Processing Emotionally Charged Words in the First and Second Language

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Abstract

This thesis presents an investigation on the emotional impact of bilingual speakers' first (L1) and second language (L2). The key question addressed is whether L1 and L2 differ in the way the emotional content is processed at the level of single words. The research is motivated by the fact that bilinguals often find their mother tongue to be more potent in its emotional impact than later acquired languages (e.g. Dewaele, 2004). The present investigation demonstrated that emotional words in L2 can activate emotional meanings fast and automatically: The behavioural evidence from emotional and taboo Stroop tasks as well as lexical decision tasks revealed rapid access of emotional content in both L1 and L2. Event-related potential recording further showed a reduced N400 for emotional words in L2 suggesting that emotional content of L2 can facilitate visual word recognition. Skin conductance recording, however, indicated that L2 may result in somewhat less physiological arousal than L1. Such reduced responsiveness may be contributing to the perceived lack of emotional immediacy in L2. Differences that were found in response to L1 and L2 may also be produced by the lack of knowledge of negative vocabulary in L2. Such a finding has important implications for language education, as effective communication in L2 requires the ability to understand emotional meanings communicated through language and the competence in expressing both positive and negative emotions.

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Chapter 1. Emotionality in Bilinguals' Different Languages

1.1. Introduction

Although there has been over two decades of systematic investigation on the organisation of bilinguals' two languages in the memory, the emotional consequences of bilingualism have received relatively little attention until very recently (French & Jacquet, 2004; Pavlenko, 2006). The importance of the role of emotions in processing different languages, however, is highlighted by the finding that bilinguals often find their first language (L1; mother tongue) more emotional than their second (L2) and consecutive languages (e.g., Dewaele, 2004). It has been also proposed that bilingualism does not only involve the ability to use two or more different languages as tools for communicating information, but that bilinguals' different languages entail different ways of thinking and feeling. Wierzbicka (2004) argues the following:

> For bilingual people, living with two languages can mean indeed living in two different emotional worlds and also travelling back and forth between those two worlds. It can also mean living suspended between two worlds, frequently misinterpreting other people's feelings and intentions, and being misinterpreted oneself, even when on the surface communication appears to proceed smoothly. (p. 102)

Thus, the use of different languages can have important emotional consequences in that bilinguals may perceive, experience, and express emotions in different ways depending on the language they are communicating in. Indeed, previous studies have shown that bilinguals tend to find taboo and swearwords more forceful, the expression "I love you" to be stronger, and prefer expressing anger in L1 than L2 (Dewaele, 2004, 2006, 2008). Bilinguals have also been shown to respond with greater physiological arousal to childhood reprimands in L1 than L2 (Harris, Ayçiçeği & Gleason, 2003).

Research examining the relationship between different languages and emotions has largely been conducted within the field of linguistics (e.g., Pavlenko, 2004), with relatively small number of cognitive psychological and psychophysiological studies having been reported to date. Furthermore, the results from studies applying cognitive psychological methods are mixed, some supporting the view that L1 is associated with a greater emotional activation than L2 (e.g. Harris et al., 2003), others failing to find differences between the two languages (e.g. Eilola, Havelka & Sharma, 2007). Yet other authors find that L2 might be more emotional than L1 (Ayçiçeği & Harris, 2004).

Such mixed findings can be in part due to methodological limitations, but also because of the lack of a theoretical framework through which the different findings could be explained. As a consequence, further research is required to elucidate the way bilinguals' L1 and L2 are processed in respect to their emotional meaning. The research on emotionality of bilinguals' L1 and L2 would especially benefit from being understood as part of the wider field of emotion research, which views emotion as a dynamic multicomponential system rather than a stable, unitary entity (Kuppens, Stouten & Mesquita, 2009). The aim of the present thesis therefore is to identify theoretical models than can help to better understand the emotional processing of L1 and L2, and to extend the cognitive psychological investigation of the processes involved in emotional word recognition in bilinguals' L1 and L2 by applying implicit behavioural (the lexical decision and emotional/ taboo Stroop tasks) and psychophysiological measures (ERPs and skin conductance recording).

In the current chapter, previous studies on emotional consequences of bilingualism and the limitations of this research are first considered. This is followed by a discussion of the definition of bilingualism. A number of key theories and models of semantic representation, visual word recognition, and emotion are then outlined and discussed in the context of emotional word processing in L1 and L2. The chapter concludes with the statement of the specific aims of the thesis that are motivated by methodological and theoretical considerations.

1.2. Background to the study of bilingualism and emotions

1.2.1. Bilinguals' first and second language may differ in their emotionality

Early evidence for the hypothesis that L1 and L2 are not equally emotionally arousing came from clinical sources. Observations of language use in individuals undergoing psychotherapy showed that bilinguals tended to switch to the second language when discussing anxiety-arousing topics, and reported higher levels of anxiety when pronouncing taboo words in their mother tongue than in the second language (Gonzalez-Regiosa, 1976). This tendency for bilinguals' to find first language more emotionally immediate than their second language was further demonstrated with a non-clinical population. Bond and Lai (1986) found that in an interview setting Chinese-English bilinguals spoke longer about embarrassing topics (i.e. sexual attitudes and embarrassing personal events) in L2 than in L1. This seems to suggest that the mother tongue is often perceived by bilinguals as the language of emotional engagement, whereas the second language involves emotional distance.

