In both studies, remembering increased with emotionally negative information and knowing was not systematically affected. In the first study, repeated testing after a 4-day interval increased know responses and decreased remember responses. In the second study, memory was tested immediately and after a 7-day retention interval in different groups. The observed forgetting was accompanied by a decrease in remember responses but know responses were not affected. The results only partially support the distinctiveness-fluency of processing hypothesis (Rajaram, 1996). We suggest that remembering arises from both distinctiveness and fluency of processing whereas knowing is mainly influenced by fluency of processing.

Effects of emotion and time on awareness in memory

Retrieving information from memory can lead to different feelings of awareness towards that information. Subjective states of awareness in memory were proposed by Tulving (1985) as indicators of different kinds of consciousness, which, in turn, were associated with information represented in different memory systems. In the study of awareness in memory, the focus has been on awareness responses that operationalise autonoetic and noetic consciousness, as these two types of consciousness are associated, respectively, with information represented in the episodic and in the semantic memory systems. These awareness responses have been usually termed remember and know responses, respectively, and they have been studied in a diversity of encoding and retrieval situations and populations. Remembering concerns the experience of a vivid recollection of the specific learning episode, the experience of reliving things, of sometimes having a mental picture of what happened; a know response is provided when one feels that the information presented is familiar or just known and cannot associate it with a recollection of the processing episode (e.g., Gardiner, 1988; Gardiner & Java, 1990; Gardiner & Parkin, 1990; Tulving, 1985). The justifications for the awareness responses provided by participants confirm that they do not have difficulties understanding and using the formulation above (Gardiner, Ramponi & Richardson-Klavehn, 1998).

The evidence resulting from the initial studies shows a pattern of functional and neuropsychological associations and dissociations between remember and know responses: some variables have been found experimentally to have similar effects in both responses, some variables affect one response but not, or in a low extent, the other response, and some other variables have opposite effects in the two responses (for a summary, see

Gardiner & Richardson-Klavehn, 2000). One of the criteria proposed to justify the existence of different memory systems is the observation of convergent findings from different sources of evidence such as functional dissociations on different cognitive/behavioural tasks alleged to tap different systems, neuropsychological dissociations in studies involving brain-injured patients and a differential physiological functioning (Schacter & Tulving, 1994). Therefore, the dissociations found for remember and know responses constitute strong evidence for these responses as indicators of information in different memory systems.

Awareness responses were also theorised in terms of the underlying types of processing. Initially, Gardiner (1988) proposed that remembering was positively affected by conceptual processing, whereas know responses were positively affected by perceptual processing (Gardiner, 1988; Gardiner & Parkin, 1990; Gregg & Gardiner, 1994; Rajaram, 1993). However, some posterior findings were not explained by this hypothesis (e.g., Rajaram, 1996, 1998). Remember responses were found to be affected by perceptual variables (Rajaram, 1996; 1998, exp. 2) and know responses were shown to increase with conceptual encoding manipulations (Dewhurst & Anderson, 1999, exp. 2; Rajaram & Geraci, 2000). Rajaram (1996) suggested the distinctiveness-fluency framework as an alternative explanation to the processes underlying remembering and familiarity/knowing awareness states in memory. The relationship between conceptual-perceptual processing and distinctiveness-fluency of processing is proposed to be orthogonal: remember responses are indicative of distinctiveness of processing, either conceptual or perceptual, while know responses reflect fluency of processing at retrieval, either conceptual or perceptual. In this approach, the distinctiveness of processing component is derived from research on distinctiveness in memory (e.g., Schmidt, 1991). The fluency of processing component is borrowed from

the Jacoby, Kelley and Dywan's (1989) attribution approach to memory, which proposes that the ease of processing, the readiness of information coming to mind, that is, the fluency in the processing of information, leads directly to an attribution of familiarity towards the information processed.

Several studies were conducted to test the specific predictions made by the distinctiveness-fluency of processing hypothesis (e.g., Dewhurst & Anderson, 1999; Rajaram, 1996, 1998). For example, Rajaram (1998, exp. 1) tested the effects of conceptual distinctiveness of homographic words on awareness in memory. Operationally, conceptual distinctiveness of the words was defined according to whether their meaning was dominant or non-dominant. Previous evidence cited by Rajaram (1998) had found that dominant meanings of homographs had precedence of access in relation to non-dominant meanings, they stayed activated longer and their effects did not disappear even when subjects were informed that the list of words presented consisted mainly of non-dominant meanings. In Rajaram's study dominant meaning of words was considered to render the word more salient and to induce distinctiveness of processing. Participants were asked to rate the fit of the relationship between a word and a phrase. It was found that dominant-meaning homographs led to higher overall recognition and higher remember responses than non-dominant homographs. Know responses were not significantly affected by dominant- versus non-dominant meaning homographs. Therefore, conceptual distinctiveness, as defined here, influences positively remembering while not affecting knowing significantly.

Some other studies did not find the pattern of results predicted by the distinctiveness-fluency approach. Dewhurst (2001, July, exp. 1) found that variables such as the duration of the stimulus presentation, the discriminability in terms of stimulus visibility and semantic priming, manipulations supposed to affect fluency of processing, did not lead to significant changes in the pattern

for remember and know responses for both hits and false alarms.

Emotion and awareness in memory

Anecdotally, emotional information is said to be quite vivid in one's mind, which suggests that the awareness one has about emotional information in memory has maybe a different quality than the awareness associated with emotionally neutral information. However, there are not many studies about the effects of emotional information on awareness in memory (e.g., Dewhurst & Parry, 2000; Pesta, Murphy, & Sanders, 2001; Ochsner, 2000). This state of affairs could be justified by the youth of the study of awareness in memory and because the inclusion of emotion in cognitive issues has usually occurred after some maturation of the specific area of research.

In psychology, the study of the influence of emotional information on memory has been more systematically addressed since the late 1970s and 1980s, both in more naturalistic studies using real life events (e.g., flashbulb memories) and in laboratory simulation studies in the area of eyewitness testimony. The reliance on these areas implied that the emotional information used was of a more traumatic or violent nature (Christianson, 1992b). Only in the 1990s did research using less extreme emotional materials take place (Reber, Perrig, Flammer & Walther, 1994). Overall superiority in memory for moderate emotional information has been found consistently across studies and it has been considered to be due to the inherent distinctiveness of emotional information (e.g., Christianson, 1992b; Schmidt, 1991). Emotional distinctiveness seems to rely on cognitive factors such as increased attention, increased rehearsal and increased elaboration (e.g., Hamann, 2001; Ochsner, 2000). Emotional information has also been suggested to be processed automatically by pre-attentive mechanisms (cf. Christianson, 1992b) and to engage specific neural and hormonal mechanisms (e.g., Buchaban & Lovallo,

2001; Hamann, 2001; LeDoux, 1994; Phelps, LaBar, Anderson, O' Connor, Fulbright & Spencer, 1998).

Sex of the participants does not seem to influence the effect of moderate emotional material. For instance, Buchanan, Denburg, Tranel and Adolphs (2001) did not find an overall effect of sex on free recall of emotional material (emotional vs. neutral pictures accompanied by verbal narratives). For emotionally extreme material, some sex differences have been reported for studies using recall, not recognition, for violent and non-violent news (Gunter & Furham, 1986). As the materials used in the studies reported in this article are not extremely violent, sex differences are not expected in the recognition memory tests.

Regarding awareness in memory for emotional information, the overall pattern obtained from the few studies in the literature is consistent: emotional information gives rise to feelings of recollection while not affecting feelings of familiarity systematically (Dewhurst & Parry, 2000, for mixed lists of words in exp. 1; Ochsner, 2000, for lists of photos ; Pesta et al., 2001, also using lists of words to study the false memory effect).

Ochsner (2000) tested the distinctiveness-fluency of processing hypothesis for emotional information, assessing awareness responses accompanying the recognition of affective photos (negative, positive and neutral). He hypothesised that (a) emotionally negative stimuli would be more distinctive than both emotionally positive and neutral stimuli, leading to a higher level of remembering; and (b) that emotional stimuli, and especially negative stimuli, would be processed more fluently than neutral stimuli, which should lead to a higher level of familiarity responses towards emotional information, especially negative information. In three studies, participants performed intentional and incidental tasks regarding the emotional characteristics of the photos and they were tested for recognition memory and

awareness two weeks after the study phase. The pattern of results for awareness responses was similar across the three studies. As expected, remembering was higher for emotionally negative items and, to a less extent, for positive items. Know responses did not vary consistently in terms of statistical significance, but they tended to be higher for positive and neutral photos. These results go in the opposite direction of the prediction, that is, the supposedly higher fluency of processing for negative information did not lead to a higher level of know responses. Emotional valence and emotional arousal seemed to have independent effects as the same overall pattern of results was obtained when arousal, emotional valence and visual complexity were controlled for.

The set of studies included in this article aims at exploring whether verbally complex emotional material (news stories) can lead to visible and systematic patterns of awareness in memory. Based on the literature reviewed, emotional information involves both distinctive processing and more fluent processing than neutral material, because it requires more cognitive resources (attention, elaboration) and it triggers a pre-attentive processing that allows emotional information to be processed faster and with more elaboration. At retrieval, emotional information does not seem to affect significantly feelings of familiarity/knowing (Ochsner, 2000).

Therefore, the main hypothesis is that emotional distinctiveness will increase remember responses for emotional news stories in comparison with neutral news stories. Know responses are not expected to be affected by the emotional valence of the news stories. Ochsner' s study did not include guess responses as a response alternative to remember or to know responses. Consequently, some guessing could have occurred in know responses and obscured the results (e.g., Gardiner, Java & Richardson-Klavehn, 1996;

Gardiner, Kaminska, Dixon & Java, 1996, exp. 3). We used a guess response category to prevent this possibility.

Memory for emotional information has also been claimed to increase with long retention intervals (e.g., Parkin, Lewinsohn, & Folkard, 1982). However, it is not often than memory for more complex material, and even simpler ones, is tested in different retention intervals and compared. In the first study, memory was tested repeatedly, immediately and after a 4-day retention interval. In the second study, the immediate and delayed testing was done for different groups, in order to investigate the awareness pattern accompanying forgetting.

Experiment 1

Arguably, people can learn more from text than from a list of unrelated words, which suggests that text can be a suitable material to explore the role of know responses as indicators of information represented in a semantic memory system, as proposed by Tulving (1985). While the basic meaning of remembering as an indicator of information represented in an episodic memory system is consensual, the basic meaning of knowing has been prone to some controversy (Gardiner & Conway, 1999). The source of this controversy concerns the claim that it is not fully adequate to associate the representation of semantic knowledge and the noetic consciousness that comes with it only to a transient feeling of familiarity that the information was experienced recently. In order to address partially this objection, promotion of consolidation of the information was attempted in this study. Experimental manipulations that promote learning of information could be aimed at the encoding (e.g., repeated study) or at the retrieval (e.g. repeated testing). We chose repeated testing after a delayed interval.

The predictions regarding awareness for emotional material follow Ochsner's (2000) findings. Due to emotional distinctiveness remember responses are expected to be higher for emotional stimuli than for neutral ones; know responses should not be affected. These predictions are made for both an immediate memory testing and a delayed testing. If emotional information leads both to better memory over time and to a slowdown of forgetting, then memory should be higher for emotional stories than for neutral stories at both an immediate and a delayed memory testing due to its distinctiveness. After a repeated testing situation, some hypermnesia should occur (e.g., Kazén & Solís-Macías, 1999) either because some information was encoded or more consolidated episodically, increasing remembering, or because some information was encoded or consolidated semantically, leading to an increased level of know responses. Whether these effects occur differently or not for both emotional valences is analysed in this study.

Method

Participants

Nineteen people participated in this study: 12 women (10 postgraduate students and 2 professionals) and 7 men (4 postgraduate students and 3 professionals). The age mean is: M = 30.08 (SD = 5.00) for the women, M = 28.00 (SD = 4.33) for the men, and M = 29.32 (SD = 4.33) for the overall sample.

Materials

Eleven news stories were selected from a British broadsheet daily newspaper. This initial selection was based on news stories' length and on the researcher's assessment of their negative and neutral emotional content.

The final eight news stories used in the data analysis were selected based on the assessments provided by the participants (see appendices 1 and 2). Study material consisted of a booklet containing each news story in a different page alternated with the assessment scales (emotional content, comprehensibility, and previous knowledge) in a different page (see appendices 5 and 6). The emotional valence of the news stories was assessed in a 5-point scale (from 1-'very negative' to 5-'very positive'), comprehensibility was rated in a 5-point scale (from 1-'very easy to understand' to 5-'very difficult to understand') and previous knowledge was assessed by asking participants if they had read or heard anything about each news story before (answers options: yes, no, don't know).

Test material consisted of two booklets, one for the immediate testing and another for the delayed testing. Both began with instructions about how to perform the recognition memory test (a forced four-choice questionnaire, in which only one of the options was correct) and how to report the awareness state associated with each answer (remember, know or guess; see appendix 7). These instructions were followed by the recognition memory questionnaire, which included awareness options for each question (see appendix 8). Each question and its awareness options were placed in a separate page. As the questions for each story followed the sequence of information in the story, if they were simultaneously visible, reading a late question could influence the answer to an earlier one. The questions for each story respected the same story sequence used in the study material. Recognition memory booklets for the immediate and for the delayed interval differed in a final short questionnaire included in the booklet presented in the immediate interval. This questionnaire collected information about age, sex and about the participant's news consumption (the latter are not analysed in this article).

Design and Procedure

This was a 2 x 2 x 2 mixed factorial design with retention interval (immediate memory testing vs. four-day delayed memory testing) and emotional valence of the news stories (negative vs. neutral) as within-subject factors and sex (women vs. men) as a between-subject factor. Participants were tested individually or in small groups. First, the participants were told that they were going to participate in a study about the way people process mass media information. They were also told that they would need to do another questionnaire after an interval of four days. They were asked to read carefully the news stories and to rate them for emotional content, comprehensibility and previous knowledge. The presentation sequence of the news stories was counterbalanced across subjects (see appendix 3). Participants were told that after this task they would have to answer some questions about the stories, but their nature was not specified. After reading and assessing the news stories, participants were explained about how to perform the four-choice questions and the awareness responses. They were also given written instructions and asked whether they understood them or not. If not, the task was explained again. When this task was completed, participants were thanked. The second questionnaire was conducted four days later and it also included written instructions. After finishing, participants were thanked again and debriefed.

Results

Stories assessment

The news stories selected were reported to be unknown by the participants, as shown by their mean proportions: M = .82 (SD = 0.18) for emotionally negative stories and M = .89 (SD = 0.03) for neutral stories. The

difference between these means was not statistically significant. Emotionally negative stories were rated as quite negative (M = 1.66, SD = 0.57) and neutral stories were rated as neutral (M = 3.42, SD = 0.43). Emotionality ratings were significantly different between negative and neutral stories [$t(18) = -9.29$, $p < .01$, two-tailed]. Both emotionally negative stories and neutral stories were rated as easy to comprehend (M = 1.68, SD = 0.51; M = 1.95, SD = 0.64, respectively). These two mean ratings were quite low but the difference between them was statistically significant [$t(18) = -2.34$, $p = .03$, two-tailed], indicating that emotionally negative stories were rated as easier to understand than neutral stories.

Memory and awareness performance

The memory and awareness data were analysed in two ways: one analysis involving all the answers provided by the participants and the other including only the answers from the stories reported to be unknown by the participants. Because these two datasets led to similar pattern of results, only the results from the complete dataset are reported. As sex did not produce any main effect or any systematic interaction, this variable was removed from the following analyses.

Mean proportions of correct remember, know or guess responses (see table 1) were calculated dividing the total number of correct remember, know or guess responses by the maximum possible number of correct responses (N = 29 for emotionally negative stories, N = 26 for neutral stories). Overall recognition memory proportions and proportions of correct remember, know and guess responses were analysed separately using a repeated measures analysis of variance with retention interval (immediate memory testing vs. four-days delayed memory testing) and emotional valence of the news stories (negative vs. neutral) as within-subject factors.

Table 1 about here

The prediction that emotional distinctiveness would increase memory and awareness feelings of remembering was supported: overall recognition memory was higher for emotionally negative than for neutral stories [main effect of emotional valence: $F(1, 18) = 30.41$, $p < .01$] and correct remember responses were also higher for emotionally negative stories than for neutral stories [main effect of emotional valence: $F(1, 18) = 40.12$, $p < .01$]. Correct know responses were not affected by the emotional valence of the stories. As expected, memory did not decrease after repeated testing over a time period of four days, remaining at similar levels at both memory tests ($F < 1$). However, the awareness pattern was not the same at the two tests. From the immediate to the delayed testing, correct remember responses decreased [main effect of time of testing: $F(1, 18) = 4.95$, $p = .04$] but correct know responses increased [main effect of time of testing: $F(1, 18) = 6.63$, $p = .02$]. The interaction between emotional valence and time of testing was not significant for both correct remember and correct know responses.

Mean proportions were also compared across awareness categories using simple comparisons, a procedure used by Herbert & Burt (2001, 2003, 2004). As awareness categories are mutually exclusive in our methodology, comparing them via an analysis of variance including type of awareness responses as a factor would violate the assumption of independence. Simple comparisons showed that feelings of remembering predominated memory as correct remember responses were significantly higher than both correct know responses [$t(18) = 5.20$, $p < .01$, two-tailed] and correct guesses [$t(18) = 7.38$, $p < .01$, two-tailed]; correct know responses were higher than correct guess responses but the difference between them was not significant ($t < 1$).

For guess responses, correct answers were higher for neutral than for emotionally negative stories [$F(1, 18) = 9.63$, $p = .01$], mirroring the pattern obtained for correct remembering, and they remained at similar levels from the immediate to the delayed testing. The interaction between emotional valence and time of testing was not significant. Mean proportions of incorrect responses ranged from 0.05 to 0.09 for both remember and know responses and from .10 to .27 for guess responses (see table 2). Only one significant effect was observed: there were more incorrect guesses for neutral than for emotionally negative stories [main effect of emotional valence: $F(1, 18) = 49.74$, $p < .01$].

Table 2 about here

Discussion

Two major findings were obtained with this study. The first is that emotional information, as predicted, produced better memory and higher remembering than neutral information at both immediate and a four-day delayed testing. Know responses were not affected by the emotional valence of the stories. Emotional material, which has been suggested to be more distinctively (and fluently) processed at encoding (e.g., Ochsner, 2000), had mainly an impact on remembering. This finding converges with the evidence available on awareness for emotional information regarding other materials (Dewhurst & Parry, 2000; Ochsner, 2000; Pesta et al., 2001).

The second important finding concerns the changes in awareness over time. The overall level of memory did not increase with repeated testing – the information in the news stories remained constant over time. One of the most interesting findings was that the same memory levels in the two testing occasions showed different awareness patterns: the level of remember

responses decreased while the level of know responses increased from the immediate to the delayed interval. This finding suggests that some information, regardless of its emotional valence, was transferred or re-encoded into a semantic memory system, according to Tulving' s (1985) memory systems approach.

Guessing pattern mirrors the one obtained for remember responses: there are more guess responses to neutral than to emotionally negative stories, as found in other studies (e.g., Gardiner, Java & Richardson-Klavehn, 1996). Most likely, if guess responses had not been included, this inverse relationship would have been obtained between remember and knowing, leading to inadequate inferences about the relationship between these two awareness experiences.

Experiment 2

The results of the previous study show that repeated testing affects memory awareness. In the absence of repeated testing, the effect of retention intervals on memory should produce some memory decrease, which should be accompanied by a different awareness pattern than the one observed in experiment 1 (Gardiner, 1988; Gardiner & Java, 1991). For instance, Gardiner and Java (1991) asked different groups of participants to memorize a list of words and to answer a memory test 10 minutes, 1 hour or 1 week after the study phase (exp. 1), or 1 week, 4 weeks or 6 months after the study phase (exp. 2). They found that remember responses decreased over time and know responses did not change significantly over a period of one week; with longer periods, both these responses declined.

In experiment 2, we intend to investigate the effect of time in awareness in memory for emotional material (news stories). We expect that if memory is tested after a 7-day retention interval, it will lead to forgetting accompanied by

an awareness pattern similar to the one obtained by Gardiner and Java (1991, exp. 1): awareness feelings of remembering should decrease but awareness feelings of familiarity/knowing should not be significantly affected. Memory performance for emotionally negative stories is expected to worsen less than the performance for neutral stories in the delayed interval, as the former are considered more distinctive and leading to deeper elaboration than neutral information. Besides, emotional information is claimed to be more resistant to forgetting than neutral information (Heuer & Reisberg, 1992; Revelle & Loftus, 1992). The memory pattern should also be similar to the one found in the previous study – remember responses are expected to be higher for emotionally negative stories than for neutral stories, whereas know responses should not be affected by emotional valence.

Method

Participants

Forty-four people (university students and staff members of City University) participated in this experiment (22 women and 22 men). The participation in this study was rewarded either with credits or with a £5 payment. Eleven participants were excluded and replaced because they did not comply with the study requirements. The age mean for the final sample is: M = 25.00 (SD = 5.01) for the women, M = 24.09 (SD = 4.84) for the men, and M = 24.55 ($S\,D$= 4.89) for the overall sample.

Materials

The set of eight news stories from experiment 1 was again used in this study. The study material and test materials for these eight stories were similar to the materials used in study 1.

Design and Procedure

This is a 2 x 2 x 2 mixed-factorial design with retention interval (immediate interval vs. seven-days interval) and sex as between-subject factors and emotional valence of the news stories (negative vs. neutral) as a within-subject factor. Participants were tested individually or in small groups (2 to 5 people). First, the participants were told that they were going to participate in a study about the way people process mass media information. If they were assigned to the delayed retention interval condition, they were also told that they would need to participate in the second part of the study after an interval of seven days. They were asked to read carefully the news stories and to rate them in scales pertaining to emotional content, comprehensibility and previous knowledge. In the immediate interval condition, after reading and assessing the news stories, participants were explained about how to perform the multiple choice questions and the awareness responses. They were also given written instructions. This task was done one week later for the participants in the delayed condition. When the test phase was completed, participants were thanked and debriefed.

Results

Assessment of the news stories

Participants reported not to know most of the stories, being the mean proportions for answering that the story was unknown similar for emotionally negative news stories and for neutral news stories (M = .86, SD = 0.20, for negative stories; M = .86, SD = 0.21, for neutral stories). Emotional valence and retention interval did not lead to statistically significant differences between these two means.

Emotionally negative stories were rated as quite negative (M = 1.82, SD = 0.72) and neutral stories were rated as neutral (M = 3.41, SD = 0.45). This difference is statistically significant [$F(1, 42) = 139.43$, $p < .01$]. There was no difference in the ratings as a function of the retention interval. Regarding comprehensibility, both emotionally negative stories and neutral stories were rated as easy to comprehend (M = 1.87, SD = 0.58; M = 2.39, SD = 0.62, respectively), but emotionally negative stories were rated as easier to understand than neutral stories. The difference between these ratings was statistically significant [$F(1, 42) = 38.24$, $p < .01$]. Retention interval did not affect comprehensibility ratings.

Memory and awareness performance

Two datasets were analysed, as in experiment 1: one including all the answers and another including only the answers from stories previously unknown. The pattern of results from the two datasets was similar, with two exceptions. Therefore, the option was to report thoroughly the results obtained with the complete dataset and to report also the differing results from the dataset only including answers from previously unknown stories. The proportions were calculated using the same method as in experiment 1. The factor sex was not included in the analyses reported here because it did not lead to systematic differences in the results.

Overall recognition memory proportions and proportions of correct remember, know and guess responses were analysed separately using a mixed-design analysis of variance with emotional valence as a within-subject factor and retention interval as a between-subject factor. Mean correct proportions are displayed in table 3.

Table 3 about here

Forgetting occurred after a 7-day retention interval, as expected: correct responses were higher in the immediate than in the delayed interval [main effect of retention interval: $F(1, 42) = 20.94$, $p < .01$]. The accompanying awareness pattern supports our predictions – there were more correct remember responses in the immediate than in the delayed interval [main effect of retention interval: $F(1, 42) = 13.43$, $p < .01$] but correct know responses were not significantly affected by the retention interval ($F = 1.31$).

Emotionally negative news stories led to overall better memory than neutral stories, as expected, and supporting the hypothesis that emotional distinctiveness enhances memory [main effect of emotional valence: $F(1, 42) = 20.94$, $p < .01$]. After the retention interval memory decreased more for emotionally negative stories than for neutral stories, but the interaction effect between emotional valence and retention interval was not statistically significant. Correct remember responses were higher for emotionally negative stories than for neutral stories [main effect of emotional valence: $F(1, 42) = 87.70$, $p < .01$], which supports the hypothesis that emotional distinctiveness increases feelings of remembering. Correct know responses showed a different pattern in the complete dataset and in the dataset only including answers from previously unknown stories. In the complete dataset, correct know responses were not affected by emotional valence. In the incomplete dataset, correct know responses were significantly higher for emotionally negative stories than for neutral stories [negative stories: $M = 0.08$, $SD = 0.11$; neutral stories: $M = 0.06$, $SD = 0.08$; $F(1, 42) = 5.13$, $p = .03$]. The interaction between retention interval and emotional valence was not significant for both correct remember and know responses.

Simple comparisons between awareness categories showed that feelings of remembering predominated memory as correct remember responses were higher than both correct know responses [$t(43) = 8.08$, $p < .01$, two-tailed] and correct guesses [$t(43) = 4.95$, $p < .01$, two-tailed]; correct guess responses were significantly higher than correct know responses [$t(43) = -4.98$, $p < .01$, two-tailed].

Correct guess responses were higher for neutral stories than for emotionally negative stories [main effect of emotional valence: $F(1, 42) = 12.62$, $p < .01$]. There were more correct guesses in the delayed interval than in the immediate interval, which indicates forgetting, but the effect only reached statistical significance in the dataset including answers from unknown stories [immediate interval: $M = 0.15$, $SE = 0.02$; delayed interval: $M = 0.21$, $SE = 0.02$; $F(1, 42) = 5.88$, $p = .02$]. The interaction between retention interval and emotional valence was not significant.

Mean proportions of incorrect responses ranged from 0.03 to 0.09 for both remember and know responses and from 0.16 to 0.38 for guess responses (see table 4). Incorrect remembering was not affected by the variables. Incorrect know responses were only affected by emotional valence – there were more incorrect know responses for neutral stories than for emotionally negative stories [main effect of emotional valence: $F(1, 42) = 5.55$, $p = .02$]. Incorrect guess responses were higher for neutral stories than for emotionally negative stories [main effect of emotional valence: $F(1, 42) = 34.50$, $p < .01$] and they were higher in the delayed interval than in the immediate interval [main effect of retention interval: $F(1, 42) = 12.41$, $p < .01$].

Table 4 about here

Discussion

Memory was better for emotional news stories, which was reflected in higher remembering for emotionally negative news stories than for neutral news stories, supporting the view that emotional information not only enhances memory at both immediate and delayed testing but also that it promotes feelings of recollection. Memory for news stories suffered the effect of time, as significant forgetting occurred for both emotional valences. Interestingly, it was remembering that was mainly affected, as know responses and guessing did not change significantly over time. This finding replicates Gardiner and Java (1991, exp. 1)'s results with a more complex verbal material, as they used lists of words and our study used lists of news stories.

Feelings of familiarity/knowing towards the information were not affected by emotional valence when all the answers were analysed, a finding that replicates the results reported in the literature (e.g., Dewhurst & Parry, 2000; Ochsner, 2000) and the result obtained in experiment 1. When answers from stories reported to be previously unknown by the participants were analysed, correct know responses were higher for emotionally negative stories than for neutral stories. This result should be considered cautiously as the values of correct know responses were not very high.

As in study 1, guess responses mirrored the pattern found for remember responses – there was more correct guessing associated with neutral stories than associated with emotionally negative stories. When guesses are reported, they usually show an inverse relationship to remember responses (e.g., Gardiner, Java & Richardson-Klavehn, 1996) and, sometimes, to know responses too (e.g., Gardiner, Kaminska, et al., 1996, exp. 3). Therefore, having guess responses as a response option seemed to have removed guessing from know responses and prevented possible erroneous

conclusions about the relationship between remember and know awareness responses.

General Discussion

Three major points should be addressed here. The first concerns the influence of emotional information on awareness. We provide further evidence for the finding that feelings of recollection increase with emotion. This superiority of remembering was obtained after processing text, a finding that converges with results from studies using other processing materials (Dewhurst & Parry, 2000, exp. 1; Ochsner, 2000). It was also obtained at different time periods, showing that emotional information can lead to greater memory and greater feelings of recollection immediately, after a time period of days and still after repeated testing. Emotional information has been suggested to trigger more attention, more elaboration and more rehearsal than neutral information (e.g., Christianson, 1992b), which can explain its memory superiority not only when tested immediately but also over time. These dimensions have been argued to underlie the distinctiveness of processing associated with emotional information. Therefore, our results provide further evidence for the view that feelings of recollection are positively affected by distinctiveness of processing, as suggested by Rajaram (1996).

The second point concerns the effect of emotional information on know responses. The processing of emotional information did not systematically affect know responses, a result that converges with the results from other studies on awareness for emotional information (Dewhurst & Parry, 2000, exp. 1; Ochsner, 2000). However, in experiment 2, the analysis from the dataset only including answers from unknown stories found higher knowing for emotionally negative stories than for neutral stories. Ochsner (2000) also found that know responses were higher for emotionally positive and neutral

photos than for emotionally negative photos, this effect being significant in two out of three of the studies.

There are some results suggesting that the retrieval of emotional information can be affected by fluency of processing. For instance, Talmi and Moscovitch (2004) suggested that organisational processes at encoding contribute to the higher levels of memory for emotional information. They asked participants to encode lists of emotional words, lists of categorised neutral words equivalent in semantic relatedness and lists of neutral words with low semantic relatedness (exp. 1 and 2) and mixed lists of words containing words from all the conditions (exp. 3). They found that free recall was similar for emotional words and semantically related words, which was higher than memory for non-semantically related neutral words. The effect of organisation of the information at encoding (repetition of words from the same semantic category) has been found to increase feelings of familiarity/knowing and has been suggested to be due to the activation of the memory representation (Dewhurst & Anderson, 1999, exp. 2). Therefore, maybe the organisation induced by emotional information at encoding could lead to increased feelings of familiarity/knowing.

