

The comprehension of emotions in narrative texts: The role of embodied knowledge

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Abstract

This work explores how current embodied theories of cognition can account for the comprehension of narrative texts. Theoretically, this thesis develops a framework for the study of narrative text comprehension by linking current advances in embodied theories of cognition, discourse processing, and neurosciences. Experimentally, two experiments are reported in which participants were required to read passages of text implying emotional states. The coherence of critical sentences in relation to the preceding text was manipulated in terms of both the emotional adjectives used and the sensory-motor component. In the first experiment, three tasks were used to index the effect of the manipulations on the critical sentences. The first was an on-line naming task in which response times to name emotional labels which matched the implied emotional state of the texts were recorded. Lexical decision and episodic recognition tasks were completed subsequently as measures of the impact of the critical sentence manipulation on off-line processes. The results suggest a trend consistent with the notion that readers use both language-based and sensory-motor knowledge to understand characters' emotions. However, during the on-line processing language-based knowledge seems to play a guiding role in comprehension, while during the off-line comprehension sensory-motor knowledge seems to do so. The second experiment used backward masking in the naming task with the aim of providing a more sensitive index of the effect of the text manipulations on on-line processing. The backward masking paradigm also enabled error data to be analysed in addition to response times. Results from this experiment were not statistically significant. Taken together, the experiments indicate that this is a promising area of research, but that future work requires the development of specific tasks that are sensitive enough to index how sensory-motor knowledge works for the processing of abstract concepts in narrative contexts.

Keywords: narrative text, text comprehension, characters' emotions, embodied cognition.

Statement of Authorship

Except where explicit reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis by which I have qualified for or been awarded another degree or diploma. No other person's work has been relied upon or used without due acknowledgement in the main text and bibliography of the thesis.

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Abstract

This work explores how current embodied theories of cognition can account for the comprehension of narrative texts. Theoretically, this thesis develops a framework for the study of narrative text comprehension by linking current advances in embodied theories of cognition, discourse processing, and neurosciences. Experimentally, two experiments are reported in which participants were required to read passages of text implying emotional states. The coherence of critical sentences in relation to the preceding text was manipulated in terms of both the emotional adjectives used and the sensory-motor component. In the first experiment, three tasks were used to index the effect of the manipulations on the critical sentences. The first was an on-line naming task in which response times to name emotional labels which matched the implied emotional state of the texts were recorded. Lexical decision and episodic recognition tasks were completed subsequently as measures of the impact of the critical sentence manipulation on off-line processes. The results suggest a trend consistent with the notion that readers use both language-based and sensory-motor knowledge to understand characters' emotions. However, during the on-line processing language-based knowledge seems to play a guiding role in comprehension, while during the off-line comprehension sensory-motor knowledge seems to do so. The second experiment used backward masking in the naming task with the aim of providing a more sensitive index of the effect of the text manipulations on on-line processing. The backward masking paradigm also enabled error data to be analysed in addition to response times. Results from this experiment were not statistically significant. Taken together, the experiments indicate that this is a promising area of research, but that future work requires the development of specific tasks that are sensitive enough to index how sensory-motor knowledge works for the processing of abstract concepts in narrative contexts.

Keywords: narrative text, text comprehension, characters' emotions, embodied cognition.

Chapter 1: Introduction

Discourse studies see text comprehension as a process that requires from readers the use of linguistic and generic knowledge. The first sort of knowledge assists in coping with discursive properties of texts, such as anaphora, subject-verb-object structures, and so on. On the other hand, generic knowledge assists in coping with the pragmatic content of what is referred to in the narratives, such as how people usually behave under certain circumstances. The interaction of these sources of knowledge leads to comprehension of discourse. Also, it is recognized that comprehension processes, as a high-level cognitive operation, entail memory systems, attentional processes, perceptual processes, and inferential processes in order to integrate those sources of knowledge.

All of these components, which are part of the comprehension process, have been studied thoroughly by recent research in discourse processing, in relation to specific narrative dimensions. For example, there are several studies dedicated to particular narrative dimensions such as space and causation, but just a few dedicated to time and characters' emotions. The study of emotion comprehension has attracted the attention of discourse researchers with regard to what sort of inferences enable emotion comprehension, what are the differences between the reader's and characters' emotions, and what emotions are elicited by the text structure, for instance. Nevertheless, little attention has been paid to how generic knowledge influences the comprehension of characters' emotions.

Current proposals from cognitive science argue that language comprehension requires from people the use of experience-based knowledge, particularly sensory-motor knowledge, to parse language in general. It has been suggested that sensory-motor knowledge supports the comprehension of concrete concepts such as actions and objects, but it is still controversial as to how that knowledge accounts for the comprehension of abstract concepts such as emotions and time.

This thesis studies by means of two experiments how experience-based and language-based knowledge interact during the comprehension of

narratives to lead to their comprehension. In particular, it addresses how people understand narratives' emotional dimension using sensory-motor knowledge.

The relevance of this work relates to its implications for both discourse comprehension and cognitive science theories in that there is still scant research about how readers comprehend emotions in narrative texts, while the matter of how these kinds of abstract concepts are understood remains an open debate in cognitive science.

Given these features, it is necessary to explain the process of language/discourse comprehension, especially in the case of emotions, and the cognitive process that sustains the comprehension of abstract concepts. Putting these ideas together, it is possible to model an explanatory framework that accounts for language comprehension, and particularly, for the comprehension of abstract concepts in the context of narratives.

This work is organized in the following way: Chapter 2 presents the issue of language and discourse comprehension. In so doing, memory sources, inference making, and representational levels are some of the main ideas addressed. Specifically, it is argued that narrative texts are powerful devices to elicit high-level mentations.

Chapter 3 accounts for emotion comprehension as a core topic both for discourse study and cognitive science. This chapter presents how emotions are comprehended in everyday situations and fictional contexts. Finally, it is shown how they share common basic cognitive processes in both realms.

Chapter 4 explains the methodological procedure for the first experiment which aims to see how language-based and experience-based knowledge interact to lead to text comprehension. Chapter 5 shows the results obtained. Finally, Chapter 6 puts forward a discussion and conclusion. Chapters 7, 8, and 9 report the method, results, and discussion respectively of the second experiment which is based on a methodological attempt to obtain stronger data. A general discussion is presented in Chapter 10.

Chapter 2. Discourse and language processing. The case of narratives.

It is widely accepted in cognitive science that discourse processing requires the mental construction of the state of affairs described in any discursive expression (de Vega, Díaz, & León, 1999; Elosúa, 2000; Graesser, Olde, & Klettke, 2002; Holliday, Hamilton, Luthra, Oddy, & Weekes, 2005; Zwaan & Radvansky, 1998). However, to construct a reliable mental representation of the linguistic input, the reader has to interrelate cognitive systems, such as memory systems, with cognitive processes, such as inferential operations and elaborative processes (Mar, 2004). For the purpose of this thesis, comprehension is understood as the construction of a meaningful representation of text by means of the interaction among the aforementioned cognitive systems; it is a dynamic process in that all these cognitive systems must be related to each other and must be present during the construction of mental representations.

Below, memory systems, inferential operations, and elaborative processes are considered more in detail. The construction of situation models is then emphasized as a core process in comprehension for reaching the meaning of what is referred to in the discursive input (e.g., Elosúa, 2000). Finally, a summary of discourse comprehension processes and a critique of current research in the area are provided. Ideas from current theories of cognition, particularly embodied theories such as Barsalou's (1999) theory of perceptual symbol systems, underlie the concepts considered herein, particularly in relation to the construction of situation models.

2.1. Cognitive components of discourse processing

The discourse genre that has attracted the most attention of discourse researchers is narrative discourse (Graesser, Millis, & Zwaan, 1997). The study of narrative discourse has yielded important ideas about how people understand language, as its study enables researchers to understand how readers use the cognitive systems mentioned above to build a mental representation or situation model of the situation referred to in the narratives. Another appeal of this kind of discourse is that it presents human life-based

experiences, that is, fictional characters living situations in typical scenarios. Additionally, narrative discourse follows a prototypical structure, i.e., introduction, complication, and resolution (Dixon & Bartolucci, 2001; Gárate Larrea, 1994), which is tantamount to the manner in which people relate anecdotes to themselves and each other. Also, narrative discourse is commonly found in texts, such as novels, stories, and fables (Garrido Domínguez, 1993). In this thesis, narrative text and narrative discourse are considered as analogous. Taking into account the above-mentioned, narrative discourse is an important device to understand how human cognition operates using fictional-experience-based situations.

Although text comprehension has been emphasized so far, the more general issue of language comprehension in everyday-life situations is also addressed by the ideas raised here. Recently Garrod and Pickering (2004) have proposed a model for dialogue comprehension. This model states that speakers have to align their mental representations in order to achieve mutual comprehension, namely, the alignment of their situation models of the conversation topic. This proposal is also supported by psychonarratology, which states that in narrative processing readers perceive the narrator as a conversational partner (Bortolucci & Dixon, 2003). Therefore, it is possible that by explaining the central assumptions in discourse comprehension, language comprehension, in general, would be benefited from this perspective. As will be seen, empirical research demonstrates that that is the case.

The informational flow between reader and discourse requires the active use of knowledge and inferential and elaboration processes (Mar, 2004). Each component has a particular task and purpose; nevertheless they must interact to create a representation of the situation referred to in the discourse. This representation is known as a mental model or situation model, and its principal purpose is to enable an interpretation of the linguistic input and to carry out higher-level cognitive processes, such as inferences (Rickheit & Sichelschmidt, 1999). Usually, discourse comprehension has been characterized by three levels of text processing, namely, surface text, text base, and situation model (e.g., Kintsch & Rawson, 2005). The focus of this

thesis is at the level of the situation model because it is the final product of comprehension that demands interaction between generic knowledge and linguistic knowledge.

To build a situation model, the reader uses information stored in his or her memory and information provided by the narrative. The linguistic and world knowledge enable the reader to understand the situations referred to in the text, whereas the textual information serves as a set of linguistic instructions about how the mental model should be constructed (Zwaan & Madden, 2004). Figure 2.1 shows the general components of discourse processing.

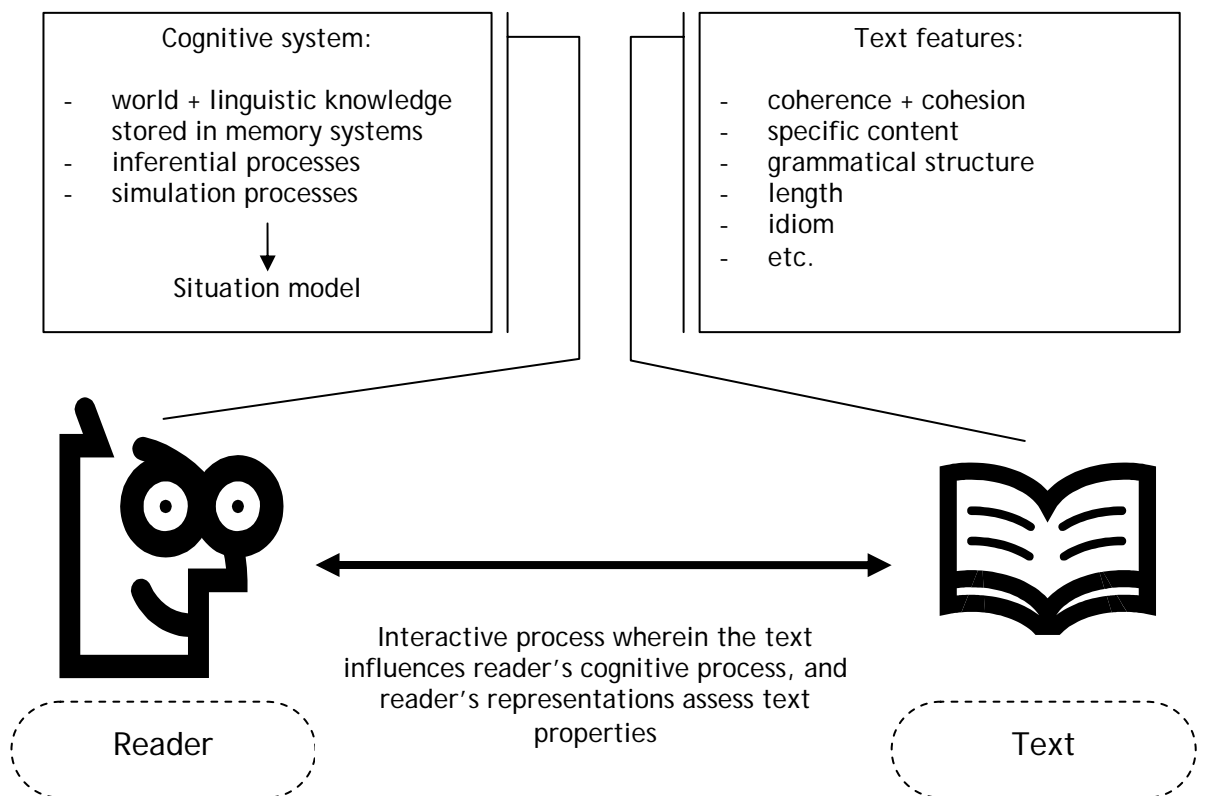


Figure 2.1. Basic components of discourse processing. On the side of the reader, memory resources, inferential, and elaboration processes permit the building of a mental representation. On the side of the text, linguistic information offers itself as an external entity to be processed that has particular features that influence the reader's mentations. Likewise, the reader assesses the discourse properties and determines its quality.

Figure 2.1 illustrates the mechanics of discourse comprehension, that is, the interaction between text and reader is driven by two types of input; namely, text features and the reader's mental representations. Recently, Bortolussi and Dixon (2003) provided a detailed account of both readers' mental constructions and text features necessary to consider in order to carry out an experimental study of narrative processing. As Figure 2.1 shows, texts have features that influence the mental representations of the comprehender. Texts must be i) objective, in that textual traces (e.g., syntactic constructions, style, etc.) can be identified, ii) precise, in that texts can be defined, iii) stable, in that enduring properties of the text do not vary with reader or reading situation, iv) relevant, in that textual features are meaningful for the reader, and v) tractable, in that textual features can be altered. On the other hand, readers' constructions must be i) direct, in that their responses can be collected, ii) replicable, in that other researchers can measure the same reader constructions, and iii) concise, in that results can be communicated in an efficient manner. Although the original methodological program proposed by Bortolussi and Dixon (2003; Dixon & Bortolussi, 2001) is based on the use of direct questionnaires more than reaction times, the distinction that they offer between text features and reader's constructions is crucial for carrying out textual experiments using literary-like texts. This new methodological approach to narrative processing highlights the mental representations achieved through manipulations of textual properties, for example, by manipulating text coherence at the global or local level. In this manner, a central feature of text comprehension is that an interaction between textual features and readers' mental representations must happen to construct a situation model of the narratives. This interaction will be exemplified when the effects of some text features on the comprehension of emotions in narratives are discussed in the next chapter. Nevertheless, the present work emphasizes the cognitive systems for discourse comprehension since, as will be seen later, current theories in cognitive science stress the important role that experience-based knowledge plays in language comprehension.

2.1.1. *Memory Systems*

The memory systems have the task of registering incoming information, maintaining it, and accessing it when required. Broadly, memory systems can be conceptualized as consisting of long-term and short-term stores (Baddeley, 2005). In the context of discourse processing, long-term memory (LTM) contains linguistic and world knowledge based on experience. The experience-based knowledge covers not only general knowledge of the world, but also particular memories or incidents or episodic memory (Graesser & Wiemer-Hastings, 1999; Tulving, 1999). Also, this memory system has information regarding reading experience in general, and experience with narrative texts in particular.

LTM is composed of two subcomponents that store long-term memories, specifically, semantic memory (SM) and episodic memory (EM). By and large, semantic memory is involved in acquiring and using knowledge about the world, whilst episodic memory permits the remembering of previous specific experiences (Baddeley, 2005). EM is a recent evolutionary achievement in human cognition, and its importance hinges on its virtue of adding affects to memories, something that SM lacks (Tulving, 1999). For this, EM is a necessary cognitive system to give meaning to memories, via access to autobiographical records.

In a classic study, Thorndyke (1977) demonstrated how memory is influenced by discourse characteristics. As mentioned earlier, texts have a particular grammar, that is to say, introduction, complication, and resolution. Thorndyke manipulated text structure in his first experiment, in such a way that some texts kept the canonical structure and other texts did not. After reading the texts participants completed recall, summarization, and recognition tasks. Participants scored very poorly for those texts for which canonical structure was altered. When Thorndyke altered the content of the stories in a second experiment, for instance by changing the set of characters and their actions, participants remembered more accurately those passages for which the content was more verisimilar and plausible (see also Black, Freeman, & Johnson-Laird, 1986). The crucial role of memory in text comprehension has also been demonstrated in educational settings (Elosúa,

García-Madruga, Gutiérrez, Luque, & Gárate, 2002; Elosúa & Martínez Romero, 2002) and in traumatic brain injury patients (Holliday et al., 2005).

Conversely, the purpose of short-term memory (STM, or working memory [WM]) is to keep active a limited amount of information for a brief period of time (Kneepkens & Zwaan, 1994). When the cognitive system is presented with incoming information, LTM and STM are interconnected by the functioning of the episodic buffer (EB). This new temporary store holds representations that integrate phonological, visual, and spatial information, and importantly, information not covered by the slave systems, like sensory-motor information. EB is episodic in that it binds information into a unitary episodic representation. These features make EB a memory component that enhances storage and retrieval, and therefore offers a more dynamic view of LTM in the comprehension of novel information.

Baddeley (2000) proposes that the episodic buffer plays an important role in merging incoming information with LTM. By means of a multimodal temporal representation, the episodic buffer enables the memory systems to maintain, for a short time, an active informational chunk filled with details proper of the situation at issue and with previous knowledge stored in the LTM, especially episodic memories.

The role of the EB is consonant with current cognitive theories that advocate a dynamic view of cognition, mainly of memory (see Glenberg, 1997; Nelson, 1999). As mentioned above, the EB can access stored episodic memories and integrate these with the incoming information currently active in STM. Memories stored in the episodic LTM are about specific events built on the basis of direct or vicarious experience with the world, and they flesh out the incoming information with specific modalities, e.g., emotional, spatial, and temporal. Given that LTM is organized by functional significance of personal experiences, this memory system works to take a more active role in the construction of mental representations (see Glenberg, 1997), that is, LTM acts not only as a storage system but as a source from which to retrieve meaningful information.

It is evident that memory plays a pivotal role in narrative discourse comprehension. Particularly, the interaction between EM and STM, via the EB,

is central to the construction of situation models. Although the memory systems are essential for knowledge acquisition in that they encode, store, and retrieve information, this information would be useless if there were not integration processes, that is, processes to create new information from old records.

2.1.2. Integration Processes

The information stored in memory must be coordinated and re-arranged, usually by addition or deletion of some memory traces. To do so, the cognitive system must draw inferences, so that generic knowledge is applied to the linguistic indications provided in the discourse, and, as a result, the mental representation is sufficiently coherent and explicative (Gutiérrez-Calvo, 1999).

This phase of the comprehension process could be regarded as a purification process, for unnecessary information is weeded out and relevant information is called for complementing the representation formed so far (e.g., Kintsch, 1988; Kintsch & Rawson, 2005). The role of inferential processes is to link concepts to each other in order to produce new information necessary to understand properties that are implicit, therefore, via inferencing, the integration processes occur. For instance, from the sentence "Mark stopped on the footpath looking at Mary without batting an eyelid; his day now was a brilliant day", the reader can infer that Mark really likes Mary, that her presence is enough to change Mark's normal day into a good one, and so on. These kinds of inferences can only be drawn by resorting to general knowledge and they provide coherence at a global level.

In addition to experience-based inferences, discourse comprehension also depends on lower level inferences based on textual input. Using the same example, the pronoun "his" in the sentence above is linked to Mark and not to Mary, since our linguistic knowledge tell us that "his" is normally attached to male names, not female ones. This inference is done in order to give local coherence to the sentence by connecting the pronoun "his" to one of the main characters. It is clear then that inferencing requires the integration of

experience-based knowledge at the top-down level plus language-based knowledge at the bottom-up level.

Consequently, without inferential processes there is no possibility of establishing coherence, or causal relations, or of resolving anaphors. In sum, without inferences, there is no comprehension (García-Madruga, Elosúa, Gutiérrez, Luque, & Gárate, 1999). This idea not only applies to text comprehension, but also to everyday reasoning in language comprehension.

Radvansky and Copeland (2004) demonstrated that mental processes used in formal and everyday reasoning share common characteristics. These investigators asked participants to perform an operation span test, a situation memory test, a categorical syllogism task, a spatial integration task, and an altered inference task. These tasks tapped cognitive processes used in language comprehension and formal reasoning. The results showed that integration and inferencing were related to narrative comprehension. According to the authors, integration is when the information from two premises is integrated into a common mental model. Inferencing involved deriving a conclusion from a mental model that is not stated by the premises. It is worth noting that these two processes are core processes in formal logical reasoning as well and therefore defined in those terms. Although the coordination of alternative models, the third feature in formal reasoning, was not related to narrative text comprehension, the overall picture supported the claim that the study of everyday reasoning aids understanding formal logical reasoning, and vice versa. As mentioned previously, by finding commonalities between everyday reasoning and discourse comprehension it can be asserted that the cognitive processes used in discourse comprehension are extensible to more general ways of reasoning and that knowledge acquired in both realms assists mutually.

The inferential processes lead to the construction of a situation model (Johnson-Laird, 1980; Zwaan & Radvansky, 1998). This construction is a mental micro-world or small-scale model of the situation referred to in the narrative that includes spatial, interpersonal, emotional, temporal, and causal attributes (see Belinchón, Rivière, & Igoa, 1992). The situation model comprises the following three dimensions:

i) The central plot: characters performing action to achieve goals, events that present obstacles, conflicts among characters.

ii) Elements that enrich the plot: spatial settings, descriptions of actions, properties and traits of the characters, time of events.

iii) Characters' mental states: characters' feelings, thoughts, knowledge, and beliefs (Graesser et al., 2002; Zwaan, 1999).

Some of these dimensions have been studied exhaustively. For instance, in a classic paper Bower & Morrow (1990) reviewed research about how readers build mental representations of situations referred to in texts. Their focus was on the spatial dimension of texts. In one of the reviewed works (Morrow, Greenspan, & Bower, 1987, as cited in Bower & Morrow, 1990), participants were asked to memorize the layout of two different buildings, a warehouse and a research centre. After memorizing the maps, they read a set of stories that took place either in the research scenario or in the warehouse. Each story introduced a new character who had different purposes and therefore performed different actions in each scenario. Also, the stories described the characters' thoughts and plans as they moved from one room to another in each scenario. Researchers measured participants' time to answer questions about the locations of objects. Pairs of test object-words were presented on a computer screen after subjects read line-by-line fragments of the stories. Subjects had to decide if the two objects were in the same room or different ones by pressing the buttons labelled as "same" and "different." The results showed that reaction times went from fastest to slowest in the following order: objects located in the current fictional place of the character, objects located in the closest room to the current one, objects in any other room, and finally objects located in any room of the other building. The researchers concluded that readers kept track of the situations referred to in the narrative and that they updated the situation model accordingly as the plot unfolded. Similar findings have been demonstrated for other dimensions of narrative such as time (e.g., Kelter, Kaup, & Claus, 2004), and emotions (e.g., Marmolejo-Ramos & Jiménez, 2006a, 2006b); nevertheless, emotion comprehension in texts has received scant attention.

2.1.3. *Elaborative Processes*

Although a situation model contains enough information as regards the situation referred to in the narrative, current theories in cognitive science claim for a more dynamic view of cognition, i.e., an embodied perspective on situation models.

Embodied theories of cognition claim that in lieu of amodal, arbitrary and abstract representation of meaning, mental representations of meaning are constituted by linking cognition and perception, which permits the cognitive system to build multimodal, grounded, and concrete representations of meaning (Barsalou, 1999; Glenberg, 1997). In doing so, simulation plays an important role since it allows the mind to create dynamic mental representations of the chain of events referred to in narratives. Therefore, an embodied perspective of situation models would enable the cognitive system to operate in a "safe mode" with grounded representations to simulate actions, perception, and anticipations of future events (Hesslow, 2002).

This new perspective on situation models has recently received empirical support. Neuropsychological evidence shows that simulation of actions, for instance mentally simulating hands movement, elicit the activation of the primary motor cortex (Hesslow, 2002). Indeed, in joint action, subjects activate motor areas in order to anticipate and understand others' actions (Sebanz, Bekkering, & Knoblich, 2006). Neurological research recently demonstrates that this sort of brain activity is pervasive even in people who have sustained a traumatic brain injury and who are in vegetative state. Owen et al. (2006) report the case of a patient who had a traumatic brain injury after being involved in a road traffic accident. These researchers used fMRI techniques to pick up her brain activity during the presentation of spoken instructions to perform mental imagery tasks (e.g., "imagining playing tennis"). Results showed that when the patient's brain activity was compared with that of healthy volunteers, no significant differences between the patient and healthy people arose in the cortical areas normally employed to process spoken language. Remarkably, there was a strong activation of supplementary motor areas that control motor responses (see also Miller, 2006; Naccache, 2006).