It has been suggested that L1 emotional words are more deeply coded when compared to their L2 translation equivalents, because they are experienced in a greater variety of contexts. This leads to multiple memory traces to be associated with L1 words, which in turn strengthen their semantic representation (Santiago-Rivera & Altarriba, 2002). Research on autobiographical memories seems to support this idea as it has been found that autobiographical memories encoded in L1 are more detailed and emotionally marked when retrieved in L1 than when retrieved in L2 (e.g. Schrauf, 2000). Anooshian and Hertel's (1994) findings corroborate this, as they found emotional words in L1 to be better recalled than L1 neutral words, while such advantage was not found for emotional words in L2.

1.2.2. Factors influencing the emotional impact of bilinguals' two languages

Not all research has provided support for the greater emotionality of L1 over L2. More recent studies have demonstrated that L2 can produce equal or even greater emotional advantage in different memory tasks (Ayçiçeği & Harris, 2004, Ayçiçeği-Dinn & Caldwell-Harris, 2009). Self-reports of the use of L1 and L2 in different emotional contexts, such as expressing anger and love (Dewaele, 2006, 2008), and using emotional language in family relationships (Pavlenko, 2006), have shown that language preference for expressing emotions depends on factors such as the level of proficiency and the extent of L2 use in a naturalistic environment. Thus, for bilinguals who are highly proficient or dominant in L2, and who have been extensively immersed in an L2 language environment (e.g., through using L2 at home) may prefer expressing emotions in L2 instead.

Self-reported and linguistic analyses of language use provide important insights into the way bilinguals perceive their two languages, and the way emotional meanings in the different languages can influence communication (e.g. Wierzbicka, 2004). However, many emotion researchers also agree that self-reported feelings provide an incomplete understanding of the structures and operations that underlie emotions (Cacioppo, 2004). This is due to the fact that emotional processes that are associated with bilinguals' different languages are not necessarily consciously accessible for the speaker. Complementing self-reported feelings of the emotional significance of L1 and L2 with cognitive psychological and psychophysiological methods can therefore provide important insights into the relationship between language and emotions in bilinguals.

Harris et al. (2003) applied electrodermal monitoring to study differences between L1 and L2 in the level of emotional arousal they elicit. They asked Turkish-English bilinguals to rate neutral, positive, aversive (negative) and taboo words as well as childhood reprimands with regard to their pleasantness while their skin conductance responses (SCRs) were recorded. They found higher SCRs to taboo words presented aurally, and childhood reprimands when presented either visually or aurally in L1 when compared with L2. Yet, they did not find significant differences in electrodermal activity between languages when taboo words were presented visually nor when positive and aversive words were presented either visually or aurally. In a follow-up study, Harris et al. (2006) also demonstrated a reduction in the differences of SCRs between languages of early sequential bilinguals to emotionally charged words and childhood reprimands when compared to late bilinguals.

Based on their research, Harris et al. (2006) proposed *the emotional contexts of learning theory*. This theory suggests that differences in emotionality of L1 and L2 depend on the age of acquisition (i.e. whether L2 was learnt before the age of 7 or later), and the level of proficiency of the speaker. In their view, the age of acquisition may play a role in emotionality of a language due to the fact that early language acquisition co-occurs with the development of the emotional regulation system. However, they acknowledge that sufficient evidence for this view is still lacking. The role of proficiency, according to Harris et al. (2006) is also important as human learning is associative and context-dependent. As a consequence, languages reflect the contexts in which they have been learnt or habitually used. Emotion-words (e.g. anger) and emotion-related words (e.g. funeral) are associated with the events that co-occur with the language use. Emotion words in L1 have typically been encountered in many more different contexts than L2 words, and as a consequence those words in L1 are able to activate more associations than L2 words. Therefore, greater exposure to L2 in emotionally evocative contexts increases the links to long-term emotional memory associations, thus explaining the impact of proficiency on emotionality of L2.

A number of findings from Harris et al. (2003, 2006) studies, however, remain unexplained: No differences between visually presented emotional words were found between L1 and L2, nor were there differences between positive and negative words between L1 and L2 when they were presented aurally. Furthermore, the studies of Ayçiçeği and Harris (2004) as well as Ayçiçeği-Dinn and Caldwell-Harris (2009) did not find emotional memory advantage for L1 in less proficient bilinguals. It appears that at the level of discourse (i.e. interviews and listening to emotional expressions) expected differences between L1 and L2 are often found (e.g. Bond & Lai, 1986; Rintell, 1984). However, when the processing of single emotional words has been studied, the findings have been less consistent.