The third point concerns the increase in know responses due to repeated testing, which occurred for both emotional and neutral news stories. From a processing point of view, performing the same memory questionnaire a second time could induce fluency of processing, that is, the participant could process the information in the questions more fluently, he could assign this ease of processing to a past encounter with the information and assume that that piece of information had occurred in the news stories. Furthermore, from a memory systems' point of view, this enhancement can also suggest that some of the knowledge acquired from the stories could have been encoded in a semantic memory system. As know responses are theoretically considered

an indicator of awareness associated with information in a semantic memory system, factors that promote consolidation of the information in memory such as repeated testing could potentially affect positively these awareness responses. This idea was supported by Conway, Gardiner, Perfect, Anderson & Cohen (1997) in a study about knowledge acquisition by psychology undergraduates. Our result also suggests that schematisation of knowledge seems to be independent of the emotional valence of the information. Therefore, knowledge seems to be acquired/schematised both from emotional and neutral information, and memory superiority for emotional information occurs mainly due to deeper episodic encoding and accompanying remembering awareness.

Finally, one criticism for the distinctiveness-fluency framework is that the operational definition of distinctiveness of processing can be also justified as a definition of fluency of processing. For instance, Rajaram (1996) found that the same size and the same orientation of objects at study and at test led to higher recognition and to higher remembering, and suggested that this result showed that remembering was affected by perceptual distinctiveness. However, the same perceptual conditions at study and at test could be considered to reflect a more fluent processing rather than a more distinctive processing. This position is supported by Jolicoeur's (1987) finding that patterns with the same size at study and at test were not only more accurately recognised but their recognition times were also faster in comparison with recognition for visual shapes differing in size between study and test. According to this line of reasoning, remembering is affected by fluency of processing, either conceptual or perceptual. In any event, it is possible that these same processing conditions, somehow, provided the opportunity for further elaboration of the individual stimuli, but this possibility seems to be justified a posteriori, after the finding that remembering increased. Therefore,

the relationship between type of processing and recollective awareness experience does not seem to be unidimensional, that is, distinctiveness of processing could constitute the main type of processing associated with recollection feelings, but not the only one. Feelings of remembering could be affected by both distinctiveness and fluency of processing. Given that emotional information is not only distinctively processed but is also more fluently encoded, maybe emotional fluency allows emotional information to be available sooner for episodic encoding, which suggests that emotional fluency can indirectly foster feelings of remembering. Phylogenetically, the episodic memory system is suggested to have evolved out of the semantic memory system; ontogenetically, it also develops later than semantic memory (e.g., Tulving, 2002). Therefore, in terms of awareness associated with information in the two memory systems, it makes sense to suggest that know responses, an indicator of awareness of information in semantic memory, could be mainly affected by fluency of processing, while remember responses, an indicator of information in episodic memory, would depend not only on distinctiveness of processing but also on fluency of processing. There is evidence now supporting this claim, as we have shown, but it is not clear in which conditions fluency of processing would affect which type of awareness experience.

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Table 1

Means proportions of correct responses as a function of time of testing and emotional valence (with standard deviations in parentheses)

	Immediate		Delayed	
	Negative	Neutral	Negative	Neutral
Remember	.56 (.19)	.32 (.12)	.52 (.22)	.27 (.15)
Know	.11 (.11)	.12 (.11)	.16 (.15)	.17 (.16)
Guess	.10 (.08)	.15 (.10)	.09 (.07)	.16 (.11)
Overall	.77 (.16)	.59 (.11)	.77 (.15)	.60 (.11)

Table 2

Means proportions of incorrect responses as a function of time of testing and emotional valence (with standard deviations in parentheses)

	Immediate		Delayed	
	Negative	Neutral	Negative	Neutral
Remember	.06 (.06)	.07 (.06)	.07 (.08)	.06 (.07)
Know	.05 (.09)	.07 (.10)	.05 (.07)	.09 (.09)
Guess	.12 (.09)	.27 (.11)	.10 (.08)	.25 (.11)
Overall	.23 (.16)	.41 (.11)	.23 (.15)	.40 (.11)

Table 3

Means proportions of correct responses as a function of retention interval and emotional valence (with standard deviations in parentheses)

	Immediate		Delayed	
	Negative	Neutral	Negative	Neutral
Remember	.51 (.20)	.31 (.18)	.35 (.16)	.15 (.09)
Know	.11 (.13)	.08 (.10)	.06 (.08)	.07 (.06)
Guess	.13 (.07)	.17 (.11)	.15 (.09)	.24 (.11)
Overall	.75 (.13)	.56 (.14)	.57 (.13)	.45 (.10)

Table 4

Means proportions of incorrect responses as a function of retention interval and emotional valence (with standard deviations in parentheses)

	Immediate		Delayed	
	Negative	Neutral	Negative	Neutral
Remember	.06 (.06)	.09 (.06)	.09 (.07)	.09 (.09)
Know	.03 (.04)	.05 (.07)	.05 (.08)	.07 (.08)
Guess	.16 (.12)	.29 (.12)	.29 (.13)	.38 (.10)
Recognition	.25 (.14)	.43 (.14)	.43 (.13)	.54 (.09)

Chapter 3 Encoding effects on awareness in memory for emotional news stories

Running head: Encoding and emotion on awareness in memory

Encoding effects on awareness in memory for emotional news stories

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Abstract

Two studies investigated the effects of depth of encoding and levels of attention at encoding on awareness in memory for emotional news stories. The prediction that both remember and know responses would be undermined under impoverished encoding due to disruption in elaboration and relational processes, respectively, was not confirmed. Remembering was undermined by shallow encoding and divided attention, while know responses were not affected, which replicates previous findings and extends them to text materials. Encoding did not interact with emotional valence. The prediction that emotional distinctiveness would increase remember responses was confirmed. An explanation integrating processing and systems views is proposed.

Encoding effects on awareness in memory for emotional news stories

The main goal of the studies reported in this article was to explore the effects of emotional information on awareness in memory. Consciousness in memory is a fairly young area of research in cognitive psychology – more systematic research has only taken place in the last 20 years, after Tulving (1985) defended the idea that subjective states of awareness in memory are indicators of different kinds of consciousness. He defined two kinds of consciousness associated with information in episodic memory and in semantic memory. They were, respectively, the feeling that the information in mind has been personally experienced in the past and that it can be recollected vividly, and the feelings that the information experienced is familiar or known to the subject in the absence of specific recollection. The former has been measured via 'remember' responses while the latter has been measured via 'know' responses (e.g., Gardiner, 1988).

The dual-memory systems view is supported by the pattern of dissociations between these two types of awareness responses found in experimental and neuropsychological studies: some variables affect one response but not, or to a lesser extent, the other response, and some other variables have opposite effects on the two responses (for a review, see Gardiner & Richardson-Klavehn, 2000). In terms of the processing underlying remember and know responses, the first approach proposed that remembering depended mainly on conceptual processing (e.g., Gardiner, 1988; Gardiner & Parkin, 1990), whereas feelings of familiarity/knowing depended mainly on perceptual processing (e.g., Gregg & Gardiner, 1994; Rajaram, 1993). To accommodate evidence suggesting that perceptual processing can increase remember responses (e.g., Rajaram, 1996, 1998) and conceptual processing can increase know responses (e.g., Dewhurst & Anderson, 1999, exp. 2; Rajaram & Geraci, 2000), the current approach is that remember responses are positively affected by distinctiveness

of processing, either conceptual or perceptual, while know responses reflect fluency of conceptual or perceptual processing (e.g., Rajaram, 1996).

Distinctiveness of processing has been consistently found to increase feelings of recollection (e.g., Dewhurst & Parry, 2000; Gardiner, 1988). However, it has proved more difficult to find greater feelings of familiarity/knowing after fluent processing (Dewhurst, 2001, July, exp. 1). Furthermore, it can be argued that remembering is influenced by distinctiveness and fluency of processing whereas familiarity/knowing is maybe only influenced by fluency of processing (see chapters 1 and 2, this thesis). For instance, the launching studies for the distinctiveness-fluency approach found that remembering increased with conceptual and perceptual distinctiveness: dominant meanings of homographic words (vs. non-dominant meanings) were considered to be more salient and to trigger distinctive conceptual processing (Rajaram, 1998, exp. 1), and the same size and same orientation of objects at study and test (vs. different size and orientation at study and test) were considered to trigger perceptual distinctive processing (Rajaram, 1996). However, dominant meaning of words are, among other characteristics, more easily accessed and activated than non-dominant meanings (as justified by Rajaram, 1996) and the same perceptual conditions at study and at test lead to faster processing (Jolicoeur, 1987). Ease of access, ease of activation and faster processing characterise fluency of processing (e.g., Jacoby, Kelley & Dywan, 1989), which implies that feelings of remembering can also increase after fluent processing of the information. This suggestion is in line with Tulving' s (1995) proposal that encoding in the memory systems is serial, particularly from the semantic system to the episodic system. Considering that information is first encoded semantically, if no further encoding is pursued, the semantic representations of the information will mainly give rise to feelings of familiarity/knowing at retrieval. If information is further episodically encoded, then feelings of recollection will rise in memory awareness. Furthermore, information more fluently processed may be available sooner for

distinctive processing, which implies that fluency of processing could indirectly foster feelings of remembering.

Turning now to the processing of emotional information, it is widely accepted that emotional information is more distinctive than neutral information as it triggers, via specific neural and hormonal mechanisms, the use of cognitive resources such as increased attention, increased rehearsal and increased elaboration (e.g., Hamann, 2001; Ochsner, 2000). Emotional information also seems to be processed at a pre-attentive stage, in a rather automatic way (Christianson, 1992b), which suggests that emotional stimuli, and especially negative stimuli, are processed more fluently than neutral stimuli at the encoding stage. Both distinctive and fluent processing characteristics can explain the superior memory found for emotional information rather than neutral information in many situations (Christianson, 1992b; Heuer & Reisberg, 1992).

Applying the distinctiveness-fluency hypothesis to the influence of emotional information on awareness in memory, one could expect that feelings of recollection would increase with the processing of the distinctive features of emotional stimuli (Ochsner, 2000). Feelings of familiarity/knowing arise from the retrieval context. Not much is known about the retrieval of emotional information, but the published studies have not found that emotional information is more fluently retrieved. Studies of awareness in memory for emotional information are sparse (Dewhurst & Parry, 2000; Ochsner, 2000; Pesta, Murphy & Sanders, 2001; chapter 2, this thesis), but the overall findings are consistent – in lists containing emotional and neutral stimuli, emotional information increases feelings of remembering, while either not affecting feelings of familiarity/knowing significantly or leading to more frequent feelings of familiarity/knowing for neutral or positive items (Dewhurst & Parry, 2000, exp. 1, for lists of words; Ochsner, 2000, with lists of photos; chapter 2, this thesis, for lists of news stories). For instance, Ochsner (2000) found that know responses were higher

for emotionally positive and neutral photos than for emotionally negative photos, but this effect only reached significance in two out of three studies. This finding goes against the prediction that know responses would be affected mainly by emotionally negative stimuli, which are supposedly more fluently processed at retrieval than emotionally positive and neutral stimuli. However, this author did not include guessing as an alternative response option to remember and know responses. Including a guess option could remove possible guessing from know responses (e.g., Gardiner, Java & Richardson-Klavehn, 1996). It would also allow a check on whether there was an inverse relationship between feelings of remembering and feelings of familiarity/knowing, as suggested by some of Ochsner (2000) findings, or between guess responses and remember responses. Guess responses have been reported to show an inverse relationship to remember responses (e.g., Gardiner, Java & Richardson-Klavehn, 1996) and, sometimes, to know responses too (e.g., Gardiner, Kaminska, et al., 1996, exp. 3). In our studies, a guess option was included to prevent the possible situations just mentioned.

The studies reported here had also a more specific goal – to examine how resource-restraining manipulations can affect awareness in memory for emotional complex verbal stimuli, particularly, for emotional news stories. Variables such as level or depth of processing and divided attention have been shown to impair overall memory performance and feelings of remembering but not to affect feelings of familiarity/knowing significantly (Gardiner & Parkin, 1990; Parkin, Gardiner & Rosser, 1995). The conceptual processing induced by the deep level of encoding in level of processing (LOP) studies or by the full attention condition in full attention versus divided attention studies can be claimed to be more distinctive as it is item-based or item-specific rather than inducing the processing of inter-items relationships (McDaniel, Einstein & Lollis, 1988). Item-specific processing has been facilitated because most materials used so far have been lists of rather simple items (e.g., lists of words)

accompanied by instructions to process each item individually (e.g., read each item, associate a meaning with each item, count the vowels in each word; e.g., Gardiner, 1988). When the instructions concern the relationships between items, relational or organisational processing is required, which seems to promote more fluent processing and to lead to an increase in feelings of familiarity/knowing (Dewhurst & Anderson, 1999, exp. 2). Fluency in conceptual processing has not been often addressed by the studies using divided attention or level of processing manipulations. One exception is a study by Craik and Kester (2000, exp. 4) who found that divided attention at encoding impaired both the level of elaboration and the organisation of the information processed. Text processing involves both distinctive and relational processing (Einstein, McDaniel, Owen & Coté, 1990), which makes it plausible that memory and awareness for text under impoverished processing conditions could show a different pattern than the one found for list of items.

Experiment 1

In the remember-know approach, LOP manipulations were initially used to study the conceptual or perceptual basis of awareness responses and the dissociation between feelings of recollection and feelings of familiarity/knowing (e.g., Gardiner, 1988; Gardiner, Java & Richardson-Klavehn, 1996, exps. 1 and 2). LOP effects have been explained to be due to transfer appropriate processing, which consists in the notion that the retrieval conditions recapitulate or reinstate the encoding conditions, and it is that overlapping of processing that produces better memory (e.g., Hamann, 1990; Morris, Bransford & Franks, 1977). Therefore, if manipulations that enhanced conceptual processing led to an increase in remembering, then remembering would be sensitive to conceptual processing. The same reasoning applied to the relationship between perceptual processing variables and feelings of familiarity/knowing.

LOP effects have been observed in remembering but they have been small or non-existent for familiarity/knowing (e.g., Gardiner, 1988; Gardiner, Java & Richardson-

Klavehn, 1996; Gregg & Gardiner, 1994; Java, Gregg & Gardiner, 1997, exp. 2). A reversed LOP effect (higher performance for the shallow encoding condition) has also been reported for know responses (e.g., Perfect, Williams & Anderton-Brown, 1995; Rajaram, 1993, exp. 1). However, it has been attributed to either the type of experimental design and to the use of uncorrected recognition scores (Gregg & Gardiner, 1994, explaining Rajaram' s, 1993, exp. 1, reversed LOP effect in know responses) or to not measuring guess responses, which, rather than know responses, have been found to show a reverse LOP effect (Gardiner, Java & Richardson-Klavehn, 1996).

One of the goals of the current study was to check whether different processing instructions for text lead to a depth of processing (DOP) effect and to a dissociation in remember and know responses, as it was found for other types of material. When more than one level of a more semantic or a more perceptual type of encoding is used, as it is often the case with text, the authors seem to prefer the expression 'depth of processing' (DOP) instead of 'level of processing' (e.g., Schallert, 1976). There are not many studies that use a depth of processing manipulation with text materials (Schallert, 1976; Velichkovsky, 1999). Schallert (1976) used two levels of semantic processing (to learn the text and to rate the level of ambiguity of the text) and two levels of shallow processing (counting 4-letter words and counting pronouns). After reading the texts according to the different encoding instructions, participants performed a free recall test, followed by a multiple-choice recognition test. There was significantly less recall and lower recognition in the shallower encoding tasks than in the deeper ones. There were no significant differences either between the two semantic tasks or between the two shallow encoding tasks, both for recall and for recognition measures. In Velichkovsky' s (1999) study, short texts (biographical sketches) were processed according to three encoding instructions: counting all the words, counting the adjectives, or counting the adjectives that had a self-referential value for the participant. A DOP effect was observed in the number of words reported in a free recall test.

In line with these results, we also expect to obtain a DOP effect in memory for news stories, regardless of their emotional valence. Our main prediction regarding overall memory awareness is that both remember and know responses will show a depth of processing effect. As text processing has been suggested to involve both distinctive and relational processing (Einstein, McDaniel, Owen & Coté, 1990), a situation that disrupts semantic text processing will likely undermine both these processes. Consequently, it will undermine memory and both remember and know responses, because feelings of remembering have been suggested to reflect distinctiveness of processing and feelings of familiarity/knowing have been suggested to be fostered by fluency of processing (e.g., Rajaram, 1996, 1998) and by relational or organisational processing (Dewhurst & Anderson, 1999, exp. 2). In a normal reading condition, these processes are restored and should give rise to feelings of remembering and familiarity/knowing towards the information retrieved. However, if previous literature results are replicated, remembering will be undermined while familiarity/knowing will not be significantly affected by depth of encoding, and our prediction will not be confirmed.

The second research goal concerns the effect of emotional information on memory and awareness. Emotional information, particularly emotionally negative information, has been suggested to elicit distinctiveness of processing (Dewhurst & Parry, 2000; Ochsner, 2000; chapter 2, this thesis). Consequently, overall memory should be enhanced for emotional stories. The distinctiveness of processing emotional information should also lead to more feelings of recollection; feelings of familiarity/knowing should not be affected by the emotional valence of the news stories, replicating previous findings (Dewhurst & Parry, 2000; Ochsner, 2000; chapter 2, this thesis).

Method

Participants

Forty-four City University students participated in this study: 34 women and 10 men. Their mean age was $M = 20{,}70$, $SD = 3.87$. The participation in this study was rewarded either with course credits or with a monetary payment. Two participants were excluded from the shallow encoding condition and were replaced because they did not comply with the instructions.

Materials

Six news stories from a British broadsheet daily newspaper were used (see appendices 1 and 2). The stories were selected from broader sets that had been previously rated by independent judges in terms of knowledge levels ('yes', 'no', 'don't know' as response options), emotionality levels (5-point scale from 'very negative' to 'very positive') and comprehensibility (5-point scale from 'very easy to comprehend' to 'very difficult to comprehend'). The stories used here obtained ratings of low previous knowledge levels (unknown to 75% of the judges), of negative and neutral emotionality levels (mean ratings below 2 for negative stories and ratings above 2 and below 4 for neutral stories) and easy comprehensibility (mean ratings below 2).

The study material consisted of one booklet containing the six news stories (3 emotionally negative and 3 emotionally neutral stories), one in each page. The stories were cut from the newspaper and photocopied into a white A4 piece of paper. Each story occurred once in each sequence position and there were no more than two emotionally negative or two neutral stories in sequence (see appendix 3). For the shallow encoding condition there was a form to report the number of people counted for each story (see appendix 5). The test material consisted of two booklets. The first one began with instructions about how to perform the recognition memory and awareness task, which were followed by a training task about the different awareness

responses (see appendix 7). The second booklet consisted mainly of the recognition memory questionnaire (see appendix 8). It was a four-choice questionnaire with 48 questions in total. Each question and its awareness choices (remember, know and guess) came in a separate page. By the end of this questionnaire there were questions about age, sex and about the frequency of news consumption and which specific media were used. The data collected with these latter questions are not analysed in this article.

Design and Procedure

This was a 2 x 2 mixed factorial design with depth of encoding (shallow vs. deep) as a between-subject factor and emotional valence of the news stories (negative vs. neutral) as a within-subject factor. Each encoding condition had 22 participants. Participants were tested individually or in small groups (2 to 4 people). First, the participants were told that they were going to participate in a study about the way people process mass media information. In both groups, participants were also informed that they would answer some questions about the stories later, but the nature of the questions was not specified. They also were asked to sign a consent form (see appendix 4). The sequence of the news stories was changed for each participant in order to counterbalance possible sequence effects (see appendix 3). In the deep encoding condition, participants were asked to read the news stories carefully and attentively and they were told they could take the time they needed (see appendix 5). In the shallow encoding condition, they were asked to skim each story in order to count the number of people mentioned in it and write it down in a form (see appendix 5). In order to prevent reading instead of skimming the text, participants were also asked to read each story as fast as they could and they were informed that their reading times were going to be measured. After the study phase, they answered a question about whether they have read or heard about each news story before with the following response options: yes, no, don't know (see appendix 6). Afterwards, they answered

the recognition memory test. By the end, participants were thanked and given an oral and a written debriefing.

Results

Memory performance and awareness responses were analysed from two datasets: one including all the answers provided by the participants and another including only the answers from the stories reported to be unknown by the participants. Because these two datasets led to converging patterns of results for remember and know responses, only the results from the complete dataset will be reported. For guess responses, when the results from the two datasets differ, both will be presented. For each participant, proportions of correct remember, correct know and correct guess responses were calculated dividing the total number of correct remember, know or guess responses given by the participant by the maximum possible number of correct responses (N = 24 for both emotionally negative and neutral stories). Mean proportions obtained (see table 1) were analysed using a mixed-design analysis of variance with emotional valence of the news stories (negative vs. neutral) as a within-subject factor and depth of encoding (shallow vs. deep) as a between-subject factor. Mean proportions were also compared across awareness categories using simple comparisons, a procedure used by Herbert & Burt (2001, 2003, 2004). As awareness categories are mutually exclusive in our methodology, comparing them via an analysis of variance including type of awareness responses as a factor would violate the assumption of independence.

Table 1 about here

The encoding manipulation led to the expected DOP effect [$F(1, 42)= 160.37$, $p < .01$] – overall, there were more correct answers in the deep encoding condition than in the shallow encoding condition. However, our prediction that both feelings of

remembering and feelings of familiarity/knowing would be impaired under shallow encoding due to the disruption of distinctive and relational processing, respectively, was not confirmed. The pattern obtained replicates the one reported in the literature for other types of material. Only correct remember responses were negatively affected by shallow encoding [main effect of depth of encoding: $F(1, 42) = 66.86$, $p < .01$]. Correct know responses were higher in the deep condition than in the shallow condition but the difference was not statistically significant.

Contrary to what had been predicted, there was no overall memory superiority for negative stories ($F < 1$). Correct remember responses were higher for emotionally negative stories than for neutral stories, but the difference was not statistically significant, which does not support our prediction that emotional distinctiveness would increase feelings of remembering. As expected, correct know responses were not affected by the emotional valence of the stories ($F < 1$). None of the interactions were significant.

Overall, correct remember responses predominated awareness as they were significantly higher than both correct know responses [$t(43) = 6.01$, two-tailed, $p < .01$] and correct guess responses [$t(43) = 6.08$, two-tailed, $p < .01$]. Correct know responses and correct guess responses showed similar values ($t < 1$).

Correct guess responses showed a significant DOP effect [$F(1, 42) = 5.57$, $p = .02$, but this effect was not obtained in the dataset only including answers from stories reported to be unknown by each participant], suggesting that the texts were less semantically processed in the shallow condition than in the deep encoding condition and providing further evidence that the encoding manipulation worked. Correct guesses were higher for neutral than for emotionally negative stories [main effect of emotional valence: $F(1, 42) = 4.36$, $p = .04$, but this effect was not obtained in the dataset only including answers from stories reported to be unknown by each participant]. Mean proportions of incorrect answers ranged from 0.03 to 0.11 for both remember and know responses and from 0.10 to 0.34 for guesses (see table 2).

Incorrect mean proportions were significantly higher in the shallow encoding task than in the deep encoding task for all the awareness categories [remember responses: $F(1, 42) = 7.73$, $p < .01$; know responses: $F(1, 42) = 9.79$, $p < .01$; guess responses: $F(1, 42) = 82.85$, $p < .01$]. They were not significantly affected by the emotional valence of the study material.

Table 2 about here

Discussion

Reading news stories in impoverished encoding conditions such as the ones used in this study did replicate the depth of encoding effect reported in the literature for text processing (Schallert, 1976; Velichkovsky, 1999). This DOP effect was only reflected in feelings of remembering, a finding that did not confirm our prediction that both feelings of remembering and feelings of familiarity/knowing would be affected negatively by shallow encoding. Shallow encoding was argued to disrupt elaborative and relational processing of text and, consequently, to undermine respectively feelings of remembering and feelings of familiarity/knowing. Instead, our results replicated previous findings reporting LOP effects for feelings of remembering but not for feelings of familiarity/knowing, extending the pattern of awareness found under depth of processing manipulations to text materials (e.g., Gardiner, 1988; Gardiner, Java & Richardson-Klavehn, 1996; Gregg & Gardiner, 1994; Java, Gregg & Gardiner, 1997, exp. 2). This is a significant finding – as text involves both elaboration and organization of information, this result contributes to the mapping of what processing conditions involving fluency or relational processing may or not affect feelings of familiarity. It also suggests that the fluency brought by relational processing of text is not reflected in feelings of familiarity/knowing.

Oschner (2000) predicted that emotional stimuli would be more fluently retrieved than neutral stimuli and that they would show higher levels of feelings of

familiarity/knowing than neutral stimuli. However, this has not been found previously (Dewhurst & Parry, 2000; Oschner, 2000; chapter 2, this thesis) and it was not found in this study.

Emotional valence of the news stories did not lead to a significant memory enhancement and to a higher remembering level, contrary to what had been predicted. The mean proportions difference went in the expected direction though. From a theoretical point of view, this difference contributes to the view that emotional information does not lead to memory superiority, at least after very short retention intervals, due to emotional arousal interference (e.g., Heuer & Reisberg, 1992). However, this is an area of mixed results. From a methodological point of view, several reasons could account for this lack of an emotional valence effect. One concerns the materials – emotionally negative news stories could have been not negative enough. Alternatively, neutral stories could have been felt as positive stories, due to participants' interest or enjoyment of the stories, which could have made the stories quite distinctive. We did not ask participants to rate the news stories with affective scales, as we did in the second study reported in this article, because we did not want the rating instructions to interfere with the shallow encoding task. It was quite likely that if participants knew they had to rate each story after skimming it, they would process the story with a rating processing goal, which is a more semantic task than skimming the stories fast. Nonetheless, most of these stories have been used in other studies not reported here and emotional valence effects have always been found. Another possible reason concerns the instructions given in the deep encoding condition. In order to stress the processing difference between the two encoding conditions, in the deep condition participants were asked to read the stories attentively and carefully. Normally, in the other studies we have been running, participants are asked to read the stories normally, just to understand them. The next study is another attempt to investigate the effects of impoverished encoding conditions on memory awareness for emotional information. It uses two different lists of news stories, which

constitutes a better controlling of the study material. We also asked the participants to assess the news stories, allowing for the detection of any incongruity between our classification and participants ratings.

Experiment 2

The main goal of the current study was to investigate whether or not another resource-constraining manipulation – divided attention – undermined memory and feelings of recollection for text and whether or not this effect was independent of the emotional valence of the information. In terms of awareness in memory, according to the distinctiveness-fluency hypothesis, elaboration has been suggested to induce awareness feelings of recollection and relational processing has been suggested to induce awareness feelings of familiarity/knowing (Rajaram, 1996). Divided attention at encoding was suggested by Craik and Kester (2000, exp. 4) to impair both level of elaboration and organisation of the information processed. They measured both elaboration and organisation of the retrieved information after participants had generated mental images to words that had an underlying categorical organisation and found lower levels of both elaboration and organisation under divided attention than under full attention encoding conditions. Therefore, if both these processes could be impaired under divided attention encoding, then both remember and know responses could also decrease under divided attention. Nonetheless, similarly to what has been found with LOP manipulations, divided attention studies have shown that only overall memory and feelings of remembering are impaired under conditions of divided attention; know responses are not affected by the amount of attentional resources available (e.g., Gardiner & Parkin, 1990, with lists of words; Parkin et al., 1995, with lists of faces).

In line with this pattern of evidence, we also predicted enhanced memory performance for information from news stories read under full attention than from news stories read under divided attention. In terms of the effect of divided attention on

awareness in memory, two opposite predictions are made. The first prediction is that, if remember and know responses reflect awareness induced by elaborative and organizational processes, respectively, then both these responses would be undermined by divided attention at encoding. To test this prediction, we included a divided attention condition in which the participant had to read bits of text alternated with figures to be added mentally. This task was performed at the participants' s own pace.

Another prediction is based on Tulving' s (1995) view that the encoding in memory systems is serial: information is first encoded in a semantic system and, if elaboration can take place, the information is also encoded episodically. Therefore, we can predict that feelings of familiarity would increase with a situation that allows some semantic encoding but that prevents further elaborative encoding of the information. We also base this prediction on two studies that suggest than when elaboration is prevented, some effects would be visible in know responses rather than in remember responses. One is Gardiner, Gregg, Mashru and Thaman' s (2001) study, which replicated Rajaram' s (1996) finding that size congruency of pictures enhanced remembering under satisfactory processing conditions such as full attention or semantic processing. Under impoverished encoding conditions such as divided attention and shallow level of processing, this effect was no longer observable in remembering but it was significantly visible in know responses.

The second study informing our predictions was Gardiner, Gawlik and Richardson-Klavehn's (1994), which investigated the effects of elaborative rehearsal and maintenance rehearsal in awareness in memory for words using the directed-forgetting paradigm. Participants were asked to study a list of words, and each word was followed by a cue indicating whether the word was to be learnt or to be forgotten. Until the cue appeared, participants were supposedly engaged in non-associative rehearsal whose aim was to keep the word in short-term memory until further information was given. The authors manipulated the cue preceding each word (to be

learnt vs. to be forgotten) and the delay between the presentation of the word and the presentation of the cue (0 seconds vs. 5 seconds). Elaborative rehearsal, which involves elaboration and associative processing, was induced by the cue to learn the word and by a short delay between word and cue; maintenance rehearsal was induced by cue delay, as it augments the time dedicated to maintenance rehearsal. As predicted, the authors found that remember responses increased for the cue to learn and for short delays between word and cue and that know responses increased with a long cue delay, regardless of the type of cue. In our study, to test the prediction that text processing under divided attention conditions that intend to promote maintenance rehearsal lead to increased familiarity/knowing towards the information, we included another divided attention condition. In this condition, the length of time the figures were displayed was long and could not be controlled by the participants, increasing the chance of promoting maintenance rehearsal. The comparison between the patterns of results from the two divided attention conditions will allow circumscribing the conditions that could or not affect feelings of familiarity/knowing. The inclusion of two divided attention conditions for reading text, a study material not often used with divided attention manipulations, also provided a tighter control of the encoding resources than just having a full attention and a divided attention condition.

In study 1, contrary to our predictions, emotional material did not enhance memory and did not lead to a differential pattern in awareness responses. However, this is not what we have found in a previous study (see chapter 2, this thesis). In the current study, the emotional valence of the news stories was better controlled, as we used two different lists of news stories and participants also provided affective ratings for each story. We expected to replicate previous results (Ochsner, 2000; chapter 2, this thesis), that is, we expected to observe higher memory for emotional stories, which should be reflected in remember responses, rather than know responses. This pattern has been explained by the distinctiveness of processing emotional information (e.g.,

Schmidt, 1991), as feelings of recollection seem to depend on distinctiveness of processing (e.g., Rajaram, 1996).

Method

Participants

Forty-eight university students (21 women and 27 men) participated in this experiment, receiving course credits or a monetary payment for their participation. Their mean age was M = 20,40, SD = 3.61.