In the case of story comprehension, Mar (2004) reports several brain-imagery studies that show that specific brain areas activate when processing narratives, and interestingly, motor cortex areas are active when reading narratives that entail mental inferences. Also, Mar states that the medial prefrontal cortex, lateral prefrontal cortex, temporoparietal region, anterior temporal region (including temporal poles), and posterior cingulate cortex are brain areas implicated in narrative comprehension, and indeed, production. In this order, they are in charge of ordering and selecting information, computing theory-of-mind operations, attributing mental states, constructing mental states, and modulating emotion appraisals during recall of past experiences. Mar finally concludes that neuroscientific research does support an embodied perspective for text comprehension; in particular, predictions derived from behavioural data suggest this.

For instance, in a behavioural study Zwaan, Madden, Yaxley, and Aveyard (2004) asked participants to listen to sentences describing the motion of a ball towards or away from the observer (e.g., "The pitcher hurled the softball to you"). After the sentence was presented, a picture of an object was shown for 500 ms followed by another image. The two pictures matched or mismatched with the event mentioned in the sentence. Researchers found that subjects responded faster, via a keyboard, when the implied movement of the balls matched the movement depicted in the sentence. These data support the idea that language comprehension requires dynamic mental simulations and support embodied cognition assumptions. This sort of behavioural research suggests that language processing relies heavily on knowledge constructed in sensory-motor interaction with the environment (see also Kaup, Lüdtke, & Zwaan, 2006).

These results support current ideas about embodied frameworks. In particular, they suggest that knowledge is grounded in representations created through interactions between humans and objects in particular situations, and that that knowledge allows action in the world and the simulation of objects and situations when they are not present (see Barsalou, 1999; Glenberg, 1997). If it is taken into account that simulation processes allow the re-creation of actions, perceptions, and anticipations, whenever the

reader is to understand fictional situations, he or she is to activate motor areas in the brain as if they were performing situation-related actions. Also, the reader has the capacity to account for simulated perceptual entities, for instance by responding faster or slower to word-objects that are part or not of a spatial setting. Most importantly for an up-to-date discourse processing theory, it seems that readers can elicit actions and perceptions that would happen if an action were actually performed, in the case of, for example, the anticipation of events (see Hesslow, 2002). The evidence illustrated so far indicates that, from a behavioural (e.g., Zwaan et al., 2004) and a neurological (e.g., Mar, 2004) point of view, this is what does take place while reading narratives.

2.2. Embodied situation models as the highest comprehension level in discourse processing

It is generally agreed that text comprehension comprises basically three representational levels: surface level, text-base, and situation model (Kintsch, 1988; Kintsch & Rawson, 2005). In broad terms, the surface level accounts for the verbatim linguistic form of the text, i.e., how the text is grammatically and syntactically composed, its style and rhetoric. The text base accounts for the propositional network of the semantic content of the text, i.e., the main ideas or what is said in the text; finally, the situation model is a representation of the situation referred to in the text (Kneepkens & Zwaan, 1994). Hence, the situation model is the highest representational level achieved when comprehending discourse.

In the previous section an updated version of situation models was discussed that postulates that situation models must be embodied so that knowledge is based in a perception-cognition interaction. Furthermore, it was argued that memory systems must have a more dynamic role in knowledge establishment, especially in that memory for specific events must be used to understand new information. The stored information is then used through inferential processes in order to create new information. Finally, a situation model can be simulated on condition that the information stored in memory is employed dynamically (the role of the EB), particularly language and generic

knowledge. Given these features and the current findings in narrative neuroscience (e.g., Mar, 2004), a sketch of a neurocognitive system loop for narrative comprehension is proposed here, as shown in Figure 2.2

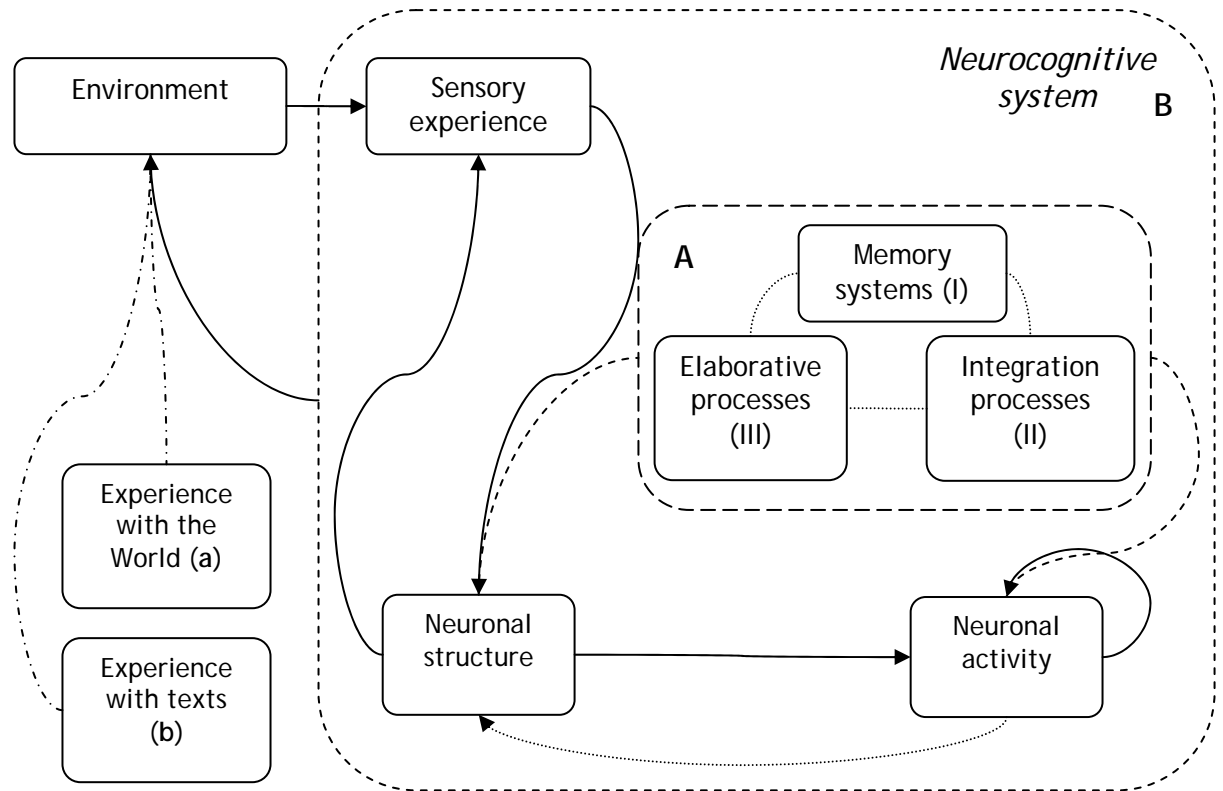


Figure 2.2. Narrative comprehension neurocognitive loop. The main cognitive system stressed in this thesis revolves around the loop A. However, it is worth noting that loop A is ingrained in a major neurocognitive system that supports it (loop B); specifically, memory systems, integration processes (inference), and elaborative processes (simulation) have a neuronal substratum which in turn entails a neuronal activity. The specific neuropsychological aspects of this loop are explained in detail elsewhere (Marmolejo-Ramos, 2006). Nevertheless, in broad terms, this argues that the construction of an embodied situation model relies on the coordinated operations among the components in loop A. The connection with the environment is vital for acquiring experience-based knowledge (a) and language-based knowledge (b) via sensory experience.

If this loop is correct, then, for instance, knowledge acquired by interactions with the world must be called for and its influence would be reflected in simulation processes that sustain the situation model construction. Specifically, if a reader is presented with fictional situations that entail actions that are mutually exclusive in that they recruit the same sensory-

motor systems, reading times would be affected since the construction of a coherent mental representation is interrupted. This idea is supported in a recent study.

de Vega, Robertson, Glenberg, Kaschak, and Rinck (2004) investigated how text comprehension is influenced by interaction between the properties of actions and the temporal relations expressed by adverbs. In Experiment 1 short narratives describing a character performing two actions that involved similar or different sensory-motor systems were read by participants. The actions were presented as simultaneous or successive by means of using the temporal adverbs "while" and "after." A typical passage in this experiment was like the following: "The artist was looking forward to getting to work on a portrait. *While/After* unlocking the studio door, he carefully painted a woman's face. The portrait was finished, and it was beautiful." This sort of passage was used to test if reading times were impaired by using either the temporal adverb "while" or "after" when they implied that the main character was employing the same sensory-motor systems.

Passages like the following were created to test if the temporal adverb has any effect when the actions performed implied different sensory-motor systems: "The artist was looking forward to getting to work on a portrait. *While/After* holding a pipe between his teeth, he carefully painted a woman's face. The portrait was finished, and it was beautiful." The researchers found slower reading times, both in Spanish and English, for sentences depicting actions recruiting the same sensory-motor system and including the adverb "while"; nevertheless this was not the situation for sentences implying different sensory-motor systems regardless of the use of "while" or "after" adverbs.

In a second experiment de Vega et al. (2004) depicted actions requiring the same sensory-motor systems but where one of the actions was presented as a mental plan. The temporal adverbs were used in this second experiment as well. Passages like this were created: "The shop assistant had a day off, which she spent at home. *While/After* she wrote/had written a letter, she thought of driving a nail into the wall. Then she hung a self-painted picture on the nail." Researchers found that comprehension, in German, was equally

easy with “while” and “after” adverbs when one of the actions was described as a mental plan. As their major conclusion, de Vega et al. claimed that comprehension is guided by syntax and embodied constraints within multiple non-interacting mental spaces. In other words, this research reveals that actions and mental plans are simulated and that the resulting situation model is affected if the actions at issue cannot be meshed given experience-based constraints.

In this same vein of ideas, a model of discourse processing ought to predict that an embodied situation model must be filled with perceptual entities relevant for the fictional events. This has also been recently demonstrated by Borghi, Glenberg, and Kaschak (2004).

The researchers hypothesized that if people use conceptual knowledge to simulate action in the world, then people’s interaction with physical objects will be reflected in the speed of retrieval and the content that is retrieved. To examine this, three experiments were designed in which a part verification procedure was employed. In this sort of tasks participants receive a word for a concept (e.g., horse), or a sentence as in the Borghi et al. experiments, followed by a word for a property (e.g., mane), then subjects must to verify if the property is true of the concept (Pecher, Zeelenberg, & Barsalou, 2003; Solomon & Barsalou, 2004).

Experiments 1 and 2 revealed that speed of part verification varied with the perspective imposed on the object in accordance with the linguistic information referring to the object (e.g., “you are driving a car” or “you are fuelling a car”). The verification task times were faster for words naming parts of the object that were closer to the current fictional position of the reader. For instance, when readers read the sentence “you are driving the car,” probe words such as “horn,” “steering wheel,” or “gear” were verified faster than words such as “trunk,” “fuel gauge,” or “back seat.” Inverse results were obtained when the main sentence was “you are fuelling a car.” These results enabled the researchers to determine that people construct fine-grained spatial information for concepts, and that these concepts become available according to the linguistically suggested perspective.

Borghgi et al. (2004) reported a third experiment which was designed to explore whether spatial information is based on perception-action codes, namely, whether an object is defined by how it enables interactions of particular types given its intrinsic properties, or its affordances (see Gibson, Adolph, & Eppler, 1999). In this experiment, parts were chosen with the intention that actions directed toward them required movement upward (e.g., the roof of the car) or downward (e.g., the wheels of the car). Orthogonally, responding “yes” required an upward or a downward movement to a response button. Researchers found that participants’ response times were slower when there was an incompatibility with the part’s location (e.g., responding downward to verify that a car has a roof) than when they were to respond in a direction compatible with the part’s location. The authors then concluded that people build spatial conceptual knowledge based on potential real-based actions with the world, or, to put it in another way, that affordances are used in addition to merely spatial facts.

The evidence presented to sustain an embodied perspective on situation models seems to be compelling, particularly, in that this proposes a dynamic view of narrative comprehension and language understanding. Most germane to this framework is that this grounds knowledge in perceptual experience, which implies a strong link between experience-based and linguistic-based knowledge for the construction of internal mental representations.

2.3. Chapter summary and conclusions

An updated view of discourse processing is presented herein. The empirical evidence supports an embodied view of situation model construction. Nevertheless, for the situation model to be built, it is necessary to align memory, inferential, and simulation processes. Although the research presented supports a linkage between cognition and perception for the comprehension of narratives, there are still some flaws that require examination.

On one hand, most of the current research on text comprehension from an embodied view of cognition, has revolved around concrete narrative

dimensions such as space and causality (actions). On the other hand, there is scant work on abstract narrative dimensions such as time and emotions. Finally, recent research has been limited to sentence processing and/or very simplistic sequences of events, and has not tested richer linguistic units such as narrative-like plots, thus underestimating the role of text features on comprehension.

For these reasons, the present work is designed to offer some suggestions to address the aforementioned issues. Specifically, this work seeks to explain how abstract narrative dimensions, particularly emotional appraisal, are intertwined with perceptual information, especially actions. Also, in this work text features are understood as the set of linguistic instructions that guide simulation. As a result, this work aims to test how readers comprehend characters' emotional states in narratives by relating knowledge-based components and language-based components. This is done under an embodied theory of discourse processing.

This question is re-stated in the following chapter once the processes sustaining emotion comprehension are clarified. Of special relevance is to determine whether comprehension of emotions in real, every-day-life situations, and fictional contexts, such as narratives, share similar cognitive processes (this will take place in the next chapter too). Provided that that is the case, the embodied model of discourse processing depicted in this chapter can be extended to include the processing of emotional information.

Chapter 3. Emotion comprehension in real and fictional contexts

3.1. Emotions as abstract concepts

Understanding how abstract concepts, like emotions, are processed is a critical issue for validating embodied theories of narrative processing (e.g., Barsalou, 1999); however, this remains relatively unexplored thus far. In reply to Barsalou's target article, Wiemer-Hastings and Graesser argue that perceptual symbol systems (Barsalou's embodied theory) do not account for abstract concept representation since abstract concepts do not have perceivable referents. Yet, if abstract concepts are grounded in context, their meaning representation can be achieved while contexts frame the simulation and provide clear referents. More to the point, in response to the same target article, Charland comments that Barsalou underestimates the pivotal part that emotions play in embodied theories of cognition. Charland claims that emotions must be considered as a specialized information processing system in themselves with both perceptual and cognitive components.

Studies investigating the processing of abstract concepts in text have revealed that they are more difficult than other concepts for participants to understand (Schwanenflugel, 1991). For example, behavioural (Schwanenflugel, 1991) and brain (Sabsevitz, Medler, Seidenberg, & Binder, 2005) studies have demonstrated that processing times are longer for abstract than for concrete concepts; this has been examined by using naming and lexical decision tasks both for words and sentences. Furthermore, developmental studies show that abstract words are acquired later than concrete words, and brain research points out that while concrete concepts are processed bilaterally in the brain, right and left hemisphere, abstract concepts are processed unilaterally in the left hemisphere (Binder, Westbury, McKiernan, Possing, & Medler, 2005; Schwanenflugel, 1991). To conclude, insofar as brain studies have presented abstract and concrete words in isolation to contend that abstract concepts lack perceptual-based representations, this idea can be criticized; however, if abstract and concrete words are presented in meaningful linguistic contexts (see Schwanenflugel,

1991; Wiemer-Hastings and Graesser in Barsalou's article), then, they will be perceptually grounded.

All in all, understanding the processing of abstract concepts, as emotions are, aids to flesh out embodied theories of cognition, in general, and the discourse processing realm, in particular. The interest here is to determine the cognitive components of emotion understanding in both real and fictional contexts. The former contributes to a grasp of how emotions are interpreted in real life situations, as an exemplar of abstract concepts; the latter explains how emotions are interpreted in narrative-like texts.

3.2. Comprehension of emotions

The study of emotions has occupied researchers in social (e.g., Johnson-Laird & Oatley, 2000), cognitive (e.g., Niedenthal, Halberstadt, & Setterlund, 1997), and language sciences (e.g., Gernsbacher, Hallada, & Robertson, 1998) principally. The consensus among these research areas is that cognition and emotion go hand in hand and that their interaction permits the mind to operate on physical and social entities encountered in environments, mainly by using recently-evolved brain structures (i.e., frontal lobes) (see Damasio, 1994).

The processing of emotions is as yet a little understood issue, but nonetheless there is nowadays information about emotion-appraisal processes both at the cognitive and at the neuroscientific level (see Lewis, 2005). Much of the research has been done on emotional understanding in social contexts, but there is still a gap in the literature reporting emotion understanding in fictional contexts, above all in the discourse processing realm (Groen, Syssau, De la Haye, & Brouillet, 2000).

Consequently, it is important to revise the psychological mechanisms underpinning emotion-cognition interaction in real-based experiences and the cognitive processes supporting fictional-emotion-based discourse comprehension. In this manner, it may be possible to highlight those main cognitive components that sustain emotional comprehension in general, that is, cognitive processes sustaining emotion understanding in real and fictional situations. This linkage is particularly important to determine the role that

emotional knowledge plays in the comprehension of emotions and how that knowledge is grounded in perceptual experience.

3.3. Emotion comprehension in real contexts

An emotion is generally defined as:

“[...] a psychological state or process that functions in the management of goals. It is typically elicited by evaluating an event as relevant to a goal; it is positive when the goal is advanced, negative when the goal is impeded. The core of an emotion is readiness to act in a certain way (Fridja, 1986); it is an urgency, or prioritization, of some goals and plans rather than others. Emotions can interrupt ongoing action; also they prioritize certain kinds of social interaction, prompting, for instance, cooperation or conflict” (Oatley, 1999a, p. 273; see also Damasio, 1994, Kneepknes & Zwaan, 1994).

From this definition it is clear that emotions bias actions, namely the attainment of goals. However, it must be recognized that action performance does influence emotional processes as well. This idea has been defended recently by Lewis (2005) who draws upon current developments in neurobiology and psychology of emotions to demonstrate how emotion understanding follows dynamic system principles.

Based on a dynamic cognitive system view, Lewis's model (2005) states that the bidirectional interaction between emotion and cognition happens under self-organization principles. This principle is the chief feature in dynamic (or non-linear) systems models and claims that coherent wholes emerge and consolidate from interacting constituents. This characterization of cognition is consonant with embodied theories of cognition and receives support from several trends in psychology (see comprehensive review in Lewis target article; see also Karmiloff-Smith, 1994).

The self-organizing emotional interpretation model, as Lewis refers to his model, involves three steps; the trigger event, the self-amplification phase, and self-stabilisation phase. The trigger event influences the

psychological system through a perceptual stimulus (e.g., winning the lottery), then a self-amplification process happens to activate emotional components (mainly neuronal wiring) that lead to the activation of other components in recursive cycles of increasing magnitude, with, for example, perceptual, emotional, and attentional processes being activated. Finally, in the self-stabilization phase, feedback among components stabilizes the whole system to establish global coherence. Most germane to this process, the self-stabilization phase enables more elaborated emotion-appraisal states through stabilizing coherence among working memory, planning, and attention. The outcome of the three steps in Lewis's model (2005) is a coherent mental representation of the situation being appraised. This idea dovetails with other researchers who consider the construction of mental models in emotional reasoning as key element to reach a complete emotional evaluation of the situation at stake (see Oatley & Johnson-Laird, 2002).

3.3.1. *Memory and emotions*

It is important to note that the Lewis model of emotion comprehension considers memory issues as a relevant component. Particularly, he states that people learn cognition-emotion associations and use them for future events. In fact, in his review of the place of memory in emotion understanding, he recognizes several memory systems in charge of assisting in this task, such as the hippocampus, lateral prefrontal cortex, and amygdala. However, he notes that the orbitofrontal cortex functions as an independent working memory system for emotional processing.

The important role of memory in emotion understanding is endorsed as well by other investigators. Niedenthal and Halberstadt (2000) review several behavioural studies that demonstrate that emotion binds experiences in memory and action, that is to say, "the experience of an emotion entails the activation of the appropriate emotion unit in memory. Activation then spreads from the central unit to the related information, thereby potentiating the use of those concepts in ongoing information processing" (pp. 175-176). For example, Niedenthal and colleagues (Niedenthal et al., 1997) employed lexical decision (Experiment 1 and 2) and naming tasks (Experiment 3) to

determine influences of emotions on visual word recognition. By employing music induction, emotional states such as happiness and sadness were induced. Participants under the effects of "sad," "happy," and "neutral" classical music made lexical decisions about letter-strings with meanings, some of them related to a range of emotions. Participants had facilitation of response, in both tasks, to words categorically related to the emotional state that was induced. A central conclusion gleaned from their work is that emotions operate as a kind of organizing theme for objects and events in the world, in the sense that each emotion indexes events and information that are causally related to it, so that emotional appraisals become associated with memories.

In a more applied context, Kealy, Kuiper and Klein (2006) found that memory for emotionally charged situations, be these real or made-up, is subject to event valence, individual differences, and manner of event recalling (e.g., guided imagery vs. journaling techniques). Researchers found that pleasant events (either real or made-up) were perceived as more typical, and more probable to have happened and be true, than unpleasant events. However, when the participants were depressed individuals, their recall of unpleasant personal events was twice that recalled by non-depressed individuals. These results were interpreted as biased by personal emotional memories. On the whole, these results corroborate the notion that memory processes and emotional elaborations are solidly welded (for an extensive review see Bower & Forgas, 2000; J. P. Forgas, personal communication, September 11, 2006).

3.3.2. *Inferences and emotions*

In emotional understanding processes, planning plays a central role as a reasoning procedure mediating emotional appraisal (Lewis, 2005). Notwithstanding, planning is known as well for being accompanied by inferential operations (R. Parrila, personal communication, September 5, 2006). In accord with this line of ideas, Oatley and Johnson-Laird (2002) demonstrate the crucial part of inferential processes in emotional interpretation. These authors cite research demonstrating that emotions work as heuristics for cognition: for goal-plan dyads there is a planning processor

(Oatley, 1999) that emits an “emotion signal” to the rest of the brain once an event that relates to the dyad occurs. In other words, emotions aid the selection of the most appropriate solution of several found by alternative methods. This selection happens at successive stages during the thinking process and is used in further steps. The main method for building a plan is through finding consistencies between the state of the world and goals. The cognitive tool that assists in this process is abduction, a particular sort of inference. By means of inferences, hypotheses based in available knowledge are created and enable emotions to detect inconsistencies in order to, in the end, build an overall mental representation of the situation.

Similar to these ideas, Conolly and Reb (2005) review research on feelings of regret, expounding the idea that decision-related regret is a negative emotion associated with thinking about a past or future choice. The thinking component is characterized by comparing options pointing to what actually did or will take place in relation to a better alternative - counterfactual thinking (which entails inferencing). The authors finally link this thinking mode to mental simulations of the upshots that could result from different choice options. In sum, a major conclusion gleaned from these works is that inferential operations take part in processing emotionally-charged information.

3.3.3. Situation models and emotions

Just recently it has been emphasized that the construction of situation models is the final stage in emotion understanding (see Lewis, 2005; Oatley & Johnson-Laird, 2002). Oatley and Johnson-Laird (2002) report a series of experiments wherein participants ($N = 157$) were asked to record any thought that they had about a workmate. Participants were asked to perform some tasks in cooperation with other colleagues, and when joint errors occurred, participants tended to ascribe negative personality traits to each other. The authors interpreted these results in terms of construction of mental models of the other person after the detection of inconsistencies. These results show that people create situation models about others according to evaluations made on the basis of the ongoing event where participants interact. Once

again, Oatley and Johnson-Laird's work highlights how related cognition and emotion are and how relevant is the construction of situation models in social construction of emotions (see Johnson-Laird & Oatley, 2000).

In a more practical vein, Feeney (2005) asked participants ($N = 224$), who were couples, to provide retrospective accounts of an experience of being hurt by a romantic partner, and their emotional reactions (Study 1). Their accounts were judged by experts who concluded that most hurtful events involved relational transgressions that indicate a deterioration of the relationship by threatening mutual positive mental models. Once again, the construction of mental models seems to play a relevant role in emotional interpretations.

If emotional mental models are built through inferential processes - abduction -, as Oatley and Johnson-Laird (2002) argue, then planning must be affected somehow. This idea has been supported by Johnson-Laird and Oatley (2000), who present research demonstrating that counterfactual thinking emerges when expected goals are not accomplished. For instance, when someone has to be punctual for an appointment and something impedes the occurrence of the meeting, the person creates two states of affairs: "if I had woken earlier, then I wouldn't get there late." This is the counterfactual version of the original fact "I woke up late and I got there late." The authors suggest that this way of reasoning is a way to learn from mistakes (imagine the emotional state of the person if the appointment was with her partner!) and correct plans that did not work. This entails the idea that the conscious evaluation done on social situations refers inevitably to mental models of the self or others (Johnson-Laird & Oatley, 2000).