Eilola et al. (2007) have further investigated the question of whether emotional words in L1 and L2 are able to activate emotional processes to a different extent. They applied the emotional and taboo Stroop tasks, as these tasks have been previously shown to indicate automatic processing of threat-related content in single words. They presented late Finnish-English bilinguals neutral, positive, negative and taboo words both in Finnish and in English. The participants were asked to ignore the meanings of the words, and to indicate the print colour of the words using manual response as quickly and accurately as possible. Significant interference from negative and taboo words when compared to neutral words was found in both languages, whereas positive words were not found to differ from neutral words. Importantly, no differences between languages were observed. Sutton, Altarriba, Gianico and Basnight-Brown's (2007) findings concurred with this: In a similar experiment with Spanish-English bilinguals no significant differences between L1 and L2 in the level of interference from negative words was found.

Eilola et al. (2007) have suggested that for late bilinguals with a good knowledge of their second language, the first (L1) and second language (L2) may be equally capable of activating the emotional response to word stimuli representing threat and thus interfering with the cognitive processes involved in responding to the print colour of the words. Such conclusion, however, appears to conflict with bilinguals' subjective experience of L2 being less meaningful emotionally than L1. It also contradicts several previous findings that have found expected differences between L1 and L2. Yet, it is not clear how to interpret such contradictory findings. It is possible that methodological factors may have contributed to such mixed findings. These will be considered next.

1.2.3. Methodological limitations in the previous research

Bilingual speakers' responses to emotional words are influenced both by emotional factors, such as the emotional valence (i.e. how positive or negative the word is) and other, non-emotional lexical factors, such as word form frequency, subjective familiarity, orthographic neighbourhood size, and concreteness. Several of these lexical characteristics were not controlled for in the studies discussed above. For example, the word stimuli used in Harris et al. (2003), Ayçiçeği and Harris (2004), as well as Ayçiçeği-Dinn and Caldwell-Harris (2009) were not controlled for their level of arousal. It is therefore possible that the word stimuli used in the different studies did not carry similar emotional connotations in both languages.

Previous research has demonstrated that emotion words have both similar and different meanings to their translation equivalents in other languages. For example, Altarriba and Bauer (2004) found that the Spanish word *cariño*, which can be translated as a feeling similar to both liking and affection in English overlaps with English but is also distinctive from them. *Cariño*, according to Altarriba (2006), has familial or relational quality that is not expressed in either of the above English words. Grabois (1999) has also shown that associations to words such as love, fear and happiness vary from one language to another. Monolingual Spanish and monolingual English speakers were found to produce different types of associations to the above words: English speakers preferred symbolic and metaphorical associations, while Spanish speakers used terms related to sensory cues. Therefore it would be important to control for as many lexical factors as possible, and use word stimuli that overlap to great extent in their meaning across languages, in order to avoid conflicting findings that are difficult to explain.

The challenge for bilingual research is the lack of normative data for affective features in different languages. While affective norms are now available for American English (Affective Norms for English Words, ANEW; Bradley & Lang, 1999), German (Berlin Affective Word List Reloaded, BAWL-R; Võ et al., 2009) and Spanish (Redondo, Fraga, Padrón & Comesaña, 2007), no such norms has been published for Finnish words, for example. The development of normative databases for different languages that also include affective ratings would enable greater control over and manipulation of lexical characteristics in future studies. Furthermore, it would be important to investigate bilinguals from different language backgrounds in order to establish to what extent the differences between L1 and L2 in their emotionality may be due to the particular languages spoken by the bilinguals, and to what degree the differences can be accounted for by the age of acquisition, level of proficiency and the extent of immersion in L1 and L2 language environment.

It may be that single words activate emotional aspects of word meanings to a lesser extent than more complex linguistic stimuli and as a consequence differences between L1 and L2 will not necessarily be detected (Eilola et al., 2007). This interpretation is supported by findings from electrophysiological studies that have found reduced emotionality effects in response to emotional words when compared to emotional pictorial stimuli (e.g., Hinojosa, Carretié, Valcárcel, Méndez-Bértolo & Pozo, 2009). Thus, some tasks may be more sensitive in detecting differences between L1 and L2 than others. The involvement of two distinct systems in the brain in emotional processing may be also implicated: The subcortical brain areas are associated with automatic, non-conscious processing of emotions, while the prefrontal cortex seems to be involved with the conscious experience of emotions (Lane, 2006; Davidson & Irwin, 1999; LaBar & Phelps, 1998). It is possible that different tasks may be tapping into different aspects of emotional language processing. In the emotional Stroop experiment participants were trying to ignore the meanings of the words and focus on responding to the print colour. Thus, any effect of the words on the response times was likely to reflect automatic and early lexical processing. In studies requiring participants to identify the emotional tone of a tape recording (Rintell, 1984), or to rate word stimuli for pleasantness (Harris et al., 2003), the tasks are likely to involve more effortful, conscious processing of the linguistic material. In order to detect potentially small effects of emotionality in single word processing, alternative experimental designs ought to be applied. Furthermore, the use of alternative techniques that tap into the different levels of processing emotional content in words can help to clarify why previous research has produced conflicting findings.