Materials

The study material consisted of twelve news stories taken from a British broadsheet daily newspaper – 6 emotionally negative stories and 6 neutral stories (see appendices 1 and 2). The stories were selected from broader sets that had been previously rated by independent judges in terms of knowledge levels ('yes', 'no', 'don't know' as response options), emotionality levels (5-point scale from 'very negative' to 'very positive') and comprehensibility (5-point scale from 'very easy to comprehend' to 'very difficult to comprehend'). The stories used in this experiment obtained ratings of low previous knowledge levels (unknown to 70% of the judges in all cases but one, which was unknown to 62% of the judges), of negative and neutral emotionality levels (ratings below 2 for negative stories and ratings above 2 and below 4 for neutral stories) and easy comprehensibility (ratings below 2).

The stories were distributed in two study lists (A and B) comprising 3 emotionally negative and 3 neutral stories (see appendix 2). Half of the participants were presented with list A and the other half with list B. Each story occurred once in each sequence position and there were no more than two emotional or two neutral stories in sequence (see appendix 3).

The way stories were presented differed across conditions. For the full attention condition, the stories were organised in a booklet containing one story per page. The stories had been cut from the newspaper and photocopied into a white A4 piece of paper. For the participant-controlled divided attention condition (PCDA), each story was contained in a booklet, whose first page contained the headline of the story. The other pages contained bits of 3 lines of text, respecting the sequence of the original text, alternated with random figures between 1 and 10. This procedure aimed at preventing participants to read more than 3 lines of text at a time and integrating that information with previous information. Presenting people with the whole story and asking them to stop reading at specific points to process the numbers could have raised doubts concerning the validity of the divided attention manipulation. This same arrangement of text and figures was used in the experimenter-controlled divided attention condition (ECDA), but the presentation was done via a computer screen and keyboard. When the screen was showing text, participants should press the space bar of the keyboard to advance to the next screen, which was a figure. The figure stayed in the screen for 5 seconds, the same length of time used in the long delay condition by Gardiner et al. (1994). It advanced automatically to the next screen, which contained the next bit of text. To allow for individual reading speed, each participant controlled the amount of time the bits of text were displayed in the computer screen. In both DA conditions there was a sheet to report the results of the mental calculations performed with the figures for each news story (see appendix 5).

In all conditions there was another booklet in the study phase. It included assessment scales for each story (see appendix 6). The stories were rated for emotional valence in the dimensions happy-sad, distressing-pleasant and amusing-serious, and for reported arousal using the dimensions boring-interesting, exciting-calming and simple-complex. They were also rated for difficulty of understanding. All these dimensions were rated in 5-point scales. Participants also reported whether they

had read or heard about each news story before (response options: yes, no, don't know).

The test material consisted of two booklets. The first one contained instructions about how to perform the recognition memory task – how to answer the memory four-choice questionnaire and how to report the awareness states (see appendix 7). It was followed by a training task about the different awareness responses (see appendix 7). The second booklet was the recognition memory questionnaire (see appendix 8), with each question and its awareness choices in a separate page. By the end of this questionnaire there were questions about age, sex and about the frequency of news consumption and which specific media were used. The data collected with these latter questions is not analysed in this article.

Design and Procedure

This was a 3 x 2 x 2 mixed-factorial design with level of attention at encoding (full attention, participant-controlled divided attention and experimenter-controlled divided attention) and story list (list A vs. list B) as between-subject factors and emotional valence of the news stories (negative valence vs. neutral valence) as a within-subject factor. Each attention condition had 16 participants.

Participants were tested individually. In all conditions participants were told they were going to participate in a study about the way people think about news stories, that they were going to read some stories and answer some questions about them, but the nature of the questions was not specified (see appendix 5). Participants also signed a consent form to participate in the study (see appendix 4).

For each experimental condition, and in both lists, the sequence of the news stories was changed for each subject in order to counterbalance possible sequence effects (see appendix 3). In each attention condition, half of the participants studied list A of news stories, while the other half studied list B. In the full attention condition, participants were asked to read one list carefully and attentively (see appendix 5). In

the PCDA, participants were asked to read the stories while performing mental arithmetic (see appendix 5). They read 3 lines of text, then saw a number that they should keep in mind, then read the next 3 lines of the story, then saw another number that should be added to the previous one and kept in mind, and so on until the end of the text. The final result of the mental arithmetic had to be reported in a sheet after finishing reading each story. After the study phase, the stories were rated as in the full attention condition. In the ECDA, the study phase used the same materials as in the PCDA condition, but they were presented in a computer screen. Participants were told that the news stories would be presented as bits of text alternated with numbers – a bit of text on one screen, followed by a number on the next screen, then a bit of text on another screen, then another screen with a number and so on. Participants were asked to read the text and to add mentally all the numbers consecutively and they were explained how they should proceed with the computer presentation (see written instructions in appendix 5). There was a training period with the presentation procedure using two short texts. All the participants reported to be comfortable with the procedure. After this training, the study phase began.

In all attention conditions, after reading each story, participants were asked to rate them in dimension pertaining to emotionality, comprehensibility and previous knowledge. Next, participants were explained how to answer the recognition memory task, followed by a training task regarding the use of the awareness responses and, finally, by the recognition memory task. After they finished, they were asked to justify some of the awareness responses given and were provided with an oral and written debriefing.

Results

Assessment of the news stories

The news stories used in the analysis were mostly unknown to the participants. Mean proportions for answering that the stories were unknown were $M = .88$ ($SD = 0.22$) for emotionally negative stories and $M = .94$ ($SD = 0.16$) for neutral stories. A mixed-design analysis of variance with emotional valence as a within-subject factor and level of attention and list of stories as between-subjects factors did not produce any significant effects.

Overall, emotionally negative news stories were considered very sad, very or quite distressing, very serious, whereas neutral news stories were seen as neither happy nor sad, as neither distressing nor pleasant, and as neither amusing nor serious. Emotionally negative stories were rated as slightly more interesting, slightly more exciting and slightly simpler than neutral stories. Both emotionally negative and neutral stories were considered easy to comprehend.

Similar repeated measures analyses were run for each affective rating scale (see table 3 for descriptive statistics). For the rating scales 'happy-sad', 'distressing-pleasant' and 'amusing-serious', which were theoretically related to the emotional valence of the stories, the observed differences between emotionally negative and neutral news stories were statistically significant [happy-sad: $F(1, 42) = 433.14$, $p < .01$; distressing-pleasant: $F(1, 42) = 283.94$, $p < .01$; amusing-serious: $F(1, 42) = 265.77$, $p < .01$]. There were no significant differences in the ratings as a function of list of stories and level of attention. The only significant interaction occurred between emotional valence and list of stories for the happy-sad scale [$F(1, 42) = 4.84$, $p = .03$], indicating that the differences in ratings between emotional and neutral stories was higher in list B than in list A. For the rating scales 'boring-interesting', 'exciting-calming' and 'simple-complex', theoretically related to the reported arousal associated with the news stories, the mean ratings were apparently close between emotional and neutral stories but the

differences were statistically significant: [boring-interesting: $F(1, 42) = 15.44$, $p < .01$; exciting-calming: $F(1, 42) = 6.40$, $p = .02$; simple-complex: $F(1, 42) = 6.09$, $p = .02$]. There were no significant differences in the ratings as a function of list of stories and level of attention. The only significant interaction was the one between emotional valence and list of stories for the 'boring-interesting' scale [$F(1, 42) = 7.49$, $p < .01$], indicating that the differences in ratings between emotional and neutral stories were higher in list A than in list B. Regarding the comprehensibility scale, no significant effects were found.

Table 3 about here

Memory and awareness

The memory and awareness data were initially analysed from two datasets: one including all the answers provided by the participants and the other including only the answers from the stories reported to be unknown by the participants. As a similar pattern of results was obtained from the analysis of these datasets, only the results from the complete dataset are reported in this article. The procedure for analysing the data followed the one described for experiment 1. Mean proportions of correct remember, know or guess responses (see table 4) were calculated for each condition by dividing the total number of correct remember, know or guess responses by the maximum possible number of correct responses in that condition (N = 24). Mean proportions were analysed using a mixed-design analysis of variance with emotional valence of the stories as a within-subject factor and with level of attention and story list as between-subject factors. Mean proportions were also compared across awareness categories using simple comparisons, as in experiment 1.

Table 4 about here

Our prediction that a DOP effect would be obtained with text was confirmed – full attention at encoding enhanced overall memory significantly in relation to both divided attention conditions [main effect of level of attention: $F(2, 42) = 8.39$, $p < .01$; significant pairwise comparisons between full attention and participant-controlled divided attention, $p = .02$, and between full attention and experimenter-controlled attention, $p < .01$, no significant difference between the two divided attention conditions]. However, the awareness pattern did not confirm our prediction that both distinctive and relational processes would be undermined under divided attention and would lead, respectively, to a decrease in remember responses and in know responses. Only correct remember responses decreased equally under both divided attention conditions [main effect of level of attention: $F(2, 42) = 9.02$, $p < .01$; significant pairwise comparisons between the full attention condition and both divided attention conditions, $p < .01$, non-significant difference between the two divided attention conditions]. The level of attention at encoding did not affect significantly feelings of familiarity/knowing. Therefore, against our prediction, conditions designed to promote maintenance rehearsal with text processing did not seem to influence fluency of processing, at least in a way that would be reflected in awareness of familiarity.

Our hypothesis that emotional distinctiveness would increase memory and feelings of recollection was confirmed. Mean proportions of correct answers were significantly higher for emotionally negative stories than for neutral stories [main effect of emotional valence: $F(1, 42) = 9.19$, $p < .01$]. Correct remember responses were also higher for emotionally negative stories than for neutral stories [significant main effect of emotional valence: $F(1, 42) = 25.39$, $p < .01$]. Correct familiarity/knowing, unexpectedly, showed an emotional valence effect opposite to the one found for correct remembering, that is, the level of correct know responses was significantly higher for neutral than for negative stories [main effect of emotional valence: $F(1, 42) = 13.07$, $p < .01$]. The interaction between emotional valence and level of attention was not significant for both remember and know responses. Overall, correct remember

responses predominated awareness as they were significantly higher than both correct know responses [$t(47) = 3.91$, two-tailed, $p < .01$] and correct guess responses [$t(47) = 3.91$, two-tailed, $p < .01$]. Feelings of familiarity/knowing and guessing were at the same level ($t < .01$).

The main systematic difference between the lists of stories is that list A seemed to have produced higher memory performance and bigger differences between the levels of both variables than list B. List A led to higher overall memory performance than list B [$F(1, 42) = 10.47$, $p < .01$]. Story list interacted significantly with emotional valence [$F(1, 42) = 4.88$, $p = .03$] – emotional stories led to higher memory performance than neutral stories apparently in both lists, but the difference was higher in list A than list B. Story list also interacted significantly with level of attention at encoding [$F(2, 42) = 4.43$, $p = .02$], being memory performance higher for list A in the full attention condition and in the experimenter-controlled divided attention condition, and similar for both lists in the participant-controlled divided attention condition. The other possible interactions between the variables were not statistically significant. Separate analysis of variance for each awareness category as a function of story list did not provide a systematic pattern. Correct remember responses were not significantly affected by story list in the complete dataset. For correct know responses, the only significant interaction was the 3-way interaction between emotional valence, attention, and story list [$F(2, 42) = 4.41$, $p = .02$] – in all the experimental conditions, correct familiarity/knowing was higher for neutral stories, with one exception: in the participant-controlled divided attention condition for list B, mean proportions were similar across emotional valences, but slightly higher for emotional than for neutral stories. Correct guess responses showed an interaction between emotional valence and story list [$F(1, 42) = 5.30$, $p = .03$], indicating that correct guesses were higher for emotional stories in list A and higher for neutral stories in list B.

Correct guess responses were not affected by level of attention at encoding and by emotional valence. Mean proportions of incorrect answers ranged from 0.01 to 0.13

for both remember and know responses and from 0.10 to 0.26 for guess responses (see table 5). Incorrect remember responses increased from the full attention condition, to the PC divided attention condition, and then to the EC divided attention condition list [main effect of level of attention: $F(2, 42) = 3.40$, $p = .04$; none of the pairwise comparisons was significant]. Incorrect know and guess responses were not affected by level of attention. Emotional and neutral news stories had a similar level of incorrect remember responses but incorrect know responses and incorrect guesses were higher for neutral than for emotional stories [know responses: $F(1, 42) = 6.78$, $p = .01$; guess responses: $F(1, 42) = 6.48$, $p = .02$]. Story list interacted significantly with emotional valence for incorrect remember responses [$F(1, 42) = 8.33$, $p < .01$], showing that list A had more incorrect responses for neutral stories than for emotional stories and that list B showed the reverse pattern. Incorrect guesses were also affected by story list. There were more incorrect guesses in list B than in list A [$F(1, 42) = 6.18$, $p = .02$]. Story list and level of attention interacted significantly [$F(2, 42) = 3.72$, $p = .03$] – there were more incorrect guesses in list B than in list A for the full attention condition and for the ECDA condition; the reverse pattern was observed in the PCDA condition.

Table 5 about here

Discussion

Emotionally negative news stories led to a higher level of memory and correct remembering than neutral stories in both lists. This finding has been observed in the studies ran so far (e.g., see chapter 2, this thesis) but it had not been obtained in study 1. It supports the view that remembering is affected by distinctiveness of processing, particularly by emotional distinctiveness.

There was an unexpected reversed emotional valence effect in correct know responses, with feelings of familiarity/knowing being higher for neutral stories than for emotionally negative stories. There is no apparent methodological reason for this

pattern of results, as the stories in this list have been used in previous studies (e.g., study 1 in this article; chapter 2, this thesis), this being the first time they appear together in a list. Oschner (2000) also found that know responses were higher for neutral than for emotionally negative photos, but the difference was significant only in two out of three studies. Emotionally negative information, which has been suggested to be more distinctively encoded than emotionally positive and neutral information (e.g., Christianson, 1992b), increases feelings of recollection rather than feelings of familiarity/knowing. Feelings of familiarity/knowing could be influenced by information processed more fluently due to a past encounter, but not subjected to an extensive distinctive processing. This hypothesis could explain the enhanced familiarity/knowing awareness for neutral information. One way of investigating this hypothesis would be by conducting a meta-analysis including more studies to check the direction of the effect of emotional valence on know responses.

The pattern found for the full and divided attention conditions was the one already reported in the literature – decreasing of memory and of feelings of recollection under divided attention whereas feelings of familiarity/knowing were not affected. Therefore, when cognitive resources are less, it is mainly elaborative processing that is undermined. The experimenter-controlled divided attention condition and the participant-controlled divided attention condition led to similar patterns of significant results. This finding did not support our prediction that conditions aimed at promoting maintenance rehearsal with text processing would not only undermine recollection but would also increase feelings of familiarity/knowing. From a theoretical point of view, we can argue that know responses do not always seem to reflect awareness induced by fluency of processing, as discussed previously. From a methodological point of view, we can argue that the task may have not promoted maintenance rehearsal as intended. However, we used the same length of time as Gardiner et al. (1994) did and the participants in our study had more information to keep in mind – the text and the sum of the figures from the second task. One could also argue that, contrary to

Gardiner et al. (1994), in this study people knew they were going to answer questions about the stories, so the information was supposed to be always to learn, and not sometimes to forget as in Gardiner et al.' s study. However, they obtained increased familiarity/knowing as a function of time delay; the cue to learn or to forget did not influence know responses.

General discussion

We reported two studies investigating the effects of impoverished study conditions such as depth of processing and level of attention on awareness in memory for emotional text. Processing text under scarce attentional resources or under shallow processing goals led to similar patterns of results, and replicated the findings in the literature for other materials such as lists of words (Gardiner & Parkin, 1990) and lists of faces (Parkin et al., 1995). Overall memory and feelings of recollection were undermined by shallow depth of processing and by divided attention at encoding, while feelings of familiarity/knowing remained at similar levels. However, these results are somewhat unexpected for news stories – text has been reported to depend on both elaborative and organisational processes, which could be negatively affected by impoverished encoding conditions. Therefore, these results seem to suggest that fluency of processing information aimed at elaborative encoding, which was disrupted by the constraining encoding conditions, is not captured by feelings of familiarity/knowing.

Emotional information was expected to increase memory and feelings of recollection. These effects were obtained in the second study, which tested level of attention, but not in the first one, testing depth of processing. This difference is most likely methodological rather than theoretical. The first study presented some methodological limitations that the second one did not. Firstly, the news stories used could have been an inadequate operationalisation of emotional valence for the participants in the study. Usually we ask the participants to rate the news stories in

affective and comprehensibility dimensions (see chapter 2, this thesis). However, this procedure could have biased the shallow processing goal and we did not include it. The second experiment in this article used a better control of the study material, as we included two lists of stories. We also collected the participants' ratings of the news stories, which allow checking for discrepancies between our classification of the news stories and the participants' ratings. Secondly, in order to make the levels of processing manipulation more extreme, the instructions in the deep condition emphasised an attentive and thorough reading of the stories, which could have led to a deeper processing of the neutral news stories. In the experiment 2, both lists of stories led to the predicted emotional valence effects – emotionally negative news stories increased memory and recollection. This pattern was also found by Dewhurst and Parry (2000), Oschner (2000) and in the studies reported in chapter 2 of this thesis. Therefore, the view that distinctiveness of processing affects positively feelings of recollection is supported as emotional distinctiveness led to an increase in remembering. Retrieval of emotional information is not experienced to be more fluent than the retrieval of neutral information – know responses were not significantly affected by the emotional valence of the material in study 1 and they were higher for neutral than for emotional stories in study 2. This latter pattern was also found by Oschner (2000).

In comparison with emotional information, neutral information is less distinctively processed. When information from neutral stories is processed twice (reading the story and then answering the recognition memory questionnaire), the fluency of processing this information could be attributed to the first encounter in the learning phase, and one could answer that the information is familiar. Consequently, neutral information could show lower recollection than emotional information and it could also increase familiarity, as we found in study 2. The higher fluency of encoding emotional information could make it be available sooner for distinctive processing, therefore influencing indirectly feelings of recollection for emotional information in memory. The

point is that, in some circumstances, know responses could be influenced positively by fluency of processing at retrieval in the absence of distinctive processing, whereas remember responses could be affected by both processes together. We have supported this claim using a re-interpretation of the results found by Rajaram (1996, 1998) studies (see chapter 2, this thesis). This suggestion also fits Tulving' s (1995) proposal that encoding in memory is serial and contingent upon the successful encoding in the precedent memory system. Considering the semantic and the episodic memory systems, encoding occurs first in the semantic memory system, and then, in the episodic memory system. The fluency of processing semantic information underlying episodic knowledge can contribute to the retrieval of the episode, which implies that feelings of recollection could also benefit not only from distinctiveness of processing, as suggested by Rajaram (1996), but also from fluency of processing.

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Table 1

Mean proportions of correct responses as a function of depth of encoding and emotional valence (with standard deviations in parentheses)

	Shallow		Deep	
	Negative	Neutral	Negative	Neutral
Remember	.20 (.14)	.21 (.13)	.58 (.17)	.52 (.17)
Know	.13 (.11)	.12 (.09)	.17 (.14)	.16 (.10)
Guess	.15 (.09)	.16 (.10)	.08 (.06)	.12 (.09)
Overall	.48 (.10)	.48 (.12)	.83 (.10)	.81 (.09)

Table 2

Mean proportions of incorrect responses as a function of depth of encoding and emotional valence (with standard deviations in parentheses)

	Shallow		Deep	
	Negative	Neutral	Negative	Neutral
Remember	.09 (.09)	.08 (.06)	.03 (.03)	.05 (.05)
Know	.11 (.10)	.10 (.11)	.03 (.04)	.05 (.05)
Guess	.32 (.12)	.34 (.12)	.10 (.06)	.10 (.08)
Overall	.51 (.10)	.51 (.12)	.17 (.10)	.19 (.09)

Table 3

Mean ratings for emotionally negative and neutral news stories in each story list (standard deviations in parentheses)

	List A		List B	
	Negative	Neutral	Negative	Neutral
Happy-Sad	4.44 (0.41)	2.92 (0.23)	4.63 (0.42)	2.74 (0.43)
Distressing-Pleasant	1.68 (0.52)	3.28 (0.23)	1.64 (0.55)	3.38 (0.47)
Amusing-Serious	4.53 (0.49)	2.92 (0.55)	4.58 (0.55)	2.79 (0.64)
Boring-Interesting	3.99 (0.51)	3.14 (0.58)	3.61 (0.61)	3.46 (0.64)
Exciting-Calm	2.73 (0.37)	3.03 (0.35)	2.90 (0.40)	3.01 (0.41)
Simple-Complex	2.76 (0.60)	2.43 (0.53)	2.47 (0.79)	2.32 (0.80)
Comprehensibility	2.35 (0.63)	2.38 (0.55)	1.97 (0.51)	2.29 (0.70)

Table 4

Mean proportions of correct responses as function of level of attention, emotional valence and story list (with standard deviations in parentheses)

	Full attention		PCDA		ECDA	
	Negative	Neutral	Negative	Neutral	Negative	Neutral
Remember	.61 (.20)	.44 (.14)	.38 (.15)	.28 (.17)	.38 (.21)	.29 (.18)
Know	.14 (.12)	.17 (.12)	.21 (.17)	.27 (.18)	.14 (.17)	.18 (.16)
Guess	.08 (.06)	.12 (.07)	.10 (.08)	.08 (.06)	.14 (.11)	.12 (.09)
Overall	.82 (.17)	.73 (.13)	.69 (.12)	.63 (.16)	.65 (.18)	.59 (.16)

Note. PCDA = participant-controlled divided attention; ECDA = experimenter-controlled divided attention.

Table 5

Mean proportions of incorrect responses as function of level of attention, emotional valence and story list (with standard deviations in parentheses)

	Full attention		PCDA		ECDA	
	Negative	Neutral	Negative	Neutral	Negative	Neutral
Remember	.04 (.05)	.01 (.03)	.05 (.05)	.07 (.07)	.06 (.07)	.07 (.07)
Know	.03 (.06)	.08 (.06)	.09 (.06)	.10 (.07)	.08 (.11)	.11 (.07)
Guess	.10 (.11)	.18 (.15)	.17 (.07)	.21 (.12)	.21 (.13)	.23 (.10)
Overall	.17 (.17)	.27 (.13)	.31 (.12)	.37 (.16)	.35 (.18)	.41 (.15)

Note. PCDA = participant-controlled divided attention; ECDA = experimenter-controlled divided attention.

Chapter 4 Effects of repetition of processing on awareness in memory for emotional news stories

Running head: Repeated processing and awareness in memory

Effects of repetition of processing on awareness in memory for emotional news stories

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Abstract

Using an extension of Tulving's (1985) remember-know procedure including remember, know and familiar responses, two studies investigated the effects of repeated encoding on awareness in memory for emotional news stories. In the first study, memory and remembering increased for emotional and, more pronouncedly, for neutral news stories, after consecutive study trials. Feelings of familiarity were not affected by repeated study. In the second study, schematisation of knowledge, as indexed by feelings of knowing, was obtained for both emotional and neutral stories by learning the stories over time. Feelings of remembering and familiarity were not affected by repeated study. The results are discussed within the systems approach (Tulving, 1985, 1995) and the distinctiveness/fluency hypothesis (Rajaram, 1996).

Effects of repetition of processing on awareness in memory for emotional news stories

Processing the same information repeatedly in different occasions improves memory, that is, some knowledge is acquired. This memory improvement also changes the states of consciousness experienced in the course of that knowledge acquisition (e.g., Conway, Gardiner, Perfect, Anderson & Cohen, 1997).

The issue of how the acquisition of knowledge affects awareness in memory has not been explored in laboratory studies, but there are a few published studies about knowledge acquisition in university students using more naturalistic study materials (Conway et al., 1997; Herbert & Burt, 2001, 2003, 2004). Investigating knowledge acquisition requires the use of complex study materials such as text or image, which are more difficult to control experimentally. These materials should be processed under conditions promoting elaboration of the information to-be-learnt, and promoting also integration of that information with both new information and information already in memory (e.g., Kintsch, Britton, Fletcher, Kintsch, Mannes & Nathan, 1993; Seifert, 1993). Furthermore, repeated processing should also take place on different encoding occasions and over a period of time (e.g., Conway et al., 1997). All these requirements of selection and control of the materials and repeated study opportunities are time consuming for both experimenters and participants, which can explain the scarcity of studies in the area.

The focus of our research has been on the effects of emotional information on awareness in memory. Emotional information has been reported to be quite vivid and to remain that way over long periods of time (Christianson, 1992a). Consequently, it is possible that the learning of emotional and neutral information is accompanied by different awareness patterns. In this article, we explore changes in memory awareness with repeated processing using news stories as study materials, which are more prone to be learnt than simpler materials such as lists of words.

The Remember-Know Approach

The initial theoretical approach on subjective states of awareness in memory was Tulving's (1985) association between episodic memory and autonoetic consciousness and between semantic memory and noetic consciousness. These states of consciousness were defined operationally via reports of subjective states of awareness: remember responses and know responses, respectively. Remember awareness responses have been described as a vivid recollection, visualisation or mentally reliving the event; know responses have been characterised as a feeling of familiarity towards the information processed or retrieved or as a feeling of just knowing that information (e.g., Gardiner, 1988; Tulving, 1985).

One of the criteria proposed to justify the existence of different memory systems consists of convergent findings from different sources of evidence such as functional dissociations on different cognitive/behavioural tasks alleged to tap different systems, neuropsychological dissociations in studies involving brain-injured patients and a differential physiological functioning (Schacter & Tulving, 1994). Remember and know responses have been shown to produce a convergent pattern of functional, physiological and neurological dissotiations (for a review, see Gardiner & Richardson-Klavehn, 2000), which supports Tulving's (1985) dual-memory systems approach to awareness in memory.

Remember and know responses have also been explained in terms of the underlying cognitive processing (e.g., Gardiner, 1988). One of the most recent processing approaches is the distinctiveness-fluency hypothesis (Rajaram, 1996). It states that distinctiveness of processing, either conceptual or perceptual, enhances remembering, whereas fluency of processing, either conceptual or perceptual, enhances familiarity/knowing. Some general predictions derived from the distinctiveness-fluency of processing hypothesis have been experimentally confirmed. Studies using conceptual processing manipulations that elicit elaboration of processing of individual items such as level of processing and full versus divided attention (e.g.,

Gardiner, 1988; Gardiner & Parkin, 1990), provided the evidence supporting the claim that remembering is enhanced by distinctive conceptual processing. Remember responses have also been shown to increase under perceptual processing conditions considered to render the stimuli perceptually distinctive (picture superiority effect, same size and same orientation of objects at study and at test, Rajaram, 1996; orthographic distinctiveness of words; Rajaram, 1998, exp. 2). Know responses have been shown to increase with fluency of perceptual processing (e.g., Gregg & Gardiner, 1994) and with fluency of conceptual processing (repetition of words from the same semantic category of the target words, Dewhurst & Anderson, 1999, exp. 2; words primed with related primes, Rajaram & Geraci, 2000).

Despite the evidence supporting the distinctiveness-fluency approach, a criticism to this approach can be raised. It concerns the vagueness in the characterisation of the conditions promoting distinctiveness of processing and fluency of processing. This approach has inherited a theoretical problem from the research on distinctiveness of processing. On the whole, research has not yet defined distinctiveness independently of measures of memory, which makes it difficult to predict the types of information that will be distinctively processed (Schmidt, 1991, 1996). Even fluency of processing is a loosely defined concept in the sense that it refers to a vague spread of activation of information. In the remember-know approach, fluency of processing has been manipulated mainly by repetition of stimuli (Dewhurst & Anderson, 1999, exp. 2) and priming tasks in order to promote ease of processing or information coming to mind (Rajaram, 1993, exp. 3; Rajaram & Geraci, 2000). However, Dewhurst (2001, July) did not obtain changes in the pattern of remember and know responses with variables supposed to affect fluency of processing such as the duration of stimuli presentation, the discriminability in terms of stimuli visibility and semantic priming.

Awareness in Memory for Emotional Information

Emotional information has been proposed to be processed more distinctively than neutral information as it engages specific neural and hormonal mechanisms and it triggers an enlarged use of cognitive resources such as increased attention, increased rehearsal and increased elaboration (e.g., Hamann, 2001; Ochsner, 2000; Schmidt, 1991). Emotional information also seems to be processed rather automatically at a pre-attentive stage (Christianson, 1992a; Öhman, 1988), promoting a more fluent processing at the encoding stage, especially for emotionally negative stimuli (Ochsner, 2000).

If emotional information is processed more distinctively than neutral information, then the prediction that follows from the distinctiveness-fluency hypothesis is that distinctiveness of processing would increase feelings of recollection. This prediction has been consistently confirmed: emotional information, either negative or positive, increases feelings of recollection. Feelings of familiarity/knowing arising from the retrieval of emotional information have not been systematically affected by emotional information. Sometimes, feelings of familiarity/knowing increase for neutral or emotionally positive stimuli, a result that goes in the opposite direction of the prediction, that emotionally negative information could be more fluently retrieved (Oschner, 2000). This overall pattern has been obtained for lists of words (Dewhurst & Parry, 2000, using mixed lists of words in exp. 1; Pesta et al., 2001, also using lists of words to study the false memory effect), for lists of photos (Ochsner, 2000), and for lists of news stories (see chapters 2 and 3 in this thesis).

Learning information seems to involve further episodic encoding and to be accompanied by increased remembering when the repeated processing involves exact repetition of the study material (e.g., Dewhurst & Anderson, 1999, exp. 1). Otherwise, learning information can be reflected in increased feelings of familiarity/knowing when the information processing involves semantically related information (Dewhurst & Anderson, 1999, exp. 2). Learning information can also increase feelings of knowing

(assessed separately from feelings of familiarity) when the learning process occurs over a time period and involves different encoding situations (Conway et al., 1997). As emotional information is so distinctive, will repeated exposure promoting deeper or more elaborated representations foster mainly episodic encoding as assessed by remember responses or will it also promote semantic encoding as assessed by know responses? We present two studies that explore the effects of different repeated encoding situations on awareness in memory for emotional information (news stories). The first study focused on the effects of repeated consecutive processing on awareness in memory, while the second one investigated the effects of learning over time on schematisation of knowledge as indexed by feelings of knowing.