3.3.4. *Embodied theories and emotions*

Emotions, as an exemplar of abstract concepts, are usually recognized as concepts that are not grounded in perception and action, in other words, they do not activate perceptually based representations (see Sabsevitz et al., 2005). However, research conducted by Clark, Bradshaw, Field, Hampson, & Rose (2005) demonstrates that sensory-motor interactions with the environment do influence the construction of emotional concepts and that the

interpretation of emotions also depends on the contextual properties that go together with them. Clark et al. examined whether people can identify the emotional content of behaviour from bodily postures and movements using point-light displays¹ where pair of actors were engaged in interpersonal communication. Participants viewed brief clips of the point-light displays presented the right way up and upside down (Experiment 1). Participants had to rate the emotional content of the displays by moving a slider along a horizontal scale. Sadness, anger, joy, disgust, fear, and romantic love were among the emotions included - all the emotions were rated for every clip.

Results of this first experiment showed that participants identified correctly the emotion implied in each upright-clip. Performance diminished when identifying the emotions for the inverted displays. In a second experiment, researchers presented only upright versions of the original dyads, a single actor, and a dyad composed of a single actor and his/her mirror image. Results still reflected that participants were able to recognize the implied emotions, though their performance was poor for the second and third condition. Clark et al. concluded that biological motion is sufficient for the perception of emotion, even when inverted displays reduced performance. The authors also claimed that emotion perception can be affected by the verisimilitude of social contexts within the displays.

A test of emotional attribution using static images also corroborates that even through the perception of simple images, people can distinguish social qualities, particularly emotional states. Pavlova, Sokolov, and Sokolov (2005) asked participants to estimate the instability of geometric shapes rotated in 15° steps in the image plane, and then rate the intensity of basic emotions that could be assigned to the figures. Results showed that when figures were deviated from vertical orientation, negative emotions were

¹ Point-light displays are video sequences of body motions. People or actors (as in this research) wear markers (points of light) that are especially designed to be registered by a motion capture analysis system. These markers are attached to body parts relevant to evidence broad body movements, for example, ankles, forehead, hips, elbows, and the like. Body movements are recorded and then transferred into a computer for future presentation through a monitor. Examples of this interesting research can be found at <http://www.perceptionweb.com/misc/p5203>.

attributed to them, that is, there was a positive correlation between perceived instability and negative emotions. Instead, positive emotions were attributed to figures when they suggested more steadiness. The authors claim to have demonstrated for the first time that the dynamics conveyed by static images can support specific emotional attributions. Most importantly, these results resonate with frameworks that claim that neural networks for production of movements and understanding the dispositions of others are inextricably bonded. In tandem, these studies provide evidence that emotions are grounded in perception and that stored internal representations of emotions assist in the understanding of the emotional states that accompany personal interactions by interpreting both verbal and non-verbal cues.

Furthermore, the neurology of emotions indicates an association between brain areas involved in the perception and interpretation of bodily movements and emotional processing. For instance, Pavlova et al. (2005) acknowledge that disorders of the mirror-neuron system, the system that links production of body movements and perception localized in the premotor cortex and inferior parietal cortex, are associated with social impairments that result from a lack of understanding of the emotional states of others. Also, the insula appears to play a pivotal role in emotion processing through its connections with the cortical areas that represent action within the limbic system. This area is considered as crucial for processing somatosensory information involved in emotion interpretation (Lewis, 2005; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Pavlova et al., 2005). These brain studies show that sensory-motor responses are involved in emotional understanding and that there are specific brain areas whose task is to integrate emotion, cognition and action.

Recently, in a thorough review of embodied theories of emotional understanding, Niedenthal et al. (2005) favoured an embodied approach to ground abstract concepts, such as emotions, in perception. According to these investigators, social information processing involves embodiment, where embodiment implies actual bodily states (on-line cognition) and simulation of experience (off-line cognition) in the brain's modality-specific systems for perception, action, and introspection. After reviewing empirical research

done on social psychology and similar embodied theories, the authors recast an embodied framework to explain social information processing. The authors conclude that Barsalou's (1999) Perceptual Symbols Systems (PSS) was the most suitable theory to explain the central phenomena in social cognition, such as attitudes (their acquisition and processing), social perception (mimicry and imitation, category priming and motor responding), and emotions.

Niedenthal et al.'s (2005) revised version of the PSS provides neurological and psychological foundations regarding social information processing in on-line and off-line cognition. Among the new features of the PSS are: i) specific neuroscientific models that account for emotional comprehension, such as the theory of convergence zones, ii) re-enactments (or simulation) of modality-specific states, that is, brain areas in charge of processing specific information (concepts or simulators in PSS jargon) activate without any input from the original stimulus, and iii) a distinction between shallow (word-level representations) and deep processing (simulations), in which conceptual processing is flexible, and people do not necessarily need to employ simulation at all times since informational properties determine the better processing strategy to be used, either shallow or deep (see also Craik & Lockhart, 1972; Craik & Tulving, 1975).

Finally, based on the reviewed empirical data, Niedenthal et al. (2005) emphasize simulation as the core process for a PSS approach to social information processing. The authors argue that evidence from modality switching costs, instructional equivalence, and perceptual effort support simulation as a necessary step for conceptual processing. Evidence from modality switching tasks indicates that there is a switching cost when participants are asked to verify properties in different modalities. For example, if participants process concepts that require simulation in one modality (e.g., LEMON-sour, which involves gustatory simulation), and then they are asked to verify properties of a second concept which entails a different modality (e.g., BLENDER-loud, which requires an auditory simulation), verification times are slower than when people verify a second concept that implies the same modality as the first concept.

The evidence from the instructional equivalence data indicates that comprehension engages perceptual simulation by default. Researchers found similar results when participants were asked to list properties of certain concepts regardless of whether they were explicitly instructed to engage in simulation or not. These results suggest that the instruction to simulate concepts does not affect processing because people engage in simulation naturally. Finally, the evidence from perceptual effort studies indicates that simulation involves a perceptual effort since this must have perceptual properties. A clear example of this assumption was provided previously through Borghi et al.'s (2004) experiment when discourse processing matters were tackled. Recall that in their experiments, participants were asked to verify if a property was true of a concept, for example "gear" in "you are driving car", vs. "gear" in "you are fuelling a car." Researchers found faster response times for the former situation since a spatial simulation of driving a car affords easier perceptual access to elements that are part of that spatial focus.

To sum up, it seems evident that emotion processing in real contexts demands the use of memory resources, and inferential and simulation processes. Most importantly, emotional information processing requires from people the use of events appraisal rooted in sensory-motor experiences with the context in which they took place. It seems plausible then to sustain the argument that emotion understanding in real contexts does require the use of similar cognitive systems employed in language comprehension, and that the use of experience-based knowledge plays a central role in this process.

3.5. Emotion comprehension in fictional contexts

The study of emotional comprehension in fictional situations has only recently begun to be researched in the discourse processing literature. As such, there is only a small number of studies that can be reviewed. Because most of the research on fictional emotional understanding indicates that memory, inferencing, and situation modelling issues are interwoven, these issues are treated together in this section. The pioneering studies in emotional comprehension in texts were carried out by Gernsbacher and colleagues (Gernsbacher et al., 1998; Gernsbacher, Goldsmith, & Robertson,

1992). Gernsbacher's main findings indicate that readers build an on-line representation of the emotional states of fictional characters, and that this inferencing process (or knowledge activation) comes about in a relatively automatic manner during the reading of narratives. For instance, in her classical experiment, Gernsbacher et al. (1992) asked participants to read 24 experimental stories (each of them tackling a different emotional state) plus 24 filler stories (stories emotionally neutral). After each of the emotional stories, participants read a target sentence that contained either matching or mismatching emotion words (Experiment 1). The following is one of the stories used by the investigators:

Paul had always wanted his brother, Luke, to be good in baseball. So Paul had been coaching Luke after school for almost two years. In the beginning, Luke's skills were very rough. But after hours and hours of coaching, Paul could see great improvement. In fact, the improvement had been so great that at the end of the season, at the Little League Awards Banquet, Luke's name was called out to receive the Most Valuable Player Award.

The stories were presented sentence by sentence in the centre of a computer screen and participants had to press a key to ask for the next sentence. In the emotion matching condition the target sentence for the example story was: "It would be weeks before Paul's pride would subside." The mismatching condition was: "It would be weeks before Paul's guilt would subside." The final target sentence was preceded by either the words "please continue the story," which invited participants to write down a suitable continuation for the story, or "short wait," which announced that the target sentence was about to appear on the screen.

The authors measured reading time for the target sentence. Gernsbacher et al. hypothesised that if readers build a rich situation model which includes information about characters' emotional states, then target sentences that contain a matching emotional state would be read faster than target sentences that contain a mismatching emotional state. This was precisely the result that the researchers found in this first experiment.

Later, these initial findings were extended by de Vega and colleagues (de Vega, Díaz, & León, 1997; de Vega, León, & Díaz, 1996; León & Hernández, 1998) who found that readers construct updatable situation models of characters' emotions and these representations remain accessible beyond the local context. Also, these authors found that readers can discriminate between characters' and their own beliefs about an emotional narrative situation. In a series of experiments, de Vega et al. (1996) tested if emotional representations may contribute to overcoming narrative incoherencies and ambiguities. They manipulated incoherencies by removing explicit emotional labels (Experiment 2) and including characters' external behaviours that could be interpreted as emotional reactions consistent or inconsistent with the situations depicted in the antecedent context (Experiment 3). de Vega et al. found that even when local context does not provide any emotional clue, readers' representation of the emotion activated by the first part of the story is kept accessible in memory. To put it simply, the emotion primed by the initial narrative context persists even when following information is emotionally neutral.

In Experiment 3 emotional labels were replaced with sentences that mirrored implicitly the main character's emotional state. The results of this experiment produced further ideas with respect to emotion understanding. The researchers (de Vega et al., 1996) concluded that readers track emotions even in the absence of explicit emotional labels, thus discarding the idea that emotional representation is a lexical-based process used only when readers meet emotional labels. As regards the main character's actions and reactions emotionally appropriate to the situation, de Vega et al. claimed that emotional representation is constructed and updated according to whether those reactions and actions are congruent or not with the general emotional situation.

In another set of experiments de Vega et al. (1997) explored the temporal course of mental perspective taking in narratives (Experiments 4, 5, and 6). The texts used followed this structure: i) an early bias context, ii) an information sentence, iii) late bias context, iv) filler sentence, v) neutral sentence, vi) target word or sentence, vii) end of the story. The first part

introduced a situation favouring an emotional state in an implicit fashion, for example, sympathetic. The information sentence provided (informed) or not (ignorant) the main character with information about a following critical event. The late bias context was a sentence that contradicted the early biased emotion. The filler and neutral sentence had the purpose of continuing the passage. The target word or sentence then included an explicit emotional word that matched the early bias context. Finally, there was a wrap-up sentence. Below is an example of one of the texts used by the researchers:

Carmen had an appointment at 10 with Carlos, her boyfriend, in the cafeteria where they usually meet. It was 10 and Carlos hadn't arrived yet. She realized that she would probably have to wait for him for a long time. Lately, he was so inundated with work that she didn't want to put pressure on him even more (i) (biased emotion = sympathetic)

In any case, Carmen decided to call him at home. Carlos' brother answered the phone and told her (informed condition) / but he didn't tell her that (ignorant condition) (ii)

Carlos and his friends were totally engrossed in a poker match (iii)

When she went back to the bar, (iv)

Carmen was thinking of her boyfriend (v)

SYMPATHETIC (vi) (the target word always matched the early biased emotion)

She got her bag and took out a packet of cigarettes (vii)

The researchers (de Vega et al., 1997) wanted to determine if the time course of emotional inferences was automatic (forward inferences) or not (backward inferences). The dependent variable was naming time for the target word. The independent variable was the condition of informed or ignorant protagonist. It was hypothesised that if there is an informed protagonist, then his or her perspective would be updated forward in an automatic manner. Under this situation naming latencies were expected to be faster for the informed condition versus the ignorant condition.

In so doing, de Vega et al. (1997) employed a naming task which, according to the authors, is a direct activation measure and sensitive to forward inferences. The results showed that, despite target presentations times (SOA or Stimulus Onset Asynchrony) being extremely varied between the

target and the preceding sentence or word (e.g., 250ms vs 1050ms), the naming task did not show any significant difference between the conditions (Experiments 4 and 5). Even using a cross-modal naming task, where the story was presented auditorily over headphones and the target word visually on a screen, and with different time intervals, there was no evidence demonstrating that readers produce emotional forward inferences (Experiment 6). It was concluded that emotional inferences are made when readers reach the end of the narrative, particularly an emotional label. The results were consistent with the idea that the emotional representation is updated using backward emotional inferences and not forward emotional inferences.

Recently, Gygax and colleagues (Gygax, Garnham, & Oakhill, 2004; Gygax, Oakhill, & Garnham, 2003) reported results that complement the studies of de Vega et al. and Gernsbacher et al. Specifically, their main argument is that emotional inferences about characters in texts are not as specific as proposed by previous work. Instead, emotional inferencing is generally done by grouping together emotional labels that are synonymous and similar to the overall evoked emotional state. In one of their experiments (Experiment 2), Gygax et al. (2003) gathered reading times for target carrier sentences including emotional labels that matched (e.g., depressed), were synonyms (e.g., miserable), were similar to (e.g., useless), or mismatched (e.g., happy) with the implied emotional states presented in the stories. Their results showed no significant differences in reading times among the matching, matching synonym, and matching similar conditions. Instead, significant differences were evident between the matching conditions and other mismatching emotional words for which the valence was the opposite to the implied emotional state.

In a further series of experiments, Gygax et al. (2004) composed extended versions of the stories used in their previous experiments. The stories, originally used by Gernsbacher et al. (1992), were elaborated by adding contextual information that enhanced a specific emotional state (Experiments 1 and 2). The results of these experiments demonstrated that by lengthening the stories participants chose only a particular set of emotional

labels for every story. However, this was true when the task was off-line, that is, by asking participants to judge the stories and select from a list of emotional labels those that best fitted the implied emotional state for every passage. When reading times were taken (Experiment 2), the modified stories with extra contextual information did not show any effect on emotional words that were similar, synonym, or matched with the overall emotional state of the stories. This pattern of results was found for a second time even when the stories were altered by including ambiguous sentences at the beginning of every passage (Experiments 3 and 4). Despite these results, the authors stated that “[...] the conclusion that readers do not infer specific emotions would have to be revisited.” (p. 633), and that future research should examine the semantic elements required for readers to assign specific emotional states to stories. The experiments designed for the present thesis, particularly the episodic recognition task (see next chapter), may cast further light on this issue.

3.5.1. *The role of text features in characters’ emotion comprehension*

The comprehension of characters’ emotions can be achieved not only by the use of experience-based knowledge but also by the text features that enhance them (see Greimas & Fontanille, 1991/1994). This is a matter that has been overlooked in current discourse research. However, recently some work has emerged to demonstrate the value of linguistic devices in the facilitation of narrative comprehension.

So far, in this thesis the emphasis has been on the cognitive processes that readers employ when comprehending texts. However the features of the text also influence how readers grasp what is referred to in the narratives. Bortolussi and Dixon (2003; Dixon & Bortolussi, 2001) carried out several experiments to determine the influence of text features in readers’ mental constructions. They referred to this research program as textual experiments. One of their main findings was the distinction between readers’ constructions and those text features that enable readers to engage with the events and plots of the stories, for instance literary devices. The linguistic devices found to aid readers in comprehending narrative rank from text coherence and

cohesion to content and plausibility of the narrated events. Most germane is that by means of using literary devices such as suspense or presence of characters' emotions for example, readers can build more detailed perceptual information about the events and fictional scenarios in narratives, since textual features permit perceptually salient descriptions.

The influence of text manipulations and features on readers' situation models of the stories' plot has been recognized as a research program in itself (see Haberlandt, 1981). Nevertheless, the scope here is only to emphasise the idea that the construction of a situation model by the reader can be altered according to the linguistic devices used to portray the content of the narrative. Indeed, it is argued that the study of text comprehension has developed "mini-theories" for specific components that in fact are tangled and interact with one another (Rapp & van den Broek, 2005). Therefore a proper research program in text comprehension must consider both readers' cognitive processes and text features to build a comprehensive explanation of the mechanics of reading.

The ideas mentioned above emphasize the influence of text features on text comprehension in general. However, some work has been developed as to the comprehension of the emotional dimension in narrative texts exclusively. Zwaan and colleagues (Dijkstra, Zwaan, Graesser, & Magliano, 1994; Kneepkens & Zwaan, 1994) tested the influence of specific stories' aspects both on readers' and characters' emotions. Employing multiple regression analyses, Zwaan and colleagues (Dijkstra et al., 1994) determined the impact of story aspects on characters' emotions and suspense as well as the effects of character emotions and suspense on reading times. One of the main features of their research is that they used eight original literary stories written by recognized authors and different literary epochs. The stories were around 8 to 10 book pages in length.

In their experiments, stories were analysed by judges according to the presence of characters' emotions, suspense, imaginative sentences, pragmatic intent, described activities in a given segment, the use of literary devices, attribution of information to the outcome of the story, plausibility, the amount of dialogue among characters, and coherence of some passages. Every

variable was clearly defined and rated on a four-point scale. The main result was that characters' emotions and suspense were enhanced via text features. In the same research, the authors summarize previous research conducted to measure reading times for the same stories when these yielded suspense or characters' emotions. Longer reading times were found for the first condition (suspense) than for the second condition (characters' emotions). The researchers explained these results arguing that readers count on extensive knowledge about human emotions and thanks to that they can be updated easily. Zwaan and colleagues complemented this explanation, also affirming that a thorough narrative comprehension requires the reader to track characters' goals and emotional states and that, given certain text features (e.g., suspense, literary devices, etc.), this processes can be impeded or facilitated. These ideas have been demonstrated also for readers' feelings toward the structure and content of narratives (Hoeken & van Vliet, 2000) and particularly when the texts used in experiments resemble literary stories (Miall & Kuiken, 2001).

From a psycholinguistic point of view, it is also speculated that emotional representation in texts may assist in resolving narrative ambiguities and inconsistencies in order to bring global coherence. In this respect Miall (1989, as cited in de Vega et al., 1996) holds that "the reader's sensitivity to the protagonist's affective states can contribute to giving unity to different episodes that, otherwise, may appear less coherent" (p. 306). Experiments 2 and 3 of de Vega et al. (1996) described earlier, were designed to determine whether readers keep their emotional representations accessible for global coherence; however, as these authors affirm, global coherence establishment is a topic in discourse processing that needs extra investigation. This idea receives support also from neuropsychological work. Hamann (2001) shows that the enhancement of emotional memories engages specific cognitive and neural mechanisms. Particularly, the amygdala is in charge of encoding, consolidating, and retrieval of emotional stimuli. This determines then that the initial memory representation for emotional appraisals is used when an analogous emotional situation is encountered, and then this memory serves as a rule to appraise new incoming emotional information. This notion also

matches with what Lewis (2005) called the self-stabilization phase, in that an emotional appraisal process finally seeks to establish global coherence. Hence, from a psycholinguistic and neuropsychological realm it can be deduced that emotional memories already stored as episodic memories contribute to overcoming inconsistencies in incoming emotional stimuli. This is particularly important when the texts present incongruities that can affect their comprehension either at a local or global level.

In sum, text features do influence readers' mental representations and reiterate the crucial role that linguistic knowledge (e.g., experience with texts) has on constructing a situation model of the situations referred to in the narratives. In particular, it is important to determine whether the search for global coherence is a process that operates not only in real situations but also in fictional situations. By answering this question a more complete explanation of how characters' emotions in narratives are understood can be achieved.

3.5.2. The influence of embodied frameworks in discourse processing. The case of emotions.

Recently some researchers have started to pay attention to the processing of emotions in language comprehension from an embodied point of view. The main prediction of these studies is the contention that symbols used by language reach meaning through linking them to perceptual properties. For example, Glenberg, Havas, Becker, & Rinck (2005) asked participants to hold a pen in their teeth or their lips while reading sentences describing pleasant or unpleasant situations (e.g., you and your lover embrace after a long separation / the police car rapidly pulls up behind you, siren blaring). The authors predicted that readers holding a pen in their teeth (which forced a partial smile) would read pleasant events faster than unpleasant events, and when participants held the pen in their lips (which forced a partial frown) they would show faster reading times for unpleasant situations than for pleasant situations. The data from their experiments supported these predictions. Based on an embodiment framework, Glenberg et al. argued that

language about situations that elicit emotions may be grounded in bodily states which, in turn, are reflected in behavioural features.

In further experiments, Havas and colleagues (Havas, Glenberg, & Rinck, in press), used a lexical decision task to determine to what linguistic extent simulation is employed when processing emotional words. Participants held a pen either in their teeth or in their lips while reading pairs of words. For one of their experiments (Experiment 3a) the pair consisted of two types of prime words (neutral or associated word) and two types of target words (word or non-word) (e.g., associate-nonword combination = kiss-bermace or associate-word = embrace-kiss). The target words used for this experiment were taken from the sentences used in the experiment described previously, and the nonwords were constructed by transposing the letters of the target words. In their other experiment (Experiment 3b) target words were strongly valenced positive or negative words taken from a word database. The authors predicted that readers would show faster response times for word targets preceded by associated primes than when preceded by neutral primes. Also, it was predicted that the pen conditions would prime emotion-congruent targets reflecting in faster RTs both in the associated word prime and neutral word prime conditions.

Previous studies using brain imagery have shown that action words referring to face, arm, or leg action (e.g., to lick, pick, or kick) activate areas along the motor cortex that either are contiguous with or coincide with brain areas activated by real movements of those body parts (Hauk, Johnsrude, & Pulvermüller, 2004). Based on these results, Havas et al. (in press) expected a pen-to-word priming. However, contrary to those results and their predictions, the investigators found that there was a word-to-word priming but not pen-to-word priming. Based on these findings, these researchers concluded that emotion simulation may affect language beyond the lexical level, and that this process operates during the comprehension of phrases or sentences. Their strong conclusion asserts that "different neural and bodily systems can affect simulation at different levels of language processing. Thus, action systems appear to affect processing at both the lexical and sentential levels, whereas simulation using emotional systems is predominantly a sentence or phrase-

level phenomenon." (p.12). Not only does this conclusion point out that simulation processes, or comprehension in general, are enhanced through meaningful linguistic units (such as texts), but also that emotionally-charged information processing requires a particular approach.

Even though these results are consistent with embodied theories of language processing, they do it accordingly to the linguistic unit used in their experiments and the research questions in themselves. The study by Glenberg et al. (2005) and Havas et al. (in press) aimed to determine the effects of participants' emotional states on language processing, using words or sentences as their main linguistic unit. Also, their tasks compelled participants to perform actual actions instead of requiring a solely mental simulation.

Recently an interesting work from a neuropsychological framework has offered complementary results as to the mental processes carried out when understanding fictional emotions. Ferstl, Rinck, and von Cramon (2005) mapped the neural activity of participants ($N = 18$) while they listened to 32 short stories of seven sentences each. Half of the stories contained globally inconsistent information. The inconsistencies were with respect to temporal or emotional events that affected the protagonist. The inconsistencies were determined by a target word, which was placed in the penultimate sentence, depicting either the emotional state of the character or mentioning information about a temporal sequence. Participants were asked to carefully look for any inconsistency regarding the content of the stories. Participants did so by pressing a "good" (consistent) or a "bad" (inconsistent) button after every story ended. Neuropsychological data showed that the integration of inconsistent emotional situations activated the dorsal frontomedial cortex, while the processing of inconsistent chronological situations engaged the lateral prefrontal cortex in both hemispheres. Based on such results the authors concluded that i) listening to stories requires content-specific processes, ii) that the updating of a situation model is a process that entails several components, iii) that situation model building depends on particular requirements of the texts, and iv) that not only the right hemisphere

intervenes in language processing in context, but so do the left medial and bilateral prefrontal cortices.

The results of this work are not explained from an embodied framework, but nonetheless they are consistent with notions offered by the neuropsychology of narrative (Mar, 2004) and revised versions of embodied theories (Niedenthal et al., 2005). In particular, the processing of different narrative dimensions requires specific cognitive and neural processes which, in turn, are guided by the kind of concepts underlying them. Also, the authors highlight the role that text properties play in the updating of the situation model. This appears logical if it is recalled that not only experience-based knowledge influences the situation model construction, but also the linguistic devices used to express what is referred to in the text.

The studies described in this section reveal interesting information about the relationship between emotion and language. However, as the researchers in this arena emphasize, further investigation is required to understand, for example, i) how simulation works for emotion comprehension, and ii) how language affects emotion processing, particularly, in narrative texts. More interesting is to note that these recent studies implicitly underscore that the main components for text comprehension match with those already proposed in previous chapters, namely, memory systems, inferential processes (or integration), and simulation (or elaborative processes).

Also, an evident pattern in current research is that researchers emphasize the simulation process as an essential component of comprehension. This is true if it is assumed that a simulated mental model is governed by rules of coherence more than of truth, meaning that emergent properties arise as long as the simulation system links up fundamental elements. That is, without interrelating these elements understanding cannot be extracted (Oatley, 1999). In other words, it is viable to think of the simulation process as the last part of the comprehension process in that all the necessary memory processes and inferential elaborations have been performed to feed the final embodied situation model. However, recall that those readers' mental representations are affected by the particular

requirements of the texts, particularly, the sort of linguistic devices supporting the events in any narrative dimension (e.g., emotional, spatial, temporal).