1.2.4. Theoretical limitations

Aside from the methodological concerns, a major challenge for studying the impact of emotional content on bilingual language processing is the lack of a theoretical framework that would help to explain why different research designs might produce different, apparently conflicting findings. This limitation is true also for research investigating the processing of emotional words in monolinguals. While models of visual word recognition, such as the Dual Route Cascaded model (DRC; Coltheart, Rastle, Perry, Langdon & Ziegler, 2001), have included word semantics as a component contributing to word processing, the impact of word semantics, and the emotional meanings specifically, have not been tested in the context of these models. In order to provide a wider theoretical framework for the investigation of the emotional effects of L1 and L2, several key theories and models concerning semantic representation of concepts, visual word recognition and emotion will be outlined and applied to the emotional word processing in L1 and L2. However, before doing this, the definition of bilingualism is first considered.

1.3. Defining bilingualism

Bilingualism can be defined as the knowledge and use of more than one language (Butler & Hakuta, 2006). However, it can be debated who exactly could be considered a bilingual. If it is necessary for a bilingual to speak their second language as fluently as their first language, very few would actually qualify as bilinguals. This is because the different languages are rarely used in exactly the same situations, leading to two sets of vocabularies that are not completely identical with each other (Hoffmann, 1991). If a requirement for "perfect" fluency is abandoned, what would be the cut-off point for sufficient fluency? Hoffmann (1991) has recommended that the following factors ought to be considered: age of acquisition, competence, context of acquisition, relationship between sign and meaning, function of the second language, order and consequence of language acquisition, as well as attitude towards the second language. The first four factors are discussed here as they have direct relevance to the way the present research was conducted.

1.3.1. The age of acquisition

The age of acquisition can lead to considerable differences. Those who have learnt their second language before puberty are referred to as infant or child bilinguals, and this type of bilingualism is known as early bilingualism. If a bilingual has learnt their second language after puberty they are considered to be adult bilinguals, and this type of bilingualism is called late bilingualism (Hoffmann, 1991). Although earlier L2 acquisition predicts greater proficiency in L2 due to greater exposure to that language, the differences between early and late bilinguals are not necessarily to the advantage of early bilinguals. While early bilinguals tend to develop superior pronunciation of the second language and show less interference from L1 when L2 is activated than is the case with late bilinguals (Hoffmann, 1991), the extent that a bilingual uses L1 and L2 in different contexts has an important impact on their level of proficiency in those languages. Previous research suggests that differences in emotionality between L1 and L2 are more likely to be observed in bilinguals who have acquired their second language after the age of seven years (Harris et al., 2006). As a consequence the present investigation focuses on bilinguals who had started learning L2 in their middle childhood or later. However, it is possible that important differences between early bilinguals' L1 and L2 are also present. Such differences ought to be addressed in future research.

1.3.2. The level of competence

The level of competence (also *proficiency*) in L2 is a controversial issue. In the maximalist view, a bilingual is a person who knows both languages equally well as a monolingual knows one language. This definition has been criticised for being too harsh, since very few people speak both languages to the same level of perfection. A minimalist view defines a bilingual as anybody who can produce full, meaningful utterances in L2. This minimalist view, however, is probably too broad a definition to be useful. As a consequence it has been suggested that language competence ought to be measured with tests designed specifically for this purpose (Hoffmann, 1991). This would make it possible to focus the research on bilinguals with a specific kind of language competence. It is also meaningful to study bilinguals with different levels of proficiency, as this can provide some important information about the way the second language is acquired. In the context of emotional language processing, it can be interesting to study more and less proficient bilinguals in order to see how the level of proficiency influences bilinguals' emotional responses to L2.

In the present research a wide definition of bilingualism was adopted, whereby a bilingual is anyone who can make use of two or more languages at different levels of proficiency. Bilinguals' level of proficiency was assessed through self-reports, and the role of their level of proficiency in contributing to the findings is discussed where relevant. The focus of the research was primarily on bilinguals who were relatively high in their level of proficiency, yet who were clearly dominant in L1 and were less competent in L2 than in L1. The impact of the level of proficiency on differences between L1 and L2 in their emotionality was also directly addressed in the study reported in Chapter 3, where more and less proficient bilinguals were studied.