Experiment 1

Processing the same information repeatedly often leads to an improvement in memory for that information, either with repetition at encoding via repeated study trials or massed versus spaced repetition (e.g., Kahana & Greene, 1993) or with repetition at retrieval via repeated testing (e.g., Kazén & Solís-Macías, 1999). The evidence obtained so far by studies of awareness in memory suggests that, when people already have some prior schematic representation of the information, exact repetition at study – either massed or spaced – increases feelings of recollection whilst not affecting feelings of familiarity/knowing (Dewhurst & Anderson, 1999, exp. 1, with lists of words; Gardiner, Kaminska, Dixon & Java, 1996, and Gardiner & Radomski, 1999, with music excerpts from a familiar background; Parkin, Gardiner & Rosser, 1995, exp. 2, with lists of faces). For unfamiliar study material, as in the case of unfamiliar music excerpts (Gardiner & Radomski, 1999), both feelings of recollection and familiarity/knowing increase with repeated study.

When the repetition at the study phase concerns not the exact repetition of the target material but the repetition of semantically related stimuli, then feelings of familiarity/knowing increase (Dewhurst & Anderson, 1999). Dewhurst and Anderson

(1999) found that exact repetition of words increased correct remember responses and did not affect correct know responses significantly, whereas repetition of words from the same semantic category of the target words increased correct know responses but it did not affect correct remember responses. Incorrect remember and incorrect know responses also increased with category repetition. Increased correct remembering was considered to be due to the creation of multiple episodic traces during the repeated encoding occasions. When reading a word at the study phase, other words could have been generated and, consequently, they could have produced memory traces. The retrieval of the memory traces of these non-presented words could underlie feelings of incorrect remembering. The increase of correct know responses and incorrect know responses was explained by the spreading of activation between related items in a semantic network.

In our study, we asked participants to read news stories twice and consecutively. Based on previous evidence, we expect memory to increase. More importantly, we predict that the memory improvement brought by repeated reading will be accompanied by an increase in feelings of remembering and in feelings of familiarity/knowing. As reading a story twice allows further elaboration of the text information and the update of its memory representation (Raney, 1993), then feelings of remembering should increase after repeated study trials. The second reading also seems to foster a more fluent processing of the information, as shown by faster reading times, due to the integration of the information and to a lesser processing effort for perceptual processes at the letter and at the word-level (Raney, 1993). Therefore, we predict that know responses will increase after the second reading for both emotional and neutral stories.

The effects of repeated reading on awareness in memory for emotional information can be twofold. If repetition of encoding promotes processing of distinctive material, then emotional stories will have a boost in their performance and in their remembering levels in comparison with neutral stories. If repetition of encoding

produces a general processing improvement, promoting both elaborative and relational processing, then remember responses will not increase significantly with repeated reading for emotional stories anymore than for neutral stories.

Following our earlier review, we can hypothesise that distinctiveness of processing emotional information will lead to more remember responses for emotional news stories. Know responses will either not be affected by emotional content or will decrease.

Method

Participants

Thirty-six City University students participated in this study: 27 women and 9 men. Their mean age was $M = 21.22$, $SD = 3.35$.

Materials

The study material consisted of six news stories selected from a British broadsheet daily newspaper (see appendices 1 and 2). The stories were selected from broader sets that had been previously rated by independent judges in terms of knowledge levels ('yes', 'no', 'don't know' as response options), emotionality levels (5-point scale from 'very negative' to 'very positive') and comprehensibility (5-point scale from 'very easy to comprehend' to 'very difficult to comprehend'). The stories used here obtained ratings of low previous knowledge levels (unknown to 70% of the judges), of negative and neutral emotionality levels (ratings below 2 for negative stories and ratings above 2 and below 4 for neutral stories) and easy comprehensibility (ratings below 2). Each news story was photocopied into a white A4 piece of paper and it was included in a booklet containing the six stories. There was a second booklet in the study phase that contained the ratings scales for each story (see appendix 6). The emotional valence dimensions used in the rating scales were happy-sad,

distressing-pleasant, and amusing-serious. The reported emotional arousal dimensions used were boring-interesting, exciting-calming and simple-complex. There was also a rating scale about the level of comprehensibility of the stories. All these dimensions were displayed in 5-point rating scales. A question about previous knowledge of the stories was also included in this booklet (response options: yes, no, don't know). Test material began with instructions about how to answer the four-choice recognition memory task, about how to report the awareness states, and included a training task about the different awareness responses (see appendix 7). Test material also included the recognition memory questionnaire, which had eight questions for each story (see appendix 8). Concluding the memory questionnaire there were questions about age, sex and media consumption (the latter are not analysed in this article).

Design and Procedure

The design was a 2 x 2 mixed factorial with repeated trials (one study trial vs. two study trials) as a between-subject factor and emotional content of the news stories (negative vs. neutral) as a within-subject factor. Participants were tested individually or in small groups (2 to 4 people). They were told the purpose of the study was to investigate the way people process mass media information and that they would answer some questions after reading stories, but the nature of the questions was not specified (see appendix 5). They also were asked to sign a consent form (see appendix 4). Then, participants read one list of stories and rated them in dimensions pertaining to their emotionality and comprehensibility. They also reported whether they had read the stories previously. Six different sequences of news stories were built in such a way that each story occurred once in each sequence position and there were no more than two consecutive emotional stories or two consecutive neutral stories. These six sequences were counterbalanced across participants and across conditions (see appendix 3). In the repeated study condition, after participants finished reading the

stories, they were asked to read them again in order to ensure they comprehended them well (see appendix 5). After the study phase, the recognition memory task was explained and participants performed a training task for the answering of the awareness responses. They then performed the self-paced recognition memory task. Immediately after, participants were asked to justify two of the awareness responses provided for each awareness category. At the end, they were thanked and debriefed orally. A written debriefing was also provided. The procedure lasted around 40 minutes for the one-study-trial condition and around 50 minutes for the two-study-trials condition.

Results

Assessment of the news stories

Mean affective ratings, mean comprehensibility ratings and proportions of unknown stories were analysed by a mixed-design analysis of variance with emotional valence as a within subject factor and study trials as a between-subject factor. The stories used in the analysis were mostly unknown to the participants. The proportions of unknown stories were $M = .85$ ($SD = 0.20$) for emotionally negative stories and $M = .90$ ($SD = 0.17$) for neutral stories; these proportions did not vary significantly as a function of emotional valence and study trials.

Mean affective ratings and mean comprehensibility ratings did not vary systematically across study trials. Therefore, we only present mean ratings as a function of emotional valence in table 1. For the rating scales 'happy-sad', 'distressing-pleasant' and 'amusing-serious', which were theoretically related to the emotional valence of the stories, the observed differences between emotionally negative and neutral news stories were statistically significant [happy-sad: $F(1, 34) = 654.61$, $p < .01$; distressing-pleasant: $F(1, 34) = 700.66$, $p < .01$; amusing-serious: $F(1, 34) = 336.40$, $p < .01$]. The only significant difference between ratings in different study trials occurred

in the 'amusing-serious' scale [one trial: $M = 4.07$, $SE = .06$; two trials; $M = 3.86$, $SE = .06$; $F(1, 34) = 336.40$, $p = .03$], indicating that stories in both trial conditions were rated as quite serious, but they were rated as more serious in the one-trial condition. The only significant interaction between study trials and emotional content occurred in the 'happy-sad' scale [$F(1, 34) = 4.08$, $p = .05$], suggesting that stories were rated as sadder in the one-trial condition than in the two-trials condition. For the rating scales 'boring-interesting', 'exciting-calming' and 'simple-complex', theoretically related to the reported arousal associated with the news stories, only one significant effect was obtained. The ratings in the scale 'boring-interesting' differed significantly as a function of emotional valence [$F(1, 34) = 23.03$, $p < .01$]: emotionally negative stories were considered more interesting than neutral stories. Regarding comprehension difficulty, stories from both emotional valences were considered quite easy to understand (see table 1), but neutral stories were considered significantly less easy to understand [$F(1, 34) = 31.47$, $p < .01$].

In summary, emotionally negative news stories were considered sadder, more distressing, and more serious than neutral news stories, which were seen as non-extreme on these measures. Emotionally negative stories were rated as slightly more interesting than neutral stories, but both negative and neutral stories were rated as neither exciting nor calming and as rather simple. Stories of both emotional types were rated as quite easy to understand.

Table 1 about here

Memory and awareness performance

As the same pattern of results was observed from the dataset including all the answers provided by the participants and the dataset including only the answers from

the stories reported to be unknown by the participants, only the results from the complete dataset are reported here.

Mean proportions of correct answers for each awareness category were calculated for each experimental condition: in each trial condition, the number of correct responses in each awareness category was divided by the maximum possible number of correct responses for emotional and for neutral news stories ($N = 24$ for both negative and neutral stories). Mean proportions of correct remember, know and guess responses and overall recognition (see table 2) were analysed separately using a mixed-design analysis of variance with emotional content of the news stories (negative vs. neutral) as a within-subject factor and study trials (one vs. two trials) as a between-subject factor.

Table 2 about here

Simple comparisons[1] between awareness categories showed that feelings of remembering predominated memory as correct remember responses were higher than both correct know responses [$t(35) = 7.97$, $p < .01$, two-tailed] and correct guesses [$t(35) = 7.77$, $p < .01$, two-tailed]; correct know responses were higher than correct guess responses but the difference between them was not significant ($t < 1$).

Overall recognition memory improved with repeated study trials, as hypothesised [main effect of study trials: $F(1, 34) = 17.44$, $p < .01$]. This improvement occurred for both emotionally negative and neutral stories, but it was more pronounced for neutral stories than for emotionally negative stories [interaction effect between emotional valence and study trials: $F(1, 34) = 11.13$, $p < .01$]. One could claim that memory for emotionally negative stories did not increase as much as memory for neutral stories because of a ceiling effect. However, mean proportions of correct responses for emotionally negative stories show that there was still opportunity for memory improvement (see table 2). This memory pattern was accompanied by a similar pattern

in awareness feelings of remembering, which increased after two study trials [main effect of study trials: $F(1, 34) = 8.89$, $p < .01$], and increased more for neutral than for emotionally negative stories [interaction effect: $F(1, 34) = 4.59$, $p = .04$]. Feelings of knowing/familiarity were not affected by repeated exposure ($F < 1$). These results suggest that the fluency of a second reading was not reflected in awareness in memory, but that the benefits of a second consecutive reading were due to further elaboration and episodic encoding.

Emotional news stories led to higher overall recognition memory than neutral stories, as expected [main effect of emotional valence: $F(1, 34) = 82.82$, $p < .01$], replicating previous results. This memory improvement was only accompanied by increased remembering, as predicted. Mean proportions of correct remember responses were higher for emotionally negative stories than for neutral stories [main effect of emotional valence: $F(1, 34) = 97.49$, $p < .01$], but correct know responses were not affected by emotional valence ($F = 1.12$).

Correct guesses were higher for neutral stories than for emotionally negative stories, mirroring the effect found for correct remembering [main effect of emotional valence: $F(1, 34) = 35.39$, $p < .01$]. Mean proportions of incorrect answers ranged from 0.02 to 0.06 for both remember and know responses and from 0.05 to 0.28 for guess responses (see table 3). Incorrect remember responses and incorrect know responses did not vary significantly as a function of emotional valence and study trials. Incorrect guesses were higher for neutral stories than for emotionally negative stories [$F(1, 34) = 70.93$, $p < .01$] and they decreased after reading the stories twice [$F(1, 34) = 17.38$, $p < .01$]. This decrease was steeper for neutral stories than for emotionally negative stories [interaction effect: $F(1, 34) = 12.40$, $p < .01$].

Table 3 about here

Discussion

Repeated study trials benefited memory, which was reflected on recollective experience for both types of emotional content. As distinctiveness of processing has been claimed to elicit subjective awareness feelings of remembering (Rajaram, 1996, 1998), then elaboration of distinctive information seems to have been reinforced by reading the same story twice. Therefore, repetition improves memory even for information already quite distinctively processed such as emotional information. Nonetheless, it was neutral stories that most benefited with repeated processing, as the increase in memory and recollection was steeper in neutral than in emotionally negative stories. However, memory and feelings of recollection for neutral stories still did not attain the level shown by emotionally negative stories after repeated reading. One possible explanation for the steeper increase in memory and recollection observed for neutral stories is that, as emotionally negative stories require more elaboration than neutral stories in the first encounter due to their emotional content, maybe a second reading requires less cognitive resources for emotional stories, allowing a deeper processing of the neutral stories.

Rereading a text is usually faster than reading it just once (Raney, 1993), which indicates that processing the text becomes more fluent. However, this fluency was not captured by feelings of familiarity/knowing. Other variables supposed to affect fluency of processing such as the duration of the stimulus presentation, the discriminability in terms of stimulus visibility and semantic priming have also not affected feelings of familiarity/knowing (Dewhurst, 2001, July, exp. 1). The conditions in which fluency of processing can increase feelings of familiarity still remain to be better characterised in order to clarify the extension of the application of the distinctiveness-fluency hypothesis.

The awareness in memory pattern obtained after repeated study trials — increase in remembering, no changes in familiarity/knowing — parallel the ones found with repeated study trials for music excerpts of a familiar type (Gardiner, Kaminska, Dixon &

Java, 1996; Gardiner & Radomski, 1999). The findings from these studies suggest that, when people already have some form of knowledge representation in memory concerning the type of information studied, the encoding of information in the episodic memory system continues when people are presented repeatedly with the same information. The news stories used in this study were unknown to most participants, but the types of situations they portrayed were most likely quite familiar, which could be seen as similar to the processing of a familiar type of music excerpts. When the study material is unfamiliar (e.g., music excerpts of folk songs from an unfamiliar musical culture), both remember and know responses increase (Gardiner et al., 1996; Gardiner & Radomski, 1999).

Replicating previous results and supporting our predictions, there was better memory and more feelings of recollection for emotionally negative stories than for neutral stories but know responses were not affected by the emotional content of the stories. These results suggest that emotional distinctiveness leads to more feelings of recollection, therefore supporting one of the components of the distinctiveness-fluency hypothesis – the view that distinctive processing increases feelings of recollection in awareness in memory. Emotional information does not seem to be more fluently retrieved than neutral information – correct know responses were not affected by the emotional valence of the stories, replicating the findings in the literature (Dewhurst & Parry, 2000; Oschner, 2000).

The next study investigates the effects of study repetition over a longer period of time (e.g.; three to four weeks) in different encoding situations and for different emotional valences. We intend to promote knowledge schematisation, and analyse the way it interacts with the information's emotional valence on awareness in memory.

Experiment 2

The transfer of information across memory systems as assessed by subjective states of awareness in memory has not been fully addressed in the research

conducted so far. There is an important exception, a study conducted by Conway et al. (1997) about knowledge acquisition in psychology undergraduates. The authors considered that repeated encounters with the information and in different situations along the school year could contribute to the acquisition of knowledge, that is, to the promotion of schematisation of information in a semantic memory system, which would be subjectively experienced as a 'feeling of just knowing'.

The definition of know responses usually comprises two different awareness experiences: a transient feeling of familiarity (e.g., a familiar face) and the awareness that the information presented is just known (e.g., just knowing that Paris is the capital city of France without recollecting learning it). In most studies, know responses, although encompassing these two meanings, have emphasised feelings of familiarity, as information processed just once is more prone to induce awareness of being familiar than being just known. However, having only feelings of familiarity as an operational definition of noetic consciousness, which is associated with information represented in a semantic memory system, can seem controversial (e.g., Gardiner & Conway, 1999). The feeling of 'just knowing' some information seems to capture more adequately the consciousness associated with general knowledge about the world (Conway et al., 1997; Gardiner & Conway, 1999). Therefore, when research deals with awareness associated with knowledge acquisition, it is heuristic to separate these two meanings encompassed in the initial definition of know responses. The differential measurement of feelings of familiarity and feelings of knowing was first done by Conway et al. (1997), and, later, by Herbert & Burt (2001, 2003, 2004).

In Conway et al.'s study, awareness associated with knowledge acquisition for lecture courses and research methods courses was measured shortly after the courses finished. Knowledge and awareness for one of the lecture courses was also re-assessed some time later. When knowledge acquisition was tested immediately after a lecture course had been completed, students with higher marks outperformed their colleagues because they remembered more. When students were re-tested after a

retention interval during which additional learning took place, the dominant response category shifted from remembering to knowing, mainly for higher performing students. Immediately after research methods courses finished, higher mark students also showed better memory and this was due to know responses. The explanation suggested by the authors for the difference in awareness found for the different types of courses was that more closed or self-contained domains of knowledge, such as methodology knowledge, seem more prone to be schematised and to be represented in a semantic memory system than broader domains such as the ones covered in lecture courses. Correct familiarity and guess responses increased with decreasing marks for both types of courses. Familiarity and know responses did not show parallel effects, which supports the need to consider the distinction between familiarity and just knowing when assessing awareness for knowledge acquisition. Herbert & Burt (2001) replicated Conway et al.'s study but, while Conway et al. only retested the lecture course participants, they investigated the remember-to-know shift in both a lecture course and a research methods course. They found a remember-to-know shift only in the methods course, which was convergent with higher schematisation of the information as assessed by another measure of the students' level of schematisation.

The remember-to-know shift was explained by Conway et al. (1997) as possibly reflecting two processes. One concerns the loss of the ability to retrieve specific episodic information. The second concerns the increasing availability of semantic representations – repeated opportunities to process the same information under different tasks may foster conceptual organisation and lead to a schematisation of the information, which will be accompanied by feelings of 'just knowing'. This second process is supported by evidence showing that regular review opportunities with different tasks are more likely to produce a remember-to-know shift in students' awareness in memory than regular review opportunities with the same task (Herbert & Burt, 2003).

Besides comparing the amount of information correctly recognised for each awareness category, Conway et al. (1997) also compared the accuracy of awareness responses – the proportion of correct responses from the total of responses (correct and incorrect) given in each awareness category. The accuracy patterns differed for remember and (just) know responses. Accuracy of knowing was high and independent of the number of correct responses, whereas accuracy of remembering diminished when the number of correct responses decreased – this pattern was also found by Herbert & Burt (2001, 2003).

Would a hypothetical shift from remembering to knowing be observable equally for emotionally negative and neutral information? Or, would it be less pronounced in emotional information than in neutral information, since emotional information triggers more distinctive processing and increases remembering? Hypothetically, repeated processing over time of emotional information could lead to two main patterns of results. It could consolidate the representation in episodic memory and increase the autonoetic consciousness experienced towards the information, but it could not affect the schematisation of emotional information. Otherwise, processing the information over time and under different conditions could promote the encoding of emotional information in a semantic memory system, giving rise to a noetic consciousness. However, even in this scenario, it is likely that feelings of recollection will still be predominant as emotional distinctiveness fosters episodic encoding (e.g., Ochsner, 2000).

In our own research (chapter 2 in this thesis, exp. 1), repeated testing of recognition memory for news stories after a 4-day interval produced a shift in remembering to knowing as correct remember responses decreased and correct know (familiar) responses increased equally for both emotionally negative and neutral stories. This finding suggests a similar rate of the encoding in the semantic memory system for both emotional and neutral stories. From a processing perspective, answering the same recognition memory test in the delayed testing could have brought

fluency of processing, which could have produced memory accompanied by feelings of familiarity/knowing.

In the current study, participants processed the same set of emotionally negative and neutral news stories in repeated occasions across a period of 3 to 4 weeks, performing different tasks on each occasion. Their recognition memory and awareness for the information was tested twice: after the first study of the material and after the material was studied more times across a time period. We expect that the learning and consolidation of the information will lead to an increase in memory performance over time, which should be accompanied by a remember-to-know shift (a decrease in remember responses and an increase in know responses). Conway et al. (1997) obtained this pattern of results in a naturalistic context with their study about knowledge acquisition in psychology undergraduates. We do not expect repeated encoding to interact with emotionally negative information, that is, we expect that the rate of schematisation of the information will be similar for both emotionally negative and neutral news stories. The difference between emotional and neutral information is that the former should present a stronger episodic representation than the latter, since the distinctiveness of emotional information promotes episodic encoding. Therefore, we expect that the distinctiveness of emotionally negative stories will increase memory and feelings of remembering, while not affecting feelings of knowing and feelings of familiarity. This result will replicate the memory awareness pattern obtained so far for emotional information.

Method

Participants

We report the combined data from two similar studies, one involving 18 participants and the other 24 participants. The final sample had 42 participants (26 women, 16 men), including mature university students and professionals. The mean

age is $M = 30.57$ ($SD = 7.96$). Three participants were excluded and replaced because they were not able to comply with the time requirements of the study.

Materials

Six news stories from a British broadsheet daily newspaper were used in this study (see appendices 1 and 2). The stories were selected from broader sets that had been previously rated by independent judges in terms of knowledge levels ('yes', 'no', 'don't know' as response options), emotionality levels (5-point scale from 'very negative' to 'very positive') and comprehensibility (5-point scale from 'very easy to comprehend' to 'very difficult to comprehend'). The stories used here obtained ratings of low previous knowledge levels (unknown to 70% of the judges), of negative and neutral emotionality levels (ratings below 2 for negative stories and ratings above 2 and below 4 for neutral stories) and easy comprehensibility (ratings below 2). This set of news stories is not the one used in the previous study, although some of the stories were included in both studies.

The study material consisted of three sets of booklets. The first set included a booklet containing the six news stories, one in each A4 page, and another booklet containing the rating scales for each story (emotionality, comprehensibility, previous knowledge and familiarity with the type of situation described in the story; see appendix 6). The other two sets of booklets concerned the two semantic tasks to be performed. The 'answering why-questions' task included a booklet with the stories, in which the part of the text corresponding to each why-question was identified, and another booklet containing the instructions (see appendix 5), the questions and answering space. The 'generating elaborations' task also included two booklets: one with the news stories, in which the paragraphs for each elaboration asked for were identified; and another booklet with the instructions and answering space (see appendix 5). The test material was similar to the one used in the previous study, but adjusted to the specific stories

used here (see appendices 7 and 8). There were two identical sets: one for the first test and another for the delayed test.

Design and Procedure

This was a 2 x 2 within-subjects design with the following factors: emotional valence of the news stories (negative vs. neutral) and time of testing (immediate vs. delayed testing – 3 to 4 weeks). Participants were tested individually and signed a consent form (see appendix 4). In the first meeting, they read the stories and rated them in dimensions pertaining to emotionality, comprehensibility, previous knowledge and familiarity with the type of situation described in the story (see appendices 5 and 6). Each story occurred once in each sequence position and there were no more than two emotional or two neutral stories in sequence. The sequence of the news stories was changed for each subject in order to counterbalance possible sequence effects (see appendix 3). Afterwards, it was explained to participants how to answer the recognition memory task and they did a training task to clarify the definition of the awareness responses. Then participants answered a recognition memory task including awareness responses and they justified two of the awareness responses provided in each category.

There were two semantic tasks to be performed one and two weeks after the first reading of the stories: (a) answering 'why-questions' about the story, and (b) generating elaborations related to the self and related to general knowledge. These tasks were derived from the literature concerning text comprehension. Considering the strategies that have been studied in the processing of prose passages, the one that seems to lead to better comprehension and memory is elaborative interrogation (answering why-questions; e.g., Seifert, 1993). The generating-elaborations task was based on the claim that one of the reader's goals is the construction of a situation model, which involves not only processing information from the text but also relating it

to general world knowledge and personal experiences (e.g., Kintsch, Britton, Fletcher, Kintsch, Mannes & Nathan, 1993).

Half of the participants answered why-questions first and generated elaborations secondly. The order was reversed for the other half of the participants. Finally, participants did a second recognition memory task similar to the first one, from one to two weeks after finishing the semantic tasks.

Results

Assessment of the news stories

The stories used in the analysis were mostly unknown to the participants. The mean proportions for answering that the stories were unknown were M = .86 (SD = 0.25) for emotionally negative stories and M = .91 (SD = 0.15) for neutral stories. A paired-samples t-test did not find these proportions to be significantly different (p > .05).

Mean affective ratings and mean comprehensibility ratings for emotionally negative and neutral stories (see table 4) were compared using paired-samples t-tests. The scales 'happy-sad'; 'distressing-pleasant' and 'amusing-serious', theoretically related to the emotional valence of the stories, showed significant differences between emotionally negative and neutral news stories [happy-sad: $t(41) = 16.19$, $p < .01$; distressing-pleasant: $t(41) = -15.63$, $p < .01$; amusing-serious: $t(41) = 20.09$, $p < .01$]. The rating scales 'boring-interesting', 'exciting-calming' and 'simple-complex', theoretically related to the reported arousal, showed apparently similar ratings across emotional valences, which were, nonetheless, significant: [boring-interesting: $t(41) = 3.76$, $p < .01$; exciting-calming: $t(41) = -3.09$, $p < .01$; simple-complex: $t(41) = 2.30$, $p = .03$]. Overall, emotionally negative news stories were considered quite sad, quite distressing, very serious, whereas neutral stories were seen as slightly happy, slightly pleasant and neither amusing nor serious. Emotionally negative stories were also

rated as more interesting, more exciting and more complex than neutral stories. The news stories were considered to be quite easy to understand in both emotional valences and they were rated as neither familiar nor familiar, but with neutral stories considered more unfamiliar than emotionally negative stories.

Table 4 about here

Memory and awareness

A similar pattern of results was obtained from the analyses of the complete dataset and of the dataset only including answers from unknown stories. Therefore, only the results from the complete dataset will be reported here. The procedure for analysing the data followed the one described for study 1. The dataset analysed combined data from two studies, which differed in the length of the retention interval between the second semantic task and the second memory testing. One study used a one-week retention interval and the other used a two-week interval. An analysis including study as a between-subject factor did not produce a different pattern of results. Therefore, this factor was excluded from the analysis we report here.

Mean proportions of correct remember, know, familiar and guess responses (see table 5) were calculated for each condition by dividing the total number of correct responses in the awareness category by the maximum possible number of correct responses in each experimental condition (N = 24). Mean proportions for each awareness category were analysed using a repeated measures analysis of variance with time of testing and emotional content of the stories as within-subject factors.

Table 5 about here

Further elaboration of the information over time increased overall recognition memory, as expected [main effect of time of testing: $F(1, 41) = 29.00$, $p < .01$]. This memory improvement was accompanied by an increase in feelings of knowing [main effect of time of testing: $F(1, 41) = 4.21$, $p = .05$], supporting our hypothesis that there would be a significant schematisation of knowledge after further processing of the information. The rate of schematisation of information was similar to both emotional contents, as there was no significant interaction between emotional content and time of testing for feelings of knowing ($F = 1.14$).

We had predicted a remember-to-know shift after further processing over time. However, feelings of knowing increased, as we have just mentioned, while remembering awareness did not change ($F < 1$). Therefore, and considering that remember responses indicate information represented in episodic memory, both emotional and neutral information remained represented episodically at a similar level across time. Feelings of familiarity also remained at the same level after further elaboration of the stories.

We also analysed the case-by-case changes in awareness states from the first to the second memory test. Frequencies of types of transitions (e.g., remember to remember, remember to know, etc.) were compared using paired samples t-tests. We only report comparisons that are theoretically relevant. The theoretically more important comparison is the one between the transition remember-to-know and the other types of transitions. The transition in memory awareness from remember-to-know ($M = 2.57$, $SD = 3.28$) was higher than the transition for know-to-know [$M = 1.45$, $SD = 2.37$; comparison: $t(41) = 1.80$, $p = .04$, one-tailed]. In other words, after further processing of the stories, the amount of episodic information that became represented semantically was higher than the amount of schematised information that remained that way across the two memory tests. New episodic encoding as indexed by feelings of remembering also occurred after further elaboration of the news stories. For instance, there were more familiar responses that became remember responses than

familiar responses that remained that way across the two memory tests [familiar-to-remember: $M = 2.57$, $SD = 2.38$; familiar-to-familiar: $M = 1.62$, $SD = 1.65$; comparison: $t(41) = 2.03$, $p = .05$, two-tailed]. There was also some transition from know-to-remember ($M = 1.62$, $SD = 2.34$), but it was similar to the transition from know-to-know ($M = 1.45$, $SD = 2.37$).

Emotional information, as predicted, led to overall higher memory than neutral stories [main effect of emotional content: $F(1, 41) = 36.71$, $p < .01$]. Our hypothesis that distinctiveness of emotional information would increase feelings of remembering was supported: emotionally negative stories increased correct remembering [main effect of emotional content: $F(1, 41) = 30.70$, $p < .01$], whereas the other awareness categories were not significantly affected by the emotional content of the material.

To enable further comparison of our data with Conway et al.'s (1997) results, we analysed the dataset in terms of the accuracy of the information recognised. The accuracy analysis concerns a posteriori probabilities, that is, accuracy proportions were calculated by dividing the number of correct responses in each awareness category by the total number of answers (correct and incorrect answers) provided by the participant in that category (e.g. accuracy of remember responses for emotional stories = number of correct remember responses for emotional stories / total number of remember responses for emotional stories). This analysis shows the chance that a certain awareness response pertains to a correct memory. Mean accuracy proportions for each awareness category are displayed in table 6.

Table 6 about here

Some participants did not have responses in one or two of the awareness categories – these missing cases (N = 79 out of 672) were excluded from the analysis. Accuracy of remembering was very high ($M = .94$, $SD = .06$), followed by a close level of accuracy for knowing ($M = .89$, $SD = .14$), then accuracy for familiar responses ($M =$

.72, *SD* = .13), and, lastly, accuracy for guessing (*M* = .45, *SD* = .15) – all the simple comparisons between pairs of awareness categories are significant, p < .01, except the comparison between accuracy for remember and accuracy for knowing, which tends to significance (*p* = .055). The accuracy levels for all the awareness categories, including guess responses, are well above chance level (0.25). Accuracy for remembering and familiarity were not affected by the variables. Emotional content increased accuracy for know responses [main effect of emotional content: $F(1, 18) = 5.14$, $p = .04$] and for guess responses [main effect of emotional content: $F(1, 31) = 4.52$, $p = .04$]. Further elaboration of the stories only increased accuracy for guessing [main effect of time of testing: $F(1, 31) = 7.28$, $p = .01$].

Correct feelings of recollection (*M* = .48, *SD* = .14) predominated awareness in memory, followed by correct familiar responses (*M* = .15, *SD* = .07), then by correct know responses (*M* = .11, *SD* = .10) and correct guess responses (*M* = .07, *SD* = .04) – all the simple comparisons between pairs of awareness categories are significant, p < .01). This pattern did not exactly parallel the pattern observed for accuracy. Remember responses were both the most frequent and the most accurate ones. The most important point is that while feelings of just knowing were less frequent then feelings of recollection and of familiarity, they were, nonetheless, very accurate.

Correct guess responses were not significantly affected by the variables. Incorrect responses ranged from 0.01 to 0.07 for feelings of recollection, just knowing and familiarity; incorrect guesses were more frequent and ranged from 0.09 to 0.14 (see table 7). Incorrect remember responses did not vary significantly as a function of emotional valence and time of testing. Both incorrect feelings of knowing and feelings of familiarity were more frequent to neutral than to emotionally negatives stories [respectively, $F(1, 41) = 9.67$, $p < .01$; and $F(1, 41) = 11.50$, $p < .01$]. Incorrect guesses were also higher for neutral than for emotionally negative stories [$F(1, 41) = 19.12$, $p < .01$] and they decreased in the second testing [$F(1, 41) = 28.61$, $p < .01$].