3.6. Chapter summary and conclusions

Several experiments have investigated how concrete concepts such as actions, space, and objects are mentally simulated during language comprehension (e.g., de Vega, Glenberg, and Zwaan's works); however few studies have been devised to explain the processing of abstract concepts, especially emotions. Recent experiments have tapped the processing of emotions from an embodiment framework, but they did not require from participants a pure mental simulation (e.g., the experiments of Glenberg et al., 2005; and Havas et al., in press). As those studies were aimed to test how embodied theories of cognition account for language processing in general, their assertions need to be tested for narrative text comprehension in particular.

Previous studies on the comprehension of emotions in narratives have advanced knowledge about how an emotional situation model is built via the reader's cognitive processes (e.g., Gernsbacher, de Vega and Gygax's work), but recent advances in cognitive science, particularly embodied theories of cognition, have not been explicitly proposed to explain this phenomenon. A last factor has to do with the strong emphasis of the embodied framework to explain language processing in general, and an underestimation of the role that language-based components play in the formation of a situation model. This is true particularly for the understanding of narrative texts wherein experience-based knowledge and text features are crucial for the construction of a situation model.

Therefore, it is important to test how embodied theories of cognition explain the comprehension of narrative texts. A current challenge for the embodiment framework is to explain how abstract concepts are processed. Then, by investigating how abstract concepts are processed in narratives from an embodiment framework, not only is empirical evidence collected as to what extent those theories contribute to text comprehension, but also, as to how abstract concepts are understood in narratives, such as characters'

emotions. As shown in the preceding review, the comprehension of emotions is a matter that deserves more study in the area of text comprehension, in particular, but also in the area of embodied theories of cognition, in general.

Havas et al. (in press) asked in their research how participants' emotional states affect language processing. The central question of the present work recasts that question specifically for narrative comprehension: how do linguistic and generic knowledge influence the understanding of characters' emotional states? Also, it has been argued that emotion simulation goes beyond the lexical level, therefore if more meaningful linguistic units are employed then simulation could be readily captured. Reliable tools to do so are texts since they elicit fictional emotions. Finally, if participants are to perform mental simulations rather than physical simulations, it could be considered as a proper simulation task to understand emotions in fictional contexts, which is in fact the way readers understand texts.

Chapter 4: Experiment 1. Introduction and method

4.1 Introduction

The aim of the present study is to determine the extent to which the comprehension of characters' emotional states is influenced by sensory-motor knowledge and linguistic knowledge provided in the narratives. As explained in previous chapters, this work assumes a flexible processing order among these components: generic knowledge and linguistic knowledge must be used to process the linguistic input, then, through inferential processes, implicit information becomes available, and finally, an embodied situation model is built through simulation.

The experiment consists of a reading situation in which the congruence of a final critical sentence was manipulated in relation to both the emotional and action-based content. The emotional content could either be consistent (E+) or not (E-) with the emotion implied in the body of the text, and the action component was either physically possible (A+) or not (A-). Thus, there were four experimental variations of the critical sentence as follows:

- E+ A+: In this condition, two simultaneous actions are referred to, one being the performance of an actual sensory-motor action and the other being a mental plan for an action using the same sensory-motor system. In addition, two emotional adjectives qualifying an action and an object in the critical sentence both matched the overall emotional state implied in the passage (condition 1 or emotion-matching and action-matching).
- E- A+: in this condition, two simultaneous actions are referred to, one being the performance of an actual sensory-motor action and the other being a mental plan for an action using the same sensory-motor system. In addition, two emotional adjectives qualifying an action and an object in the critical sentence both mismatched the overall emotional state implied in the passage (condition 2 or emotion-mismatching and action-matching),
- E+ A-: in this condition, two simultaneous actions are referred to, both implying the same sensory-motor systems. In addition, two emotional adjectives qualifying an action and an object in the critical

- sentence both matched the overall emotional state implied in the passage (condition 3 or emotion-matching and action-mismatching),
- E- A-: in this condition, two simultaneous actions are referred to, both implying the same sensory-motor systems. In addition, two emotional adjectives qualifying the action and the object in the critical sentence both mismatched the overall emotional state implied in the passage (condition 4 or emotion-mismatching and action-mismatching),

The effect of manipulating the emotional and action based content of the final sentence of each passage was then investigated using three probe tasks. The first was an on-line naming task, which was integrated with the reading task, in which participants named aloud an emotional adjective that matched the implied emotional content of the passage. After completing the reading/naming task two off-line memory tasks, lexical decision and episodic recognition, were used to probe the potential effect of the sentence manipulations on the lexical and episodic memory traces for the emotional words named in each of the passages. Participants' response times served as the dependent variable for the naming task, while both response time and error data were dependent variables in the lexical decision and episodic recognition tasks.

4.1.1. *Naming task*

The first task used to investigate the effect of emotional and action/embodiment congruency on emotional label naming was the naming task. This task was chosen because it is considered a direct activation measure, sensitive to forward inferences (de Vega et al., 1997). Therefore, it is a suitable task to account for automatic processes, i.e., this task taps readers' performances that are fast, do not require attention, are unconscious, and unavoidable. If there is any significant difference in the RTs among the four main conditions (see Table 1), then it could be assumed that the comprehension of emotions in narratives is done using emotional forward inferences and that either emotional adjective matching and/or action/embodiment matching must be present to achieve this.

Experimental evidence (de Vega et al., 1997) has shown that after manipulating several SOA (Stimulus Onset Asynchrony) conditions in naming tasks, an absence of forward emotional inferences was determined. Instead, the evidence suggested that emotional inferences update information backward. Then, if there are no significant differences in the RT among the four experimental conditions, it could support the idea that fictional emotion comprehension is done through backward inferences once all the linguistic input is processed, that it is not an automatic process, and that a post-lexical process is needed for a semantic integration of the text (see de Vega et al., 1997). A contrary position would be that emotional processing is an automatic process and that certain conditions, according to the conditions that show faster or slower response times (RTs), had an effect.

4.1.2. *Lexical decision task*

The second task used to investigate the effect of emotional words related to every condition on semantic memory was the lexical decision task. This task was chosen because it is assumed to tap how quickly people classify stimuli as words or nonwords and determine for which words people have built a stronger mental representation.

In this task half of the words were nonwords and the other half words. Half of the words were the emotional labels and the other half mental states. Mental states words were used since they i) are also considered abstract concepts, and ii) they appear frequently in narratives, either explicitly or implicitly.

Previous research done on the processing of abstract vs. concrete concepts (e.g., Schwanenflugel, 1991), and particularly the processing of emotional concepts (e.g., Gernsbacher et al., 1992) has indicated that, seemingly, naming and lexical decision tasks are reliable methods to capture these processes. These same authors argue that lexical decision tasks can account for conceptual priming and that they assesses stimulus encoding and post-access decision processes, whereas the naming task is considered a more fine-grained indicator of word recognition (Schwanenflugel, 1991). Furthermore, research in this arena has stated (Niedenthal et al., 1997) that

future research should cover both automatic and controlled processes in emotion-related phenomena. It is plausible to consider that a naming task would account for automatic processes and that the lexical decision task would tap controlled ones. In particular, the lexical decision task would tap any residual effect that the prior processing of the experimental items in the reading task has had on subsequent lexical access to these words in lexical decision-making.

4.1.3. *Episodic recognition task*

The third task used in this experiment was an episodic recognition task. This task was used in order to investigate if readers assign a specific mental representation for those emotional labels with which preceding context was coherent (i.e., E+A+, E-A+) over those for which was not the case (i.e., E+A-, E-A-).

The task consisted of the emotional words that had appeared in the reading task as well as a set of emotional words that had not been seen previously. In episodic recognition participants are asked to indicate which of the items appeared previously in the reading task.

4.1.4. *Hypotheses and analyses*

A sequence of five planned comparisons was used to investigate the effect of the emotional and action based manipulations for each task. These comparisons comprise a) the comparison of the situations that were totally coherent against totally incoherent, b) then situations where only actions were manipulated, and c) situations where only emotional adjectives were altered:

a) The first comparison was an overall one which sought to check whether experience-based knowledge and/or language-based knowledge are necessary conditions for comprehension. Under this condition E+A+ vs. E-A- were compared.

b) In order to index the impact of manipulating the action content of the critical sentence while the emotional component was held constant,

conditions E+A+ vs. E+ A- were compared. The comparison E-A+ vs. E-A- was performed in order to check this situation under an extreme incongruent case.

c) In order to index the effect of manipulating the emotional component of the critical sentence while the action component was held constant, conditions E+A+ vs. E-A+ were compared. The comparison E+A- vs. E-A- was performed in order to check this situation under an extreme incongruent case.

If the action based component is the main determinant for comprehension, no matter whether the emotional component matches or mismatches the implied emotional state, then it is expected E+A+ and E-A+ conditions to be significantly faster than E+ A- and E-A- conditions, wherein the action based component is incongruent and the emotional component supports or not the implied emotional state. If language-based knowledge is the source that determines comprehension, then it is expected that E+A+ and E+A- will show significantly faster RTs than E-A+ and E-A-.

4.2. Method

4.2.1 *Participants*

Forty seven students at the University of Ballarat (28 females) participated in this experiment in return for partial credit towards an introductory psychology research requirement. All the participants were native English speakers. The University of Ballarat is a small regional university in Victoria, Australia.

4.2.2. *Materials*

4.2.2.1. *Stories:*

Thirty-four short stories were developed for the experiment. Twenty-four of the stories were modified versions of the long versions used by Gygas et al. (2004, Experiments 1 and 2) which in turn were based on the stories originally developed by Gernsbacher et al. (1992).² The content of these stories was modified for Australian readers. For example, cricket was referred to instead

² I would like to thank Pascal Gygas for making these stories available.

of baseball, and terms such as room-mate were replaced with flat-mate. In order to increase the number of items in each condition an additional 10 stories were constructed, eight of which served as experimental items, making a total of 32 experimental items, with the other two items serving as practice items. The stories described situations that invoked basic negative and positive emotional states as well as allied emotions.

Four versions of each story were created defined by manipulations of the emotional and action-based content of a critical final sentence. Each passage appeared in all four experimental conditions across four counterbalanced versions of the experiment (i.e., 8 items in each experimental condition per version). The critical sentences were based on the materials used by de Vega et al. (2004). An example of one of the passages and the four critical sentences is provided in Table 1.³

In discourse research it is also traditional to use completion tasks, audio recorders, and filler stories to engage participants with the task (e.g., de Vega et al., 1997; Gernsbacher et al., 1992). In these experiments, deliberately, none of these experimental procedures and materials was used in order to bring a more natural reading environment (see Bortolussi & Dixon, 2003).

Table 4.1. Example stories and target word.

For two days now, the snowstorm had confined Jackie to her small house. The power was down and the phones were out. There was really nothing she could do except wait for the storm to pass. She paced from room to room. First she went into the living room and picked up a book. She read two paragraphs, and then put it down. It was too hard to read in the poor light. She wandered into the kitchen where there was a bit more light and she flicked through a cook book for some ideas. She put it down when she realised that the stove wouldn't work anyway. She decided to go into the lounge and water the plants. That was useful. She then sat on the sofa for a while and picked at her fingernails. After a couple of minutes, she got up and went back to the kitchen. Several times she wiped down the bench and rearranged the crockery. It was getting dark again. Soon she would not be able to see.

Critical sentence

Condition 1 (E+ A+):

³ I would like to thank Manuel de Vega for making these sentences available.

While Jackie impatiently lit a candle in the kitchen, she thought about lighting the other candles throughout her confining house.

Condition 2 (E- A+):

While Jackie patiently lit a candle in the kitchen, she thought about lighting the other candles throughout her comforting house

Condition 3 (E+ A-):

While Jackie impatiently lit a candle in the kitchen, she lit the other candles throughout her confining house.

Condition 4 (E- A-):

While Jackie patiently lit a candle in the kitchen, she lit the other candles throughout her comforting house.

Warning sentence

Jackie felt...

Emotional label

RESTLESS

4.2.2.2. Naming task

The naming task consisted of the 32 stories described above as well as the 32 emotional labels implied by the situations described by the stories that served as target words to be read aloud by participants at the end of every passage. The naming response was signalled by a warning sentence which included the name of the main character in the preceding story followed by "felt..." (see Table 1). The warning sentence was then replaced by the appropriate target emotional label. Target words always matched the general emotional state implied in their preceding stories. They were presented in 14 point courier new uppercase letters. The list of 32 emotional label target words is given in Appendix A.

4.2.2.3. Lexical decision task

For the lexical decision task, a total of 128 words were selected. Thirty-two words were the emotional states used for the naming task, 32 were abstract words (mental states), and 64 nonword foils. The nonwords were

constructed using the ARC nonword data base (Rastle, Harrington, & Coltheart, 2002), and the abstract words were constructed using the Edinburgh Associative Thesaurus (Kiss, Armstrong, Milroy, & Piper, 1973) and matched as to their frequency with the emotional adjectives and the nonwords by using the software N-Watch (Davis, 2005). The criteria for constructing the nonsense words were that their number of letters and neighbourhood density had to match the range for the emotional labels (3-14), neighbourhood size (0-832, minimum and maximum value). The nonwords were also selected on the basis that they were orthographically legal and pronounceable letter strings. All of the words used in the lexical decision task are provided in Appendix B.

4.2.2.4. Episodic recognition task

For this task 64 words were used. Thirty-two words were the emotional labels used both in the naming and the lexical decision task, plus another 32 emotional words not seen previously in the experiment. These new emotional labels were composed by pairing every emotional word used in the previous tasks with new emotional labels that were considered to be either synonymous with or closely related in meaning to the 32 target emotional words. The whole set of words was matched as to their frequency and neighbourhood size using the N-Watch software. The additional emotional words used for the episodic recognition task appear in Appendix C.

4.3. Apparatus

The experimental tasks were presented in a Pentium II PC running the Microsoft Windows 98 operating system using the software DMDX version 3.1.4.5 (Forster & Forster, 2003). This was installed with a PIO-DIO card interfacing, a two-button response box, and footswitch. The monitor was a 17 in. CRT with 120 Hz refresh rate, yielding a refresh time of 11.763 milliseconds.

For the naming tasks the responses were collected and transduced using an Ovann (Ref. OV510MV) headset microphone, and using an Intel 0815EEA sound card with 6-channel audio onboard (Ref. Integrated AC97).

4.4 Procedure

4.4.1. *Naming task*

At the beginning of the naming task, the participants were given written and verbal instructions about the experiment and they were asked to sign consent forms afterwards. Each participant was assigned to one of the four versions of the experiment. Participants first viewed two practice stories to familiarise them with the experimental procedure and equipment. Then, they were presented with the 32 stories in a different random order for each participant. The participants were asked to read for comprehension and to try to imagine the situation and how the protagonist should feel in it. They were instructed to read each passage silently at their own pace and then to name out loud the emotional adjective at the end of every text as quickly and as accurately as possible. Participants were informed both verbally and in the written instructions that their naming latencies and voice were being recorded. Also, they were told that the microphone would pick up on any disruptive sound; for this reason it was important to avoid making unrelated sounds, especially prior to the naming response.

Participants were instructed to advance to the critical sentence by pressing a footswitch. After pressing the footswitch the warning sentence appeared for 588 ms, which was then replaced in the centre of the computer screen (interstimulus interval [ISI] = 0) by the emotional word for naming. The emotional word remained on the screen until the participant named it, but its maximum duration was set at 4000 ms, after which the word disappeared and the item accounted as "no response" from the participant. After each item participants requested a new passage by pressing a footswitch. After each target word feedback was provided regarding the naming latency.

4.4.2. *Lexical decision task*

After completing the naming task, participants completed the lexical decision task. Participants were instructed to indicate as quickly and as accurately as possible whether or not what they saw on the screen was a real word, or a nonword. The response was made by pressing one of two buttons on a response box. Word responses were to be made with the dominant hand.

The lexical decision task was preceded by seven practice items. After the practice items a written instruction indicated that the experiment was about to commence. The first 2 items were always the same for each participant and were not analysed. The experimental items were then presented in a different random order for each participant. Every item appeared in 14 point courier new upper case letters for 3000 milliseconds. A trial terminated at a button press, or after 3000 milliseconds, whichever happened first. The computer recorded the response times. Feedback was provided after each response. For correct responses, the word "correct" was displayed on the screen, as well as the response time in milliseconds. For incorrect responses, the word "wrong" was displayed on the screen. This part of the experiment took approximately 10 minutes to complete. The change between tasks lasted approximately 2-4 minutes.

4.4.3. *Episodic recognition task*

In the episodic recognition task participants were asked to distinguish as quickly and as accurately as possible which of the displayed words had been encountered previously in the reading task and which had not been seen previously. Participants used their dominant hand to respond "yes" to previously seen words and "no" to new words. In all other respects, the procedure for the episodic recognition task was the same as that for the lexical decision task. It took approximately 5 minutes to complete.

The whole session took approximately 1 hour to complete. On its completion, participants were debriefed, thanked, and dismissed.

4.5. Design and analysis

The data were analysed using a one-way ANOVA in which the four critical text manipulations served as four levels of the independent variable, text coherence. Both subject (F_1) and item (F_2) results were reported. The omnibus ANOVA was followed with the series of planned comparisons described in the introduction to this experiment. One-tailed t-tests were used for the comparisons and a significance level of .05 was applied to all analyses. Response times served as the dependent variable for the naming task. Both

response time and error data were analysed for the lexical decision and episodic recognition tasks.

Chapter 5. Experiment 1. Results

Response times were analysed for correct responses only. Outliers were removed from the response time data by coding responses greater than 3000 ms or less than 150 ms as errors. Additionally, individual subject response times were trimmed by correcting any response greater than 2 standard deviations above or below their mean to the 2 standard deviation values.

Seven participants were removed from the analyses and replaced with a new participant on the basis that their mean response time was more than 2 standard deviations above or below the group mean.

5.1. *Response time data for the Naming task*

The means and standard errors of means for the response time for the naming task are shown in Table 5.1. A one-way ANOVA was conducted using adjusted (correct) naming times as the dependent variable. The analysis revealed no significant overall effect of the experimental conditions on naming times for emotional labels for either a by-subjects analysis, $F_1(3,117) = 1.188$, $p = .159$, or a by-items analysis, $F_2(3,93) = .904$, $p = .221$.

A series of planned comparisons was conducted to determine if comprehension of characters' emotion is supported by sensory-motor knowledge and/or linguistic knowledge. The comparison between the extreme congruent and incongruent conditions (E+A+ vs. E- A-) was carried out first. The results indicated that naming response times were significantly faster when the critical sentence contained fully consistent emotional and action-based content compared to when the critical sentence contained fully inconsistent information, $t(39) = -2.024$, $p = .025$ (one-tailed).

The means for the E+A+ and E+ A- conditions were then compared in order to investigate the effect of action-based content while holding the emotional content constant. The results indicated no significant difference in their RTs, $t(39) = -0.341$, $p = .367$ (one-tailed). This was also true when their RTs were compared under the extreme incongruent situation (E-A+ vs. E-A-), $t(39) = -0.717$, $p = .239$ (one-tailed).

The RTs of the conditions E+A+ vs. E-A+ were compared in order to index the effect of manipulating the emotional component of the critical sentence while the action component was held constant. The results indicated that naming RTs were not significantly different, $t(39) = -0.856, p = .198$ (one-tailed). However, when the emotional content was manipulated when the action component was incongruent (E+A- vs. E-A-), results indicated faster RTs when the critical sentence was congruent at least in its emotional content than when neither emotional content nor action content were congruent, $t(39) = -1.770, p = .042$

Table 5.1. Mean naming times (in ms) and standard error of mean for the naming task in Experiment 1.

Condition	RT Mean	Standard error of mean
E+ A+	455	9
E- A+	464	9
E+ A-	454	9
E- A-	468	9

5.2. Response time and error data for the lexical decision task

The means and standard error of means for the response time and error data for the lexical decision task are shown in Table 5.2. A one-way ANOVA was conducted with adjusted (correct) response times as the dependent variable. There was a significant main effect of conditions on emotional words in both the by-subject analysis, $F_1(3,117) = 2.639, p = .026$, and the by-items analysis, $F_2(3,93) = 2.740, p = .024$.

A series of planned paired sample t tests was conducted to determine if characters' emotion comprehension is supported by sensory-motor knowledge and/or linguistic knowledge as a controlled process. The comparison between the extreme congruent and incongruent conditions (E+A+ vs. E- A-) was carried out first. The results indicated that lexical decision response times were significantly faster when the critical sentence contained fully consistent

emotional and action-based content compared to when the critical sentence contained fully inconsistent information, $t(39) = -1.714, p = .047$ (one-tailed).

The means for the E+A+ and E+ A- conditions were then compared in order to investigate the effect of action-based content while holding the emotional content constant. The results indicated no significant difference in their RTs, $t(39) = -1.128, p = .133$ (one-tailed). However, when the action component was manipulated while the emotional adjectives did not match the implied emotional state (E-A+ vs. E-A-), conditions where the action component matched the implied emotional state showed significantly faster RTs, than when both action component and emotional adjective mismatched the implied emotional state, $t(39) = -2.434, p = .01$ (one-tailed).

The RTs of the conditions E+A+ vs. E-A+ were compared in order to index the effect of manipulating the emotional component of the critical sentence while the action component was held constant. The results indicated that lexical decision RTs were not significantly different, $t(39) = 0.920, p = .181$ (one-tailed). This results was true as well when the emotional content was manipulated and the action component held incongruent (E+A- vs. E-A-), $t(39) = -.569, p = .286$ (one-tailed).

Table 5.2. Mean response times (in ms) and percentage errors for the lexical decision task in Experiment 1. Standard errors of means are presented in parentheses.

Condition	RT Mean	Percentage error
E+ A+	545 (6)	.03 (.01)
E- A+	538 (7)	.03 (.01)
E+ A-	554 (7)	.03 (.01)
E- A-	558 (7)	.03 (.01)
Mental states	609 (5)	.09 (.01)
Nonwords	629 (3)	.07 (.00)

Error analysis did not show a significant main effect in either the subject, $F_1(3,117) = .077, p = .486$ or item ANOVAs, $F_2(3,93) = .066, p = .489$. The same series of planned comparisons was carried out for the error data.

There were no significant differences between any of the experimental conditions, all F values < 1 .

5.3. *Response time and error data for the episodic recognition task*

The means and standard error of means for the response time and error data for the episodic recognition task are shown in Table 5.3. A one-way ANOVA was conducted with adjusted (correct) response times as the dependent variable. There was no significant effect of conditions manipulating the coherence of the texts on emotional labels either in the by-subject analysis, $F_1(3,117) = 1.204$, $p = .155$, or the by-items analysis, $F_2(3,93) = .851$, $p = .235$.

A series of planned paired sample t tests was conducted to determine if characters' emotion comprehension is supported by sensory-motor knowledge and/or linguistic knowledge as a residual process in episodic memory. The comparison between the extreme congruent and incongruent conditions (E+A+ vs. E-A-) was carried out first. The results indicated that episodic recognition RTs were not significantly faster when the critical sentence contained fully consistent emotional and action-based content compared to when the critical sentence contained inconsistent information, $t(39) = -1.148$, $p = .129$ (one-tailed).

The means for the E+A+ and E+A- conditions were then compared in order to see the effect of action-based content while holding the emotional content constant. The results indicated no significant difference in their RTs, $t(39) = 0.164$, $p = .435$ (one-tailed). This was true too when the action component was manipulated while the emotional adjectives did not match the implied emotional state (E-A+ vs. E-A-), $t(39) = -1.53$, $p = .066$ (one-tailed).

The RTs of the conditions E+A+ vs. E-A+ were compared in order to index the effect of manipulating the emotional component of the critical sentence while the action component was held constant. The results indicated that episodic recognition RTs were not significantly different, $t(39) = 0.642$, $p = .262$ (one-tailed). This results was true as well when the emotional content

was manipulated and the action component held incongruent (E+A- vs. E-A-), $t(39) = -1.387, p = .086$ (one-tailed).

Table 5.3. Mean response times (in ms) and percentage errors for the episodic recognition task in Experiment 1. Standard errors of means are presented in parentheses.

Condition	RT Mean	Percentage error
E+ A+	705 (12)	.19 (.02)
E- A+	694 (13)	.20 (.02)
E+ A-	700 (12)	.18 (.02)
E- A-	716 (14)	.17 (.02)
Different matching emotional labels	725 (6)	.22 (.01)

The error analysis did not show a significant main effect in either the subject, $F_1(3,117) = .270, p = .423$ or item ANOVAs, $F_2(3,93) = .308, p = .41$. The same series of planned comparisons was carried out for the error data. There were no significant differences between any of the experimental conditions, all F values < 1.

Chapter 6. Experiment 1. Discussion

The purpose of the present experiment was to examine the proposition that the comprehension of characters' emotional states is influenced by sensory-motor knowledge and linguistic knowledge provided in the narratives.