1.3.3. Contexts of acquisition

Natural and cultural contexts of acquisition have been distinguished to highlight the differences between bilinguals who have acquired their second language in an unstructured way from those that have learnt L2 at school or other structured environment. These different types of bilinguals are also called primary and secondary bilinguals, respectively (Hoffmann, 1991). Research evidence seems to suggest that informally learnt languages are more automatic and therefore processed using more of the subcortical areas of the brain such as the hippocampus and basal ganglia, whereas formally learnt languages are more consciously processed, and thus require more of the cortical language areas (Fabbro, 2001). Furthermore, in some cases learning a second language does not affect the competence in L1, but in some cases it might lead to reduced proficiency in L1 (Hoffmann, 1991). Reduction of proficiency in a language due to limited use is known as language attrition. In the present study all bilingual participants had learnt their second language primarily through formal instruction, but varied in the extent they had learnt L2 also in informal contexts. Chapters 3 and 5 report studies with bilinguals who were immersed in L1 environment at the time of the study and had relatively limited experience of immersion in L2. Chapter 4 reports an investigation where the bilinguals were immersed in L2 environment at the time of the study. This is likely to result in a higher level of proficiency in L2, and potentially a degree of L1 attrition. It was therefore possible to consider the impact of immersion on the emotionality effects on word processing in L1 and L2.

1.3.4. Relationships between the linguistic signs and their meaning

Bilinguals have different kinds of relationships between the linguistic signs and their meaning: On the one hand, the linguistic sign in one language may have an independent unit of content to a linguistic sign in another language. On the other hand, the content of each sign may overlap to some extent but also involve unique features. In some instances signs from different languages may largely share the same unit of meaning (Hoffmann, 1991). In the context of the present research, word stimuli were used that could be translated from one language to another unambiguously. Normative data were collected (Chapter 2) and employed in order to make sure the words would be compatible in their affective content. However, it is possible that words in the different languages vary in terms of their affective and other semantic content. In order to overcome this limitation, some of the experiments were conducted only in one language (English), and native speakers' responses were compared to those of non-native speakers of that language (Chapters 3 and 5). Adopting this strategy made it possible to address the problem with potential differences between connotations of words from different languages. It is also possible that there are idiosyncratic differences between bilinguals in the emotional connotations of L1 and L2 words. Therefore in Chapter 4 bilinguals' own ratings of emotionality were used to assess the potential impact of this factor on the pattern of responses found. The question of shared and non-shared features of L1 and L2 words will be also further discussed in section 1.4.

1.3.5. The function of language

Focusing on the function of language provides insight into the way bilinguals vary depending on why and how they use the second language. In some cases they might be able to speak and understand spoken L2, but not read or write it, while other bilinguals may be relatively competent in reading and writing, but not speaking or understanding speech in L2. Thus, bilinguals' pattern of proficiency in L2 reflects the ways they use the language (Hoffmann, 1991). This is true of L1 as well, as in some cases L1 has been acquired at home while the formal education has been attended to in L2 resulting in a limited ability to read and write in L1. In the present investigation all participants had acquired L1 at home and also carried out most of their formal education in that language. L2 was primarily acquired through classroom instruction, but also to some degree in a naturalistic environment. In order to establish the bilinguals' competence in the different language skills, a language history questionnaire was used, which asked the participants to rate their competence in all four different language skills in both L1 and L2. The summaries of the bilinguals' language skills can be found in the appendices. The results showed that the bilinguals' studied were more competent across all language skills in L1 than L2.

1.3.6. Summary

The research on bilingualism is complicated by the different ways bilingualism can be defined and the plethora of factors required for classifying a particular bilingual. In the present investigation the concept of bilingual will be used loosely to refer to any person who can understand and produce two or more different languages at different levels of proficiency. The focus of the present investigation is on bilinguals who have started learning L2 after at or after the age of six years, and who had initially learnt L2 in a formal rather than natural environment. Furthermore, they were recruited to represent bilingual speakers who have a good command of L2, but who are less proficient in L2 than L1. They were also recruited to represent bilinguals who have relatively limited immersion to L2. This approach was selected as the previous research suggests that unbalanced bilinguals who have started learning L2 around or after the age of seven years and who have relatively limited experience of immersion in L2 environment are more likely to perceive L2 as less emotional than L1. In Chapter 4 the bilinguals studied had more extensive experience of immersion in L2 than in the other studies reported. This enabled the consideration of the role of this factor in influencing the emotional processing of L1 and L2 words.

1.4. Semantic representation of words

It is often assumed that emotional meaning of a word is a subcomponent of the overall semantic representation for that word. However, the models of semantic representation of words rarely discuss this explicitly, and therefore it is not clear whether it is possible to equate emotional meaning with its semantic representation. In the following, the semantic representation (the present section) and processing (section 1.5) of single words will be outlined and discussed in the context of emotional word processing in L1 and L2.

Three levels of concept representation can be distinguished: the lexical, semantic and conceptual levels (Pavlenko, 2000). The lexical level represents the word form, including the word's phonological and morphosyntactic properties. The semantic component entails all explicitly available information, which links word to other words, idioms and expressions. The conceptual level has been suggested to represent all non-linguistic multi-modal information, such as imagery, schemas, and motor programs (Pavlenko, 2000). While the distinction between lexical level on the one hand and semantic/ conceptual level on the other is widely accepted, the separation between the semantic and conceptual levels of representation is currently still contested (e.g. De Groot, 2000; Francis, 2005). Many researchers, especially within cognitive psychology, have treated these terms interchangeably. Yet, some investigators view this distinction as crucial (e.g. Pavlenko, 1999), and some recent evidence appear to support the separation of the semantic and conceptual levels of concept representation (Vigliocco, Vinson, Paganelli & Dworzynski, 2005). As the debate remains unresolved, the present thesis follows the approach predominant in cognitive psychology and cognitive neuroscience, which treats the terms semantic and conceptual representation interchangeably. However, it is important to bear in mind that differentiating between these levels may be of importance in future research.