Table 7 about here

Discussion

Opportunities to learn the information over a long time period (3-4 weeks) did increase the awareness of just knowing the information for both emotionally negative and neutral stories, and only with two semantic tasks performed one week apart. This finding supports our prediction that further elaboration of the information would lead to encoding in semantic memory as indexed by know responses. Studies in awareness in memory about students' knowledge acquisition have also found that feelings of remembering diminished while feelings of knowing increased – an effect described as a remember-to-know shift (Conway et al., 1997; Herbert & Burt, 2001). In our experiment 2 there was no evidence that remembering diminished after further elaboration of the material, as it did in the acquisition of knowledge by students (Conway et al., 1997; Herbert & Burt, 2001) and with repeated memory testing for emotional stories (chapter 2 in this thesis, exp. 1). The lack of a remember-to-know shift in our study may be due to the nature of the study materials used – news stories are stories about situations, about people, which always include a significant amount of specific/contextual information. News stories from certain knowledge domains can also be structured as an event script (a semantic representation) but, nonetheless, they will always contain specific information, which is what makes them a 'story'. The contents of lecture and methodology courses in the studies by Conway et al. (1997) and by Herbert and Burt (2001) contain more general knowledge. Nonetheless, Conway et al. (1997) suggested that broad and open information domains, such as the information in lecture courses (and in news stories), are likely less prone to schematisation in comparison with more self-contained information domains, such as information about procedures and methodology. These characteristics suggest that a better memory representation of information in stories would have to be significantly episodic rather than predominantly semantic. Another possible reason that could have contributed to the

high levels of remembering is that the recognition memory test used was the same in the two testing occasions. Conway et al. and Herbert & Burt (2001) also used the same test, but their time interval between tests was of 24-25 weeks, much longer than the interval used in our study.

Conway et al. (1997) had proposed that a remember-to-know shift could result from two processes: the loss of the ability to retrieve episodic details and the increased availability of schematised representations. Our results only provide support for the second process – the increase in know responses after further elaboration of the news stories supports the occurrence of schematisation of knowledge. As feelings of remembering remained at a similar level after further elaboration, it is clear that the increase in feelings of knowing is not a side effect of the loss of availability of episodic details, as already pointed by Herbert & Burt (2001).

Know and familiar awareness responses were used in this study as a finer grained assessment of awareness in memory for information represented in a semantic memory system. Familiar responses were found to be more frequent than know responses, even after 3 weeks, but they did not increase with learning while know responses did. Conway et al. (1997) and Herbert & Burt (2001) also found a dissociation between know and familiar responses. Therefore, when assessing awareness for long-term semantic memory, it seems more adequate methodologically to separate the meanings of familiarity and just knowing.

The observation that feelings of knowing increased for both emotional contents suggests that the encoding in semantic memory is independent of the emotional content of the information processed. This finding converges with a previous observation that repeated testing increased feelings of familiarity/knowing for both emotionally negative and neutral news stories (chapter 2 in this thesis, exp. 1). In this previous study, we asked participants to read a set of emotionally negative and neutral news stories and to answer the same recognition memory test immediately and after a 4-day interval. We found that no forgetting occurred but that the awareness pattern

accompanying memory was different in the immediate testing and in the delayed testing. Feelings of remembering decreased while feelings of familiarity/knowing increased for both emotional contents from the immediate memory test to the delayed repeated memory test.

Emotional news stories produced the expected pattern of results: increased memory and feelings of recollection, whereas feelings of familiarity and of just knowing were not affected by the emotional content of the stories. This finding replicates the one obtained in experiment 1 with a different set of news stories, which strengthens the support for the view that awareness in memory for emotional information is mainly influenced by emotional distinctiveness.

Feelings of recollection were the most frequent and the most accurate states of awareness. This finding converges with Conway et al.'s (1997) suggestion that remembering is very accurate when it is the predominant response category. In their study, when remembering decreased and when it was not the predominant response category, accuracy for remembering also decreased. Herbert and Burt (2001) observed that, in lecture courses, a decrease in remembering was accompanied by an increase in accuracy of remember responses, but remember responses were still the dominant response category. Feelings of knowing were less frequent than feelings of familiarity but they were more accurate than feelings of familiarity. This finding supports Conway et al. (1997) and Herbert and Burt (2001) observation that when people reported feelings of just knowing the information, they were also very accurate, regardless of their frequency, because they are mediated by schematised knowledge.

General discussion

Two studies investigated the effects of repeated encoding on awareness in memory for emotional information. In the first study we tested the effect of exact repetition: half of the participants read each news story twice consecutively. This variable increased correct remembering for emotional stories, but mainly for neutral

stories, while not affecting significantly correct feelings of familiarity/knowing. This pattern of results replicated previous findings obtained with other types of materials such as music excerpts from a familiar background (Gardiner et al., 1996; Gardiner & Radomski, 1999), lists of words (Dewhurst & Anderson, 1999, exp. 1) and lists of faces (Parkin, Gardiner & Rosser, 1995, exp. 2). It has been suggested that exact repetition of the stimuli leads to the creation of multiple episodic traces during the two encoding situations, which will provide more retrieval cues and, consequently, will enhance memory (Dewhurst & Anderson, 1999; Hintzman, 1988). This position is further supported as feelings of remembering – indicators of information in episodic memory – increase with exact repetition, while feelings of familiarity/knowing – indicators of information in semantic memory – do not (Dewhurst & Anderson, 1999).

In the second study, repetition of encoding was spread over a long period of time (from 3 to 4 weeks) and involved different encoding situations. In this study, besides assessing feelings of remembering, we assessed separately feelings of just knowing the information and feelings of familiarity towards the information. This distinction was made as feelings of knowing seem to better capture the awareness felt towards information schematised in semantic memory (Conway et al., 1997). We observed that the only awareness responses that changed significantly over time were the correct know responses – they increased with only four exposures to the information, equally for both emotional and neutral stories. This finding suggests that there was some schematisation of knowledge, and that the rate of semantic encoding is independent of the emotional content of the material. This result parallels the increase in feelings of familiarity for both emotionally negative and neutral news stories after a 4-day interval repeated testing (chapter 2 in this thesis, exp. 1). The finding that schematisation of knowledge occurs independently of the emotional valence of the study material requires further evidence, but it implies that transferring information to semantic memory is achieved independently of the distinctiveness of the information.

Emotional information increased not only memory but also feelings of recollection, supporting the view that remembering is mainly affected by distinctiveness of information. Previous findings showing that emotional information does not seem to increase feelings of familiarity/knowing were replicated here (Dewhurst & Parry, 2000; Ochsner, 2000; Pesta et al., 2001; chapters 2 and 3 in this thesis).

Distinctiveness of processing can be characterised by an initially more fluent encoding. In fact, Schmidt (1991) mentioned evidence linking distinctive stimuli and orienting responses, which suggests that the initial processing of distinctive stimuli is more fluent than the processing of non-distinctive stimuli. The suggestion that distinctiveness of processing includes aspects of fluency of processing can also be found implicitly in Rajaram (1998, exp. 1), one of the launching studies for the distinctiveness-fluency approach. Rajaram considered that some of the processing characteristics that made dominant meanings of homographic words more distinctive than non-dominant meanings were their ease of processing and activation. Ease of access and ease of activation have, however, been proposed as core characteristics of fluency of processing (e.g., Jacoby, Kelley & Dywan, 1989).

The proposal that distinctiveness entails an initial more fluent processing raises the possibility that feelings of recollection could be affected by both distinctiveness and fluency of processing. We can use Rajaram' s (1996) results to support this claim. Rajaram concluded that remembering is affected by perceptual distinctiveness because size congruency of objects at study and at test and the same orientation of objects at study and at test led to higher recognition and higher remembering. However, the same perceptual conditions at study and at test have been suggested to reflect a fluent processing (Jolicoeur, 1987). Jolicoeur (1987) found that patterns with the same size at study and at test were not only more accurately recognised but they had also faster recognition times in comparison with recognition for visual shapes differing in size between study and test. Therefore, our re-interpretation of Rajaram's findings (1996, 1998) suggests that remembering could be affected by fluency of

processing, either conceptual or perceptual. It is possible that the same processing conditions at study and at test, somehow, provided the opportunity for further elaboration of the individual stimuli in Rajaram's (1996) study, but this possibility needs to be clarified. The vagueness in the characterisation of the conditions promoting distinctiveness of processing is a central theoretical problem that affects the research on distinctiveness of processing: research has not produced yet a set of predictors about which type of information will be distinctively processed and which will not (Schmidt, 1991, 1996).

The concept of fluency of processing is also vaguely defined. It can refer to a fast processing, but it can also mean a spread of activation along the cognitive representations without the need to assume processing speed. For instance, Dewhurst & Anderson (1999, exp. 2) found that, after relational processing of the information, both true and false memories were accompanied by an increase in feelings of familiarity/knowing. Relational processing activates general knowledge structures, which can lead to inference of information and, therefore, increase both true and false memories.

To conclude, the definitions of fluency and distinctiveness of processing remain vaguely defined as explanatory concepts and the assumption that fluency and distinctiveness of processing are orthogonal has not been reasonably justified. Feelings of familiarity and feelings of knowing seem to be mainly elicited by fluency of processing and by relational processing in the absence of strong distinctive or elaborative processing (e.g., Dewhurst & Anderson, 1999, exp. 2; Rajaram & Geraci, 2000), which supports the fluency component of the distinctiveness-fluency hypothesis. Moreover, most definitions of distinctiveness of processing seem to include aspects of fluency of processing. This suggestion is in line with Tulving's (1995) proposal that encoding in the memory systems is serial, particularly from the semantic system to the episodic system. If information is first encoded semantically, then, if no further episodic encoding is pursued, the process of activation of semantic representations will mainly

give rise to feelings of familiarity at retrieval. More fluently information processed can be available sooner to be episodically processed. If information is further encoded episodically, then further elaboration of distinctive features takes place and its retrieval can elicit feelings of recollection.

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Footnote

Comparing mean proportions across awareness categories with an analysis of variance including type of awareness responses as a factor would violate the assumption of independence. Awareness categories are mutually exclusive in the methodology used, that is, the respondent can only choose one awareness option, excluding the other awareness options. Therefore, mean proportions across awareness categories were compared using simple comparisons, which is the procedure also followed by Herbert & Burt (2001, 2003, 2004).

Table 1

Mean ratings for emotionally negative and neutral news stories in experiment 1 (standard deviations in parentheses)

	Negative	Neutral
Happy-Sad	4.67 (0.36)	2.55 (0.41)
Distressing-Pleasant	1.52 (0.40)	3.52 (0.34)
Amusing-Serious	4.77 (0.35)	3.16 (0.43)
Boring-Interesting	4.12 (0.53)	3.45 (0.56)
Exciting-Calm	2.85 (0.48)	2.96 (0.31)
Simple-Complex	2.49 (0.75)	2.48 (0.69)
Comprehensibility	1.78 (0.50)	2.23 (0.55)

Table 2

Mean proportions of correct responses as a function of emotional valence and study trials (with standard deviations in parentheses)

	One trial		Two trials	
	Negative	Neutral	Negative	Neutral
Remember	. 59 (.18)	.33 (.17)	.70 (.16)	.53 (.16)
Know	.17 (.12)	.18 (.13)	.16 (.10)	.18 (.08)
Guess	.05 (.06)	.12 (.06)	.03 (.04)	.09 (.08)
Overall	.81 (.12)	.62 (.10)	.89 (.10)	.80 (.09)

Table 3

Mean proportions of incorrect responses as a function of emotional valence and study trials (with standard deviations in parentheses)

	One trial		Two trials	
	Negative	Neutral	Negative	Neutral
Remember	. 03 (.04)	.03 (.04)	.03 (.03)	.02 (.03)
Know	.06 (.06)	.06 (.06)	.03 (.05)	.05 (.05)
Guess	.10 (.08)	.28 (.12)	.05 (.06)	.09 (.07)
Overall	.19 (.12)	.38 (.11)	.11 (.10)	.19 (.10)

Table 4

Mean ratings for emotionally negative and neutral news stories in experiment 2 (standard deviations in parentheses)

	Negative	Neutral
Happy-Sad	4.34 (0.46)	2.50 (0.40)
Distressing-Pleasant	1.87 (0.48)	3.50 (0.39)
Amusing-Serious	4.75 (0.38)	3.22 (0.41)
Boring-Interesting	4.00 (0.52)	3.62 (0.52)
Exciting-Calm	2.79 (0.35)	2.99 (0.23)
Simple-Complex	2.61 (0.78)	2.31 (0.68)
Comprehensibility	1.75 (0.52)	1.85 (0.55)
Familiarity	3.25 (0.80)	2.94 (0.75)

Table 5

Mean proportions of correct responses as a function of emotional valence and time of testing (with standard deviations in parentheses)

	Immediate testing		Delayed testing	
	Negative	Neutral	Negative	Neutral
Remember	. 52 (.17)	.41 (.19)	.55 (.20)	.44 (.20)
Know	.09 (.11)	.09 (.11)	.12 (.12)	.13 (.15)
Familiar	.13 (.06)	.15 (.09)	.16 (.11)	.18 (.12)
Guess	.07 (.05)	.08 (.05)	.06 (.06)	.06 (.08)
Overall	.82 (.10)	.72 (.13)	.89 (.09)	.81 (.10)

Table 6

Mean accuracy proportions as a function of level of emotional valence and time of testing (with standard deviations in parentheses)

		Immediate testing		Delayed testing	
		Negative	Neutral	Negative	Neutral
Remember	(*N* = 41)	.94 (.07)	.93 (.09)	.97 (.06)	.93 (.09)
Know	(*N* = 19)	.90 (.17)	.81 (.19)	.95 (.11)	.89 (.146)
Familiar	(*N* = 39)	.72 (.21)	.67 (.22)	.81 (.20)	.73 (.28)
Guess	(*N* = 32)	.46 (.28)	.34 (.23)	.62 (.36)	.48 (.37)

Note. The number of cases is not the same across categories because mean accuracy proportions were calculated separately for each awareness category, excluding the missing cases in each category.

Table 7

Mean proportions of incorrect responses as a function of emotional valence and time of testing (with standard deviations in parentheses)

	Immediate testing		Delayed testing	
	Negative	Neutral	Negative	Neutral
Remember	. 03 (.04)	.03 (.05)	.02 (.04)	.03 (.05)
Know	.01 (.03)	.02 (.03)	.01 (.01)	.01 (.02)
Familiar	.05 (.05)	.07 (.05)	.04 (.11)	.07 (.06)
Guess	.09 (.06)	.14 (.10)	.04 (.05)	.07 (.08)
Overall	.18 (.10)	.27 (.13)	.11 (.09)	.19 (.10)

Chapter 5 Effects of context distinctiveness on awareness in memory for emotional news stories

Running head: Emotional distinctiveness and awareness in memory

Effects of context distinctiveness on awareness in memory for emotional news stories

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Abstract

Emotional information has been found to increase memory and feelings of remembering in awareness in memory, which has been explained by the distinctiveness of emotional material. The hypothesis that the effects of emotional distinctiveness are context-related was not confirmed, that is, memory and remembering superiority for emotional information did not disappear when study lists contained only emotionally negative items or emotionally neutral items. After reading lists of emotionally negative news stories and lists of neutral news stories, participants showed a pattern similar to the one obtained in mixed lists – increased memory and feelings of remembering for emotionally negative information. Therefore, the distinctiveness of emotional information seems to be inherent to the material.

Effects of context distinctiveness on awareness in memory for emotional news stories

Retrieving information from memory can elicit different feelings of awareness towards that information. The theoretical conceptualisation of feelings of awareness in memory in cognitive psychology was launched by Tulving (1985), who suggested that information represented in different memory systems raised different subjective states of awareness. He proposed that information represented in the episodic memory system induces an autonoetic consciousness, which can be measured by feelings of vivid recollection, of mentally reliving the situation. These feelings have been termed remember responses. Information represented in the semantic memory system elicits a noetic consciousness, measured by feelings of familiarity and by feelings of just knowing the information retrieved, in the absence of conscious recollection. These responses have been usually termed know responses (e.g., Gardiner, 1988).

Processing explanations soon complemented the memory systems approach. The initial proposal was that conceptual processing increased feelings of recollection, whereas feelings of familiarity/knowing were elicited by perceptual processing (e.g. Gardiner, 1988). However, contrary evidence such as the finding that remembering could increase with perceptual processing manipulations (Rajaram, 1996; 1998, exp. 2) supported another processing approach – the distinctiveness-fluency approach (Rajaram, 1996). It proposes that feelings of recollection are elicited by conceptual or perceptual distinctiveness of processing and that feelings of familiarity/knowing arise from conceptual or perceptual fluency of processing. This approach has produced some supporting evidence (e.g., Dewhurst & Anderson, 1999; Rajaram, 1996, 1998). Failures to observe expected effects have also been reported, mainly regarding the fluency component of the hypothesis (e.g., Dewhurst, 2001, July, exp. 1).

In one study to test the predictions of the distinctiveness component, Dewhurst & Parry (2000) explored the idea that distinctiveness can be absolute or relative to the study context. Absolute distinctiveness occurs when stimuli elicit distinctive processing

per se, as they are distinctive in relation to long-term memory representations (secondary distinctiveness, according to Schmidt, 1991). When an item becomes salient in relation to its surrounding context, then its distinctiveness is termed relative (Dewhurst & Parry, 2000) or primary distinctiveness (Schmidt, 1991).

To investigate the effects of absolute and relative distinctiveness on awareness in memory Dewhurst & Parry chose emotional information, as the higher memory usually found for these stimuli has been explained by the distinctiveness of emotional information. They predicted that, if distinctiveness of information increases feelings of recollection, then higher memory for emotional stimuli should be accompanied by an increase in remember responses. Furthermore, if the distinctiveness of emotional material arose from it having mixed with neutral items, which would make emotional items more distinctive, then distinctiveness of processing would be relative to the context and not absolute or inherent to the stimuli. In that case, in emotionally homogeneous lists of words, memory and feelings of recollection should attain similar levels for both emotional and neutral words. Their predictions that the effects of emotional distinctiveness in memory and awareness were relative to the context, rather than absolute, were confirmed: emotional words led to higher recognition memory and increased remembering only in mixed lists; in emotionally homogeneous lists of words, memory and awareness performance was similar for emotional and neutral words.

However, the current characterisation of the processing of emotional information would rather predict that the processing of emotional information is inherently distinctive than that its distinctiveness arises from emotional stimuli being salient in relation to their immediate context. Processing emotional information involves specific neural and hormonal mechanisms and it triggers an enlarged use of cognitive resources such as increased attention, increased rehearsal and increased elaboration (e.g., Hamann, 2001; Ochsner, 2000; Schmidt, 1991). Emotional stimuli also seem to be processed rather automatically at a pre-attentive stage (Christianson, 1992b). Taking this evidence into consideration, distinctiveness of processing emotional

information at the encoding stage should increase feelings of recollection even in lists of emotionally homogeneous items, as emotional information seems to elicit a different pattern of physiological, neurological and cognitive processing. In the literature, feelings of familiarity/knowing have not been affected by the emotional valence of the material, or, less frequently, they have increased with emotionally positive or neutral information (e.g., Dewhurst & Parry, 2000; Ochsner, 2000; Pesta, Murphy & Sanders, 2001; see chapters 2, 3 and 4 in this thesis). We also expect that emotional valence would not affect know responses.

In previous studies we have been investigating the effect of emotionally negative news stories on awareness in memory. In all of them we used mixed lists of emotionally negative and neutral stories, and we have obtained the pattern of results just described above: greater feelings of recollection for emotionally negative stories and no effect on feelings of familiarity/knowing or an increase in feelings of familiarity/knowing for neutral stories (see chapters 2, 3 and 4 in this thesis). Here we report a study with emotional valence of the news stories being manipulated within-lists, that is, we had lists of only emotionally negative news stories and of only neutral news stories. We had the same group of participants processing the news stories, in a counterbalanced order. We expected to find both memory and remembering superiority for emotionally negative news stories in homogeneous lists. This result would indicate that emotional distinctiveness usually is not significantly dependent on the study context. Therefore, distinctiveness of emotional information should arise from features inherent to the emotional stimuli.

Method

Participants

Fourteen City University students participated in this study: 9 women and 5 men. Their mean age was $M = 20.79$, $SD = 3.09$.

Materials

The study material consisted of two blocks of six news stories from a British broadsheet daily newspaper (see appendices 1 and 2). The stories were selected from a broader set that had been previously rated by independent judges in terms of knowledge levels ('yes', 'no', 'don't know' as response options), emotionality levels (5-point scale from 'very negative' to 'very positive') and comprehensibility (5-point scale from 'very easy to comprehend' to 'very difficult to comprehend'). The stories used here obtained ratings of low previous knowledge levels (unknown to 75% of the judges in all cases but one, which was unknown to 62% of the judges), of negative and neutral emotionality levels (ratings below 2 for negative stories and ratings above 2 and below 4 for neutral stories) and easy comprehensibility (ratings below 2).

One block of stories contained emotionally negative stories and the other block contained stories rated as emotionally neutral. There were two sets of booklets for each block of stories – the study set and the test set. The study set comprised a booklet containing the news stories and a booklet containing the rating scales. Each news story was photocopied into a white A4 piece of paper included in the booklet containing the six stories. The scales booklet included eight rating scales for each news story: six affective rating scales concerning emotional valence and reported arousal, one scale for the ease-difficulty of comprehending the news story and one scale about previous knowledge of the story (see appendix 6). The emotional valence dimensions used were happy-sad, distressing-pleasant, and amusing-serious. The reported arousal dimensions used were boring-interesting, exciting-calming and simple-complex. All these dimensions and level of comprehensibility were rated in 5-point scales. Participants were also asked to report whether they had read or heard about each news story before (response options: yes, no, don't know).

The test set included instructions about how to answer the four-choice recognition memory task and about how to report the awareness states, a training task about the different awareness responses (see appendix 7) and the recognition memory

questionnaire, which had 48 questions for each set of stories (see appendix 8). Concluding the memory questionnaire there were questions about age, sex and about media consumption (the latter are not analysed in this article). A written debriefing was also provided after all the tasks were completed.

Design and Procedure

This study used one independent variable – emotional valence of the stories with two levels (negative and neutral stories) manipulated as a within-subject factor. Participants were tested individually or in small groups (2 to 4 people). They were told the study was about the way people process mass media information and that they would answer some questions after reading news stories, but the nature of the questions was not specified (see appendix 5). They also were asked to sign a consent form (see appendix 4). Participants were asked to read a first block of six stories (either emotionally negative or neutral) in order to comprehend them. After reading each story, participants had to rate it in dimensions pertaining to emotionality, comprehensibility and previous knowledge. After this study phase, participants were explained about how to answer the recognition memory task and the awareness responses questions. They also performed a short training for the awareness questions. Afterwards, they performed the recognition memory task. Immediately after they finished, they were asked to justify some of the awareness responses provided. Then, participants were asked to read the other set of six stories, which contained the stories from the emotional valence not presented in the first block. Participants therefore read the first set of news stories and answered the correspondent recognition memory and awareness questionnaire before proceeding to the second set of news stories.

The procedure for the study and test phases was similar to the one used for the first block of stories. Half of the participants was presented with the emotionally negative set of stories first and with the neutral set afterwards; the order of presentation

of the sets was reversed for the other half of the participants. The order of presentation of the news stories within the blocks was also counterbalanced across participants (see appendix 3). Six different sequences were used. In each sequence, each story occurred once in each serial position and there were no more than two emotional or two neutral stories in sequence. By the end, participants were thanked and debriefed. The whole procedure lasted around 80 minutes.

Results

Assessment of the news stories

Mean ratings and proportions of unknown stories were analysed by two-tailed paired-samples *t*-tests. The stories used in the analysis were mostly unknown to the participants (mean proportion of unknown emotionally negative stories: $M = .89$, $SD = 0.14$; mean proportion of unknown neutral stories: $M = .81$, $SD = 0.17$), and these proportions were not significantly different.

The mean ratings for emotionally negative and neutral stories are displayed in table 1. For the rating scales 'happy-sad', 'distressing-pleasant' and 'amusing-serious', which were theoretically related to the emotional valence of the stories, the observed differences between emotionally negative and neutral news stories were statistically significant [happy-sad: $t(13) = 9.56$, $p < .01$; distressing-pleasant: $t(13) = -7.02$, $p < .01$; amusing-serious: $t(13) = 8.64$, $p < .01$]. Emotionally negative stories were rated as quite sad, quite distressing and quite serious, while neutral stories were considered neither sad nor happy, neither distressing nor pleasant and neither amusing nor serious. For the rating scales 'boring-interesting', 'exciting-calming' and 'simple-complex', theoretically related to the reported arousal associated with the news stories, only one significant effect was obtained. The ratings in the scale 'simple-complex' differed significantly as a function of emotional valence [$t(13) = 2.26$, $p = .04$]: emotionally negative stories were considered neither simple nor complex while neutral

stories were considered quite simple. Both emotionally negative and neutral stories were rated as rather interesting and neither exciting nor calming. Regarding comprehension difficulty, stories from both emotional valences were considered quite easy to understand.

Table 1 about here

Memory and awareness

As the dataset including all the answers provided by the participants and the dataset including only the answers from the stories reported to be unknown by the participants produced the same pattern of results, only the results from the complete dataset are reported in this article. We also checked whether the order of the blocks of news stories led to any difference in the results by conducting a mixed-design analysis of variance with emotional valence as a within-subject factor and order of presentation as a between-subject factor. As the order of presentation of the blocks of news stories did not lead to systematic differences or interactions, the results including this factor are not reported here.

Mean proportions of correct answers for each awareness category and in total are displayed in table 2. Mean proportions of correct answers in each awareness category were calculated for each emotional valence level. This was done by dividing the number of correct responses in each awareness category by the maximum possible number of correct responses for emotional and for neutral news stories (N = 48 for both emotionally negative and neutral stories).

Table 2 about here

As predicted, even in emotionally homogeneous lists of news stories, overall memory was higher for emotionally negative than for neutral stories [$t(13) = 4.47$, $p = .01$, two-tailed]. Enhanced memory for emotionally negative news stories was only reflected in correct remember responses [$t(13) = 3.13$, $p = .01$, two-tailed], which supports the claim that emotional information affects awareness in memory mainly via its inherent distinctiveness of processing. Correct know and correct guess responses were not significantly affected by the emotional valence of the stories ($t < 1$).

As awareness categories are mutually exclusive in the methodology used, mean proportions across awareness categories were compared using simple comparisons to avoid violating the assumption of independence required by an analysis of variance (a procedure also used by Herbert & Burt, 2001, 2003, 2004). Feelings of remembering predominated memory as correct remember responses were higher than both correct know responses [$t(13) = 6.73$, $p < .01$, two-tailed] and correct guesses [$t(13) = 12.25$, $p < .01$, two-tailed]. Correct know responses were the second most frequent awareness responses, being significantly higher than correct guess responses [$t(13) = 5.01$, $p < .01$, two-tailed].

Mean proportions of incorrect answers ranged from 0.03 to 0.08 for both remember and know responses and from 0.09 to 0.14 for guesses (see table 3). Incorrect mean proportions of both remember and know responses were quite low and did not vary significantly as a function of the variables. There were significantly more incorrect guesses to neutral than to emotionally negative stories [$t(13) = -2.25$, $p = .04$, two-tailed].

Table 3 about here

Discussion

Our results show clearly that the memory and remembering superiority for emotionally negative news stories obtained in previous studies was not a context effect

(see chapters 2, 3 and 4 in this thesis). Emotionally negative news stories led to higher memory and to more frequent feelings of recollection than neutral stories when presented in emotionally homogeneous lists. This finding also suggests that the lower memory and remembering for neutral stories is not due to constraints in cognitive resources being used for the processing of emotional information.

Therefore, the finding by Dewhurst & Parry (2000, exp. 2) that emotional distinctiveness vanishes in emotionally homogeneous study contexts was not replicated here. Both their and our study used a within-subject design but there is an important methodological difference between the experiments – the study material. Dewhurst and Parry used lists of words. We used more complex verbal material – news stories, which can be argued to consist of a mixture of emotional and neutral information throughout instead of being emotionally homogeneous. Consequently, a text can in itself constitute a context where primary distinctiveness takes place. However, this would be also the case for other complex stimuli such as pictures or sentences or for most of the information surrounding people in their daily lives, making it worthwhile characterising in terms of the required cognitive processing.

Obtaining the same memory and awareness pattern in non-mixed lists, as we did here, and in mixed lists of emotional and neutral items (e.g., Dewhurst, 2001, July, exp. 1; Oschner, 2000; see also chapters 2, 3 and 4 in this thesis) supports the view that the distinctiveness associated with emotional information does not arise from the context. Schmidt (1991) suggested that primary distinctiveness effects should be only obtainable in within-lists designs, as target items only become distinctive in relation to the surrounding context. In a secondary distinctiveness situation, that is, when stimuli are distinctive or dissimilar to the representations activated from long-term memory, better memory for these stimuli should be obtained in both within-lists or between-lists designs. We have obtained better memory and higher remembering for emotional stimuli in both mixed lists (see chapters 2, 3 and 4 in this thesis) and in this within-list

study. Therefore, we can argue that emotional information could be characterised as triggering secondary distinctiveness processing.

However, secondary distinctiveness, as defined by Schmidt (1991), refers only to the similarity of a stimulus in relation to memory representations either in working memory or in long-term memory. He distinguishes emotional distinctiveness from the other types of distinctiveness because emotional information triggers a specific response from the sympathetic nervous system. This characterisation implies that emotional distinctiveness effects are not dependent on the surrounding processing context, and, consequently, should be obtained in both within- or between-lists designs, which we confirmed with our study.