Specifically, it was expected that if characters perform actions supporting the implied emotional state in the text, and it is physically possible for these actions to be performed simultaneously, then comprehension will be facilitated, which in turn would be reflected in faster task response times (RTs). By contrast, it was expected that if those actions could not be performed at once (given actual experience constraints based on embodied knowledge), then comprehension would be adversely affected, probably because that knowledge does not permit a simulation that leads the reader to construct a plausible situation model.

Additionally, language-based knowledge was expected to contribute to text comprehension about emotion. Therefore, a perfectly coherent text would depend on not only actions that can be performed simultaneously, but also adjectives that are compatible with the implied emotional state, whereas adjectives incompatible with the overall implied emotional state would impede comprehension.

Three tasks were devised to assess comprehension. The naming task was designed to investigate the effect of linguistic emotional and action/embodiment congruence on the on-line comprehension of characters' emotions. The lexical decision and episodic recognition tasks were designed to investigate the potential impact of the manipulations on emotional and action/embodiment content on off-line comprehension processes - lexical and episodic memory respectively.

Considering the naming task as an index of comprehension, the results indicated that having congruence in both information sources - linguistic and action/embodiment - aids comprehension of emotion, compared with having congruence in neither. However, this comparison did not provide information about which of the two information sources contributes to this superiority, or whether both do so. Breaking this down to further understand the roles of the

linguistic and action/embodiment information, it was found that congruence in action/embodiment did not give superior comprehension over incongruence in this information source, whether paired with congruent or incongruent linguistic information. Taken alone, this suggests that the action/embodiment aspect did not play a role in comprehension as assessed by the naming task. However, considering the linguistic manipulation, while this was found to make no difference to comprehension when action/embodiment was congruent, it was found to do so when the action/embodiment information was incongruent. Taken together with the trends across conditions, the findings are suggestive of an interaction between the two types of information, and a stronger role for linguistic than action/embodiment information on this task. Although suggestive, the findings are not decisive about the roles of the two information sources and, as discussed later, it is possible that the task requirements impeded a clear demonstration of their individual roles in comprehension.

Considering the lexical decision task, findings were very similar except that in this case it was the action/embodiment manipulation that seemed to have a greater effect on comprehension than the linguistic information.

The fact that the linguistic manipulation seemed more critical for the naming task under more incongruent conditions suggests that this kind of information is the more important one for automatic on-line processing, and is entailed in forward inferencing. By contrast, the apparently greater role of action/embodiment under more incoherent conditions for the lexical decision-making task suggests that this source of information has a greater role in off-line controlled comprehension processes.

By contrast with the first two tasks, the episodic recognition task did not produce any significant results or trends, giving no grounds for suggesting that either sensory-motor or language-based knowledge has a guiding role in this phase of comprehension. These results could be interpreted in terms of a repair or integration of inconsistencies step, wherein readers seek to establish global coherence and keep in memory an emotional representation that plays down inconsistencies (critical sentences) and instead plays up the logicity of the text (story contexts).

6.1. General conclusions

The aim of this experiment was to examine the proposition that the comprehension of characters' emotional states is influenced by both sensory-motor and language-based knowledge elicited by the narratives.

The results of this experiment suggest that the comprehension of emotional states utilizes both sensory-motor and language-based knowledge. However, there is some indication that the first on-line processing step is guided in general more by the language-based components of the text which in turn demands that source of knowledge from the reader. Thus, the construction of a situation model requires tracking the linguistic devices employed in the texts.

A subsequent step in comprehension comprises more controlled processes. In the off-line processing of emotional states, there is some indication that sensory-motor knowledge plays a greater role in the processing of narratives. During this phase, it seems that experience-based or generic knowledge may play a greater role since the reader can spend more time on further elaborations that go beyond the language-based level. Then, at this level simulation could have a decisive role in managing memory and integration processes. In other words, simulation interrelates experience-based memories and concepts to build representations of the actions supporting the emotional states.

A final stage accounts for the residual elaborations in comprehension. At this stage a depth of processing account could be used to interpret the results found herein. As a final step in the representation of fictional emotions, readers seem to adjust and control the final mental representation of the situations supporting emotions. Maybe by superimposing experience-based knowledge on inconsistencies, readers resolve narrative ambiguities to establish global coherence. The knowledge stored about previous emotional experiences could be used to assess new incoming emotional information, then overcoming narrative incoherencies according to well-known past emotional memories.

The major limitation of Experiment 1 comes from the naming task since this is the task that introduces the main experimental conditions, i.e., stories,

critical sentences, and emotional labels. The naming task is understood as a task that reflects what is currently activated in readers' mental representation and not how easily a stimulus (e.g., a word or target sentence) can be integrated in that representation. Researchers assume that subjects do not try to integrate the word into their mental representation; rather, subjects simply pronounce the test word as fast and accurately as they can. Therefore, it is assumed that the pronunciation task does not reflect any type of "context checking" (Gernsbacher et al., 1992, 1998).

It could be argued that as the target word remained on the screen until the participant named it over the microphone, then participants had some extra time to check the target word against the preceding context. Also, as stories were presented as a block, it could facilitate the reader in having a more accessible memory for the text, including the critical sentence. These conditions could account for the non-statistically-significant differences between the experimental conditions. A potential modification to this task that could provide a more sensitive measure should work on these two components of the task.

Firstly, texts should be presented by parts composed of meaningful sentences so that the possibility of an integration process occurring during the reading part would be somehow reduced. Also, the presentation of the target word should be manipulated to avoid integration or further elaborations from the reader. A way of doing this could be by shortening the duration of the target word on the screen. By doing so, it is probable that the readers invest time and attention in remembering the word they just saw to name it, instead of using time and attention to integrate the target word with the previous story-context. These conditions are the basis for a follow-up experiment.

Chapter 7. Experiment 2. Introduction and Method.

7.1. Introduction

Although the data from the naming task in Experiment 1 were suggestive of a trend, they were not sensitive enough to provide strong statistically significant differences between the critical experimental conditions. The aim of the second experiment is to alter the task in an attempt to provide a more sensitive index of on-line processing.

Experiment 1 provided evidence to suggest that both experience-based and language-based knowledge interact to reach comprehension, and that if there are deficiencies in one of them, the other supports comprehension. However, from a mere methodological point of view it could be asked if these results are sustainable even if experimental conditions are altered.

The naming task was the task that included the on-line reading task and also proved to be moderately sensitive to RTs analysis. Recall that in that task participants read every text in one-block fashion, including the critical sentence, then a warning sentence, and finally the emotional label. As was argued in previous sections, the fictional contexts were presented in that manner in order to offer readers a more natural reading situation. This modification is different from typical studies in narrative comprehension in that texts are usually presented by parts. Also, in the previous experiment the emotional label remained on the screen until the participant named it into the microphone.

Thus, it could be said that maybe because participants had sufficient time to view the target word, they could perform a complete central processing of the word (see Xu & Perfetti, 1999). However, if time viewing the word is reduced participants will necessarily operate at a more automatic level and more sensitive RTs and error data could be gathered. This second experiment seeks to find more sensitive data by altering the naming task and also to corroborate the predictions put forward for the first experiment. The interest here is to verify the results for the on-line comprehension of the stories when the reading and naming tasks are altered. Therefore, the lexical decision and the episodic recognition are not considered.

7.1.1. *Some methodological caveats for the naming task*

The basic assumption for the naming task is that the pronunciation of the inferred emotional label will be facilitated if the corresponding concept has been previously activated when the inference was elaborated. This facilitation will be then reflected in the naming RTs (Gutiérrez-Calvo, 1999). This task has normally been employed to study phonemic activation during word identification (e.g., Perfetti & Bell, 1991) or the time course of inference generation (e.g., Calvo, Castillo, & Schmalhofer, 2006; Calvo, Estevez, & Dowens, 2003), but has not been extensively used in narrative texts situations, particularly in its backward visual masking version (C. Perfetti, personal communication, October 11th, 2006). To put it simply, the backward masking paradigm has been used to tap the use of phonemic or graphemic knowledge in word representation, but not to tap how semantic or pragmatic knowledge is used. This task therefore could be worthwhile for the study of how emotions are comprehended using sensory-motor and language-based experiences.

Some studies in characters' emotion comprehension have employed naming task to determine if readers represent characters' emotional states (e.g., Gernsbacher et al., 1992), and how readers take the protagonist's mental perspective in stories involving conflicting beliefs about a situation (e.g., de Vega et al., 1997), for example. However, similar to Experiment 1 reported previously, the target word remained on the screen until the participant said it over the microphone. So, as mentioned before, this situation could give time to the participant for some extra processing. This therefore raises a question about whether the naming task in Experiment 1 did in fact indicate the occurrence of forward inferencing.

If the presentation of the target word is reduced it could urge the participant to invoke more automatic processes. This variation of the naming task, called the backward visual masking procedure, has been used in studies devised to study semantic or phonological word-to-word priming. In this task participants view for brief time a target word that is replaced by a letter string, the mask, that interrupts the visual processing of the word, and finally a pattern mask that ends the sequence and remains on the screen until the

subject names the target word (Perfetti & Bell, 1991; Perfetti & Zhang, 1991). A typical sequence looks like this: brick-PRICK-#####. The participants' task is to name the word in lower case. In these studies the masked word is the variable that determines the naming RTs according to its relation to the target word, for example, in the previous example the relation target and masked words share features at both the phonological and orthographic levels.

In another variation of this task, the mask is removed. By comparing this unmasked presentation and the backward masking, researchers have demonstrated that there is higher word identification without a character mask (Perfetti & Zhang, 1991, Experiment 2), which demonstrates the main role that the mask plays according to its relation to the target word. Following the previous example, an unmasked presentation would look like this: BRICK-#####. Both the masked and the unmasked presentation have two properties that urge the reader to invoke more automatic processes, namely, the presentation time of the target word and the pattern mask.

Previous work in this area has shown that when the target word exposure is approximately 30 ms subjects are able to provide accurate naming responses (Perfetti & Zhang, 1991). Seemingly, at this duration any sort of word knowledge is activated. However, if the time is set to around 55 ms identification of the target word becomes extremely easy (Perfetti & Bell, 1991). Also, evidence demonstrates that when the target word is followed immediately by a pattern mask, the identification of the target word is more accurate than when using a mask (Perfetti & Zhang, 1991). If there is no mask, then there is no word that reinstates properties of the target word, instead the pattern mask has the role of simply interrupting the processing just when more controlled processes or further elaborations could occur, thus forcing more automatic responses.

The present experiment follows this variation of the backward masking paradigm as a way to lead participant to process the target word without reaching further cognitive elaborations. The typical backward visual masking procedure is not employed since it includes a mask. By using a mask the task itself would have another purpose. Instead, it is expected that the brief

presentation of the target word activates some semantic-pragmatic information related to the preceding narrative context.

The same predictions stated for Experiment 1 are held for this experiment. Nevertheless, it is expected that thanks to the variations in the naming task, Experiment 2 could produce more sensitive results as to the role of sensory-motor and language-based knowledge during the comprehension of characters' emotions.

The present experiment had several modifications in order to do so. Firstly, the presentation of the texts was not in blocks, as in Experiment 1, but in parts. This way of presenting texts is typical in discourse research. Secondly, following canonical experiments in discourse research, this experiment also included filler stories. Thirdly, reading tasks are usually accompanied by supplementary tasks such as writing suitable continuations for some of the stories or answering to yes/no questions. These tasks are devised just to encourage comprehension of the stories. In this experiment a similar task, a cloze task, was devised. In this task participants had to write down the word they just named for the experimental stories, and for the filler stories to write down a word that matched them. Fourthly, the warning sentence was varied. Instead of having a unique warning sentence (e.g., *Melissa felt...*), longer and linguistically richer sentences were constructed in order to announce that the emotional word was about to appear on the screen (e.g., *There was no doubt that Melissa felt...*). Finally, the presentation of the target word was done following the criteria explained above. All these modifications were performed in order to maximise the potential for detecting significant differences between the critical sentence conditions.

7.2. Method

7.2.1 Participants

Forty students at the University of Ballarat participated in this experiment. Some of them received in return partial credit towards an introductory psychology research requirement, while others were paid \$15 AUD for a session that lasted for around the same time as Experiment 1. All

the participants were native English speakers. None of the participants from the previous experiment took part in this study.

7.2.2. Materials

The same materials used for the naming task in Experiment 1 were used for this experiment. Also, all the materials in this experiment were presented in Franklin gothic book font style.

The naming task consisted of the same 32 stories and 32 emotional labels used in the Experiment 1 plus 10 filler stories. Emotional labels were named at the end of every passage.

Forty-five stories were used: 32 experimental, 10 filler, and 3 practice. The experimental stories were the same used in Experiment 1. The filler stories were taken from those originally used by Gernsbacher et al. (1992) and Gygax et al. (2004).⁴ They simply described a character performing actions and describing some thoughts and they did not elicit any particular emotional state. Table 7.1 illustrates the general experimental materials and conditions.

Table 7.1. Example stories and target word.

For two days now, the snowstorm had confined Jackie to her small house. The power was down and the phones were out. There was really nothing she could do except wait for the storm to pass. She paced from room to room. First she went into the living room and picked up a book. She read two paragraphs, and then put it down. It was too hard to read in the poor light. She wandered into the kitchen where there was a bit more light and she flicked through a cook book for some ideas. She put it down when she realised that the stove wouldn't work anyway. She decided to go into the lounge and water the plants. That was useful. She then sat on the sofa for a while and picked at her fingernails. After a couple of minutes, she got up and went back to the kitchen. Several times she wiped down the bench and rearranged the crockery. It was getting dark again. Soon she would not be able to see.

Critical sentence

Condition 1 (E+ A+):

While Jackie impatiently lit a candle in the kitchen, she thought about lighting the other

⁴ I would like to thank Pascal Gygax for making these filler stories available. The Gernsbacher's filler stories were downloaded from her research laboratory web site at <http://psych.wisc.edu/lang/MGcover.html>

candles throughout her confining house.

Condition 2 (E- A+):

While Jackie patiently lit a candle in the kitchen, she thought about lighting the other candles throughout her comforting house

Condition 3 (E+ A-):

While Jackie impatiently lit a candle in the kitchen, she lit the other candles throughout her confining house.

Condition 4 (E- A-):

While Jackie patiently lit a candle in the kitchen, she lit the other candles throughout her comforting house.

Warning sentence

It was not surprising that Jackie felt...

Emotional label

RESTLESS

7.3. Apparatus

The same equipment was used as for Experiment 1. The only difference was that the monitor yielded a refresh time of 16.66 milliseconds.

7.4. Procedure

The procedure was identical to Experiment 1 except for the following modifications. Participants were given three stories for practice. Two of them were naming tasks and the third was a filler story. For the filler stories participants were asked write down in the right column of an answer sheet a word that matched with the story; that word could be either an object or an action. For the naming task participants were required to write down the emotion they just named into the microphone in the left column of the same answer sheet. This cloze procedure was devised to ensure that participants read the stories carefully, and the written emotional labels were only taken into account for further error analysis.

These instructions were given over the computer and verbally. Also, participants were told to read each story sentence by sentence in a self-paced manner, and to avoid making unrelated sounds as far as possible when naming the last word on the screen.

Again, as there were four conditions per story, four different lists of stories were constructed, and ten participants were assigned to each. Nevertheless, each condition had 42 texts because of the filler stories. As in Experiment 1, participants were tested individually.

The participants were told that they would read each passage on the screen of a computer, and to advance each sentence they needed to press the footswitch. The participants first read the passage biasing a particular emotional state sentence by sentence, then the critical sentence, the warning sentence, and finally the emotional label. The passages, the critical sentences, and the warning sentences were presented sentence by sentence following classical presentation methodologies in discourse research.

After pressing the footswitch a fixation point (plus sign "+"), appeared immediately after the warning sentence (interstimulus interval [ISI] = 0). This fixation remained on the screen for 266.56 ms. The fixation cross was then replaced by the emotional label for naming (ISI = 533.12 ms). The emotional label remained on screen for 33.32 ms, and was followed immediately (ISI = 0) by the pattern mask which contained the same number of characters and font size of the preceding emotional word. The pattern mask remained on screen until the participant completed their naming response, or for a maximum of 4000 milliseconds, whichever occurred first. The naming response time was provided on the screen as feedback or the words "no response" appeared on the screen if a naming response had not been provided prior to the 4000 ms cut-off.

Following the naming response, participants were instructed to write down the emotional word they just named. Participants proceeded to the next passage of text by pressing a footswitch.

The experimental stories were presented in five parts (of two or more sentences), with the last parts being the critical and warning sentence. The filler stories were presented in two or three parts.

The standard presentation of the stories was modified following typical procedures in discourse studies (e.g., de Vega et al., 1997): i) the passage biasing a particular emotional state, ii) the critical sentence, iii) a warning sentence, and iv) the emotional label. Sections i) and ii) were presented in parts, except section ii) which appeared on the screen as a sentence in itself. The warning sentence was presented on one screen by itself and this stayed on until the participant pressed the footswitch. After pressing the footswitch participants read the emotional label and named it into the microphone.

Different warning sentences were written to anticipate the target word. These were diverse so that participants did not become too accustomed to a particular linguistic form at the end of every story. The sentences were approximately the same length and included the name of the character and the word "felt" always at the end followed by dots.

The session commenced with the calibration of the key voice for the participant. Instructions were then presented on the screen, followed by the training stories. Once the participant became familiar with the experimental environment, the experimenter switched on a video recorder and left. The video recorder was used to engage participants with the experiment. This task took around 40 minutes.

7.5. Design and analysis

The data were analysed using a one-way ANOVA in which the four critical text manipulations served as four levels of the independent variable, text coherence. Both subject (F_1) and item (F_2) results were reported. The omnibus ANOVA was followed the same series of planned comparisons outlined for the first experiment. One-tailed t-tests were used for the comparisons and a significance level of .05 was applied to all analyses. Both response time and error data were analysed for the naming task.

Chapter 8. Experiment 2. Results

Response times were analysed for correct responses only. Outliers were removed from the response time data by coding responses greater than 2000 ms or less than 150 ms as errors.

8.1. Response time data for the naming task

The means and standard error of means for the response time and error data for the naming task are shown in Table 8.1. A one-way ANOVA was conducted using adjusted (correct) naming times as the dependent variable. The analysis revealed no significant overall effect of the experimental conditions on naming times for emotional labels either in the by-subjects analysis, $F_1(3,117) = .380$, $p = .384$, or the by-items analysis, $F_2(3,93) = .603$, $p = .307$.

The same series of planned comparisons used in Experiment 1 was conducted to determine if characters' emotion comprehension is supported by sensory-motor knowledge and/or linguistic knowledge. There were no significant differences between any of the experimental conditions, all F values < 1 .

Table 8.1. Mean naming times (in ms) and percentage errors for the naming task in Experiment 2. Standard errors of means are presented in parentheses.

Condition	RT Mean	Percentage error
E+ A+	553 (18)	.06 (.01)
E- A+	565 (17)	.08 (.02)
E+ A-	542 (16)	.08 (.02)
E- A-	558 (17)	.08 (.02)

The ANOVA conducted on the error data also failed to show a significant main effect in either the subject, $F_1(3,117) = .733$, $p = .267$ or item ANOVAs, $F_2(3,93) = .410$, $p = .373$. The same series of planned comparisons was carried out for the error data. There were no significant differences between any of the experimental conditions, all F values < 1 .

Chapter 9. Experiment 2. Discussion

Experiment 2 aimed to find the optimal means to test the hypothesis that the comprehension of characters' emotional states is influenced by sensory-motor knowledge and linguistic knowledge provided in the narratives. Results from this Experiment did not produce any significant results. Even though the error analysis suggested that, as in Experiment 1, readers made fewer errors when processing conditions in which both sensory-motor and language-based knowledge supported the implied emotional state, these results were not significant. Also, by looking at the RTs no pattern can be established and no significant results emerged when the experimental conditions were compared.

9.1. Methodological considerations for the results obtained

Nevertheless, some ideas can be raised with respect to the task in itself and possible causes for these results. A first factor has to do with the reading situation. Experiments carried out in the discourse processing field using naming tasks are preceded by a reading situation (e.g., de Vega et al., 1997). During the reading situation, texts are usually not presented as a block on the screen (see Experiment 1 reported here), but split into parts of two to three sentences so that readers can self-administer the texts at their own pace. This way of reading induces readers to keep in memory relevant aspects that have been mentioned before but that are not visually available any more. While in Experiment 1 participants had this visual access to the text as a whole, presumably they could read back to look for inconsistencies. Under the reading situation of Experiment 2, participants had to recall what they just read (or elaborated) before in order to match it with the incoming passage.

The first reading situations (Experiment 1) enabled readers to keep a normal reading flow, since, by experience, when people read novels, stories or newspapers, they have visual access to the linguistic string previous to the sentence currently being read. Therefore, demands on short-term memory are minimized and further elaborations are reduced, since, when facing incongruencies, readers can track down linguistic markers that either

corroborate or contradict what has just been read. Under the reading situation presented in Experiment 2, as readers do not have visual access to previous passages in the story, they must rely on what they have understood so far and is held in short-term memory. Recall that when readers access previous memory traces, this episodic representation includes elaborations that are a product of the episodic buffer, the task of which is to bind long-term memories to what is being read. Therefore, it is quite probable that as there is no visual access to linguistic marks that support or contradict what is being read, then readers only have access to episodic representations that are biased by semantic and episodic records. This first factor could explain differences between the reading situations devised for the experiments reported here, particularly regarding the accuracy of the representations kept in short-memory.

A second factor has to do with the warning sentence. In Experiment 1, the warning sentence remained on the screen for just a few milliseconds, which gave the reader sufficient time to read it clearly and elicit a potential emotional label. Recall that this warning sentence appeared on a different screen after the one-block previous story was read (which included the critical sentence as well). In Experiment 2, the warning sentence remained on the screen until the participant pressed the footswitch to request the emotional word. This situation is similar to what was stated above regarding the presentation of the stories. The way this sentence was presented in Experiment 2 could give time to the reader for a controlled processing of what was read before. Therefore, readers had time to resolve text ambiguities and then come up with an elaborated emotional label. While in Experiment 1, the warning sentence was quick enough (588 ms) to elicit in readers an emotional label which immediately after had to be matched with the one that appeared on the screen.

The third factor relates to the presentation of the emotional label. In Experiment 1, the emotional label was not masked in any way and remained on the screen until the participant named it over the microphone. This presentation mode is used commonly in discourse research and it is designed to tap automatic processes. However, the backward naming task seems to be

somehow more effective for capturing automatic processes. As mentioned in chapter 7, this task has been used in the study of phonemic or graphemic knowledge in word representation, but not in the study of text representation. Therefore, Experiment 2 sought to obtain a more sensitive measure of the effect of the critical sentence manipulations by forcing readers to rely on the expectations primed by the text to resolve the rapidly decaying visual memory trace of the emotional label. While in Experiment 1, the emotional label appeared immediately after the warning sentence (ISI = 0), in Experiment 2 the sequence was different. Immediately after the participant pressed the footswitch after reading the warning sentence, a fixation point appeared on the screen, followed by a blank screen, the emotional label, and a pattern mask. Perhaps this relatively long sequence could have created a sort of disruption or gap in relation to the preceding narrative context. The participants were perhaps more focused on trying to see the emotional label than relating that word to the story they just read.

A fourth factor that could contribute to the non-significant results in Experiment 2, could be related to the cloze task. Participants were not only asked to write down the emotional label they just named into the microphone, but also words that matched with the filler stories. Although the use of filler stories and/or completion task is a common practice in discourse research, the results found here could suggest that those peripheral tasks be used carefully; they could not only influence the cognitive load in general but impinge on participants' disposition to perform the experiment. On the whole, these sorts of tasks, if used in excess, could create extra variables that would influence the subjects' performance in general.

9.2. A proposed variation of the naming task

A tentative alternative for the naming task could be proposed, mixing some features of this task from both experiments. As discussed above, it seems viable to think that when the story-context is presented as a whole, readers find it a more "natural" reading situation. Also, short-term memory issues are probably facilitated, guiding comprehension by what is linguistically expressed in the text more than by elaborations biased by long-term memory.

Therefore, this part of the reading situation seems to be effective. The same could be said as to the warning sentence. If the presentation time of this sentence is modified, then this situation would elicit in the readers' mind a candidate emotional label which had to be matched with the experimental emotional label immediately after reading the warning sentence. Of course, the longer the sentence (e.g., It was a moment when Andrea felt really...), the longer its presentation time. This is a factor to be considered at this stage since the more time the sentence is on the screen, the more time for the reader to elaborate extra processing.

A main feature of the naming task is the presentation of the emotional label; therefore modifications to this part could have a crucial role in obtaining sensitive RTs. An initial straightforward modification could be made to the time exposure of the emotional label: presenting the emotional label immediately after the warning sentence and keeping it on the screen for enough time for the participant to see it. A similar variant could be done using a pattern mask as the final screen, instead of a blank screen, which would appear right away after the emotional word. However, something that must be taken into account under these conditions is to set individual thresholds to identify reliable baseline identification rate (e.g., Xu & Perfetti, 1999).

A central conclusion from this experiment is that extra studies must be carried out to devise a task which is sensitive enough to capture the on-line representation of characters' emotions from an embodied framework. It is of particular interest to devise further experiments to reach a better understanding of how sensory-motor and language-based knowledge interact during the on-line and off-line comprehension of narratives.