It has been suggested that the conceptual level can been seen as a large set of distributed features, which are bound together by the lexical-semantic level to enable language use (Vigliocco & Vinson, 2007). While several alternative models of semantic representation has been put forward (e.g. Barsalou, Simmons, Barbey & Wilson, 2003; Caramazza & Mahon, 2006), the distributed feature approach is the only one that has been applied to the bilingual semantic representation and therefore will be discussed here. The distributed conceptual feature model suggests that words in bilinguals' two languages share semantic features to different degrees (De Groot, 1992). Thus, words that share a large set of features across languages can be translated from one language to another with relative ease, while words that do not share many common features can be viewed as language specific and can be therefore difficult to translate.

The extent to which concepts in bilinguals' two languages share features has been further elaborated in terms of nesting, split, differentiation and core overlap (Pavlenko, 2008). As an example of nesting, a word in L1 may share all features with a word in L2, but L2 also possesses features L1 word does not. A split can be observed, when a single word in one language accounts for all the features that are accounted for by two (or more) words in combination in another language. For example, while there is only one word for anger in English, in Russian two separate words are used depending on whether a person is actively cross at someone (*serdit'sia*) or they are actively angry, but not necessarily at a particular person (*zlit'sia*) (Pavlenko, 2008). Differentiation refers to a more complex form of split where one word in a language shares features with several words in another language, but at the same time also possesses features specific only for the word in that particular language. Finally, overlap describes an overlap between the core features of words from the two languages whilst both words also retain language specific features (Pavlenko, 2008).

The distributed feature model for processing emotional words would therefore imply that words in bilinguals' L1 and L2 may differ in their emotional meaning because of linguistic differences. Furthermore, the level of proficiency and the degree to which bilinguals have knowledge of and have been immersed in L1 and L2 language environment is likely to influence their understanding of the language specific features of emotional words in L1 and L2. Therefore bilinguals who are less proficient in L2 than in L1 may be more knowledgeable about the features of emotional words that overlap across languages, but may have more limited understanding of the language-specific features of L2. This difference in their knowledge of language specific features of L2 words may account for the perceived differences between L1 and L2 in their emotionality.

As discussed above, in the present research word stimuli were selected in such a way that they could be translated from one language to another relatively unambiguously. Such approach, as well as the comparison of L1 and L2 speakers' responses to words in only one language enabled a further control for the linguistic differences from confounding the findings. Thus, any differences found between L1 and L2 in their emotionality could be addressed primarily to the later and less extensive exposure to L2 in bilinguals studied. However, in future research it would be interesting to address the question to what extent the lack of overlap in semantic features across emotional words across languages may account for the perceived differences in the emotional impact of L1 and L2.

1.5. Visual word recognition

The mechanisms underlying visual word recognition in monolinguals have been studied extensively, computer modelling having focused on two aspects of the process: Models have been put forward that describe the functional architecture of word recognition, such as the Logogen model (Morton, 1961, 1980) and the Dual Route Cascaded model (Coltheart et al., 2001), while others have focused on the decision making processes involved in word recognition tasks, including the Diffusion model (Ratcliff, Gomez & McKoon, 2004) and the Bayesian Reader model (Norris, 2006). For the purpose of the present chapter, the Dual Route Cascaded model will be discussed in more detail, as this model provides an explicit link between the visual word recognition process and word semantics. As bilingual word recognition process is not accounted for by DRC, the Revised Hierarchical Model (Kroll & Stewart, 1994), and the revised Bilingual Interactive Activation model (BIA+; Dijkstra & Van Heuven, 2002) will be then discussed, as they provide further understanding of the word recognition process in speakers of two or more languages.

1.5.1. The Dual Route Cascaded model

The Dual Route Cascaded model (DRC; Coltheart et al., 2001) is a computational model of visual word recognition and reading aloud (see Figure 1.1). It comprises of input modules and output modules, corresponding to processes involved in word recognition and word production. The input modules include the visual feature module, the letter module and the orthographic input lexicon, while the output modules consist of the phonological output lexicon and the phoneme system. The visual feature module receives input from the visual system and passes activation onto the letter module. The letter module comprises of units representing all letters available in the language and is therefore responsible for single letter recognition.