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Table 1

Mean ratings for emotionally negative and neutral news stories (standard deviations in parentheses)

	Negative	Neutral
Happy-Sad	4.32 (0.48)	2.80 (0.28)
Distressing-Pleasant	1.92 (0.61)	3.29 (0.30)
Amusing-Serious	4.34 (0.54)	3.00 (0.42)
Boring-Interesting	3.71 (0.53)	3.59 (0.45)
Exciting-Calm	2.87 (0.22)	3.06 (0.42)
Simple-Complex	2.77 (0.62)	2.23 (0.55)
Comprehensibility	2.12 (0.46)	2.05 (0.49)

Table 2

Mean proportions of correct responses as a function of emotional content (with standard deviations in parentheses)

	Negative	Neutral
Remember	. 58 (.14)	.50 (.15)
Know	.18 (.11)	.19 (.10)
Guess	.06 (.04)	.05 (.04)
Overall	.82 (.13)	.74 (.13)

Table 3

Mean proportions of incorrect responses as a function of emotional content (with standard deviations in parentheses)

	Negative	Neutral
Remember	. 03 (.04)	.04 (.03)
Know	.05 (.06)	.08 (.08)
Guess	.10 (.07)	.14 (.07)
Overall	.18 (.13)	.26 (.13)

Chapter 6 General discussion and conclusions

1. Summary of the results as a function of the hypotheses

Awareness in memory for emotional information was studied using the remember-know approach (e.g., Tulving, 1985). In this theory, feelings of remembering index information represented in episodic memory and feelings of familiarity/knowing indicate information represented in semantic memory. The distinctiveness-fluency approach (Rajaram, 1996, 1998) is one of the more recent approaches explaining the processing underlying these subjective states of awareness. It claims that distinctiveness of processing increases memory accompanied by feelings of remembering while fluency of processing increases memory accompanied by feelings of familiarity/knowing.

Emotional information has been suggested to be both more distinctively and more fluently processed than neutral information at the encoding stage (e.g., Christianson, 1992a, 1992b). Accordingly, the hypothesis that follow from the distinctiveness-fluency approach is that emotional distinctiveness should increase feelings of remembering. Retrieval of emotional information has been scarcely studied but the available evidence suggests either that emotional information is not more fluently retrieved than neutral information or that fluency at retrieval for emotional information is only marginally higher than for neutral information (e.g., Oschner, 2000). The studies reported in this thesis tested these hypotheses. The general method was as follows: participants were first asked to read emotionally negative and emotionally neutral news stories and, afterwards, to answer a recognition memory questionnaire including awareness responses.

The studies broadly support the hypothesis that emotional news stories increased feelings of 'remembering' (via emotional distinctiveness); however, emotion did not systematically affect feelings of 'knowing' (via fluency). These findings also replicated the pattern reported in the literature (Dewhurst & Parry, 2000, exp. 1, using lists of

words; Ochsner, 2000, using lists of photos), extending it to complex verbal materials (text).

Feelings of remembering for both emotional and neutral news stories were also found to increase with manipulations enhancing distinctive/elaborative processing (depth of processing and level of attention at encoding, chapter 3; repeated study trials, chapter 4, exp. 1). These results also replicated those found in the literature for other materials (Gardiner, Kaminska, et al., 1996; Gardiner & Parkin, 1990; Gardiner & Radomski, 1999; Parkin et al., 1995), and provide further support for the hypothesis that distinctive processing underlies feelings of remembering.

Emotional information does not seem to be more fluently retrieved than neutral information: feelings of familiarity/knowing did not change significantly with emotional valence. These feelings of awareness increased with manipulations fostering fluency of processing only in the absence of conditions promoting elaborative processing (repeated testing, chapter 2, exp. 1).

The hypothesis that conditions promoting learning of the information would lead to semantic encoding of the information as indexed by feelings of knowing was supported, as feelings of knowing increased for both emotional valences while feelings of familiarity did not change over time (for repeated and different encoding situations, chapter 4, exp. 2). This finding suggests that the acquisition of schematic knowledge is independent of the emotional valence of the information.

2. Distinctive processing fosters feelings of remembering

The finding that emotional news stories foster memory and feelings of recollection supports the hypothesis that remembering is promoted by distinctiveness of processing, particularly by emotional distinctiveness. Only in one experiment out of

seven did memory and feelings of remembering present a similar level for both emotional and neutral stories (shallow vs. deep encoding; chapter 3, exp. 1), and this result could have been due to the particular set of stories used and to the instructions that emphasised the need to read the text very carefully in the deep encoding condition.

Memory and, in particular, remembering superiority for emotional news stories, rather than neutral, does not seem to be due to emotional distinctiveness arising from the study context (that is, when an emotional story is more distinctive because it stands out among neutral stories): it was obtained in both mixed lists of emotional and neutral stories (chapters 2, 3, 4) and in emotionally homogeneous lists of stories (lists of only emotionally negative news stories vs. lists of neutral news stories; chapter 5). This finding also conflicts with one possible explanation for the effect of emotional stories: in mixed lists, the allocation of cognitive resources could favour the more distinctive emotional stories, at the expense of cognitive resources allocated for neutral stories. Moreover, the processing of emotional information has been characterised as involving more cognitive resources (attention and elaboration) and specific neuronal and hormonal mechanisms (e.g., Christianson, 1992a, 1992b), which suggests that emotional distinctiveness is inherent to the material rather than emerging from the context (Schmidt, 1991).

However, higher memory and remembering for emotional words was found in mixed lists rather than in pure lists by Dewhurst & Parry (2000, exp. 2): emotional words led to higher memory and remembering when presented in mixed lists (emotional and neutral words), whereas emotional and neutral words presented similar levels of memory and remembering feelings in lists of emotional words and in lists of neutral words. The differences between theirs and our study could be due to the study material used. Dewhurst and Parry used lists of words. We used more complex verbal material – news stories, which can be argued to consist of a mixture of emotional and

neutral information throughout instead of being emotionally homogeneous. Consequently, a text can in itself constitute a context where distinctiveness arising from the context can occur. This would also be the case for other complex stimuli such as pictures or sentences or for most of the information surrounding people in their daily lives.

When elaborative encoding is promoted, it is feelings of remembering that increase, while feelings of knowing/familiarity do not change, and they increase for both emotional valences (chapter 4; exp.1; chapter 3). Reading news stories twice and consecutively increased correct remembering for emotional stories, but mainly for neutral stories, while not affecting significantly correct feelings of familiarity/knowing (chapter 4, exp.1). This pattern of results replicated previous findings obtained with other types of materials such as music excerpts from a familiar background (Gardiner, Java & Richardson-Klavehn, 1996; Gardiner & Radomski, 1999), lists of words (Dewhurst & Anderson, 1999, exp. 1) and lists of faces (Parkin et al., 1995, exp. 2). Exact repetition of the stimuli has been suggested to promote the creation of multiple episodic traces during the two encoding situations, which would provide more retrieval cues and, consequently, would enhance memory (Dewhurst & Anderson, 1999; Hintzman, 1988). This position is further supported as feelings of remembering – indicators of information in episodic memory – increase with exact repetition, while feelings of familiarity/knowing – indicators of information in semantic memory – do not (Dewhurst & Anderson, 1999).

As text processing involves both elaborative and organisational processes (e.g., Einstein, McDaniel, Bowers & Stevens, 1984; Hunt & McDaniel, 1993), impoverished encoding conditions such as shallow depth of processing and divided attention were predicted to undermine memory accompanied by feelings of remembering and by feelings of familiarity/knowing. This prediction was supported for feelings of remembering, but not for feelings of familiarity/knowing, which remained at similar

levels across encoding levels (chapter 3). These results replicated the findings in the literature for other materials such as lists of words (Gardiner & Parkin, 1990) and lists of faces (Parkin et al., 1995). Once again, feelings of remembering seem to accompany memory enhancement due to distinctive or elaborative encoding.

Nevertheless, the concept of distinctive processing is not without problems. Which processing conditions promote distinctiveness of processing are not very clear in many studies, and they are defined often a posteriori and based on memory performance (Schmidt, 1991, 1996). Therefore, a central theoretical problem that affects the research on distinctiveness of processing is that research has not yet produced a set of predictors regarding which type of information will be distinctively processed and which one will not (Schmidt, 1991, 1996). This problem also affects directly most research on awareness in memory using the distinctiveness-fluency approach. For instance, Rajaram (1996) concluded that remembering is affected by perceptual distinctiveness because size congruency of objects at study and at test and the same orientation of objects at study and at test led to higher recognition and higher remembering. However, the same perceptual conditions at study and at test have been empirically found to reflect a fluent processing – Jolicoeur (1987) found that patterns with the same size at study and at test were not only more accurately recognised but they had also faster recognition times in comparison with recognition for visual shapes differing in size between study and test. Therefore, Rajaram's findings (1996) can be re-interpreted to suggest that remembering is affected by perceptual fluency of processing. It is also possible that the same processing conditions at study and at test, somehow, provided the opportunity for further elaboration of the individual stimuli in Rajaram's (1996) study.

This problem does not seem to apply to emotional information, as emotional stimuli have been characterised as triggering distinctive processing at different levels of analysis, as described in chapter 1. Therefore, there are characteristics independent of

the processing manipulations for justifying distinctiveness of emotional information, which gives strength to results obtained in the studies reported in the present thesis.

Some definitions of distinctiveness of processing acknowledge that the initial processing of distinctive stimuli is more fluent than the processing of non-distinctive stimuli. For instance, Schmidt (1991) mentioned evidence linking distinctive stimuli and orienting responses. Distinctive processing can also foster relational processing: Hunt & Mitchell (1982) found that conceptual distinctiveness of words induced relational processing while orthographic distinctiveness promoted item-specific processing. The acknowledgement that distinctiveness of processing is mingled with fluent processing is also implicit in the distinctiveness-fluency approach. Rajaram (1998, exp. 1) used dominant meanings of homographic words as distinctive stimuli. However, among the characteristics of these stimuli, she mentioned that dominant meanings were more easily accessed and activated than non-dominant meanings, which are characteristics of fluent processing (e.g., Jacoby et al., 1989). The proposal that distinctiveness entails an initial more fluent processing raises the possibility that feelings of remembering could be positively affected by both distinctiveness and fluency of processing. This claim is also supported by the re-interpretation of Rajaram's (1996) findings in the previous section that conditions fostering perceptually fluent processing can increase feelings of remembering.

3. Emotional information does not affect systematically feelings of familiarity/knowing

Emotional information does not seem to be more fluently retrieved than neutral information: know responses were not significantly affected by the emotional valence of the material, a finding also reported by other authors (Dewhurst & Parry, 2000; Pesta et al., 2001). There was one exception in the seven studies reported in this thesis in

which feelings of familiarity/knowing were statistically higher for neutral than for emotionally negative stories (chapter 3, exp. 2). Oschner (2000) also found this for emotional photos, and the effect was significant in two out of three studies. Neutral information is less likely than emotional information to be processed in a more elaborated or distinctive way and to be encoded episodically. Therefore, the encoding in semantic memory should, from a theoretical point of view, give rise to higher feelings of familiarity/knowing for neutral information than for emotional information.

There was also another exception: we found higher correct know responses for emotionally negative stories than for neutral stories in experiment 2 reported in chapter 2. However, this single result should be considered cautiously as it was obtained from the analysis of a reduced dataset (answers from unknown stories), and with quite low levels of correct know responses.

It is not only the concept of distinctiveness of processing that it is difficult to define. The concept of fluent processing has also been broadly (and vaguely) defined, as it refers to the ease of processing information (Jacoby, Kelley & Dywan, 1989). It usually refers to the speed of processing (e.g., Rajaram & Geraci, 2000); to the nature of the spread of activation among the cognitive representations, without the need to assume processing speed (e.g., duration of stimuli presentation, discriminability in terms of stimuli visibility and semantic priming, Dewhurst, 2001, July); or to relational processing, which goes beyond the basic activation of information and involves integration of information (e.g., Dewhurst & Anderson, 1999, exp. 2). For instance, Dewhurst & Anderson (1999, exp. 2) found that, after a task requiring relational processing of the information, both true and false memories were accompanied by an increase in feelings of familiarity/knowing. Relational processing activates general knowledge structures, which can lead to inference of information and, therefore, increase both true and false memories.

Text has been reported to depend on both elaborative and organisational/ relational processes, which could be negatively affected by impoverished encoding conditions. Nonetheless, the prediction that shallow depth of processing (skimming news stories to count the number of people mentioned) and divided attention would undermine relational processing or fluent processing of the stories and, consequently, would also undermine memory accompanied by feelings of familiarity/knowing was not supported (see chapter 3). Feelings of familiarity/knowing remained at similar levels for both impoverished and non-impoverished encoding conditions, which suggests that relational processing of the story structure was not disrupted by impoverished encoding conditions. If this idea does make sense for reading under divided attention, because the text is read, it is more difficult to understand when the shallow encoding task requires participants just to skim the text to identify when it mentions people. This issue could be clarified by the use of a retrieval task such as free recall, which is sensitive to the different processes underlying prose processing (e.g., relational and proposition-specific processing) and allows the assessment of organisation of the information retrieved (e.g., Hunt & McDaniel, 1993). Recognition memory performance is also dependent on relational and proposition-specific processing, but it is more sensitive to individual-item or proposition-specific processing than free recall (e.g., Einstein & Hunt, 1980; Hunt & Einstein, 1981).

4. Knowledge acquisition from emotional information

From a theoretical point of view, the remember-know approach provides a pathway to explore knowledge acquisition by different memory systems: feelings of remembering index information represented in the episodic memory system while feelings of familiarity/knowing index information represented in the semantic memory system (Tulving, 1985). To study the acquisition of semantic information, it is heuristic

to assess separately feelings of familiarity and feelings of knowing, because states of awareness that come with schematised knowledge may transcend a transient feeling of familiarity that the information was experienced recently and be better captured by a feeling of just knowing that piece of information (Conway et al., 1997; Gardiner & Conway, 1999). There are only a few studies using the remember-know approach to explore awareness for knowledge acquisition (Conway et al., 1997; Herbert & Burt, 2001, 2003, 2004), and all of them use the same type of study materials – the contents of lectures and methodology courses in university degrees.

Emotional information is quite vivid, which suggests that it is mainly represented episodically. Nonetheless, it should be prone to schematisation because we do seem to have abstract knowledge about emotional situations (e.g., some fears or phobias). In this thesis, the issue of differences in awareness in memory for knowledge acquired from emotional and neutral information was explored. Knowledge or information acquisition was promoted by repeated processing either at encoding (see chapter 4) or at retrieval (see chapter 2) and by using news stories as study materials, which are more prone to convey meaningful information than materials such as lists of words.

One important finding is that encoding in semantic memory does take place equally or at similar rates for emotional information and for neutral information. Feelings of familiarity/knowing increased with repeated testing after a four-day interval, while feelings of remembering decreased (chapter 2, exp. 1). This result does not seem to be due to the effect of time as, after a retention interval of seven days, both remember and know responses decreased (chapter 2, exp. 2). The most immediate explanation is that processing the same memory questionnaire a second time could have promoted fluency of processing, which could have been experienced by the participant that the information had been previously read in the news stories. From a dual-memory systems point of view, the acquisition of information after repeated

processing accompanied by an increase in know responses suggests that some semantic encoding took place.

To further explore this possibility, awareness accompanying semantic information was disentangled into feelings of familiarity and feelings of knowing. After repetition of encoding over a longer period of time (from 3 to 4 weeks) and involving different encoding situations (chapter 4, exp. 2), only feelings of knowing increased significantly, and this change occurred for both emotional and neutral news stories. Feelings of familiarity remained at similar levels. The finding that schematisation of knowledge occurs independently of the emotional content of the study material implies that transferring information to semantic memory is achieved independently of the distinctiveness of the information. Feelings of remembering did not change, contrary to what had been found after repeated testing and after a retention interval, maybe because the encoding tasks went on maintaining elaborative encoding and preventing forgetting.

To conclude, the definitions of fluency and distinctiveness of processing remain vaguely defined as explanatory concepts and the assumption that fluency and distinctiveness of processing are orthogonal has not been reasonably justified. Feelings of remembering seem to increase with distinctive/elaborative processing and with fluent or relational processing. In line with this suggestion is the observation that most definitions of distinctiveness of processing seem to include aspects of fluency of processing. Feelings of familiarity/knowing did not change with emotional information or conditions disrupting fluent or relational processing of the information. These feelings seem to be mainly elicited by fluency of processing and by relational processing in the absence of strong distinctive or elaborative processing (e.g., Dewhurst & Anderson, 1999, exp. 2; Rajaram & Geracci, 2000). This suggestion is

made only for awareness in memory for materials quite familiar to the subject (e.g., news stories and excerpts of popular music). When the stimuli is very unfamiliar (e.g., music excerpts of folk songs from an unfamiliar musical culture), both feelings of recollection and of familiarity/knowing have been found to increase (Gardiner et al., 1996; Gardiner & Radomski, 1999).

The proposal that feelings of remembering are affected both by distinctive and by fluent processing at the encoding stage goes against the unidimensional correspondence between states of awareness and a general type of information processing. Furthermore, it is supported by Tulving's (1995) view that encoding in the memory systems is serial, particularly from the semantic system to the episodic system. If information is first encoded semantically, then, if no further episodic encoding is pursued, the process of activation of semantic representations will mainly give rise to feelings of familiarity/knowing at retrieval. Information more fluently processed can be available sooner to be episodically processed. If information is further encoded episodically, then further elaboration of distinctive features takes place and its retrieval can elicit feelings of remembering.

5. Future research

The distinction between distinctive processing (elaborative processing of individual items) and fluent processing (which also includes manipulations of relational processing) made by the distinctiveness-fluency approach can be paralleled by the distinction between proposition-specific (or item-specific) processing and relational processing (e.g. Einstein & Hunt, 1980). In this area, memory for text has been studied as a function of proposition-specific and relational processing within the so-called material appropriate processing approach (e.g. Einstein et al., 1984; Einstein et al., 1990). Therefore, this approach could provide a means to further assess the

relationship between conditions emphasising one type of processing (distinctive/elaborative or fluent/relational) and awareness in memory.

According to the material appropriate processing approach, text processing involves both relational and distinctive processing, but the normal reading of different types of text can emphasise more one type of processing than the other (see, for instance, Einstein et al., 1984, and Hunt & McDaniel, 1993). When the text is characterised by a highly structured relationship between component propositions (e.g., a fairy tale), reading it for comprehension triggers relational processing and the consequent encoding of the text structure. On the other hand, the structure of expository text emphasises the processing of proposition-specific information during reading. If the text invites relational processing, then additional processing emphasising proposition-specific information will improve memory; when the text invites proposition-specific processing, then it is additional relational processing that will enhance memory (see Einstein et al., 1990, and Hunt & McDaniel, 1993, for short reviews). More specifically, memory for fairy tales is enhanced after proposition-specific processing (e.g., filling in deleted letters of the text, embedded questions) and does not benefit systematically from relational processing tasks (e.g., sentence re-ordering, outlining), at least when tested immediately, while memory for expository text is enhanced after relational processing and does not benefit from proposition-specific tasks (e.g., Einstein et al., 1990; McDaniel, Einstein, Dunay & Cobb, 1986).

Emotional and neutral news stories could benefit differently from proposition-specific and relational processing. For instance, if emotional stories induce relational processing due to the story structure and distinctive processing due to its emotional characteristics, then they will not benefit as much as neutral stories from encoding promoting proposition-specific and relational processing. Neutral news stories, being stories (as fairy tales), would likely benefit mainly from proposition-specific encoding. Memory and awareness could be tested using both recall and recognition memory

tests. Recognition memory has been shown to be less sensitive to the organisation of information than free recall and to improve with individual-item processing, (Einstein & Hunt, 1980, exp. 1; Einstein et al., 1990; Hunt & Einstein, 1981, exp. 1). Free recall would allow assessing organisation of information retrieved by analysing gist and verbatim recall (Einstein et al., 1984), by using clustering measures (e.g., Einstein & Hunt, 1980; for a short review, see also Klein, Loftus & Schell, 1994) or by using schematisation measures (Herbert & Burt, 2001, 2004). There is scope for future research to investigate further the processes underlying memory and awareness for text information by comparing performance in recall and recognition memory tests and by using clustering and schematisation measures.

The use of two different retrieval tasks is also in line with the claim that the retrieval process is crucial in the understanding of human memory (Roediger, 2000). The remember-know paradigm is already focused on the retrieval of information in memory, particularly on the awareness that comes with it. However, the processes underlying awareness on retrieval can be further explored by the combined use of encoding and retrieval conditions. The majority of the studies in the literature using the remember-know approach and the ones in this thesis have focused on the effects of different encoding process on awareness in memory. The repeated testing study (chapter 2, exp. 1) was an exception in this thesis. This was a retrieval study in the sense that encoding conditions remained similar and retrieval was varied by measuring it twice over a period of days. Furthermore, most of the studies in the remember-know approach have used recognition memory tests. Examples of exceptions are the use of free and cued recall by Tulving (1985) and the use of forced recall (recall of a specific number of non-repeating details and non-repeating guesses about an event) by Scrivner & Safer (1988). Roediger (2000) defends that the retrieval process could be better investigated if experimental designs employed the entire encoding/retrieval design, that is, if different encoding conditions and retrieval conditions were

manipulated together (e.g., 2 encoding conditions x 2 retrieval conditions). Having different memory tests that are able to capture different available information and that are affected by different retrieval processes could be quite useful on the mapping on the processes affecting feelings of remember and feelings of familiarity/knowing.

6. Final remarks or the research application issue

A last comment concerns the possible areas of application of the research developed in the remember-know approach. On the fundamental level, to be able to explore human cognition and its accompanying awareness further is a goal per se. It also can co-operate with research developed in other levels of analysis such as neuropsychological and neurological research. At a more obvious applied level, it can provide more tools to guide the characterisation of different phenomena such as the effects of aging, clinical situations such as schizophrenia, social anxiety, and autism (see chapter 1), and the study of cross-cultural differences (e.g., self referent effect in western cultures, Conway & Dewhurst, 1995b, and in eastern cultures, Qi & Zhu, 2002). Eyewitness memory and awareness have been studied recently (Frost, 2000; Tuckey & Brewer, 2003). This area can also benefit from research on false memory effects (e.g., Anastasi, Rhodes & Burns, 2000; Dewhurst, 2001, July; Dewhurst & Farrand, 2004; Milani & Curran, 2000; Pesta et al., 2001) and on the effects of schemas in awareness in memory (e.g., Lampinen et al., 2000).

Another area of application is the educational field. Changes in memory and awareness during learning have been addressed by Conway et al. (1997) and by Herbert and Burt (2001, 2003, 2004). Using news stories as a study material suggests that one application of my research is educational: for instance, characterising the processing of acquiring information about the world can help mass-media professionals to organise more efficiently the information they want to transmit. As Larsen (1989)

argues, the characteristics of news stories are different from the characteristics of experienced events and other reported events such as stories, namely their narrative structure, making memory for news reports worthwhile as a study object within an ecological approach to memory.

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Appendices

Appendix 2 News stories used in each study

Chapter 2 – Effects of emotion and retrieval on awareness in memory

Experiments 1 and 2

Emotionally negative news stories

. Murderer stole unborn baby

. Families of dead nuns sue leaders

. Mobile phone bullies drove teenager to suicide

. 7 held as police hunt for body

Emotionally neutral news stories

. Fewer firms go bankrupt

. Muñoz moves into spider's space

. Oxford surges on cancer finding

. Antidote for rattlesnake bites approved

Chapter 3 – Encoding effects on awareness in memory for emotional news stories

Experiment 1 – shallow encoding versus deep encoding

Emotionally negative news stories

. Murderer stole unborn baby

. Mobile phone bullies drove teenager to suicide

. Girl found hanging at home

Emotionally neutral news stories

. Policeman guilty of exposure

. Women urged to avoid the hard stuff

. The only place for physical exertion is the gym

Experiment 2 – full attention versus divided attention

List A

Emotionally negative news stories:

. Murderer stole unborn baby

. Woman may sue GPs who missed tumour

. 7 held as police hunt for body

Emotionally neutral news stories:

. New focus on jobs for women

. The only place for physical exertion is the gym

. Italian gourmets campaign to keep pasta on the menu

List B

Emotionally negative news stories:

. Mother jailed for abandoning sons to go on holiday

. Families of dead nuns sue leaders

. Mobile phone bullies drove teenager to suicide

Emotionally neutral news stories:

. Antidote for rattlesnake bites approved

. Sir Humphrey moves to India in a BBC first

. Women urged to avoid the hard stuff

Chapter 4 - Effects of repetition of processing on awareness in memory for emotional news stories

Experiment 1 – one versus two study trials

Emotionally negative news stories:

. Mother jailed for abandoning sons to go on holiday

. Families of dead nuns sue leaders

. Woman may sue GPs who missed tumour

Emotionally neutral news stories:

. Antidote for rattlesnake bites approved

. New focus on jobs for women

. Sir Humphrey moves to India in a BBC first

Experiment 2 – repeated testing after learning

Emotionally negative news stories:

. Woman may sue GPs who missed tumour

. Families of dead nuns sue leaders

. 7 held as police hunt for body

Emotionally neutral news stories:

. Antidote for rattlesnake bites approved

. New focus on jobs for women

. Sir Humphrey moves to India in a BBC first

Chapter 5 - Effects of context distinctiveness on awareness in memory for emotional news stories

Emotionally negative news stories:

. Murderer stole unborn baby

. Mother jailed for abandoning sons to go on holiday

. Families of dead nuns sue leaders

. Mobile phone bullies drove teenager to suicide

. Woman may sue GPs who missed tumour

. 7 held as police hunt for body

Emotionally neutral news stories:

. Antidote for rattlesnake bites approved

. New focus on jobs for women

. Sir Humphrey moves to India in a BBC first

. Women urged to avoid the hard stuff

. The only place for physical exertion is the gym

. Italian gourmets campaign to keep pasta on the menu

Appendix 3 Counterbalancing of the presentation order of the news stories

Chapter 2 – Effects of emotion and retrieval on awareness in memory

Experiment 1 – repeated testing

Sequences for the presentation of the news stories

Sequence	Serial position 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
a	W	F	R	H	N	P	S	B	O	C	M
b	O	R	N	W	P	H	B	M	F	C	S
c	R	O	W	S	B	F	N	P	C	H	M
d	B	M	O	F	C	S	H	N	W	R	P
e	S	N	H	O	R	M	W	F	C	B	P
f	M	O	R	H	W	P	B	C	S	N	F
g	W	S	N	O	C	M	H	B	P	F	R
h	H	M	S	W	R	B	F	P	N	O	C
i	P	R	M	F	B	O	S	W	H	N	C
j	F	N	P	C	M	W	R	H	B	S	O
k	M	F	S	P	N	C	W	R	B	O	H
l	O	H	M	N	P	S	C	R	F	W	B
m	C	H	B	S	M	O	P	N	W	R	F
n	N	C	W	R	O	B	M	S	P	F	H
o	C	W	H	P	O	F	N	S	M	B	R
p	H	P	F	B	W	R	C	O	S	M	N
q	S	C	O	B	H	N	P	F	R	M	W
r	F	B	C	R	S	W	O	M	H	P	N
s	B	P	C	M	F	N	O	W	R	H	S
t	R	B	F	C	S	H	M	O	N	P	W
u	P	S	B	N	F	C	R	H	M	W	O

Legend:

O. Oxford surges on cancer finding

C. 30% of frozen chickens 'exceed water level'

M. Munoz moves into spider's space

B. Murderer stole unborn baby

S. 7 held as police hunt for body

P. Mobile phone bullies drove teenager to suicide

N. Families of dead nuns sue leaders

H. Hospital's errors 'may total 100'

R. Antidote for rattlesnake bites approved

F. Fewer firms go bankrupt

W. Sex bias scientist wins £38,000

Experiment 2 – immediate versus delayed retention interval

Sequences for the presentation of the news stories

	Serial position							
Sequence	1st	2nd	3rd	4th	5th	6th	7th	8th
a	B	F	N	M	P	O	S	R
b	F	S	O	N	M	R	B	P
c	N	R	P	O	S	B	F	M
d	M	B	F	P	R	S	N	O
e	P	N	M	R	B	F	O	S
f	O	M	B	S	F	P	R	N
g	S	O	R	B	N	M	P	F
h	R	P	S	F	O	N	M	B

Legend:

Emotionally negative stories:

B. Murderer stole unborn baby

S. 7 held as police hunt for body

P. Mobile phone bullies drove teenager to suicide

N. Families of dead nuns sue leaders

Neutral stories

O. Oxford surges on cancer finding

M. Munoz moves into spider's space

R. Antidote for rattlesnake bites approved

F. Fewer firms go bankrupt

Chapter 3 – Encoding effects on awareness in memory for emotional news stories

Experiment 1 – shallow encoding versus deep encoding

Sequences for the presentation of the news stories

	Serial position					
Sequence	1st	2nd	3rd	4th	5th	6th
a	G	P	B	W	M	H
b	P	W	M	G	H	B
c	B	M	P	H	G	W
d	W	G	H	P	B	M
e	M	H	G	B	W	P
f	H	B	W	M	P	G

Legend:

Emotionally negative stories:

G. Girl found hanging at home

B. Murderer stole unborn baby

M. Mobile phone bullies drove teenager to suicide

Neutral stories

P. Policeman guilty of exposure

W. Women urged to avoid the hard stuff

H. The only place for physical exertion is the gym

Experiment 2 – full attention versus divided attention

Sequences for the presentation of the news stories for list A

Sequence	Serial position					
	1st	2nd	3rd	4th	5th	6th
a	B	H	T	J	S	I
b	H	J	S	B	I	T
c	T	S	H	I	B	J
d	J	B	I	H	T	S
e	S	I	B	T	J	H
f	I	T	J	S	H	B

Legend:

Emotionally negative stories:

B. Murderer stole unborn baby

T. Woman may sue GPs who missed tumour

S. 7 held as police hunt for body

Neutral stories

J. New focus on jobs for women

H. The only place for physical exertion is the gym

I. Italian gourmets campaign to keep pasta on the menu

Sequences for the presentation of the news stories for list B

Sequence	Serial position					
	1st	2nd	3rd	4th	5th	6th
a	N	R	M	W	P	B
b	R	W	P	N	B	M
c	M	P	R	B	N	W
d	W	N	B	R	M	P
e	P	B	N	M	W	R
f	B	M	W	P	R	N

Legend:

Emotionally negative stories:

M. Mother jailed for abandoning sons to go on holiday

N. Families of dead nuns sue leaders

P. Mobile phone bullies drove teenager to suicide

Neutral stories

R. Antidote for rattlesnake bites approved

B. Sir Humphrey moves to India in a BBC first

W. Women urged to avoid the hard stuff

Chapter 4 - Effects of repetition of processing on awareness in memory for emotional news stories

Experiment 1 – one versus two study trials

Sequences for the presentation of the news stories

	Serial position					
Sequence	1st	2nd	3rd	4th	5th	6th
a	N	R	T	J	M	B
b	R	J	M	N	B	T
c	T	M	R	B	N	J
d	J	N	B	R	T	M
e	M	B	N	T	J	R
f	B	T	J	M	R	N

Legend:

Emotionally negative stories:

M. Mother jailed for abandoning sons to go on holiday

N. Families of dead nuns sue leaders

T. Woman may sue GPs who missed tumour

Neutral stories

R. Antidote for rattlesnake bites approved

J. New focus on jobs for women

B. Sir Humphrey moves to India in a BBC first

Experiment 2 – repeated testing after learning

Sequences for the presentation of the news stories

	Serial position					
Sequence	1st	2nd	3rd	4th	5th	6th
a	N	R	T	J	S	B
b	R	J	S	N	B	T
c	T	S	R	B	N	J
d	J	N	B	R	T	S
e	S	B	N	T	J	R
f	B	T	J	S	R	N

Legend:

Emotionally negative stories:

N. Families of dead nuns sue leaders

T. Woman may sue GPs who missed tumour

S. 7 held as police hunt for body

Neutral stories

R. Antidote for rattlesnake bites approved

J. New focus on jobs for women

B. Sir Humphrey moves to India in a BBC first

Chapter 5 - Effects of context distinctiveness on awareness in memory for emotional news stories

Sequences for the presentation of the emotionally negative news stories

	Serial position					
Sequence	1st	2nd	3rd	4th	5th	6th
a	N	P	B	T	M	S
b	P	T	M	N	S	B
c	B	M	P	S	N	T
d	T	N	S	P	B	M
e	M	S	N	B	T	P
f	S	B	T	M	P	N

Legend:

B. Murderer stole unborn baby

M. Mother jailed for abandoning sons to go on holiday

N. Families of dead nuns sue leaders

P. Mobile phone bullies drove teenager to suicide

T. Woman may sue GPs who missed tumour

S. 7 held as police hunt for body

Sequences for the presentation of the neutral news stories

	Serial position					
Sequence	1st	2nd	3rd	4th	5th	6th
a	R	J	S	W	I	H
b	J	W	I	R	H	S
c	S	I	J	H	R	W
d	W	R	H	J	S	I
e	I	H	R	S	W	J
f	H	S	W	I	J	R

Legend

R. Antidote for rattlesnake bites approved

J. New focus on jobs for women

S. Sir Humphrey moves to India in a BBC first

W. Women urged to avoid the hard stuff

H. The only place for physical exertion is the gym

I. Italian gourmets campaign to keep pasta on the menu

Appendix 4 Consent forms

The studies reported in Chapter 2 (Effects of emotion and retrieval on awareness in memory) did not use consent forms. The consent form used in the studies reported in chapter 4, 5 and in chapter 3, excluding the divided attention conditions in experiment 2, is the following:

Thank you for taking part in this research. The study you are about to participate in involves two activities:

1. Reading some news stories. Some of them may be emotionally disturbing.
2. Answering a questionnaire about the stories.