Chapter 10. General discussion

From the results found in the experiments reported in this thesis, several ideas can be discussed in relation to the comprehension of characters' emotions in particular and the comprehension of narrative texts in general. The theoretical framework outlined in earlier chapters serves as the basis to account for the results obtained in this thesis. Also, some methodological caveats can be considered in order to devise more sensitive tasks in the study of characters' emotions from an embodied perspective.

10.1 The comprehension of characters' emotions in texts

Several previous studies have been devised to understand how concrete concepts are supported by using sensory-motor knowledge in language comprehension (e.g., Barsalou, 1999) and, recently, in narrative-like texts (e.g., de Vega et al., 2004). On the other hand, several studies have attempted to explain how readers understand characters' emotions in narratives based on discourse models but not on embodied frameworks. Therefore, there are no previous studies trying to check if i) sensory-motor knowledge, in conjunction with language-based knowledge, supports the comprehension of abstract concepts, such as emotions, and if ii) that would be the case during the comprehension of fictional emotions. This work could be considered as one of the first attempts at testing embodied theories of cognition in the comprehension of abstract concepts, particularly the comprehension of narrative texts.

Previous studies on how people understand characters' emotions in narratives have shown that the representation of emotional states happens in an automatic manner (e.g., Gernsbacher et al., 1992), and that that emotional representation is constructed if the actions described in narratives are congruent with the implied emotional state (e.g., de Vega et al., 1996). This study is consonant with those results in that readers could match emotional labels to stories in the naming task - automatic processing - based on the congruence of the emotional and action components of the critical sentences - congruence of actions.

Finally, this work supports an embodied framework in the comprehension of abstract concepts. Emotions are considered abstract concepts and as such they lack perceptual-based representations (see Sabsevitz et al., 2005). However, work developed in emotion studies has demonstrated that sensory-motor interaction with the environment does aid in the construction of emotional contexts (Clark et al., 2005). The first experiment suggests that sensory-motor knowledge does influence the comprehension of emotions in texts. However, given that the emotional situations are constrained by a fictional linguistic context, language-based knowledge also seems to have an important role in comprehension.

10.2. General considerations for the comprehension of narrative texts

According to the theoretical framework presented in this thesis, comprehension entails the use of memory, and integration (or inferential) and simulation processes. Recall that the memory system is basically composed of short-term (STM) and long-term memory (LTM). The former is in charge of processing incoming information, while the latter is in charge of bringing forth memories about personal experiences and general knowledge. Via inferencing, concepts are linked to each other to produce new information. Also, inferential processes assist with the coordination and organization of information stored in memory. Simulation processes refer to the linkage between cognition and perception in order to build multimodal, grounded, and concrete representations of meaning. At this level sensory-motor knowledge is considered to have a central role. This could suggest some ideas as to how those cognitive systems operate during the comprehension of emotions in texts.

Also, recall that when people read texts, they start to decode the linguistic information, e.g., anaphoric resolutions and subject-verb-object structures. Then, they start to create groups of ideas or scenarios so that they can keep track of the events and situations described in the text. To do this, the reader must keep some information only for a short time and some information throughout the reading of the text. Finally, to fully understand the situation referred to in the text, the reader must resort to knowledge

about the world and then elaborate inferences to build a coherent situation model.

Experiment 1 suggested that in its early on-line stages, comprehension is guided by language-based knowledge. If so, low level inferences must occur to establish local coherence. During this processes, the proposed theoretical framework suggests that STM has a particular role in keeping the incoming linguistic information for a brief period of time to be processed. However, LTM may also be activated during this process. As the sort of knowledge implied in the texts refers in some way to experiences with the world and sensory-motor experience in particular, stored in the LTM, then simulation must operate to relate that knowledge to the linguistic flow. As mentioned in the discussion for Experiment 1, this on-line processing of the text seems to be mainly guided by language-based knowledge in order to keep track of the linguistic input which guides simulation.

During the off-line processing of texts readers seem to rely more on experience-based knowledge than language-based knowledge to reach comprehension. Results from Experiment 1 suggested that sensory-motor knowledge seems to play the main role at this stage. Then high-level inferences must be performed to account not for the linguistic strings but for what they are referring to and then establish global coherence. STM could aid by chunking in an emotional label a set of the main features which accompany it, according to what was mentioned in each story. However, the workings of the LTM seem to be more decisive in that personal experiences and general knowledge serve to explain the series of situations referred to in the stories. Here, simulation may play a central role in interrelating the linguistic instructions and the specific knowledge from the LTM to build a situation model of the story plot.

A final residual product of the comprehension process would aim to correct inconsistencies and anomalies based on previous emotional experiences. The results of the final task devised in Experiment 1 could be interpreted as suggesting that readers have filled up the emotional label for the story with enough experience-based knowledge as to play down any

anomaly and instead play up a global coherent representation. This would be a conscious, intentional, and controlled process.

The preceding theoretical analysis echoes current conceptual frameworks that recast the construction-integration model of comprehension and the role that prior or experience-based knowledge plays in comprehension (see Calvo et al., 2006) - in particular, that sensory-motor (or prior world) knowledge is accessed early during text reading, and then it would facilitate an early construction of an embodied situation model.

Also, this work is congruent with experiments devised to determine how the properties of actions influence the comprehension of texts. Results indicate that the comprehension of concrete concepts (actions) is guided by syntax and embodied constraints (de Vega et al., 2004). This study complements those results for the study of abstract concepts, suggesting that the comprehension of emotions is indeed influenced by syntax, but by sensory-motor knowledge as well.

In 1999 Rickheit & Sichelshmidt put forward twelve research questions regarding how a proper study of mental models should be designed. One of their questions was specifically aimed at the discourse processing realm. They asked "How do text and knowledge interact in the development of a discourse model?" The results from Experiment 1 cast some light on this. However, future research should aim to answer "How is an embodied situation model constructed?" This question implies that it is important to understand how a mental representation of what is referred to in texts emerges from the interaction among memory systems, integration, and elaborative process.

10.3. Methodological considerations for future research

While the results of the first experiment were suggestive, they were not decisive, and the attempt to produce a more sensitive test of on-line processing of characters' emotions was not successful. From Experiment 2 several ideas regarding why the results were not significant were discussed. Also, a provisional naming task that could overcome those results was proposed. However, it would be interesting to consider some extra ideas with

respect to potential avenues for exploring how embodied theories of cognition can be tested for the comprehension of narrative discourse.

In principle, the naming task is devised to account for shallow processing, or word-level processing. However researchers in discourse comprehension usually present stories or meaningful linguistic units as a context previous to the naming task. Those contexts serve to create priming on the words to be named, depending on the relation of the words to the context and the modifications to the content of the stories. Many studies have used this paradigm and important results have emerged. Nevertheless, this task has not been modified as to account for the comprehension of narrative from an embodied framework. The two experiments carried out here had that aim.

The lexical decision task is a task that accounts for post-access decision processes, conceptual priming, but not for activation levels (see de Vega et al., 1997; Niedenthal et al., 1997). Then, this task could be effective in determining the cognitive processes that are not automatic and that are guided by high-level processes. Experiment 1 reported here seems to account for this in that the use of sensory-motor knowledge and simulation was suggested to play a central role during the off-line understanding of narratives. In fact, Havas et al. (in press) implicitly assume that simulation is a controlled process that can be tackled using a lexical decision task. The same authors affirm that emotion simulation could affect language beyond the lexical level, which supports the idea of using more meaningful linguistic units as contexts preceding a lexical decision task.

The contexts used in the experiments here were narrative-like texts. Results therefore suggest that there was a context-to-word priming, which in turn suggests that texts proved to be effective in eliciting understanding of emotional states. Then, future studies in the study of characters' emotions from an embodied view should pay particular attention to the texts used. This is true not only because the way texts are written influences the specification or not of emotional states, but because texts provide the set of linguistic instructions that guide mental simulations. Then, it would be expected that

the better the text mimics literary novels and narratives, the better results would be found as to the effects of text properties on readers' constructions.

The tasks described herein are behavioural tasks typical in discourse research; nevertheless tasks developed in other areas could contribute to understanding how narrative abstract dimensions are processed in texts. Recall the experiment carried out by Borghi et al. (2004). In that experiment researchers employed a task termed a property verification task to determine how people use conceptual knowledge, specifically sensorimotor knowledge, to simulate action in the world. In that task participants are presented with a word for a concept (e.g., horse), or a sentence as in the Borghi et al. experiments, followed by a word for a property (e.g., mane), then subjects are to verify if the property is true of the concept as fast and accurately as they can (Solomon & Barsalou, 2004). Even though this method has been useful to tap concrete concepts (see Pecher et al., 2003), it has not yet been used to determine how abstract concepts are processed, either in language processing in general or in text comprehension in particular. In the case of text comprehension, this technique could contribute, for instance, to understanding how sensorimotor knowledge is used when readers comprehend characters' emotions or chronological shifts in stories.

Also, neuroscientific and computational methods must be considered for the study of characters' emotions. The experiment of Ferstl et al. (2005) described in Chapter 3 is a good example of the use of neuroscience in explaining the brain activity underpinning comprehension of narratives. Computational models of cognition regarding how readers process texts have been developed as well. For example, the Construction-Integration model was one of the first attempts to do so (Kintsch, 1988). However, newer models attempt to improve knowledge representation (e.g., LSA of Landauer & Dumais, 1997) and implement analogical and logical inference (e.g., Syntagmatic-Paradigmatic model of Dennis, 2005). A challenge for future studies using brain techniques and computational modelling could be to unveil the neuronal substratum supporting the understanding of fictional emotions and then to model the construction of embodied situation models in narratives. A worthwhile addition would be to test populations whose

linguistic background is different. In particular, by carrying out cross-linguistic studies some generalizations could be put forward. For example, it would be possible to compare performances of readers whose linguistic background differs in complexity (e.g., Spanish-English-Japanese; see Komeda & Kusumi, 2006, for a recent study in the Japanese language).

All in all, a proper study of characters' emotions from an embodied perspective requires a mix of behavioural, neuroscience, and computational techniques. Once enough results are obtained, then a comprehensive and solid explanation could be offered as to how readers process characters' emotions in narratives and how sensory-motor and linguistic knowledge participate in it.

References

- Baddeley, A. D. (2005). The psychology of memory. In A. D. Baddeley, M. A. Kopelman, & B. A. Wilson (Eds.), *The essential handbook of memory disorders for clinicians* (pp. 1-13). New Jersey: John Wiley & Sons.
- Baddeley, A.D. (2000). The episodic buffer: A new component of working memory? *Trends in Cognitive Sciences*, 4 (11), 417-423.
- Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral and Brain Sciences*, 22, 577-660.
- Belinchón, M., Rivière, A. & Igoa, J. M. (1992). *Psicología del lenguaje. Investigación y teoría*. Madrid: Editorial Trotta, S. A.
- Binder, J. R., Westbury, C. F., McKiernan, K. A., Possing, E. T., & Medler, D. A. (2005). Distinct brain systems for processing concrete and abstract concepts. *Journal of Cognitive Neuroscience*, 17 (6), 1-13.
- Black, A., Freeman, P. & Johnson-Laird, P. N. (1986). Plausibility and the comprehension of text. *British Journal of Psychology*, 77, 51-62.
- Borghia, A. M., Glenberg, A. M., & Kaschak, M. P. (2004). Putting words in perspective. *Memory & Cognition*, 32 (6), 863-873.
- Bortolussi, M. & Dixon, P. (2003). *Psychonarratology. Foundations for the empirical study of literary response*. Cambridge: Cambridge University Press.
- Bower, G. H. & Morrow, D. G. (1990). Mental models in narrative comprehension. *Science*, 247 (4938), 44-48.
- Bower, G. H., & Forgas, J. P. (2000). Affect, memory, and social cognition. In E. Eich, J. F. Kihlstrom, G. H. Bower, J. P. Forgas, & P. M. Niedenthal (Eds.), *Cognition and emotion* (pp. 87-168). New York: Oxford University Press.
- Calvo, M. G., Castillo, D., & Schmalhofer, F. (2006). Strategic influence on the time course of predictive inferences in reading. *Memory & Cognition*, 34 (1), 68-77.
- Calvo, M. G., Estevez, A., & Dowens, M. G. (2003). Time course of elaborative inferences in reading as a function of prior vocabulary knowledge. *Learning and Instruction*, 13, 611-631.

- Clarke, T. J., Bradshaw, M. F., Field, D. T., Hampson, S. E., & Rose, D. (2005). The perception of emotion from body movement in point-light displays of interpersonal dialogue. *Perception, 34*, 1171-1180.
- Connolly, T., & Reb, J. (2005). Regret in cancer-related decisions. *Health Psychology, 24* (4), S29-S34.
- Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11*, 671-684.
- Craik, F. I. M., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of Experimental Psychology: General, 104* (3), 268-294.
- Damasio, A. R. (1994). *Descartes error: Emotion, reason, and the human brain*. New York: Avon Books.
- Davis, C. J. (2005). N-Watch: A program for deriving neighbourhood size and other psycholinguistic statistics. *Behavior Research Methods, 37*, 65-70.
- de Vega, M., Díaz, J. M. & León, I. (1999). Procesamiento del discurso. In M. De Vega & F. Cuetos (Coords.), *Psicolingüística del español* (pp. 271-305). Madrid: Editorial Trotta, S. A.
- de Vega, M., Díaz, J. M., & León, I. (1997). To know or not to know: Comprehending protagonists' beliefs and their emotional consequences. *Discourse Process, 23*, 169-192.
- de Vega, M., León, I., & Díaz, J. M. (1996). The representation of changing emotions in reading comprehension. *Cognition and Emotion, 10* (3), 303-321.
- de Vega, M., Robertson, D. A., Glenberg, A. M., Kaschak, M. P., & Rinck, M. (2004). On doing two things at once: Temporal constraints on actions in language comprehension. *Memory & Cognition, 32* (7), 1033-1043.
- Dennis, S. (2005). A memory-based theory of verbal cognition. *Cognitive Science, 29*, 145-193.
- Dijkstra, K., Zwaan, R. A., Graesser, A. C. & Magliano, J. P. (1994). Character and reader emotions in literary texts. *Poetics, 23*, 139-157.
- Dixon, P. & Bortolussi, M. (2001). Prolegomena for a science of psychonarratology. In W. van Peer & S. Chatman (Eds.), *New*

- perspectives on narrative perspective* (pp. 275-287). Albany, N. Y.: S. U. N. Y. Press.
- Elosúa, M. R. (2000). *Procesos de la comprensión, memoria y aprendizaje de textos*. Madrid: Editorial Sanz y Torres, S. L.
- Elosúa, M. R., & Martínez, R. M. (2002). El entrenamiento en la generación de inferencias temáticas durante la lectura. In J. Nicasio García Sánchez (Ed.), *Aplicaciones de Intervención Psicopedagógica* (pp. 77-85). Madrid: Pirámide.
- Elosúa, M. R., García-Madruga, J. A., Gutiérrez, F., Luque, J. L. & Gárate, M. (2002). Effects of an intervention in active strategies for text comprehension and recall. *The Spanish Journal of Psychology*, 5(2), 90-101.
- Feeney, J. A. (2005). Hurt feelings in couple relationships: Exploring the role of attachment and perceptions of personal injury. *Personal Relationships*, 12, 253-271.
- Ferstl, E. C., Rinck, M., & von Cramon, Y. (2005). Emotional and temporal aspects of situation model processing during text comprehension: An event-related fMRI study. *Journal of Cognitive Neuroscience*, 17 (5), 724-739.
- Forster, K. I., & Forster, J. C. (2003). DMDX: A windows display program with millisecond accuracy. *Behavior Research Methods, Instruments, & Computers*, 35 (1), 116-124.
- Gárate Larrea, M. (1994). *Comprensión de cuentos en los niños. Un enfoque cognitivo y sociocultural*. Madrid: Siglo XXI de España Editores, S. A.
- García-Madruga, J. A., Elosúa, M. R., Gutiérrez, F., Luque, J. L. & Gárate, M. (1999). *Comprensión lectora y memoria operativa. Aspectos evolutivos e instruccionales*. Barcelona: Ediciones Paidós Ibérica, S. A.
- Garrido Domínguez, A. (1993). *El texto narrativo*. Madrid: Síntesis.
- Garrod, S., & Pickering, M. J. (2004). Why conversation is so easy? *Trends in Cognitive Sciences*, 8 (1), 8-11.
- Gernsbacher, M. A., Goldsmith, H. H., & Robertson, R. R. W. (1992). Do readers mentally represent characters' emotional states? *Cognition and Emotion*, 6 (2), 89-111.

- Gernsbacher, M. A., Hallada, B. M., & Robertson, R. R. W. (1998). How automatically do readers infer fictional characters' emotional states? *Scientific Studies of Reading*, 2 (3), 271-300.
- Gibson, E. J., Adolph, K., & Eppler, M. (1999). Affordances. In R.A. Wilson & F.C. Keil (Eds.), *The MIT encyclopedia of the cognitive sciences* (pp. 4-6). Cambridge, MA: MIT Press.
- Glenberg, A. M. (1997). What memory is for? *Behavioral and Brain Sciences*, 20, 1-55.
- Glenberg, A., Havas, D., Becker, R., & Rinck, M. (2005). Grounding language in bodily states. The case for emotions. In D. Pecher & R. Zwaan (Eds.), *Grounding cognition. The role of perception and action in memory, language, and thinking* (pp. 115-128). Cambridge: Cambridge University Press.
- Graesser, A. C., & Wiemer-Hastings, K. (1999). Situation models and concepts in story comprehension. In S. R. Goldman, A. C. Graesser & P. van den Broek (Eds.), *Narrative comprehension, causality, and coherence: Essays in honor of Tom Trabasso* (pp. 77-92). Mahwah, N. J.: Erlbaum.
- Graesser, A. C., Millis, K. K., & Zwaan, R. A. (1997). Discourse comprehension. *Annual Review of Psychology*, 48, 163-189.
- Graesser, A. C., Olde, B. A. & Klettke, B. (2002). How does the mind construct and represent stories?. In M. Green, J. Strange & T. Brock (Eds.), *Narrative impact: Social and cognitive foundations* (pp. 231-263). Mahwah, N. J.: Erlbaum.
- Greimas, A. J., & Fontanille, J. (1994). *Semiótica de las pasiones. De los estados de cosas a los estados de ánimo*. Madrid: Siglo Veintiuno de España editores, S. A. (Original work published 1991).
- Groen, S., Syssau, F., De la Haye, F., & Brouillet, D. (2000, July). *Emotional inferences, course of activation in the Landscape Model*. Paper presented at the Tenth Annual Meeting of the Society for Text and Discourse, Lyon, France.
- Gutiérrez-Calvo, M. (1999). Inferencias en la comprensión del lenguaje. In M. de Vega & F. Cuetos (Coords.), *Psicolingüística del español* (pp. 231-270). Madrid: Editorial Trotta, S. A.

- Gygax, P., Garnham, A. & Oakhill, J. (2004). Inferring characters' emotional states: Can readers infer specific emotions? *Language and Cognitive Processes*, 19 (5), 613-638.
- Gygax, P., Oakhill, J. & Garnham, A. (2003). The representation of characters' emotional responses: Do readers infer specific emotions? *Cognition and Emotion*, 17 (3), 413-428.
- Haberlandt K. (1981). Les expectations du lecteur dans la compréhension du texte. *Bulletin de Psychologie*, 35 (11-16), 733-740.
- Hamann, S. (2001). Cognitive and neural mechanisms of emotional memory. *Trends in Cognitive Sciences*, 5 (9), 394-400.
- Hauk, O., Johnsrude, I., & Pulvermüller, F. (2004). Somatotopic representation of action words in human motor and premotor cortex. *Neuron*, 41, 301-307.
- Havas, D. A., Glenberg, A. M., & Rinck, M. (in press). Emotion simulation during language comprehension. *Psychonomic Bulletin & Review*.
- Hesslow, G. (2002). Conscious thought as simulation of behaviour and perception. *Trends in Cognitive Sciences*, 6 (6), 242-247.
- Hoeken, H., & van Vliet, M. (2000). Suspense, curiosity, and surprise: How discourse structure influences the affective and cognitive processing of a story. *Poetics*, 26, 277-286.
- Holliday, R., Hamilton, S., Luthra, A., Oddy, M., & Weekes, B. S. (2005). Text comprehension after traumatic brain injury: Missing the gist? *Brain and Language*, 95, 74-75.
- Johnson-Laird, P. N. (1980). Mental models in cognitive science. *Cognitive Science*, 4, 71-115.
- Johnson-Laird, P. N., & Oatley, K. (2000). Cognitive and social construction in emotions. In M. Lewis & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (2nd ed., pp. 458-475). New York: The Guilford Press.
- Karmiloff-Smith, A. (1994). Précis of Beyond Modularity: A developmental perspective on cognitive science. *Behavioral and Brain Sciences*, 17 (4), 693-745.

- Kaup, B., Lüdtke, J., & Zwaan, R. (2006). Processing negated sentences with contradictory predicates: Is a door that is not open mentally closed? *Journal of Pragmatics*, *38*, 1033-1050.
- Kealy, K. L. K., Kuiper, N. A., & Klein, D. N. (2006). Characteristics associated with real and made-up events: The effects of event valence, event elaboration, and individual differences. *Canadian Journal of Behavioural Science*, *38* (2), 158-175.
- Kelter, S., Kaup, B. & Claus, B. (2004). Representing a described sequence of events: A dynamic view of narrative comprehension. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *30* (2), 451-464.
- Kintsch, W. (1988). The role of knowledge in discourse comprehension: A Construction-Integration model. *Psychological Review*, *95* (2), 163-182.
- Kintsch, W., & Rawson, K. A. (2005). Comprehension. In J. Snowling & C. Hume (Eds.), *The science of reading: A handbook* (pp. 209-226). Malden, MA: Blackwell publishing.
- Kiss, G.R., Armstrong, C., Milroy, R., and Piper, J. (1973) An associative thesaurus of English and its computer analysis. In Aitken, A.J., Bailey, R.W. and Hamilton-Smith, N. (Eds.), *The Computer and Literary Studies*. Edinburgh: University Press.
- Kneepkens, E. W. E. M. & Zwaan, R. A. (1994). Emotions and literary text comprehension. *Poetics*, *23*, 125-138.
- Komeda, H., & Kusumi, T. (2006). The effect of a protagonist's emotional shift on situation model construction. *Memory & Cognition*, *34* (7), 1545-1556.
- Landauer, T. K., & Dumais, S. T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of acquisition, induction, and representation of knowledge. *Psychological Review*, *104* (2), 211-240.
- León, I., & Hernández, J. A. (1998). Testing the role of attribution and appraisal in predicting own and other's emotions. *Cognition and Emotion*, *12* (1), 27-43.
- Lewis, M. D. (2005). Bridging emotion theory and neurobiology through dynamic systems modelling. *Behavioral and Brain Sciences*, *28*, 169-245.

- Mar, R. A. (2004). The neuropsychology of narrative: Story comprehension, story production and their interrelation. *Neuropsychologia*, *42*, 1414-1434.
- Marmolejo-Ramos, F. (2006). *Nuevos avances en el estudio científico de la comprensión de textos*. Manuscript submitted for publication.
- Marmolejo-Ramos, F., & Jiménez, A. T. (2006a). How preschoolers comprehend the emotional dimension in narrative texts [Abstract]. *Australian Journal of Psychology*, *58* (Suppl.1), 9.
- Marmolejo-Ramos, F., & Jiménez, A. T. (2006b). Inferencias, modelos de situación y emociones en textos narrativos: El caso de los niños de edad preescolar. *Revista Intercontinental de Psicología y Educación*, *8* (2), 93-138.
- Miall, D. S., & Kuiken, D. (2001). Shifting perspectives: Readers' feelings and literary response. In W. van Peer & S. B. Chatman (Eds.), *New perspectives on narrative perspective* (pp. 289-301). Albany, NY: State University of New York Press.
- Miller, G. (2006). A better view of brain disorders. *Science*, *313* (5792), 1376-1379.
- Naccache, L. (2006). Is she conscious? *Science*, *313* (5792), 1395-1396.
- Nelson, K. (1999). Event representations, narrative development and internal working models. *Attachment & Human Development*, *1* (3), 239-252.
- Niedenthal, P. M., & Halberstadt, J. B. (2000). Emotional response as conceptual coherence. In E. Eich, J. F. Kihlstrom, G. H. Bower, J. P. Forgas, & P. M. Niedenthal (Eds.), *Cognition and emotion* (pp. 169-203). New York: Oxford University Press.
- Niedenthal, P. M., Barsalou, L. W., Winkielman, P., Krauth-Gruber, S., & Ric, F. (2005). Embodiment in attitudes, social perception, and emotion. *Personality and Social Psychology Review*, *9* (3), 184-211.
- Niedenthal, P. M., Halberstadt, J. B., & Setterlund, M. B. (1997). Being "happy" and seeing "happy": Emotional state mediates visual word recognition. *Cognition and Emotion*, *11* (4), 403-432.