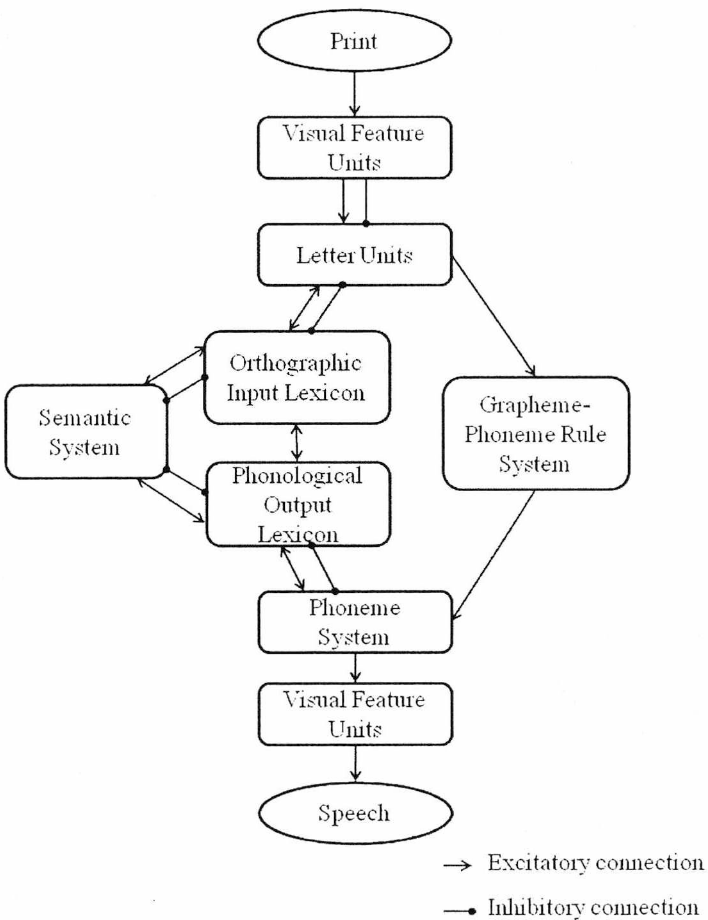

Figure 1.1. The Dual Route Cascaded model (Coltheart et al., 2001)

The activation of units representing individual letters is passed on to two different mechanisms: the grapheme-phoneme conversion system (GPC) and the lexical system (Coltheart et al., 2001). The GPC route assembles the letters into phonology serially, letter by letter using grapheme-phoneme correspondence rules. This composition occurs from left to right, until all letters have been converted to a series of phonemes, enabling the word recognition and pronunciation (e.g. Havelka & Rastle, 2005). This route is slower than the lexical route and is primarily used for the reading of unfamiliar words and nonwords.

The lexical system involves two routes: the nonsemantic and semantic route. The lexical nonsemantic route makes use of the orthographic input lexicon, which consists of units representing individual words holistically. Once the lexical entry is activated, this information is passed directly onto the phonological output module, which consists of units representing individual spoken word forms. The activation of a spoken word form results in the activation of individual phonemes in the phoneme system. The activation from the phoneme system is then passed onto the speech production system. The nonsemantic lexical system thus enables the reading of words without having to process each letter at a time or needing to access the meanings of those words. It also enables faster processing of words well known to the individual when compared to the GPC route.

The semantic lexical route is similar to the nonsemantic lexical route, but it incorporates the semantic system as a mediating module between the orthographic input lexicon and phonological output lexicon. Thus, the semantic lexical route enables the recognition of a word as a legitimate lexical form and the activation of the word meaning. Furthermore, the interaction between the orthographic input lexicon and the semantic system proposed by the model enables the word semantics, once activated, to influence word recognition. In terms of word reading, the semantic lexical route requires the activation of the word meaning before the phonological representation of the word is accessed. Thus, this model proposes that word reading can be carried out even in the absence of knowledge of the word's meaning. However, the word meaning, if known, can influence word recognition and production.

In its general design, DRC is cascaded rather than a threshold model, in that there is no threshold within modules that need to be reached before activation from one module is passed on to another module. In a cascaded model, as soon as there is even a low level of activation in a module, the activation flows on to the later modules. From this follows, that the word meaning can be activated already before the lexical representation is fully processed. Furthermore, the activation is interactive suggesting that activation flows between adjacent modules in both directions. This allows the semantic module to feedback to the orthographic input lexicon, which then modulates the level of activation of individual word forms through inhibition and excitation of the corresponding units. Thus, the model makes it possible in principle to put forward hypotheses about the potential effects of word meanings, including their affective content, on the speed at which word recognition may take place. However, the role of the semantic system in word recognition and production has not been implemented as yet.

Although the DRC accounts for a wide range of empirical findings concerning word recognition, the role of words' affective content in these processes have not been investigated; the impact of emotional valence and arousal has been addressed only in behavioural and electrophysiological studies with monolinguals. Such studies have not directly tested the DRC model, yet they have shown that emotional content of words does affect visual word recognition (e.g. Kuchinke et al., 2005). Overall, research suggests that both positive and negative emotional valence can reduce the threshold at which the words are recognised, but extremely negative content can also capture attention and subsequently slow down performance in different tasks (e.g. Carretié et al., 2008). The findings from these studies will be discussed in detail in Chapters 3 and 4.