Any data you provide will be kept confidential. It is important to remember that your participation is entirely voluntary and you are free to ask questions, or to leave the experiment at any time.

Researchers:

Alexandra Lazaro (PhD student)

Supervisor: Peter Ayton

I have read the above description of the research and I understand that I am free to withdraw at any time. I also consent to take part in this research.

Signed

Date

Name

Age

The consent form used in the divided attention conditions in experiment 2 of chapter 3 is:

Thank you for taking part in this research. The study you are about to participate in involves three main activities:

1. Reading some news stories. Some of them may be emotionally disturbing.
2. Performing mental arithmetic while reading the stories.
3. Answering a questionnaire about the stories.

Any data you provide will be kept confidential. It is important to remember that your participation is entirely voluntary and you are free to ask questions, or to leave the experiment at any time.

Researchers:

Alexandra Lazaro (PhD student)

Supervisor

Peter Ayton

I have read the above description of the research and I understand that I am free to withdraw at any time. I also consent to take part in this research.

Signed

Date

Name

Age

Appendix 5 Instructions

Chapter 2 – Effects of emotion and retrieval on awareness in memory

Experiment 1 – repeated testing

Processing of news information

You are going to participate in a preliminary study about the way people process news information. You will be presented with some news stories to read and you will be asked some questions about them. When reading each story, please do your best to understand it.

After reading each news story, please turn the page and answer the questions on the next page. When you finish answering the questions, turn the page in order to read the next news story and proceed as before, that is, turn the page and answer the questions. Proceed like this until you finish the booklet.

Thank you very much for your collaboration.

Experiment 2 – immediate versus delayed testing

Processing of news information

You are going to participate in a study about how people think about news stories. You will be presented with some news stories to read. When reading each story, please do your best to understand it.

After reading each story, you will be presented with three scales. In the first one you should rate the emotional content of the information in the news story, from 'very negative 'to very positive'. In the second scale you should rate whether the story is easy or difficult to understand, using options from 'very easy to comprehend' to very difficult to comprehend'. In the third you should say whether or not you already knew the story. In case you are not sure whether or not you knew the story, you can choose the 'don't know' option. Try to use this option only as a last resort.

Thank you very much for your collaboration.

Chapter 3 – Encoding effects on awareness in memory for emotional news stories

Experiment 1 – shallow encoding versus deep encoding

Shallow encoding condition:

Processing of news information

You are going to participate in a study about how people think about news stories. You will be presented with some news stories to read. Please, skim each story to count the number of people mentioned in it. You will be asked to report this number after you finish reading the story. Read each story as fast as you can. Your reading times will be measured. Thank you very much for your collaboration.

How many people are mentioned in each story?

Story	Number of people mentioned in each story
1st story	
2nd story	
3rd story	
4th story	
5th story	
6th story	

Deep encoding condition:

Processing of news information

You are going to participate in a study about how people think about news stories. You will be presented with some news stories to read. Please, read each story carefully and attentively. Do your best to understand it and take all the time you need. You will be asked some questions about the story afterwards. Thank you very much for your collaboration.

Experiment 2 – full attention versus divided attention

Full attention condition:

Processing of news information

You are going to participate in a study about how people think about news stories. You will be presented with some news stories. Please, read each story carefully and attentively. Do your best to understand it. You will be asked some questions about the story afterwards. Thank you very much for your collaboration.

Participant-controlled divided attention condition:

Processing of news information

You are going to participate in a study about how people think about news stories. You will be presented with some news stories in a booklet. This booklet contains bits of text alternated with numbers – a piece of paper with text, followed by a piece of paper with a number, then another piece of paper with text, another one with a number and so on. You have to perform two tasks: to read the text and to add all the numbers consecutively. By the end of each story you will have to report the result of the mental arithmetic you have just performed. Try to be as accurate as possible. After reading and performing additions for all the stories, you will be asked some questions about the stories. Thank you very much for your collaboration.

Experimenter-controlled divided attention condition:

Processing of news information

You are going to participate in a study about how people think about news stories. You will be presented with six news stories on the computer screen. The presentation of the news stories will be as follows: you will be presented with bits of text alternated with numbers – a bit of text on one screen, followed by a number on the next screen, then a bit of text on another screen, another one with a number and so on.

You have to perform two tasks: to read the text and to add mentally all the numbers consecutively. In order to do so, please proceed in the following way:

When presented with the headline of the story, press the space bar to begin the story. You will be shown the first bit of the story. Read it normally and press the space bar to go to the next screen. On this screen you will be shown a number that you have to keep in your mind. After some time you will be automatically shown the next bit of text. Read it and press the space bar to go to the next screen. On this next screen, you will be shown another number. Add it to the previous number you were shown, which you should have kept in your mind. Now, keep in mind this new total. After a short time the screen will go automatically to the next bit of text. Proceed as before until the end of the story. Then press the space bar and there will be another screen where you will be asked to report the result of the mental arithmetic you have just performed. Try to be as accurate as possible.

Before beginning this procedure with the news stories, you will be shown two short texts – they will be presented bit by bit, alternated with numbers. Please, rehearse the procedure just described with these two texts. After reading and performing mental arithmetic for all the stories, you will be asked some questions about each story. Thank you very much for your collaboration.

In the divided attention conditions, participants were asked to write down the answer for the secondary task (mental arithmetic). This question was used for *Sequence a* of the news stories in list A: the stories' headlines were adjusted for each sequence in each list of stories.

What is the result of the mental arithmetic you performed for each of the following stories?

Aa. Story	Total
Murderer stole unborn baby	
The only place for physical exertion is the gym	
Woman may sue GPs who missed tumour	
New focus on jobs for women	
7 held as police hunt for body	
Italian gourmets campaign to keep pasta on the menu	

Chapter 4 - Effects of repetition of processing on awareness in memory for emotional news stories

Experiment 1 – one versus two study trials

Processing of news information

You are going to participate in a study about how people think about news stories. You will be presented with some news stories to read. Please, read each story carefully and attentively. Do your best to understand it and take all the time you need. You will be asked some questions about the story afterwards.

Additional instructions after finishing reading the stories in the two- trials condition:

Now, please read the stories again. Even if you think you have a good understanding of the stories you just read, please read them carefully again and try to understand them well.

Experiment 2 – repeated testing after learning

Processing news stories over time

You are going to participate in a study about how people process and acquire information from news stories. You will be asked to read some stories, perform some tasks related to the stories and then answer questions about the stories. This will be done over a period of 3 weeks. In the first meeting you will be asked to read and answer some questions about the stories. Afterwards, you will be given an envelope containing two tasks to be performed in the following two weeks, one in each week. The tasks are labelled for week 1 and week 2 and are accompanied by instructions. One week after the first meeting, you will be asked to perform the first task, following the instructions provided in the envelope. One week after this task, you will then have to perform the second task, again following the instructions in the envelope. Finally, one week after this last task, you will be asked to answer some questions about the stories. The aims and predictions of this study will then be fully explained to you.

Thank you very much for your participation

The two semantic tasks performed one and two weeks after first reading the new stories are presented next.

Answering questions about the stories

Please begin reading the 1st story and answer the questions concerning it as they appear along the story. Read the story until you find the 1st question, answer it, go on reading until you find the 2nd question, answer it, and so on until you finish reading the story.
There is a separate answer sheet with the questions and space to write down the answers. If you need more space, please use the back of the page to finish your reply. Try to answer the questions as thoroughly as possible, returning to the text to check if your answers are correct and complete. Proceed in the same way for the other stories.

Families of dead nuns sue leaders

1. Why did two former leading figures in the Salvadoran army appear in court this week?
2. Why is this civil-action taking place?
3. Why are these two men considered leading figures in the Salvadoran army?
4. Why weren't these men judged at the time?
5. Why did the military kill church related personnel?
6. Why were these specific women killed?

7 held as police hunt for body

1. Why were these people arrested?
2. Why can this operation be considered to involve different types of resources?
3. Why was the operation called off?
4. Why was operation Halifax set up?
5. Why were these people arrested at different times?

Woman may sue GPs who missed tumour

1. Why is this woman, Mrs Parkinson, considering legal action against GPs?
2. Specifically, why did she make the claim to the health authority?
3. Why did the woman go to the doctor in France?
4. Why did she feel disgusted at the differences in treatment between the UK and France?
5. Why did the doctors say that she has around one more year to live?
6. Why did her weight increase?

Sir Humphrey moves to India in a BBC first

1. Why was the political comedy Yes Minister launched in a Hindi version?
2. Why were some alterations to the original scripts made?
3. Why can this experiment of recreating a series be repeated?
4. Why does the article predict the success of the series?
5. Why are Indian audiences used to watching foreign imports?
6. Why is it claimed that the BBC is very confident of the success of the series?

New focus on jobs for women

1. Why is the government creating more jobs for women?
2. Why are these types of jobs considered small businesses?
3. Why is the government dealing with uncertainty in its creation of proposals for women to return to the job market?
4. Why is there opposition in the government concerning this reform of employment?
5. Why is this reform of employment considered a necessity?
6. Why is the government encouraging new kinds of employment in the current parliament?

Antidote for rattlesnake bites approved

1. Why were sheep injected with rattlesnake venom?
2. Why does the chief executive of the company believe sales of the antidote could reach £25m a year?
3. Why are bites more common in Arizona and Texas?
4. Why should a rattlesnake bite be treated immediately?
5. Why do they want to sell stocks before next spring?
6. Why did the US food and drug administration take some extra time to approve the antidote?
7. Why is this firm considering providing services in the area of computer-aided molecular design business?

Generating elaborations related to you and to things you already know

As you read each story please try to think of how it relates to you or to things you already know. Try to do this for each paragraph or sets of paragraphs as indicated in the text. Write down in the space provided which thoughts came to your mind. Please use the back of the paper if needed.

The following table (but more spacious in the response sheet) was presented for each news story, identifying the paragraphs, or sets of paragraphs, that should be the focus of reflection.

Families of dead nuns sue leaders

Paragraph	In relation to you	In relation to other things you already know
1st		
2nd		
3rd		
4th		
5th		
6th/7th		

The paragraphs or sets of paragraphs for the generating-elaborations task in each story are:

News story	Paragraphs
Families of dead nuns sue leaders	1st, 2nd, 3rd, 4th, 5th, and 6th/7th
7 held as police hunt for body	1st, 2nd/3rd, 4th/5th/6th, and 7th/8th
Woman may sue GPs who missed tumour	1st, 2nd, 3rd, 4th/5th/6th/7th, 8th, and 9th/10th
Sir Humphrey moves to India in a BBC first	1st, 2nd/3rd, 4th/5th, 6th, 7th, 8th/9th, 10th, and 11th
New focus on jobs for women	1st, 2nd, 3rd, 4th, 5th, 6th, 7th, and 8th/9th
Antidote for rattlesnake bites approved	1st, 2nd, 3rd, 4th, 5th, 6th, and 7th

Chapter 5 – Effects of context distinctiveness on awareness in memory for emotional news stories

Processing of news information

You are going to participate in a study about how people think about news stories. You will be presented with some news stories to read. Please, read each story carefully and attentively. Do your best to understand it and take all the time you need. You will be asked some questions about the story afterwards. Thank you very much for your collaboration.

Appendix 6 Rating scales

The instructions for the rating scales used in chapter 2 are included in the initial instructions. The rating scales used were:

. How do you rate the emotional content of the news text you have just read (experiment 1)? / How do you rate the emotionality of the news text you have just read (experiment 2)? (very negative, negative, neutral, positive, very positive)
. How do you rate the comprehensibility of this news text? (very easy to comprehend, easy to comprehend, neither easy or difficult to understand, difficult to comprehend, very difficult to comprehend)
. Have you read or heard anything about this news story before? (yes, no, don't know)

The studies reported in chapters 3, 4 and 5 used the following instructions and rating scales:

After reading all stories, you will be presented with some scales. In the first six scales you should rate the story you have just read in some evaluative dimensions. Afterwards you should rate whether the story is easy or difficult to understand, using options from 'very easy to comprehend' to very difficult to comprehend'. Finally you should say whether or not you already knew the story. If you are not sure whether or not you knew the story, you can answer 'don't know'. Try to use this option only as a last resort. Thank you very much for your collaboration.

How do you rate the news story you have just read in the following scales?

. Is it a happy or a sad story? (very happy, quite happy, neither happy nor sad, quite sad, very sad)
. Is it a distressing or a pleasant story? (very distressing , quite distressing, neither distressing nor pleasant , quite pleasant , very pleasant)
. Is it an amusing or a serious story? (very amusing, quite amusing, neither amusing nor serious, quite serious , very serious)
. Is it a boring or an interesting story? (very boring, quite boring, neither boring nor interesting, quite interesting, very interesting)
. Is it an exciting or a calming story? (very exciting, quite exciting, neither exciting nor calming, quite calming, very calming)
. Is it a simple or a complex story? (very simple, quite simple, neither simple nor complex, quite complex, very complex)

How do you rate the comprehensibility of this news text? (very easy to comprehend, easy to comprehend, neither easy nor difficult to comprehend, difficult to comprehend, very difficult to comprehend)
Have you read or heard anything about this news story before? (yes, no, don't know)
[The following scale was only used in the studies reported in chapter 4] How familiar are you with the type of situation covered in the story? (very unfamiliar, somewhat unfamiliar, neither familiar nor unfamiliar, somewhat familiar, very familiar)

In chapter 3, experiment 1 (deep vs. shallow encoding) only uses the following scale for each news story:

Have you read or heard anything about this news story before? (yes, no, don't know)

Appendix 7 Instructions for the recognition memory and awareness questionnaire

The instructions used for performing the recognition memory and awareness questionnaire were the same for all the studies with one exception. Experiment 2 in chapter 4 included four awareness categories instead of three awareness categories, which required the instructions and training to be adjusted.

A training task for the use of the awareness categories was included after the two first studies (reported in chapter 2) to ensure further that the awareness categories would be understood by the participants: the task was based on an unpublished task used by Vernon Gregg in his studies.

The instructions and training task for the studies reported in chapters 3, 4 (exp. 1) and 5 were:

Now you will be presented with some questions about the content of the news stories you read. The questions about each story will be preceded by its headline. Each question has four answer options. Please, choose the option that you think is the correct one, that is, the one that you recognise. After ticking one option, you should not change your answer. Neither should you go back to change a previous answer. After ticking one of the options, you will be asked to specify if you "remember", "know" or "guess" your answer. Please read the following instructions to understand how you make these judgements.

Remember: If your recognition of the option chose is accompanied by a conscious recollection of its prior occurrence in the news text, then tick **R** (for remember). "Remember" is the ability to become consciously aware of some aspect or aspects of what happened or what was experienced at the time you read the news text (e.g. what you were thinking or doing at the time, something that happened in the room, some specific word). In other words, the "remembered" option should bring back to mind a particular association, image, or something more personal from the time of study.

Know: "Know" responses should be made when you recognise the response option from being in the news, that is, for being the correct answer for that question about the news content, but you cannot consciously recollect anything about its actual occurrence or what happened or was experienced at the time of its occurrence. In other words, tick **K** (for "know") when you are certain of recognising the correct answer but it does not evoke any specific conscious recollection from the study list.

Guess: If you do not recognise a response option based on its occurrence in the news read but on another strategy connected to the news, then you are guessing upon the specific item.

Being this the case, thick **G** (for "guess"). For example, you might judge one option as the correct one because it makes more sense than the other ones and not because you recognising it from the news read.

To further clarify the difference between these three judgements (R versus K versus G), here are a few examples. If someone asks for your name, you typically respond in the **"know"** sense without becoming consciously aware of anything about a particular event or experience. However, when asked the last film you saw, you would typically respond in the **"remember"** sense, that is, becoming consciously aware again of some aspects of the experience. Furthermore, if someone asks you whether you have seen a person from your department in college before, you might answer in the **"guess"** sense that you have seen him before based on the fact that this person is in your department, and not because you actually recognise him. If you have any questions regarding these instructions, please ask the experimenter.

To make sure you have understood the instructions, please tick what you think is the right response in the different circumstances.

		R	K	G
1	I feel strongly that the option I ticked is the right one but I cannot identify the reason why.	☐	☐	☐
2	I am certain I read about the option I ticked in the story. (sentence used only in chapter 3, exp. 1)/ I can visualise the text about the option I ticked.	☐	☐	☐
3	I thought about the location of the episode because I know where it is.	☐	☐	☐
4	I am not sure about the right answer.	☐	☐	☐
5	I am certain it is the right answers but I do not recollect anything about it.	☐	☐	☐
6	I am certain about the option I ticked because I felt quite shocked when I read that part of the story.	☐	☐	☐
7	I have a gut feeling that the option I ticked is the right one.	☐	☐	☐
8	There is something that makes me think that is the right option but I cannot say what it is.	☐	☐	☐
9	I have no idea which option is the right one.	☐	☐	☐
10	I visualised this part of the story when I read it.	☐	☐	☐

R = remember

K = know

G = guess

The instructions and the training task for the study (chapter, 4, exp. 2) using four awareness categories were:

Now you will be presented with some questions about the content of the news stories you have read. The questions about each story will be preceded by its headline. Each question has four answer options. Please choose the option that you think is the correct one, that is, the one that you recognise. After ticking one option, you should not change your answer. Neither should you go back to change a previous answer. After ticking one of the options, you will be asked to specify if you "remember", if you "know", if you think the information is "familiar" or if you are guessing your answer. Please read the following instructions to understand how you make these judgements.

Remember: If your recognition of the option chosen is accompanied by a conscious recollection of its prior occurrence in the news text, then you remember a specific part of the news story. "Remember" is the ability to become consciously aware of some aspect or aspects of what happened or what was experienced at the time you read the news text. The "remembered" option should bring back to mind a particular association, image, a feeling, or something more personal from the time of study (e.g. what you were thinking or doing at the time, the way you felt, something that happened in the room, some specific word). Answers given on this basis are called REMEMBER answers and you should tick R.

Know: It may be, however, that you do not remember a specific instance. You might "just know" the correct answer. In this case, you would not recall a specific part of the story, but you feel that you just know the answer. Answers with this basis are called KNOW answers and you should tick K.

Familiar: If you do not remember or just know the answer, you can still feel that the alternative you have selected is familiar. In this situation, the alternative you have chosen may seem or feel more familiar than any of the other alternatives, and you think it is the right one, but you cannot specify why. Answers made on this basis are called FAMILIAR answers and you should tick F.

Guess: Finally, you may not have remembered, felt the choice to be familiar or known the choice. In which case, you may have made a guess, possibly an informed guess. For example, you might judge one option as the correct one because it makes more sense than the other ones and not because you recognise it from the news read. This is called a GUESS answer and you should tick a G.

To further clarify the difference between these judgements, here are a few examples. If someone asks for your name, you typically respond in the "know" sense without becoming

consciously aware of anything about a particular event or experience. However, when asked about the last film you saw, you would typically respond in the "remember" sense, that is, becoming consciously aware again of some aspects of the experience. Sometimes, you see someone in the street and you have the feeling that you have seen him or her before. The person looks familiar to you. In this case you respond in the "familiar" sense. Furthermore, if someone asks you whether you have seen a person from your department in college before, you might answer in the "guess" sense that you have seen him before based on the fact that this person is in your department, and not because you actually recognise him. If you have any questions regarding these instructions, please ask the experimenter.

To make sure you have understood the instructions, please tick what you think is the right response in the different circumstances.

		R	K	F	G
1	I feel strongly that the option I ticked is the right one but I cannot identify the reason why.	☐	☐	☐	☐
2	I can visualise the text about the option I ticked.	☐	☐	☐	☐
3	I thought about the location of the episode because I know where it is.	☐	☐	☐	☐
4	I am not sure about the right answer.	☐	☐	☐	☐
5	I am certain it is the right answer but I do not recollect anything about it. I just know it.	☐	☐	☐	☐
6	I am certain about the option I ticked because I felt quite shocked when I read that part of the story.	☐	☐	☐	☐
7	I have a gut feeling that the option I ticked is the right one.	☐	☐	☐	☐
8	There is something that makes me think that is the right option but I cannot say what it is.	☐	☐	☐	☐
9	I have no idea which option is the right one.	☐	☐	☐	☐
10	I don't have a recollection about learning this information but I know that this is the right answer.	☐	☐	☐	☐
11	I visualised this part of the story when I read it.	☐	☐	☐	☐

R = remember

K = know

F = familiar

G = guess

Appendix 8 Recognition memory and awareness questionnaire

The recognition memory questions for each story used in the experiments reported are presented in this appendix. The news stories are organised alphabetically. In order to have the same overall number of questions for emotionally negative news stories and for emotionally neutral news stories in each study, the number of questions for each news story may not be the same in all the experiments. These occurrences are identified.

The correct option for each question is signalled by the symbol '✓'. All the questions were followed by the options concerning awareness states, as shown in the first question of the first story.

30% of frozen chickens 'exceed water level'

C1. Who reported the results about the water levels in the frozen chicken? (tick one box)

- ☐ Some British producers
- ☐ The European Union Food commission
- ☐ The government
- ☑ The Food Standards Agency

Remember	Know	Guess
☐	☐	☐

C2. The offenders were (tick one box)

- ☐ British meat producers
- ☐ Meat importers
- ☑ British producers and meat importers
- ☐ English meat producers

C3. According to the agency's deputy chairman, what is the main problem with legislation in this field? (tick one box)

- ☑ It is incomplete and inconsistent.
- ☐ The European Union does not have legislation in this field.
- ☐ British legislation is different from that of other European countries.
- ☐ The legislation only concerns other types of meat.

C4. According to the EU limits, how much water is frozen chicken allowed to contain? (tick one box)

- ☐ Up to 4%
- ☐ Up to 30%
- ☑ Up to 7%
- ☐ Up to 17%

C5. What did the British Poultry Association claim about the results concerning the water levels in frozen chicken? (tick one box)

- ☐ The results concern the situation two years ago, so they are not actual and do not fairly reflect the actual situation.
- ☑ The food standards agency had only used one of the tests available, which led to different results from those obtained by manufacturers.
- ☐ The British Poultry Association defended the manufacturers saying that they were following British legislation, because EU legislation was not very clear about the water levels for the different types of produced meat.
- ☐ One problem has to do with the maintenance of the freezing temperatures while the meat is transported, what sometimes is only respected at the minimum levels and that can lead to extra ice formation in the frozen chicken.

C6. What percentage of chicken consumed in the UK is frozen? (tick one box)

- ☐ Less than 30%
- ☐ Around 40%
- ☑ Less than 10%
- ☐ Around 17%

7 held as police hunt for body

S1. Why were seven people arrested? (tick one box)

- ☑ They allegedly imprisoned and assaulted a woman.
- ☐ They allegedly committed several murders.
- ☐ They allegedly committed several rapes.
- ☐ They allegedly robbed several houses.

S2. How long was the woman imprisoned? (tick one box)

- ☐ A week
- ☑ Nine months
- ☐ A night
- ☐ Five months

S3. What was the name of the police operation? (tick one box)

- ☐ Operation Phoenix
- ☑ Operation Condor
- ☐ Operation Halifax
- ☐ Operation Peterborough

S4. Which resources were involved in the operation? (tick one box)

- ☐ Computer and electronic equipment
- ☑ Sniffer dogs and officers working with ground penetrating radar
- ☐ National and foreign police officers
- ☐ 40 police officers

S5. Why was this operation set up? (tick one box)

- ☑ A 38-year-old woman was held hostage for most of 1999.
- ☐ The police officers had several complaints of abuse.
- ☐ There was an anonymous tip off to the police station.
- ☐ Police officers had some information from a previous operation.

S6. How many bodies were found in this operation? (tick one box)

- ☐ One
- ☑ None
- ☐ Five
- ☐ Seven

S7. How many people were arrested? (tick one box)

- ☐ Seven men
- ☐ Seven people –two men and five women
- ☐ Seven people – four men and three women
- ☑ Seven people – five men and two women

S8. How were they arrested? (tick one box)

- ☐ All of them were arrested at their homes.
- ☐ All of them appeared voluntarily at Bridge Street police station in Peterborough.
- ☑ Six appeared voluntarily at Bridge Street police station in Peterborough and one was arrested at his home in the city.
- ☐ They were arrested after being chased.

Antidote for rattlesnake bites approved

R1. How was the antidote derived? (tick one box)

- ☐ A synthetic compound based on the rattlesnake venom was produced in the laboratory.
- ☐ Rattlesnake venom was injected into mice, which produced antibodies.
- ☐ Antibodies from the rattlesnake were used.
- ☑ Rattlesnake venom was injected into sheep, which produced antibodies.

R2. [question used only in chapter 2, experiment 1] How much is the sales projection for the antidote? (tick one box)

- ☐ £38,000 a year
- ☐ $25m a year
- ☑ £25m a year
- ☐ $38,000 a year

R3. How many Americans suffer serious rattlesnake bites a year? (tick one box)

- ☐ 1,000
- ☐ 12,000
- ☐ 5,000
- ☑ 8,000

R4. Roughly, how much is the biotechnology company going to charge for each dose of the antidote? (tick one box)

- ☐ Several thousand dollars [option used in chapter 2]
  Around five hundred pounds [option used in chapters 3, 4 and 5]
- ☐ A thousand pounds
- ☑ Several thousand pounds
- ☐ A thousand dollars

R5. Where are the bites more common? (tick one box)

- ☑ Arizona and Texas
- ☐ California and Texas
- ☐ Arizona and Colorado
- ☐ Virginia and Colorado

R6. What happens if a rattlesnake bite is not treated immediately? (tick one box)

- ☐ Nausea and stomach aches
- ☑ Nausea and blackouts
- ☐ Stomach and muscular aches
- ☐ Blackouts and headaches

R6. [question not used in the studies reported in chapter 2 but used in the studies reported in chapters 3, 4, 5] When is the next 'bite season'? (tick one box)

- ☐ Next summer
- ☐ Next autumn.
- ☐ Next winter.
- ☑ Next spring.

R7. [question not used in chapter 2 but used in the studies reported in chapters 3, 4, 5] Why was the approval of this antidote delayed? (tick one box)

- ☐ Because there were concerns about the side effects of the antidote.
- ☑ Because there were concerns about the procedures at the factory.
- ☐ Because there were concerns about the commercial value of the antidote.
- ☐ Because there were doubts about the range of its medical applications.

R8. [question not used in chapter 2 but used in the studies reported in chapters 3, 4, 5] What is the area of specialisation of the company that is selling the medicine? (tick one box)

- ☐ Vaccines.
- ☐ Natural medicines.
- ☑ Counteracting poisons.
- ☐ Medicines for animal transmitted diseases.

Families of dead nuns sue leaders

N1. [question used only in chapter 2] Who were accused of the murdering? (tick one box)
[question used in chapter 3, 4 and 5] According to the article, who appeared in court this week? (tick one box)

- ☐ Two soldiers in the Salvadoran military.
- ☐ Two former leading figures in the Colombian military.
- ☑ Two former leading figures in the Salvadoran military.
- ☐ Two soldiers in the Colombian military.

N2. Who was murdered? (tick one box)

- ☐ 3 aid workers.
- ☑ 3 nuns and a social worker.
- ☐ 3 nuns and a priest.
- ☐ 3 social workers and a nun.

N3. When did the murders happen? (tick one box)

- ☐ 5 years ago.
- ☐ 10 years ago.
- ☑ 1980. [option used only in chapter 2]
  20 years ago. [option used in chapters 3, 4 and 5]
- ☐ Last year.

N4. According to the story, what is the main aim of this court trial? (tick one box)

- ☐ To prevent more murders in Central and South America. [option used only in chapter 2]
  To bring to justice US-based worldwide military responsible for atrocities like this one. [option used in chapters 3, 4 and 5]
- ☐ To prevent more murders in East Europe against US citizens. [option used only in chapter 2]
  To prevent future terrorist attacks in US territory. [option used in chapters 3, 4 and 5]
- ☑ To bring to book US-based members of the Latin American military responsible for atrocities in Central and South America. [option used only in chapter 2]
  To bring US-based members of the Latin American military responsible for atrocities in Central and South America to justice. [option used in chapters 3, 4 and 5]
- ☐ To bring to book US-based members of East European military responsible for atrocities like this one. [option used only in chapter 2]
  To prevent more murders in Central and South America. [option used in chapters 3, 4 and 5]

N5. What positions did the accused men hold at the time of the murder? (tick one box)

- ☐ Military commandant and director-general of the intelligence services.
- ☐ Military commandant and director-general of the national guard.
- ☐ Defence minister and foreign affairs minister.
- ☑ Defence minister and director-general of the national guard.