- Oatley, K. (1999a). Emotions. In R.A. Wilson & F.C. Keil (Eds.), *The MIT encyclopedia of the cognitive sciences* (pp. 273-275). Cambridge, MA: MIT Press.
- Oatley, K. (1999). Why fiction may be twice as true as fact: Fiction as cognitive and emotional simulation. *Review of General Psychology, 3* (2), 101-117.
- Oatley, K., & Johnson-Laird, P. N. (2002). Emotion and reasoning to consistency. The case of abductive inference. In S. C. More & M. Oaksford (Eds.), *Emotional cognition. From brain to behavior* (pp. 157-182). Amsterdam: John Benjamins Publishing Company.
- Owen, A. M., Coleman, M. R., Boly, M., Davis, M. H., Laureys, S., & Pickard, J. D. (2006). Detecting awareness in the vegetative state. *Science, 313* (5792), 1402.
- Pavlova, M., Sokolov, A. A., & Sokolov, A. (2005). Perceived dynamics of static images enables emotional attribution. *Perception, 34*, 1107-1116.
- Pecher, D., Zeelenberg, R., & Barsalou, L. W. (2003). Verifying different-modality properties for concepts produces switching costs. *Psychological Science, 14* (2), 119-124.
- Perfetti, C., & Bell, L. (1991). Phonemic activation during the first 40 ms of word identification: Evidence from backward masking and priming. *Journal of Memory and Language, 30*, 473-485.
- Perfetti, C., & Zhang, S. (1991). Phonological processes in reading Chinese characters. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 17* (4), 633-643.
- Radvansky, G. & Copeland, D. E. (2004). Reasoning, integration, inference alteration, and text comprehension. *Canadian Journal of Experimental Psychology, 58* (2), 133-141.
- Rapp, D. N., & van den Broek, P. (2005). Dynamic text comprehension. *Current Directions in Psychological Science, 14* (5), 276-279.
- Rastle, K., Harrington, J., & Coltheart, M. (2002). 358,534 nonwords: The ARC Nonword Database. *Quarterly Journal of Experimental Psychology, 55A* (4), 1339-1362.

- Rickheit, G., & Sichelschmidt, L. (1999). Mental models: Some answers, some questions, some suggestions. In G. Rickheit & C. Habel (Eds.), *Mental models in discourse processing and reasoning* (pp. 9-40). Amsterdam: Elsevier
- Sabsevitz, D. S., Medler, D.A., Seidenberg, M., & Binder, J. R. (2005). Modulation of the semantic system by word imageability. *NeuroImage*, *27*, 188-200.
- Schwanenflugel, P. J. (1991). Why are abstract concepts hard to understand? In P. J. Schwanenflugel (Ed.), *The psychology of word meanings* (pp. 223-250). Hillsdale, N.J.: Lawrence Erlbaum Associates.
- Sebanz, N., Bekkering, H., & Knoblich, G. (2006). Joint action: Bodies and minds moving together. *Trends in Cognitive Sciences*, *10* (2), 70-76.
- Solomon, K. O., & Barsalou, L. W. (2004). Perceptual simulation in property verification. *Memory & Cognition*, *32* (2), 244-259.
- Thorndyke, P. W. (1977). Cognitive structures in comprehension and memory of narrative discourse. *Cognitive Psychology*, *9*, 77-110.
- Tulving, E. (1999). Episodic vs. semantic memory. In R.A. Wilson & F.C. Keil (Eds.), *The MIT encyclopedia of the cognitive sciences* (pp. 278-280). Cambridge, MA: MIT Press.
- Xu, B., & Perfetti, C. (1999). Nonstrategic subjective threshold effects in phonemic masking. *Memory & Cognition*, *27* (1), 26-36.
- Zwaan, R. & Radvansky, G. (1998). Situation models in language comprehension and memory. *Psychological Bulletin*, *123* (2), 162-185.
- Zwaan, R. A. & Madden, C. J. (2004). Updating situation models. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *30* (1), 283-288.
- Zwaan, R. A. (1999). Situation models: The mental leap into imagined worlds. *Current Directions in Psychological Science*, *8*, 15-18.
- Zwaan, R. A., Madden, C. J., Yaxley, R. H., & Aveyard, M. E. (2004). Moving words: Dynamic representations in language comprehension. *Cognitive Science*, *28*, 611-619.

Appendix A: Experimental stories, critical sentences, warning sentences, filler stories and emotional labels used in Experiment 1 and 2.

Story 1

Andrea was awakened by a ray of sunshine coming in through her window. She rose and looked out to find a beautiful day. Because last week had been so productive, she knew that there was nothing urgent that needed to be done today. Her essay due in next week was already finished and the presentation she gave yesterday had gone really well. She knew she could take the day off. The weather was beautiful and warm. You could hear the birds singing. She made herself a cup of herbal tea and went out onto her back porch to simply soak in the sun.

Critical sentence

Condition 1 (E+ A+):

While Andrea merrily whistled a tune, she thought about sipping her relaxing cup of tea.

Condition 2 (E- A+):

While Andrea mournfully whistled a tune, she thought about sipping her nauseating cup of tea.

Condition 3 (E+ A-):

While Andrea merrily whistled a tune, she sipped her relaxing cup of tea.

Condition 4 (E- A-):

While Andrea mournfully whistled a tune, she sipped her nauseating cup of tea.

Warning sentence (Exp 1)

Andrea felt...

(Exp 2)

It was a moment when Andrea felt really...

Emotional label

HAPPY

Story 2

Paul had always wanted his brother, Luke, to be good at cricket. So Paul had been coaching Luke after school for almost two years. In the beginning, Luke's skills were very rough. But after many hours of coaching, Paul could see great improvement. Their many hours of hard work together had paid off. Paul's brother was now a highly skilled all-rounder and was a valued player in his team. In fact, Luke's improvement had been so great that he had received the Most Valuable Player Award at the end of season award ceremony. Not content to rest on their laurels, Paul and Luke kept training hard. Indeed, the very next day they went off to train hard again.

Critical sentence

Condition 1 (E+ A+):

While Paul enthusiastically strapped on his pads, he thought about writing a glowing tribute to Luke's achievements.

Condition 2 (E- A+):

While Paul reluctantly strapped on his pads, he thought about writing a sarcastic tribute to Luke's achievements.

Condition 3 (E+ A-):

While Paul enthusiastically strapped on his pads, he wrote a glowing tribute to Luke's achievements.

Condition 4 (E- A-):

While Paul reluctantly strapped on his pads, he wrote a sarcastic tribute to Luke's achievements.

Warning sentence (Exp 1)

Paul felt...

(Exp 2)

It was a moment when Paul felt really...

Emotional label

PROUD

Story 3

Ron entered the building. 'I just know I'll get this job', he thought to himself, as he walked up the stairs to the interviewer's office. 'How could they not hire me? I got first class honours and was president of the Student Union for two years.' As he opened the door and was greeted by the interviewer, he immediately extended his hand and said, 'Hello, I'm Ron Miller'. Ron had all the qualifications that were needed for the job. His year abroad in a similar company was also a great advantage. He really wanted to work in that company and he knew that the other person applying for the job didn't have much experience. The interviewer ushered Ron to sit down.

Critical sentence

Condition 1 (E+ A+):

While Ron firmly pulled up his chair, he thought about adjusting his stunning tie.

Condition 2 (E- A+):

While Ron awkwardly pulled up his chair, he thought about adjusting his unfashionable tie.

Condition 3 (E+ A-):

While Ron firmly pulled up his chair, he adjusted his stunning tie.

Condition 4 (E- A-):

While Ron awkwardly pulled up his chair, he adjusted his unfashionable tie.

Warning sentence (Exp 1)

Ron felt...

(Exp 2)

It was a moment when Ron felt
really...

Emotional label

CONFIDENT

Story 4

It was the end of the year. At last, the semester was over and Sara's best friends gathered at her house for an impromptu party. It was one of those parties where everything went just right. Everybody was laughing and having fun. All the people at the party had just handed their last assessment task in. It had been a difficult piece of work and the party was a perfect excuse to celebrate. The weather was warm and beautiful and everybody was in the garden around the swimming pool. There was music, food and drink. Sarah and her friends were dancing and chatting. The party was a success. Her best friend hugged her and said, 'the party is going great'.

Critical sentence

Condition 1 (E+ A+):

While Sara eagerly poured her best friend a drink, she thought about diving into the clear water.

Condition 2 (E- A+):

While Sara regretfully poured her best friend a drink, she thought about diving into the murky water.

Condition 3 (E+ A-):

While Sara eagerly poured her best friend a drink, she dived into the clear water.

Condition 4 (E- A-):

While Sara regretfully poured her best friend a drink, she dived into the murky water.

Warning sentence (Exp 1)

Sara felt...

(Exp 2)

It was a moment when Sara felt really...

Emotional label

JOYFUL

Story 5

Michelle now knew the true meaning of friendship. Her flatmate, Carol, had stayed in town for two days after finishing her own exams just to help Michelle with hers. Michelle still had to study for the psychology exam. To allow Michelle to concentrate on studying psychology, Carol had done all the cooking and cleaning. Carol offered all of this without even being asked. Michelle did not know how she would have coped without Carol's help. So, the evening after she finished her exam, Michelle decided to make a special dinner for Carol.

Critical sentence

Condition 1 (E+ A+):

While Michelle thoughtfully chopped some vegetables, she thought about wrapping up the expensive perfume she had bought as gift.

Condition 2 (E- A+):

While Michelle haphazardly chopped some vegetables, she thought about wrapping up the cheap perfume she had bought as gift.

Condition 3 (E+ A-):

While Michelle thoughtfully chopped some vegetables, she wrapped up the expensive perfume she had bought as gift.

Condition 4 (E- A-):

While Michelle haphazardly chopped some vegetables, she wrapped up the cheap perfume she had bought as gift.

Warning sentence (Exp 1)

Michelle felt...

(Exp 2)

It was a moment when Michelle felt really...

Emotional label

GRATEFUL

Story 6

It was Friday night at home. This had been the best week of Trevor's life. Tomorrow he would be graduating first in his undergraduate course. Just yesterday he had received a formal acceptance letter from Monash University for post-graduate study. Monash had been Trevor's first choice. He had worked very hard for it and finally he'd been accepted. The acceptance letter also offered him a scholarship. Without the scholarship he would not have been able to consider further study. To top it all off he had just spoken to the girl he wanted to go out with and she had agreed to go with him to the graduation ceremony.

Critical sentence

Condition 1 (E+ A+):

While Trevor ecstatically texted his mother to pass on the news, he thought about trying on his best suit to wear to the graduation.

Condition 2 (E- A+):

While Trevor dutifully texted his mother to pass on the news, he thought about trying on his worst suit to wear to the graduation.

Condition 3 (E+ A-):

While Trevor ecstatically texted his mother to pass on the news, he tried on his best suit to wear to the graduation.

Condition 4 (E- A-):

While Trevor dutifully texted his mother to pass on the news, he tried on his worst suit to wear to the graduation.

Warning sentence (Exp 1)

Trevor felt...

(Exp 2)

It was a moment when Trevor felt really...

Emotional label

EXCITED

Story 7

Pam had just returned from her regular Tuesday visit to the nursing home. When she arrived she learned that one of her favourite patients had fallen and broken her hip. When Pam had asked to see the patient with the broken hip, she was told that the patient had been transferred to the city hospital for emergency surgery. Pam knew that the anaesthetic alone might be enough to kill this woman. Then, she learned that another of her elderly patients had died suddenly overnight. Pam entered the empty room. She had known this patient well. She used to enjoy their weekly chats over a cup of tea. Now, back home, Pam was sitting on her bed.

Critical sentence

Condition 1 (E+ A+):

While Pam painfully wrote down her memories of her friend in her diary, she thought about writing a letter of condolence to the woman's family.

Condition 2 (E- A+):

While Pam joyfully wrote down her memories of her friend in her diary, she thought about writing a letter of celebration to the woman's family.

Condition 3 (E+ A-):

While Pam painfully wrote down her memories of her friend in her diary, she wrote a letter of condolence to the woman's family.

Condition 4 (E- A-):

While Pam joyfully wrote down her memories of her friend in her diary, she wrote a letter of celebration to the woman's family.

Warning sentence (Exp 1)

Pam felt...

(Exp 2)

It was a moment when Pam felt really...

Emotional label

SAD

Story 8

John, who always got good marks, had just transferred to a new university. He didn't know anyone there and had found it hard to meet new people in the large lecture groups he attended. The course he had enrolled in was not very challenging for a student of his ability and he found he had a lot of time on his hands between classes. Today was no different. When the lectures finished, John took his bag and walked slowly home with his hands in his pockets, kicking stones on the path. The weather was quite warm, but John didn't really know what to do with himself. He wished he had a hobby to occupy his time, or something to keep him busy in the afternoons until he made more

friends. He wished that he could find something to make time pass quicker. When he got home he took a can of beer from the fridge and switched on the TV.

Critical sentence

Condition 1 (E+ A+):

While John lazily opened the can of beer, he thought about typing up his notes from the day's tedious lecture.

Condition 2 (E- A+):

While John enthusiastically opened the can of beer, he thought about typing up his notes from the day's fascinating lecture.

Condition 3 (E+ A-):

While John lazily opened the can of beer, he typed up his notes from the day's tedious lecture.

Condition 4 (E- A-):

While John enthusiastically opened the can of beer, he typed up his notes from the day's fascinating lecture.

Warning sentence (Exp 1)

John felt...

(Exp 2)

It was a moment when John felt really...

Emotional label

BORED

Story 9

'How many things like this can happen in one day?' Chris asked himself. First, he was beaten out of a new job by a younger man. If that wasn't enough, on the way home he wrecked his car. Then, when he got home, he found out his

wife wanted a divorce. She had already started to pack her things. When his wife left, Chris slowly walked through the empty flat. He sat on the floor and thought about his life. He'd never had much luck. Everything he did always seemed to go wrong. All he could do was sit in his living room and stare into space for a while.

Critical sentence

Condition 1 (E+ A+):

While Chris slumped in his chair, he thought about walking down to the miserable local pub.

Condition 2 (E- A+):

While Chris relaxed in his chair, he thought about walking down to the cheery local pub.

Condition 3 (E+ A-):

While Chris slumped in his chair, he walked down to the miserable local pub.

Condition 4 (E- A-):

While Chris relaxed in his chair, he walked down to the cheery local pub.

Warning sentence (Exp 1)

Chris felt...

(Exp 2)

It was a moment when Chris felt really...

Emotional label

DEPRESSED

Story 10

Joe worked at the local bottle shop to earn some money while he studied. One night, his best friend Tom came in to buy a case of beer. Joe needed to go back to the storage room to get the last case. While he was away, Tom

noticed the cash register was open. He couldn't resist the open drawer and quickly took a couple of fifty dollar notes. After he left the shop, he thought about what he was going to buy with the money. He didn't think that Joe might be blamed for the missing cash. But, at closing time, when the manager noticed the missing money he demanded an explanation from Joe. Joe could not explain it. He hadn't seen Tom take the money. Later that week, Tom learned that Joe had been fired over the missing money. Tom was now in his room thinking about the situation.

Critical sentence

Condition 1 (E+ A+):

While Tom critically stared at himself in the mirror, he thought about writing an apologetic letter to his friend.

Condition 2 (E- A+):

While Tom proudly stared at himself in the mirror, he thought about writing a defiant letter to his friend.

Condition 3 (E+ A-):

While Tom critically stared at himself in the mirror, he wrote an apologetic letter to his friend.

Condition 4 (E- A-):

While Tom proudly stared at himself in the mirror, he wrote a defiant letter to his friend.

Warning sentence (Exp 1)

Tom felt...

(Exp 2)

It was a moment when Tom felt really...

Emotional label

GUILTY

Story 11

Jeff arrived at the hospital on Saturday at 7:00 am as usual. All summer he had been a volunteer clown working with terminally ill children. Dressed in his costume, he would begin each day by bringing the children their breakfast, always with a small surprise on each tray. He would entertain them with his antics and tricks and sometimes he would stay and listen to their stories of hope and fear. Jeff really loved children, and his heart really went out to these kids as they bravely made the most of what time they had left. But he couldn't help but be struck by the fact that every week one of the children would be gone and another terminally ill child would have taken their place. He began to wonder what use he really was to these children. After a heart wrenching conversation with a child who had cancer, he retreated to the tea room to take some time out.

Critical sentence

Condition 1 (E+ A+):

While Jeff listlessly opened a carton of milk, he thought about taking off his pathetic clown hat.

Condition 2 (E- A+):

While Jeff purposefully opened a carton of milk, he thought about taking off his wonderful clown hat.

Condition 3 (E+ A-):

While Jeff listlessly opened a carton of milk, he took off his pathetic clown hat.

Condition 4 (E- A-):

While Jeff purposefully opened a carton of milk, he took off his wonderful clown hat.

Warning sentence (Exp 1)

|| (Exp 2)

Jeff felt...

It was a moment when Jeff felt
really...

Emotional label

HELPLESS

Story 12

Maggie was driving down the freeway without a care in the world. Her best friend Laura was in the passenger seat beside her and they were both singing along enthusiastically to the radio. Then, out of nowhere, another car sped past them. It side-swiped their car and sent them careering off road. The car came to rest in a ditch. Maggie was bruised and shaken, but Laura was badly injured. Maggie quickly phoned 000 for an ambulance. They asked her if she had first aid training as she would need to do what she could for Laura while they waited for the paramedics to arrive. Maggie remembered how she had consistently put off doing her first aid training even though work had offered to pay. She had no idea what to do and could not concentrate on the instructions that were being provided to her over her mobile phone. The mobile reception was not good in this area and she was missing every other word. To top matters off, the charge on the phone was fading.

Critical sentence

Condition 1 (E+ A+):

While Maggie frantically walked up and down the road trying to get a better signal, she thought about trying to pull Laura free from the wrecked car.

Condition 2 (E- A+):

While Maggie calmly walked up and down the road trying to get a better signal, she thought about trying to pull Laura free from the intact car.

Condition 3 (E+ A-):

While Maggie frantically walked up and down the road trying to get a better signal, she tried to pull Laura free from the wrecked car.

Condition 4 (E- A-):

While Maggie calmly walked up and down the road trying to get a better signal, she tried to pull Laura free from the intact car.

Warning sentence (Exp 1)

Maggie felt...

(Exp 2)

There could be no doubt that Maggie felt...

Emotional label

USELESS

Story 13

Ever since she had been mugged, Alice had avoided going out at night. The city seemed just too dangerous after dark. It seemed that she would read about another crime in her area nearly every day. But tonight she had to go out because she had promised to go to a play that her friend was performing in. As Alice left her flat, night was just falling and she could see a storm was blowing in from the west. As she stepped out onto the footpath, she listened closely to make sure no one was following her. She heard a noise coming from the bushes beside the path. It was getting difficult to see clearly. She hurried past the bushes as fast as she could. She was sure something was moving in there. As she looked back, she saw a cat scurry out. Alice carried on walking, faster than before, continually looking around her and listening closely. The first cold raindrops began to hit her cheeks.

Critical sentence

Condition 1 (E+ A+):

While Alice shakily pulled on her rain coat, she thought about opening her rickety old umbrella.

Condition 2 (E- A+):

While Alice firmly pulled on her rain coat, she thought about opening her trusty old umbrella.

Condition 3 (E+ A-):

While Alice shakily pulled on her rain coat, she opened her rickety old umbrella.

Condition 4 (E- A-):

While Alice firmly pulled on her rain coat, she opened her trusty old umbrella.

Warning sentence (Exp 1)

Alice felt...

(Exp 2)

There could be no doubt that Alice felt...

Emotional label

AFRAID

Story 14

Emily and Angela were best friends and attended the same university. They had grown up together and were almost like sisters to one another. They had always had a strong rivalry between them as far as academic performance was concerned. But it seemed to Emily that Angela was always the one who was just that bit better. Angela always won the awards, got the highest marks, and got on best with the teachers. University was shaping up no differently. Although both had made it into Law, Angela was clearly the strongest and more confident student. Today, they had to do a role-play together in class, a test-case in which one of them would have to put the arguments for the defence, the other for the prosecution. Emily knew her defence case was not strong and that Angela would have thought up many clever lines of argument for the prosecution. She also knew that Angela generally presented much

better in these kinds of oral assessment tasks than she did. Angela was not worried at all by an audience and always seemed to dominate the room.

Critical sentence

Condition 1 (E+ A+):

While Emily shakily unfolded her notes on the lectern, she thought about adjusting the direction of the intimidating microphone in front of her.

Condition 2 (E- A+):

While Emily steadily unfolded her notes on the lectern, she thought about adjusting the direction of the reassuring microphone in front of her.

Condition 3 (E+ A-):

While Emily shakily unfolded her notes on the lectern, she adjusted the direction of the intimidating microphone in front of her.

Condition 4 (E- A-):

While Emily steadily unfolded her notes on the lectern, she adjusted the direction of the reassuring microphone in front of her.

Warning sentence (Exp 1)

Emily felt...

(Exp 2)

There could be no doubt that Emily felt...

Emotional label

INSECURE

Story 15

Eric really wanted to go to the end of semester ball, but he didn't have a date. He was thinking of asking Shelly, a girl in his history class. Chances are she'd actually consider going with him, but he hadn't been able to ask her. He'd talked to her once in class when she'd asked if she could borrow his pencil.

Eric had blushed. When she thanked him, Eric had looked at his feet and had only just managed to mumble: 'You're welcome...'. He'd been wanting to talk to her again ever since, but he was not really confident in talking to girls. The next day, while Eric was sitting in the café by himself, Shelly came over and asked if she could join him.

Critical sentence

Condition 1 (E+ A+):

While Eric tremulously took a sip of his coffee, he thought about asking this beautiful looking girl out to the ball.

Condition 2 (E- A+):

While Eric coolly took a sip of his coffee, he thought about asking this ordinary looking girl out to the ball.

Condition 3 (E+ A-):

While Eric tremulously took a sip of his coffee, he asked this beautiful looking girl out to the ball.

Condition 4 (E- A-):

While Eric coolly took a sip of his coffee, he asked this ordinary looking girl out to the ball.

Warning sentence (Exp 1)

Eric felt...

(Exp 2)

There could be no doubt that Eric felt...

Emotional label

NERVOUS

Story 16

Jennifer was at home waiting for her husband Peter to return from work. Peter was often a little bit late, but tonight he was much later than she could ever recall. Besides, Peter usually called her from his office if he thought he was going to be late. Jennifer rang his mobile, but it went straight through to the message bank. It was unusual for him not to answer. They lived in the country and Jennifer had always been concerned about the quality of the roads that they drove on every day. Many of them were poorly surfaced and very narrow. There were a lot of blind corners. It was a wonder that there had not been more accidents. It was a wet day today too, so the roads would be especially treacherous. Jennifer sat in the lounge room staring at the minutes tick by on the clock.

Critical sentence

Condition 1 (E+ A+):

While Jennifer agitatedly picked up the phone and dialled Peter's office, she thought about trying his unreliable mobile again.

Condition 2 (E- A+):

While Jennifer calmly picked up the phone and dialled Peter's office, she thought about trying his reliable mobile again.

Condition 3 (E+ A-):

While Jennifer agitatedly picked up the phone and dialled Peter's office, she tried his unreliable mobile again.

Condition 4 (E- A-):

While Jennifer calmly picked up the phone and dialled Peter's office, she tried his reliable mobile again.

Warning sentence (Exp 1)

Jennifer felt...

(Exp 2)

There could be no doubt that
Jennifer felt...

Emotional label

WORRIED

Story 17

Hannah was living on campus. Despite the fact that two women had recently been attacked walking back to their flats, Hannah continued to walk through the campus alone at night. She always carried a can of mace in case anyone tried to attack her. She had noticed an unfamiliar man hanging around the flats earlier that evening but had not taken much notice of him. Later, as she was walking back to her flat from the library, she was grabbed from behind. A man's voice told her not to struggle and everything would be alright. He had his hand over her mouth and her head in a tight grip. She bit into his hand as hard as she could and managed to break free, losing one of her high-heeled shoes in the struggle. Her attacker clutched his bleeding hand and looked at her enraged.

Critical sentence

Condition 1 (E+ A+):

While Hannah frantically picked up her shoe ready to strike him, she thought about spraying the mace in his cruel eyes.

Condition 2 (E- A+):

While Hannah casually picked up her shoe ready to strike him, she thought about spraying the mace in his kind eyes.

Condition 3 (E+ A-):

While Hannah frantically picked up her shoe ready to strike him, she sprayed the mace in his cruel eyes.

Condition 4 (E- A-):

While Hannah casually picked up her shoe ready to strike him, she sprayed the mace in his kind eyes.

Warning sentence (Exp 1)

Hannah felt...

(Exp 2)

There could be no doubt that Hannah felt...

Emotional label

TERRIFIED

Story 18

Tracey and Abbey were living in the same block of flats on campus. The two young women had got to know each other well in the short time they had been at uni and Tracey had shared a number of her private thoughts and feelings with Abbey. But now it seemed that everyone on campus knew all of Tracey's secrets. When Abbey arrived on Tracey's doorstep that afternoon for their usual study session, Tracey confronted her about it. Abbey replied, 'I'm sorry, but some of the stuff you told me was just too funny to keep secret'. Tracey wanted to slap Abbey in the face. She had confided in Abbey, believing that she was someone she could trust. Now, Abbey was standing there laughing. 'Tracey, you just don't realise what a nerd you really are, don't take yourself so seriously'.