N6. Who was initially charged with the killings? (tick one box)

- ☐ The director-general of the national guard
- ☑ Some soldiers
- ☐ The Defence minister
- ☐ Some police officers

N7. What, according to the report, seems to be one of the main reasons for the killings? (tick one box)

- ☑ The military did not approve of the activities of some sections of the church.
- ☐ The military wanted to scare the civilians.
- ☐ The military wanted to show their power to other countries.
- ☐ The military wanted to blame a terrorist group for the murders.

N8. According to the families' lawyer, why were these particular women targeted? (tick one box)

- ☐ Because they happened to be in the wrong place at the wrong time.
- ☐ Because they were suspected of being involved in an anti-army organisation.
- ☐ Because they were suspected of spying.
- ☑ Because they were sympathetic to the peasants.

Fewer firms go bankrupt

F1. According to the story, where are fewer companies going bankrupt? (tick one box)

- ☐ . In Europe
- ☑ . In Britain
- ☐ . In England
- ☐ . In the European Union

F2. How was the number of companies going bust described in the story? (tick one box)

- ☑ . The number of companies going bust has slowed dramatically.
- ☐ . The number of companies going bust has slowed slightly.
- ☐ . The number of companies going bust has slowed unexpectedly.
- ☐ . The number of companies going bust has slowed as expected.

F3. According to the story, what is the main reason for the business failure rates? (tick one box)

- ☐ . Slowdown in the economy
- ☑ . Economic stability.
- ☐ . Stronger sterling
- ☐ . Less competitive market

F4. What is a possible problem that companies could face in the near future? (tick one box)

- ☑ . Slowdown in the economy
- ☐ . Inflation.
- ☐ . Stronger sterling
- ☐ . More competitive market

F5. Where did business failure rates show the sharpest decline? (tick one box)

☑ . London

☐ . East and south west of England

☐ . Scotland

☐ . Wales

F6. Where were business failure rates static? (tick one box)

☐ . London

☐ . East and south west of England

☐ . Scotland

☑ . Wales

F7. What has been the relation between company size and bankruptcy rate lately? (tick one box)

☐ . Smaller companies have been failing at a slower rate than larger companies.

☑ . Smaller companies have been failing at a faster rate than larger companies.

☐ . Smaller companies have been failing at the same rate as larger companies.

☐ . There is no data about the relationship between company size and bankruptcy rate in the report.

Girl found hanging at home

G1. Where was the girl found hanging? (tick one box)

☐ The girl was found hanged from a bed at home.

☐ The girl was found hanged from a stairs at home.

☑ The girl was found hanged from a window at home.

☐ The girl was found hanged from a fence at home.

G2. What seems to have been the reason for this accident? (tick one box)

☑ The girl was probably imitating her pet cats.

☐ The girl was probably exploring the house.

☐ The girl was probably imitating her pet dogs.

☐ The girl was probably running away from her pets.

G3. How old was the girl? (tick one box)

☐ 1 and a half years old.

☐ 4 years old.

☑ 2 years old.

☐ 6 years old.

G4. Who found the girl? (tick one box)

☐ The grandmother.

☐ The father.

☐ A sibling.

☑ The mother.

G5. What did the mother think the kid was doing at the time of the accident? (tick one box)

- ☐ She thought the kid was sleeping.
- ☐ She thought the kid was playing with some other kids.
- ☐ She thought the kid was playing in the garden with the pets.
- ☑ She thought the kid was playing in one of the bedrooms.

G6. How are the police treating this death? (tick one box)

- ☐ As the mother's negligent behaviour.
- ☑ As an accident.
- ☐ As abusive behaviour towards the kid.
- ☐ As murder.

G7. When was the kid pronounced dead? (tick one box)

- ☐ On arrival of the paramedics at home.
- ☑ On arrival at the hospital.
- ☐ On the way to the hospital.
- ☐ After some hours in hospital.

G8. What was the warning given by the toddler's mother? (tick one box)

- ☑ The warning concerning the dangers of leaving windows wide open.
- ☐ The warning concerning the dangers of leaving kids unattended by an adult.
- ☐ The warning concerning the dangers of letting kids play with pets.
- ☐ The warning concerning the dangers of not having facilities for the kids in the community.

Hospital's errors 'may total 100'

H1. Who alerted the medical director of the hospital to the errors? (tick one box)

- ☑ Some doctors in the hospital
- ☐ Some patients' families
- ☐ The General Medical Council
- ☐ Some journalists

H2. What were the main consequences of the problems in the hospital? (tick one box)

- ☐ Some adults died or became disabled.
- ☑ Some children died or became disabled.
- ☐ Some children got infectious diseases.
- ☐ Some adults got infectious diseases.

H3. What was one of the consequences of this scandal, according to the report? (tick one box)

- ☐ . The medical director and the former hospital chief executive were strongly reprimanded and temporarily struck off the medical register by the General Medical Council.
- ☐ . In spite of some individuals being accused of professional misconduct; the hospital's lack of resources were acknowledged and it was supplied with more adequate equipment and more personnel.
- ☐ . A public inquiry was launched, which would provide a full report about the overall situation related to

the hospital's errors in two months.

☑ . The medical director and the former hospital's chief executive were struck off the medical register by the General Medical Council.

H4. Where is this hospital? (tick one box)

☐ . Brighton

☐ . London

☑ . Bristol

☐ . Sheffield

H5. How many cases of children who received heart surgery were studied? (tick one box)

☑ . 80

☐ . 50

☐ . 200

☐ . 120

H6. According to the trust that owns the hospital, what is the children's heart surgery rate like now? (tick one box)

☐ . There are no data available.

☐ . The situation has not changed.

☐ . They are about the average in the country.

☑ . They are among the best in the country.

Italian gourmets campaign to keep pasta on the menu

I1. What are Italian gourmets trying to do? (tick one box)

☐ To publicise Italian traditional food abroad, in order to compete with food from other countries.

☐ To show that Italian traditional food is much more than pasta dishes.

☑ To protect Italian traditional food, in response to the competition represented by foreign food.

☐ To make all foreign food restaurants in Italy include some Italian dishes on their menus.

I2. Where is the association of Italian gourmets going to meet? (tick one box)

☐ In the capital of Italy.

☐ In a picturesque town.

☐ In a traditional Italian restaurant.

☑ In a historical monument.

I3. What is the name of the Italian gourmets association? (tick one box)

☐ Guardians of Italian Food.

☐ Fortress for Italian Food.

☑ Academy of Italian Cooking.

☐ Against Food Globalisation.

I4. According to the gourmets' association, what is the main reason for the gradual disappearance of traditional Italian dishes from restaurants? (tick one box)

☑ Globalisation.
☐ Foreign food is cheaper.
☐ Foreign food is tastier.
☐ Fast food, which is mainly foreign food, is more suited to the busy life style people have nowadays.

I5. What is the opinion of some Italian chefs about the position defended by the gourmets' association? (tick one box)

☐ It ignores market demands.
☑ It ignores the history of Italian cuisine.
☐ The phenomenon is not unique to Italy and is visible in most countries in Europe.
☐ It is a temporary concern, as it does not reflect public views on the quality of food.

I6. Why are the purists of Italian food becoming increasingly defensive? (tick one box)

☐ Because Italians are travelling more and bringing new tastes back to Italy.
☐ Because traditional Italian food is getting more expensive.
☑ Because foreign chains of restaurants and cafes are expanding.
☐ Because the increasing number of Italian restaurants abroad do not give an accurate picture of the richness of Italian cuisine.

I7. Which shops did riot police have to protected from demonstrators? (tick one box)

☐ Chinese and Indian restaurants.
☑ McDonald's outlets.
☐ Starbucks' coffee shops.
☐ Burger king's outlets.

Mobile phone bullies drove teenager to suicide

P1. [question not included in the studies reported in chapter 2 and included in the studies reported in chapters 3 and 5] When did this girl commit suicide? (tick one box)

☐ After receiving anonymous text messages on her mobile.
☐ After receiving anonymous e-mail messages.
☑ After receiving anonymous silent calls on her mobile.
☐ After receiving anonymous letters.

P2. [question not included in chapter 2 and included in chapters 3 and 5] How old was the girl who committed suicide? (tick one box)

☐ 10
☑ 15
☐ 12
☐ 17

P3. When did the problem of mobile phone bullying become significant? (tick one box)

- ☐ After the second school term
- ☑ After Christmas 1999. [option used in chapter 2]
- After last Christmas. [option used in chapters 3 and 5]
- ☐ Two years ago
- ☐ Last month

P4. Why did this problem increase? (tick one box)

- ☐ Because of the growth of violence among children and teenagers.
- ☐ Because of the increase of Internet use in children and teenagers.
- ☑ Many children and teenagers have been given mobile phones.
- ☐ Because schools allow mobile phones on their grounds.

P5. What is the approximate proportion of children and teenagers that own a mobile phone? (tick one box)

- ☑ A quarter
- ☐ Three quarters
- ☐ 50%
- ☐ 10%

P6. Which type of organisation is dealing with this problem? (tick one box)

- ☐ A school commission
- ☐ A parents commission
- ☐ A government commission
- ☑ A support group

P7. How did the girl mentioned in the article commit suicide? (tick one box)

- ☑ She took tablets and some alcohol.
- ☐ She took tablets only.
- ☐ She cut her veins.
- ☐ She threw herself out of a window.

P8. What was the suicide note left by the teenager? (tick one box)

- ☐ It was a written note addressed to her parents left in her bedroom.
- ☐ It was a text message left on her best friend phone.
- ☑ It was a text message left on her phone.
- ☐ It was a letter that she sent to the school mentioning the bullying problem.

Mother jailed for abandoning sons to go on holiday

M1. Why did this mother leave the kids to go on holiday? (tick one box)

- ☐ She thought they would be with relatives while she was away.
- ☑ She was on the verge of a breakdown.
- ☐ She was forced to go.
- ☐ She had fallen in love with a man and wanted to spend some time with him.

M2. Where did she go for holidays? (tick one box)

☑ She went to a Mediterranean country.

☐ She went to the south coast of England.

☐ She went to the Canary Islands.

☐ She went to the north of France.

M3. What did she leave for the kids while she was away? (tick one box)

☐ Some food in the fridge and the heating on.

☐ The food was enough, but the heating was off.

☑ No food and no heating.

☐ No water, no food and not enough clothes.

M4. How did she get money for the holiday? (tick one box)

☐ She used her unemployment benefits.

☑ She sold her child benefit book.

☐ She borrowed some money.

☐ She sold some jewellery.

M5. What arrangements for the kids did this mother make before leaving for holidays? (tick one box)

☐ She tried to leave them in a holiday camp.

☑ She tried to leave them with her mother.

☐ She tried to leave them with their father.

☐ She did not think about any arrangements for the kids.

M6. How do the kids feel towards the mother? (tick one box)

☐ They feel angry but still want to stay with her.

☐ The youngest wants to stay with her but the older ones do not.

☐ They'd rather stay with the father.

☑ None want anything further to do with the mother.

M7. What does the mother intend to do now? (tick one box)

☑ She agreed not to fight for custody.

☐ She wants custody of the kids, as she feels that she will never do anything to harm them again.

☐ She wants time to recover completely from her breakdown and then she wants the kids back with her.

☐ She wants to share the custody with the father.

M8. How did the police get the mother? (tick one box)

☐ Her mother complained to the police.

☐ The Social Services complained about her.

☑ After returning from holidays she went to the police station to confess.

☐ She went to the police after the kids ran away from home.

Munoz moves into spider's space

M1. Where is the spider sculpture exhibited? (tick one box)

- ☐ . Tate Britain Gallery
- ☐ . Museum of Contemporary Art
- ☐ . The British Museum
- ☑ . Tate Modern Gallery

M2. What are the next works of art to be shown there? (tick one box)

- ☑ . Near human size figures
- ☐ . A giant size spider
- ☐ . Steel towers
- ☐ . Steel human figures

M3. What length of time will the steel spider and the steel towers spend in the museum? (tick one box)

- ☐ . 2 years
- ☐ . A few months
- ☑ . Around one year
- ☐ . Forever

M4. How many human size figures will be unveiled? (tick one box)

- ☐ . 2
- ☑ . 40
- ☐ . It's not known yet
- ☐ . 20

M5. When will the sculptures be unveiled? (tick one box)

- ☐ . June 2002
- ☐ . January 2001
- ☑ . June 2001
- ☐ . It is not known yet.

M6. What are the sculptures going to be made of? (tick one box)

- ☐ . Steel
- ☑ . Resin and silicone
- ☐ . Marble
- ☐ . Bronze

M7. Where is the sculptor from? (tick one box)

- ☐ . USA
- ☐ . England
- ☐ . South America
- ☑ . Spain

M8. According to the curator of the hall where the sculptures are going to be exhibited, what was one of the main reasons for choosing this sculptor? (tick one box)

☑ . Because his work dramatises architectural space.

☐ . Because his work changes emotions in museum visitors.

☐ . Because his work focuses on big sculptural volumes.

☐ . Because his work will provide a positive image.

Murderer stole unborn baby

B1. What happened to the mother's baby? (tick one box)

☐ . She had an abortion.

☐ . She gave birth normally at home.

☑ . She had a caesarean performed.

☐ . She gave birth normally in the hospital.

B2. Who killed the mother-to-be, Mrs Andrews? (tick one box)

☑ . Mrs Bica

☐ . Mr Bica

☐ . Her husband

☐ . A friend

B3. For how long had the mother-to–be disappeared before Mr. and Mrs. Bica announced the birth of a baby? (tick one box)

☐ . A month

☑ . A week

☐ . A few days

☐ . Since the previous day

B4. Where was Mrs. Andrews' body buried? (tick one box)

☐ . It stayed in the mortuary of the hospital.

☐ . In the garden.

☐ . In the cemetery.

☑ . In a garage floor.

B5. How were the police led to Mrs Bica? (tick one box)

☐ . Because some neighbours suspected her.

☐ . An anonymous phone call to police.

☑ . By mobile phone calls she had made to the Andrews home.

☐ . Because the hospital staff suspected her.

B6. What happened to Mrs Bica? (tick one box)

☐ . She was convicted for murder.

☑ . She shot herself after the police returned to question her.

☐ . She ran away from the police.

☐ . She confessed when the police returned to question her.

B7. What was the relationship between the two couples? (tick one box)

☑ . They lived nearby.

☐ . They were relatives.

☐ . They had met in the hospital.

☐ . They had met at the police station.

B8. What seems to have been the role of Mrs. Bicas' husband? (tick one box)

☐ . He suspected his wife, but he did not participate in the murder.

☑ . Apparently, he was convinced his wife was pregnant.

☐ . He was the one who killed the pregnant woman.

☐ . He helped his wife to kill the pregnant woman.

New focus on jobs for women

J1. Which type of jobs is the focus of this article? (tick one box)

☑ "Kitchen table" and small businesses.

☐ Local businesses.

☐ Jobs in more male dominated areas.

☐ Part-time jobs.

J2. What is one of the goals for the creation of these jobs? (tick one box)

☑ To help mothers conciliate work and family life.

☐ To provide social services not available in the community.

☐ To improve the local economy of some towns.

☐ To provide better qualifications to unqualified women.

J3. What is the faster growing source of new jobs in the UK? (tick one box)

☐ Community enterprises.

☐ The catering trade.

☐ Internet and information technology companies.

☑ One-woman enterprises run from home.

J4. What does the government intend to do with these interventions? (tick one box)

☐ Decrease unemployment rates in the UK.

☐ Encourage women to return to full time jobs after maternity leave.

☑ Present new ways for women to return to the job market.

☐ Show the public that they keep their electoral promises.

J5. According to the story, what is one of the government's concerns? (tick one box)

☑ That business will refuse further regulations after absorbing the minimum wage and working time directive.

☐ That business will want to negotiate further regulations that are less restrictive after absorbing the minimum wage and working time directive.

☐ That business could not cope with the minimum wage regulation and working time directive.

☐ That workers will go on strike because of regulations concerning the minimum wage and working time directive.

J6. Who is keen that women do not permanently break their link with the labour market after having children? (tick one box)

☐ Women's associations.

☐ The employment minister.

☑ Women ministers and the treasury.

☐ The political opposition.

J7. What have campaigners for family-friendly working said about objections to this intervention? (tick one box)

☐ The current situation contributes negatively to the economy of the country.

☐ Women and families have the right for improved maternity pay and improved job prospects.

☐ The UK should have a policy towards women employment similar to those in most European Union countries.

☑ The influx of women in the workplace over the past 20 years has made reform of employment a necessity.

J8. According to the article, what does the government hopes to achieve by encouraging new kinds of employment? (tick one box)

☐ An intention to lower unemployment.

☑ An intention to switch focus from job quantity to job quality.

☐ An intention to raise the economy of communities.

☐ An intention to deal with social issues related to gender roles.

Oxford surges on cancer finding

O1. According to the story about cancer research, what have scientists discovered? (tick one box)

☐ . A new way of restricting the supply of blood to cells

☐ . A new medicine

☑ . A new gene and a new protein

☐ . A new virus and a new protein

O2. In the light of this discovery, what is the biotechnology firm applying for? (tick one box)

☐ . Patent protection for the methods used

☐ . Sponsorship to produce a new medicine

☐ . Permission to have more shares in the stock market

☑ . Patent protection for the discoveries

O3. Where is this cancer research being carried? (tick one box)

- ☐ . Cambridge
- ☐ . Oxford
- ☑ . USA
- ☐ . London

O4. What did the report say about how cancer tumours grow? (tick one box)

- ☑ . The tissues around the tumour are destroyed, providing space for the tumour to grow.
- ☐ . A gene and a protein provide blood to the tumour.
- ☐ . The blood vessels around the tumour disappear, providing space for the tumour to grow.
- ☐ . As the tumour grows, it invades other tissues.

O5. When are trials for cancer medicines expected to begin? (tick one box)

- ☐ . Next month
- ☑ . In 18 months to 2 years
- ☐ . Next year
- ☐ . In 3 to 4 years

O6. What is the main issue related to patenting genes? (tick one box)

- ☐ . Companies should apply for patents for specific areas of research on several genes.
- ☑ . Companies should apply for patents for specific areas of research on each gene.
- ☐ . Companies should apply for patents for broad areas of research on several genes.
- ☐ . Companies should apply for patents for broad areas of research on each gene.

Policeman guilty of exposure

P1. What was the policeman accused of exposing? (tick one box)

- ☐ He was accused of being naked.
- ☐ He was accused of exposing an open zip in his trousers.
- ☑ He was accused of exposing himself.
- ☐ He was accused of showing some pornographic photos.

P2. Where did this incident happen? (tick one box)

- ☐ In a street.
- ☐ At a school.
- ☑ At a residential care home.
- ☐ At the police station.

P3. To whom did the policemen expose himself? (tick one box)

- ☑ To elderly women.
- ☐ To teenage girls.
- ☐ To men.
- ☐ To kids.

P4. How was the story about his behaviour proved? (tick one box)

- ☐ Some staff witnessed his behaviour.
- ☐ Two master tailors spoke about the efficiency of zips.
- ☑ His behaviour was captured on a concealed camera.
- ☐ Mainly by way of the victims' testimony.

P5. Who was the policeman visiting at the site of the incident? (tick one box)

- ☐ A member of the staff.
- ☑ His father.
- ☐ An old aunt.
- ☐ His mother.

P6. How did he find out that he was exposed? (tick one box)

- ☐ He saw it on camera.
- ☐ He felt the zip was undone.
- ☑ Someone pointed it out to him.
- ☐ He noticed everyone looking at him..

P7. What was the opinion of the master tailor? (tick one box)

- ☑ It was possible for the zip to disengage leaving the underwear uncovered.
- ☐ It was possible for the zip to disengage after some specific movements.
- ☐ Usually this happened to the type of zip used in the policeman's trousers.
- ☐ It was a rare incident with the zips used in similar trousers.

P8. In which shop were the trousers bought? (tick one box)

- ☐ C & A.
- ☐ At a local tailor.
- ☐ John Lewis.
- ☑ Marks & Spencer.

P9. When was the police surveillance operation set up? (tick one box)

- ☑ After the home's owner warned him about his behaviour.
- ☐ After the suspicions of the home's owner were communicated to the police but not to the police officer.
- ☐ It was an experimental surveillance operation set up in several residential care homes.
- ☐ After an anonymous call to the police.

Sex bias scientist wins £38,000

W1. Where did this scientist, Dr. Lee, work? (tick one box)

- ☐ . In a business company
- ☑ . In the Defence Evaluation Research Agency
- ☐ . At a biotechnology firm
- ☐ . In the Home Office.

W2. How did Dr. Goodfellow, her boss, interact with her while she was in the job? (tick one box)

☐ . He barely spoke to her.

☐ . He gossiped about her.

☑ . He constantly undermined her authority

☐ . He sexually harassed her.

W3. What did the court decide? (tick one box)

☐ . The scientist's boss had to keep away from her.

☐ . Dr. Lee had to pay her boss £38,000.

☑ . The court awarded her around £38,000.

☐ . Dr. Lee was given her previous job back.

W4. What position did Dr. Lee occupy? (tick one box)

☐ . Director of the Home Office

☐ . Business developer of the agency's projects management and consultancy group

☐ . Vice-director of the Defence Evaluation Research

☑ . Director of the agency's project management and consultancy group

W5. What was the view of the court? (tick one box)

☐ . The court thought the woman's boss did not resent a woman as a director.

☐ . The court partially agreed with the male boss's reasons.

☐ . The court thought that the agency should have been more careful when they appointed someone to that position.

☑ . The court thought that the male boss did not approve of the female scientist occupying such an important position.

W6. How did her colleagues describe Dr. Lee's work? (tick one box)

☐ . Deplorable

☐ . Satisfactory

☑ . Inspirational

☐ . Mediocre

Sir Humphrey moves to India in a BBC first

S1. What is this news story about? (tick one box)

☐ One Indian television channel bought a well-known British documentary.

☐ One Indian television channel launched a Hindi version of a British crime fiction series.

☑ One Indian television channel launched a Hindi version of a British political comedy.

☐ One Indian television channel launched a Hindi version of a Hollywood film.

S2. According to the story, why is it not surprising that this adaptation of a British series is taking place in India? (tick one box)

- ☐ Because of the historical bonds between Britain and India.
- ☐ Because of the cultural influences of Britain on India.
- ☑ Because of the similarities between British and Indian bureaucracies.
- ☐ Because the Indian market enjoys these type of series.

S3. According to the article, what are some of the adaptations? (tick one box)

- ☐ London becomes Bombay.
- ☐ The European Community becomes the Middle East.
- ☐ The Times becomes the Hindustan Times.
- ☑ Russia becomes Pakistan.

S4. Who recreated the series? (tick one box)

- ☑ The BBC.
- ☐ An Indian television channel.
- ☐ A Bollywood film company.
- ☐ ITV.

S5. How many times has the television company mentioned in the article recreated a series? (tick one box)

- ☐ It is the first time for India but it has already been done for other markets.
- ☑ This is the first time.
- ☐ It happens very often.
- ☐ It is the third time.

S6. [question not included in chapter 4, experiment 1, and included in chapters 3 and 5] When is another recreation of a British series going to happen? (tick one box)

- ☑ Only if this one succeeds.
- ☐ There is already another one on its way.
- ☐ It is not known yet.
- ☐ As soon as this one is finished.

S7. What was the critics' reaction to the recreation of the series? (tick one box)

- ☐ Most British critics are sceptical about its success.
- ☐ Most Indian critics are sceptical about its success.
- ☑ Most of them think it will be a hit.
- ☐ Opinion is divided.

S8. How do Indian audiences *react to foreign imports? (tick one box)*

- ☑ Indian audiences are used to watching foreign imports.
- ☐ Indian audiences are not used to watching foreign imports.
- ☐ Indian audiences are getting used to watching foreign imports.
- ☐ Indian audiences are resistant to watching foreign imports.

S9. Where is the BBC sending a boxed set of the Indian version of the British series? (tick one box)

- ☐ To the Ministry of Culture in India.
- ☑ To India's prime minister and his cabinet.
- ☐ To both the Indian and British prime ministers and their cabinets.
- ☐ To the television critics.

The only place for physical exertion is the gym

H1. What is this story about? (tick one box)

- ☑ New innovations in hotel rooms.
- ☐ New innovations in gyms.
- ☐ High tech innovations in hotels.
- ☐ New chargeable services in hotels.

H2. What type of hotels are mentioned in this story? (tick one box)

- ☐ Holiday resorts.
- ☑ International hotels chains.
- ☐ Inns and guesthouses.
- ☐ Self-catering accommodation.

H3. Which main type of luxuries are these hotels offering nowadays? (tick one box)

- ☐ Exotic food.
- ☑ Hi-tech facilities.
- ☐ More sophisticated gym facilities.
- ☐ Beauty products.

H4. According to the story, what does any good business hotel offers? (tick one box)

- ☐ Cable television with the most important news and business news channels.
- ☑ Internet connection in every room.
- ☐ Fax facilities in every room.
- ☐ A business common room with internet connection, personalised e-mail addresses and fax and photocopy facilities.

H5. What bedding is being used now? (tick one box)

- ☐ Pure wool blankets.
- ☑ Duvets.
- ☐ Electrical blankets.
- ☐ Organic cotton sheets.

H6. What has the Hilton provided in their "innovation rooms"? (tick one box)

- ☐ Specialised software such as image and video editing software and finance software.
- ☐ Computers with an internet connection.
- ☐ Interactive televisions.
- ☑ Plasma screens for use as a laptop screen or televisions.

H7. In addition to free soap and shampoo, what have many hotels begun to offer? (tick one box)

- ☐ Perfumes and designer stationery.
- ☑ Bath oils and candles.
- ☐ Beauty creams.
- ☐ Chocolates and candies.

H8. What type of bedside lamps is the Hilton introducing? (tick one box)

- ☐ Designer lamps.
- ☐ Lamps with coloured bulbs.
- ☑ Lamps with heat-resistant bulbs.
- ☐ Lamps with a remote control.

H9. [question not included in chapter 3, experiment 1, and included in chapter 3, experiment 2, and chapter 5] According to the Hilton's director of interior design, why are these innovations taking place? (tick one box)

- ☑ Because the guests are getting more sophisticated.
- ☐ Because the competition between hotels is increasing.
- ☐ Because the hotels are trying to keep up with the latest fashions in interior design.
- ☐ Because the hotel staff are getting more specialised and are now more able to provide good technological services.

Woman may sue GPs who missed tumour

T1. Where did this woman find out about her medical condition?

- ☐ Scotland.
- ☐ England.
- ☑ France.
- ☐ United States.

T2. When did this woman find out about her tumour?

- ☑ She found out about the tumour while she was on holiday.
- ☐ She found out about the tumour after she went to her family doctor.
- ☐ She found out about the tumour after she was hospitalised due to an accident.
- ☐ She found out about the tumour after she spoke to a friend who was a doctor.

T3. What is her claim concerning the doctors who missed her tumour?

- ☑ The doctors prescribed her rest and headache pills.
- ☐ The doctors only performed some medical examinations in the health centre, not in the hospital.
- ☐ The doctors thought she had a back problem, which caused the headaches.
- ☐ The doctors only saw her once.

T4. What was her main symptom?

- ☐ Vision problems.
- ☐ Fatigue.
- ☑ Migraine attacks.
- ☐ Temporary losses of consciousness.

T5. How long did the French doctor take to diagnose her condition?

- ☑ 3 hours.
- ☐ 1 hour.
- ☐ 1 day.
- ☐ 8 hours.

T6. How many doctors has this lady seen in the U.K.?

- ☐ 2
- ☐ 1
- ☑ 4
- ☐ 3

T7. According to the doctors, how long is this woman going to live?

- ☐ Around two years.
- ☑ Around one year.
- ☐ Around six months.
- ☐ The doctors did not say anything about her possible life duration.

T8. What happened to the woman's weight due to the treatment?

- ☐ It remained the same.
- ☐ It went down.
- ☑ It increased.
- ☐ It oscillated between periods of increase and periods of decrease.

Women urged to avoid the hard stuff

W1. According to the story, what is one of the reasons why women should stick to beer? (tick one box)

- ☐ Women should stick to beer because it has the same effect on them as spirits such as vodka and scotch.
- ☐ Women should stick to beer because it is healthier than spirits.
- ☑ Women should stick to beer if they want to keep up with men at the bar.
- ☐ Women should stick to beer if they are short and thin as they cannot tolerate spirits very effectively.

W2. What was the problem the research team was trying to solve? (tick one box)

- ☐ Why the same amount of alcohol leads to higher levels of booze in the blood of heavier people than in the blood of lighter people?
- ☑ Why the same amount of alcohol leads to higher levels of booze in the blood in women than in men?
- ☐ Why are there different toxic effects from different types of alcoholic drink such as beer, vodka and scotch?
- ☐ Why does alcohol from beer have different effects to alcohol from other drinks such as scotch and whisky in people?

W3. Where is the research team from? (tick one box)

- ☑ New York
- ☐ Oxford
- ☐ Harvard
- ☐ London

W4. What did the researchers do to study the effects of alcohol? (tick one box)

- ☐ They measured the activity of three mouth enzymes that get to work on alcohol.
- ☑ They measured the activity of three stomach enzymes that get to work on alcohol.
- ☐ They measured the activity of three liver enzymes that get to work on alcohol.
- ☐ They measured the activity of three pancreas enzymes that get to work on alcohol.

W5. How good is the enzyme in breaking down alcohol in the body? (tick one box)

- ☐ It is twice as effective in breaking down alcohol in heavier women as in lighter women.
- ☐ It is twice as effective in breaking down alcohol in women as in men.
- ☑ It is twice as effective in breaking down alcohol in men as in women.
- ☐ It is twice as effective in breaking down alcohol in lighter women as in heavier women.

W6. Which drinks showed a difference between men and women? (tick one box)

- ☐ It did not seem to matter when bitter and stout beers were being served, but the difference showed for lager.
- ☑ It did not seem to matter when beer was being served, but the difference showed for scotch and vodka.
- ☐ It did not seem to matter when beer and alcoholic cocktails were being served, but the difference showed for scotch and vodka.
- ☐ It did not seem to matter when beer and wine were being served, but the difference showed for scotch and vodka.

W7. According to the article, when are women and female animals more susceptible to the negative or toxic effects of alcohol? (tick one box)

- ☐ When the enzymes that broke down alcohol are more concentrated in women than men.
- ☐ When they are less heavy than men.
- ☑ In general.
- ☐ When they drink more alcoholic drinks such as scotch and vodka.