Critical sentence

Condition 1 (E+ A+):

While Tracy slammed the door in Abbey's face, she thought about asking Abbey in to explain her thoughtless actions.

Condition 2 (E- A+):

While Tracy gently shut the door in Abbey's face, she thought about asking Abbey in to explain her thoughtful actions.

Condition 3 (E+ A-):

While Tracy slammed the door in Abbey's face, she asked Abbey in to explain her thoughtless actions.

Condition 4 (E- A-):

While Tracy gently shut the door in Abbey's face, she asked Abbey in to explain her thoughtful actions.

Warning sentence (Exp 1)

Tracy felt...

(Exp 2)

There could be no doubt that Tracy felt...

Emotional label

BETRAYED

Story 19

Driving through the suburbs, Kevin saw a garage sale sign. He dropped in because he was looking for a new dining room table. After browsing for a while, he found a pine table that was very cheap. The table seemed to be in very good condition, with strong legs and no dents. Kevin guessed that the owners had not used it much. It seemed a bargain. The only problem was that he would need some help to tie it onto the roof racks of his car. The owner agreed to help Kevin carry the table out to his car and tie it on.

Critical sentence

Condition 1 (E+ A+):

While Kevin appreciatively counted out the notes to pay, he thought about tightening the sturdy straps a little more.

Condition 2 (E- A+):

While Kevin unwillingly counted out the notes to pay, he thought about tightening the flimsy straps a little more.

Condition 3 (E+ A-):

While Kevin appreciatively counted out the notes to pay, he tightened the sturdy straps a little more.

Condition 4 (E- A-):

While Kevin unwillingly counted out the notes to pay, he tightened the flimsy straps a little more.

Warning sentence (Exp 1)

Kevin felt...

(Exp 2)

There could be no doubt that Kevin felt...

Emotional label

GOOD

Story 20

Rob woke up feeling really energetic and wanting to do something good outdoors. He rang his best friend Jason and asked him if he felt like kicking the footy in the park. Footy was Rob's favourite game and he and Jason often played together. In fact, he and Jason had been playing kick-to-kick in the park together since they were boys. So Rob grabbed the Footy, filled his backpack with some snacks and some cans of Coke and headed off to the park. It was great to be out and about on such a perfect summer's day.

Critical sentence

Condition 1 (E+ A+):

While Bob skilfully kicked the footy to his friend, he thought about opening one of the cool cans of Coke.

Condition 2 (E- A+):

While Bob awkwardly kicked the footy to his friend, he thought about opening one of the warm cans of Coke.

Condition 3 (E+ A-):

While Bob skilfully kicked the footy to his friend, he opened one of the cool cans of Coke.

Condition 4 (E- A-):

While Bob awkwardly kicked the footy to his friend, he opened one of the warm cans of Coke.

Warning sentence (Exp 1)

Bob felt...

(Exp 2)

There could be no doubt that Bob felt...

Emotional label

GREAT

Story 21

Gary was an Australian student who was spending a year on an exchange programme in Italy. He was living by himself in a small flat in the industrial area of a main city. He hadn't coped well with the new environment so far. One day he received a package for his birthday. It had been some time without news from home and he was really missing his friends, family and girlfriend. When he read the label on the package, he saw it was from his girlfriend. He opened the package and found a nice jumper and a letter inside. He read the letter. His girlfriend said she was missing him and so were his family and friends. Gary looked across at the photo of his girlfriend on his desk and thought about how much he missed her.

Critical sentence

Condition 1 (E+ A+):

While Gary thoughtfully tried on the jumper, he thought about writing her a heartfelt reply.

Condition 2 (E- A+):

While Gary impatiently tried on the jumper, he thought about writing her a cheerful reply.

Condition 3 (E+ A-):

While Gary thoughtfully tried on the jumper, he wrote her a heartfelt reply.

Condition 4 (E- A-):

While Gary impatiently tried on the jumper, he wrote her a cheerful reply.

Warning sentence (Exp 1)

Gary felt...

(Exp 2)

There could be no doubt that Gary felt...

Emotional label

LONELY

Story 22

Terry's best mate Pete had asthma. The doctors had told him that his condition was so bad that he would not be able to play any sports. Despite that, Pete had battled and trained very hard to become an elite athlete and Terry had always trained alongside him for support. Now the Commonwealth Games were about to commence and Pete was training harder than ever for his favourite 100 metres hurdle event. Just one week before the games, Terry and his friend were training at the stadium. They ran quickly together and jumped almost all the hurdles on the track. However, just before the last hurdle, Pete began to stagger and wheeze and then collapsed on the track.

Critical sentence

Condition 1 (E+ A+):

While Terry half-heartedly cleared the final hurdle, he thought about carrying his ailing friend from the track.

Condition 2 (E- A+):

While Terry ecstatically cleared the final hurdle, he thought about carrying his healthy friend from the track.

Condition 3 (E+ A-):

While Terry half-heartedly cleared the final hurdle, he carried his ailing friend from the track.

Condition 4 (E- A-):

While Terry ecstatically cleared the final hurdle, he carried his healthy friend from the track.

Warning sentence (Exp 1)

Terry felt...

(Exp 2)

There could be no doubt that Terry felt...

Emotional label

DESPONDENT

Story 23

Roger had always been very shy. He had never really travelled much, mainly because he was uncertain about travelling alone and meeting new people. This summer, he had resolved to go on an overseas package tour of Colombia to broaden his horizons and meet people. When Roger arrived at the airport, there were already about twenty of his fellow travellers standing in the queue, many of whom were practising conversing in Spanish. Roger was aware that his Spanish was not very good, so he didn't try to engage in a conversation with anybody. To avoid conversation, he pretended to be very busy reading a

magazine. However, one of the passengers came up to him and asked him something in Spanish.

Critical sentence

Condition 1 (E+ A+):

While Roger confusedly opened his suitcase to put away the magazine, he thought about tearing up his expensive ticket and heading home.

Condition 2 (E- A+):

While Roger confidently opened his suitcase to put away the magazine, he thought about tearing up his cheap ticket and heading home.

Condition 3 (E+ A-):

While Roger confusedly opened his suitcase to put away the magazine, he tore up his expensive ticket and headed home.

Condition 4 (E- A-):

While Roger confidently opened his suitcase to put away the magazine, he tore up his cheap ticket and headed home.

Warning sentence (Exp 1)

Roger felt...

(Exp 2)

It was not surprising that Roger felt...

Emotional label

UPSET

Story 24

Colin had a passion for gardening. Every Saturday, he would put on his gardening clothes and get out into the garden, no matter what the weather was like. Although it was only a small garden, it was probably the best in Colin's street. There were two beautiful mature magnolia trees and many rare species of flowering plants. Colin loved getting up in the morning and looking

out at his garden while he had his coffee. However, this morning when he looked out, all he could see was devastation. Overnight there had been a violent electrical storm with gale-force winds. His precious magnolias had lost several branches and there were plants uprooted everywhere. He went outside to survey the damage.

Critical sentence

Condition 1 (E+ A+):

While Colin frantically began to clear the strewn branches, he thought about hammering in a stake to support what was left of his now wretched magnolia.

Condition 2 (E- A+):

While Colin calmly began to clear the strewn branches, he thought about hammering in a stake to support what was left of his now beautiful magnolia.

Condition 3 (E+ A-):

While Colin frantically began to clear the strewn branches, he hammered in a stake to support what was left of his now wretched magnolia.

Condition 4 (E- A-):

While Colin calmly began to clear the strewn branches, he hammered in a stake to support what was left of his now beautiful magnolia.

Warning sentence (Exp 1)

Colin felt...

(Exp 2)

It was not surprising that Colin felt...

Emotional label

DESPAIR

Story 25

Trish arrived at the airport very early before her flight. It was the first time that Trish had taken a plane and she was nervous about flying. As she walked

to the departure lounge, her legs were shaking. She decided to get a brandy to settle her nerves before getting on the plane. She took a chair at the bar and asked the barman for a glass of his best brandy. She soon found that one glass wasn't enough, so she drank several more. Just as she finished paying for her drinks, her flight was called. Trish ran to join the queue, but fell over. She tried to get up inconspicuously, but dropped her bag noisily as she did so, attracting further attention. A flight attendant pulled her aside and put in a call to the airport police. Everybody in the queue was staring at her and she hung her head. Then someone said, 'she must be an alcoholic!'

Critical sentence

Condition 1 (E+ A+):

While Tricia nervously blew into the breathalyser, she thought about explaining herself to the suspicious officer.

Condition 2 (E- A+):

While Tricia confidently blew into the breathalyser, she thought about explaining herself to the helpful officer.

Condition 3 (E+ A-):

While Tricia nervously blew into the breathalyser, she explained herself to the suspicious officer.

Condition 4 (E- A-):

While Tricia confidently blew into the breathalyser, she explained herself to the helpful officer.

Warning sentence (Exp 1)

Tricia felt...

(Exp 2)

It was not surprising that Tricia felt...

Emotional label

EMBARRASSED

Story 26

Stephanie had decided to take a pottery class this semester as a way to relax. The class met two nights a week. Tonight, she thought she would make a vase for her boyfriend, Jim. Lately, she and Jim had been having serious problems because of her short temper. She realised that controlling her anger had been a problem for her since childhood. She thought that if she could make something beautiful for him, it would ease things between them a bit and show him how much she really loved him. She put a lot of work into the vase and it was very beautiful. However, when she finally took it home and gave it to Jim, he threw it down and said, 'Do you think this will fix things? First fix your mind!' Then he stormed out of the house.

Critical sentence

Condition 1 (E+ A+):

While Stephanie reluctantly picked up the pieces of the broken vase, she thought about packing up her pathetic belongings and moving out.

Condition 2 (E- A+):

While Stephanie enthusiastically picked up the pieces of the broken vase, she thought about packing up her valuable belongings and moving out.

Condition 3 (E+ A-):

While Stephanie reluctantly picked up the pieces of the broken vase, she packed up her pathetic belongings and moved out.

Condition 4 (E- A-):

While Stephanie enthusiastically picked up the pieces of the broken vase, she packed up her valuable belongings and moved out.

Warning sentence (Exp 1)

Stephanie felt...

(Exp 2)

It was not surprising that Stephanie felt...

Emotional label

MISERABLE

Story 27

Cindy had parachuted once before, but things had not gone well. She had made a very heavy landing, shattering her arm. Her helmet had saved her from a serious head injury. Despite this, she was keen to jump again. In fact her experience had just made her more determined. She had spent many hours in rehabilitation and had trained hard for this jump. She was looking forward to the challenge of landing safely this time. Several of her friends had decided to take the challenge with her. But now, as they all sat in the plane, Cindy began to wish they weren't there. Her friends hadn't jumped before and a couple of them were very anxious. Cindy tried to keep their worries out of her mind. She was determined to jump. Besides she was wearing her lucky helmet. Cindy was to be first out of the plane, but just as she was ready to jump one of her friends held her back, screaming at her not to do it. The instructor decided to abort the jump and directed the pilot to land the plane.

Critical sentence

Condition 1 (E+ A+):

While Cindy roughly unfastened the parachute, she thought about taking off her stupid helmet.

Condition 2 (E- A+):

While Cindy calmly unfastened the parachute, she thought about taking off her lucky helmet.

Condition 3 (E+ A-):

While Cindy roughly unfastened the parachute, she took off her stupid helmet.

Condition 4 (E- A-):

While Cindy calmly unfastened the parachute, she took off her lucky helmet.

Warning sentence (Exp 1)

Cindy felt...

(Exp 2)

It was not surprising that Cindy felt...

Emotional label

FRUSTRATED

Story 28

Jane got up early and was getting ready to head off to uni, when she suddenly remembered that she had forgotten to write an essay for her Sociology class. 'I have to do something now!' she thought. She pulled out her text books and began searching desperately through them, trying to think about what she could write in such a short time. Jane thought that handing something in would be better than nothing, but she really didn't know anything about the topic. She wished she had paid much more attention in her lectures. After 15 minutes of fruitless searching and thinking, the page was still blank. Nothing would come to mind. She soon realised that there was nothing she could do. It was simply too late.

Critical sentence

Condition 1 (E+ A+):

While Jane tearfully ripped up the sheet of paper, she thought about packing up her stupid books.

Condition 2 (E- A+):

While Jane eagerly ripped up the sheet of paper, she thought about packing up her treasured books.

Condition 3 (E+ A-):

While Jane tearfully ripped up the sheet of paper, she packed up her stupid books.

Condition 4 (E- A-):

While Jane eagerly ripped up the sheet of paper, she packed up her treasured books.

Warning sentence (Exp 1)

Jane felt...

(Exp 2)

It was not surprising that Jane felt...

Emotional label

HOPELESS

Story 29

Julia was paddling along a river in her old canoe when she heard an unusual bird call. She was a keen bird watcher, so she stopped paddling to listen more closely. Everything was silent as she waited patiently. Then she heard it again. It was definitely not like any call she had heard before. She decided to paddle over to the bank to see what bird was making such an unusual call. She paddled as quietly as she could towards the edge, keeping a keen eye out for any movement in the trees above. As she approached the bank she heard some rustling in the leaves and strained her eyes to see where it was coming from.

Critical sentence

Condition 1 (E+ A+):

While Julia delicately manoeuvred the canoe onto the bank, she thought about fumbling through her pack to get her trusty binoculars.

Condition 2 (E- A+):

While Julia roughly manoeuvred the canoe onto the bank, she thought about fumbling through her pack to get her useless binoculars.

Condition 3 (E+ A-):

While Julia delicately manoeuvred the canoe onto the bank, she fumbled through her pack to get her trusty binoculars.

Condition 4 (E- A-):

While Julia roughly manoeuvred the canoe onto the bank, she fumbled through her pack to get her useless binoculars.

Warning sentence (Exp 1)

Julia felt...

(Exp 2)

It was not surprising that Julia felt...

Emotional label

INTRIGUED

Story 30

Amy was on her way to visit her parents. Today was her birthday and she was looking forward to spending some time with her family. She didn't get much time to see them these days, between study and work. Nevertheless, Amy could not help but feel a bit torn between seeing them and giving up the party that her friends had wanted to throw for her. When she arrived, her parents were at the front door waiting for her and they welcomed her into the house. Amy thought it was strange that they hadn't mentioned her birthday and the environment at home seemed to be unusually quiet. But before she had time to say anything, her mother opened the doors to the lounge room. It was decorated with balloons, cakes, and bottles of wine, and her friends burst out from behind the furniture.

Critical sentence

Condition 1 (E+ A+):

While Amy enthusiastically hugged and kissed everyone, she thought about opening one of the bottles of the expensive champagne.

Condition 2 (E- A+):

While Amy reluctantly hugged and kissed everyone, she thought about opening one of the bottles of the cheap champagne.

Condition 3 (E+ A-):

While Amy enthusiastically hugged and kissed everyone, she opened one of the bottles of the expensive champagne.

Condition 4 (E- A-):

While Amy reluctantly hugged and kissed everyone, she opened one of the bottles of the cheap champagne.

Warning sentence (Exp 1)

Amy felt...

(Exp 2)

It was not surprising that Amy felt...

Emotional label

SURPRISED

Story 31

Frank woke up and looked at the clock. It was 10:30 a.m. and he was on holidays. Lately, he had been working long hours. But now, with all his work finished and nothing pressing to be done, it was simply time to take care of himself. All he needed to do was make the most of the beautiful sunny day. After a leisurely breakfast he decided he would sit out in the garden by the pool. He took with him the book he had been given for his birthday but had not had time to read and a glass of freshly made juice. Now he could just enjoy the day sitting in the garden. He was looking at the small waves made by the wind on the surface of the pool. The water looked inviting.

Critical sentence

Condition 1 (E+ A+):

While Frank luxuriously sipped on his juice, he thought about diving into the glistening pool.

Condition 2 (E- A+):

While Frank hurriedly sipped on his juice, he thought about diving into the dirty pool.

Condition 3 (E+ A-):

While Frank luxuriously sipped on his juice, he dived into the glistening pool.

Condition 4 (E- A-):

While Frank hurriedly sipped on his juice, he dived into the dirty pool.

Warning sentence (Exp 1)

Frank felt...

(Exp 2)

It was not surprising that Frank felt...

Emotional label

RELAXED

Story 32

Mark had spent a long time perfecting his assignment and was rushing into uni to make the final submission time. The traffic was slow and he kept looking at his watch to see how much longer he had. He was really worried that he would not get there in time. He reached the university just on time. He still had five minutes before the assignment box would be cleared for the day. He grabbed his bag and ran across the campus as fast as he could. When he reached the assignment box, he rummaged frantically through his bag to find his assignment. But it wasn't there. He realised that he must have left it in the car. He would have to run back and get it. Just then, one of the administrative staff came to clear the box. Mark pleaded with her to wait a few minutes while he retrieved the paper from his car. She told him he had five minutes to get it before she closed the box for the day. Mark ran there and back as fast as he could. Finally, out of breath he arrived back at the box. He had made it.

Critical sentence

Condition 1 (E+ A+):

While Mark thankfully signed his name on the cover sheet, he thought about stapling it to the front of his excellent essay.

Condition 2 (E- A+):

While Mark regretfully signed his name on the cover sheet, he thought about stapling it to the front of his hopeless essay.

Condition 3 (E+ A-):

While Mark thankfully signed his name on the cover sheet, he stapled it to the front of his excellent essay.

Condition 4 (E- A-):

While Mark regretfully signed his name on the cover sheet, he stapled it to the front of his hopeless essay.

Warning sentence (Exp 1)

Mark felt...

(Exp 2)

It was not surprising that Mark felt...

Emotional label

RELIEVED

Filler stories for Experiment 2

Story 1

Shane was at the local hardware store waiting in line at the checkout. The saleswoman looked up at him. She said, 'That comes to \$60 AUD and we only accept cash'. Shane checked his wallet to see how much cash he had. There were only a few dollars. He had forgotten to go to the bank to get some money out. He had also left his credit cards at home. The only way for him to pay was by cheque. If he wouldn't be able to do that, he would have to leave all the food he was trying to buy. There were tins of tomatoes, three wine bottles, pasta and bread. Shane was having friends over for dinner. 'Would you mind if I pay by cheque?' Shane asked. 'OK, I'll make an exception', replied the saleswoman.

Story 2

Strobe's alarm clock went off at 6:15 a.m. He immediately went down to the basement to turn on the furnace. His wife was adamant about turning it off overnight. Every morning, the temperature was about 45 degrees in the house. But he had to admit, it saved a lot of money on the gas bill. Next, Strobe walked to the end of the driveway and picked up the newspaper. He always took time to read the paper before work.

Story 3

Max was writing and preparing to go on a lecture tour in the East. He liked to take advantage of his travels, so he planned several visits with friends and acquaintances on the way. Since Spring, preparing for this trip had consumed Max's time. The schedule he had prepared would be very busy.

Story 4

Nancy and Dorothy were visiting London for the first time. The first thing they decided to do was shopping. Nancy saw a beautiful silk scarf and decide to

buy it. The scarf was not very expensive. Nancy thought it was a bargain. She tried it on. The scarf suited her quite well. When Dorothy saw Nancy's scarf, she wished she'd seen it first.

Story 5

Sean was telling Marie, his best friend, that he had just failed his spoken oral exam. He had worked very hard for it. He was telling Marie how he suddenly panicked and couldn't remember anything. Marie was listening carefully. She also had an exam. Fortunately for her, things did go well. She knew Sean's exam had been difficult. 'I suddenly didn't know what to say, I just kept quiet' said Sean.

Story 6

Charles and Sandra were having a discussion about American cuisine. 'Some chefs include a number of continental dishes in their menu.' 'Their dishes include traditional Cajun concoctions,' Charles commented. 'They also include more familiar preparations, such as prime rib.' 'Others simply prefer to emphasize ethnic foods,' Sandra added, 'For example, Tex-Mex, Mesquite, and Ozark rabbit and quail.'

Story 7

Arthur was ten years old. He was having tennis lessons every Wednesday afternoon. Today, his coach was having trouble explaining the exercises to him. The exercises were not difficult though. Today's lesson was on serving. Arthur's coach was trying to show him how to serve with spin. Arthur had never learned spin serves. Arthur listened for ten seconds, then played with his racket for a while, then played with a ball, but did not listen to his coach for more than a few seconds.

Story 8

Sally walked outside to get the mail. She glanced at her car and noticed that the front window was broken. She also noticed that her radio was missing. She had bought that car a week ago. When she came home with her new car, Sally parked it in front of her house. It was where she used to park her old car. She'd never had any problems with it. But someone had smashed the front window to steal her radio.

Story 9

Ann came home after two weeks holiday. When she entered her flat, she could smell something strange coming from the kitchen. She walked in and opened the fridge. Ann saw a mouldy green piece of cheese. She had forgotten to throw it away when she left. The day she left, she had to hurry to finish packing. If that hadn't been enough, Ann had been unable to find her passport. She hadn't been much concerned about tidying her flat. As a result, she'd left some food in the fridge. At the sight and smell of the cheese, Ann had to shut the fridge immediately.

Story 10

Patrick was a very tall man. He was usually always asked to play basketball for the University team. He had always really liked it. Patrick had played basketball since primary school. Basketball was his favourite game. He even collected pictures of his favourite players. Some of them were quite valuable. But the coach thought he wasn't good enough this time, so he dropped Patrick from the team.

Appendix B: Words used in Experiment 1 for lexical decision task.

Practice items	Non words
FOUND	SWENTHS
SCLAFF	PRULCH
SPURL	KLYPED
TRUCK	KWILES
DRENCH	STIEF
PRUTE	CWYBE
SCRAPE	SHRITH
THROAP	GHLYNC
FRAME	CWOARDS
	SCWILNS
	DWYE
Emotional labels	PHREMED
	PROLFED
HAPPY	PEMP
PROUD	HEVS
CONFIDENT	YENT
JOYFUL	GHREX
GRATEFUL	THREMPTS
EXCITED	WRANGE
SAD	SCKRISTS
BORED	TWUINT
DEPRESSED	SKRYM
GUILTY	SKRUTCHED
HELPLESS	SHREAPED
USELESS	SHREBBED
AFRAID	WHAIMS
INSECURE	PSYM
NERVOUS	GLOOLS
WORRIED	TRIFT

TERRIFIED	SMINCH
BETRAYED	WRONZED
GOOD	DRARCHED
GREAT	SPLED
LONELY	BLURN
DESPONDENT	GOWDS
UPSET	SNULK
DESPAIR	JEACE
EMBARRASSED	TWIGH
MISERABLE	STRITS
FRUSTRATED	WRUNGE
HOPELESS	YEIGHTH
INTRIGUED	106 DRISHED
SURPRISED	TEFTS
RELAXED	BLALBS
RELIEVED	THWUBS
	CRALMED
Abstract words	GHOOTHED
	PHRUIN
SMOOTH	SPILE
DANGEROUS	FOYS
ROUGH	DWOBBED
SOFT	SCIRMS
TRUE	SHOGGED
REAL	KWORCE
EASY	FREUM
DARK	CWIPES
RELIABLE	SCINCH
COSY	SPIRST
BROAD	CORGUES
SPACIOUS	GHLOAK
STABLE	STREFT
AVAILABLE	KROALS

POLITICAL	STRIMP
POTENTIAL	SKERSED
BELIEVABLE	
THINKING	
FORGIVING	
REMEMBERING	
TRUSTED	
CONVINCING	
FORGETTABLE	
WILLING	
PONDERABLE	
ARGUABLE	
FORGETTABLE	
COMPREHENSIBLE	
CONCENTRATED	
LEARNABLE	
SOLVABLE	
WANDERING	

Appendix C: Words used in Experiment 1 for episodic recognition task.

Practice items	New emotional labels
COGITATIVE	CONTENT
WORKABLE	SATISFIED
RADIANT	POSITIVE
SILLY	PLEASED
PRAYERFUL	THANKFUL
DOUBTABLE	THRILLED
SIMPLE	GLOOMY
FAVOURED	JADED
CONTROLLED	LOW
	CULPABLE
Emotional labels	FEEBLE
	WORTHLESS
HAPPY	FRIGHTENED
PROUD	TIMID
CONFIDENT	JUMPY
JOYFUL	CONCERNED
GRATEFUL	SCARED
EXCITED	FURIOUS
SAD	FINE
BORED	AWESOME
DEPRESSED	ALONE
GUILTY	PESSIMISTIC
HELPLESS	DISAPPOINTED
USELESS	HUMBLED
AFRAID	HUMILIATED
INSECURE	GLUM
NERVOUS	ANNOYED
WORRIED	BLEAK
TERRIFIED	INTERESTED

BETRAYED

GOOD

GREAT

LONELY

DESPONDENT

UPSET

DESPAIR

EMBARRASSED

MISERABLE

FRUSTRATED

HOPELESS

INTRIGUED

SURPRISED

RELAXED

RELIEVED

AMAZED

COSY

GRATIFIED