1.5.2. The Revised Hierarchical Model

A central question to bilingual language processing has been whether fluent bilinguals possess a common memory system for both languages or independent memory systems that correspond to each language. Kroll and Stewart (1994) have put forward the Revised Hierarchical Model of bilingual memory (see Figure 1.2), which assumes that bilingual memory consists of two separate lexicons, one for each language, but only one semantic store. The lexical stores consist of word form representations, while the semantic store incorporates all representations that involve word meanings. (Note that here the terms conceptual and semantic representations are treated interchangeably.)

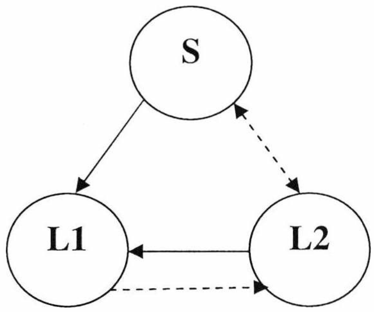

Figure 1.2. The Revised Hierarchical Model of bilingual memory (Kroll & Stewart, 1994); S = Semantic store; L1 = Lexical store for the first language; L2 = Lexical store for the second language

The bilinguals' two lexicons are linked with each other directly via lexical-level links and indirectly via the semantic system. These connections are asymmetrical in that the link from L1 to L2 is weaker than the link from L2 to L1. This is due to language developmental factors: Second language learners initially access L2 word meanings via L1 lexical representations. As a consequence the link from L2 to L1 lexical store becomes stronger than the link from L1 to L2. This reliance on L1 for semantic access may lead to asymmetric links between the two lexical stores and the semantic system. Therefore the model assumes a stronger link between L1 lexical representations and the semantic system than L2 lexical store and the word meanings. From this follows that L2 words are less likely to activate conceptual processing than L1 words, and the semantic factors are less likely to influence lexical level processing in L2 than in L1.

Although this model does not consider the way emotional content may be processed in L1 and L2, it can be hypothesised that similar asymmetry exists between L1 and L2 in respect to the words' emotional content. L1 words may be capable of activating the emotional systems faster and more reliably than L2 words. Furthermore, L1 lexical level processing may be influenced more by the emotional content of the words than is the case in L2. Such asymmetry may in part account for the perception of reduced emotionality in L2 when compared to L1.

1.5.2. The revised Bilingual Interactive Activation model

Recent research has challenged the assumptions that L1 and L2 are represented in separate lexicons. As a result, alternative models, such as the revised Bilingual Interactive Activation model (BIA+; Dijkstra & Van Heuven, 2002) have been put forward. BIA+; similarly to the Dual Route Cascaded model (Coltheart et al., 2001), includes the feature, letter and lexical levels for processing visually presented single words. In addition to these components, BIA+ also includes language nodes for each language known by the speaker as well as a task/ decision system. Critically, BIA+ assumes that words from bilinguals' different languages are not represented in separate, language-specific stores, but in one, integrated system. The bilingual lexicon, as well as the phonological and semantic representations, is proposed to be accessed in a language non-selective way (Dijkstra & Van Heuven, 2002).

BIA+ has been found to account for a series of findings from studies including those investigating neighbourhood density effects (i.e. the extent to which the recognition of a target word is affected by the number of words that are similar to it) and masked priming effects (i.e. the extent to which a briefly presented word preceding the target influences the processing of the target word)

(Dijkstra & Van Heuven, 2002). Such evidence appears to support the integrated lexicon perspective assumed by BIA+. The representation of both L1 and L2 in an integrated system results in the activation of orthographically and semantically similar words in both languages when a target is presented in one of the languages. Such activation can either facilitate or inhibit the recognition of the target word, depending on the experimental conditions (Dijkstra & Van Heuven, 2002).

According to BIA+, language nodes enable the identification of the target language membership. However, the language nodes do not function as language filters nor do they collect non-linguistic contextual pre-activation that could potentially affect word recognition. Thus, the influence of the language nodes on word recognition is believed to be relatively small. Instead, the word recognition occurs as a bottom-up process, where lexical factors such as familiarity, word form frequency and neighbourhood size have an important influence on word recognition. Contextual factors are also believed to influence word recognition, in that linguistic factors (e.g. the sentence context) influence the word identification system, while non-linguistic factors (e.g. requirements of the task at hand) influence the task/ decision system (Dijkstra & Van Heuven, 2002).

Dijkstra and Van Heuven (2002) have suggested that when the orthographic representations are activated, they start to activate related phonological and semantic representations. As semantic activation occurs slightly after word form processing has started, this activation depends on the subjective frequency (i.e. familiarity) of the lexical representations. To the degree that L2 word representations are less familiar than L1 words, they have a lower resting activation level. This can lead to the temporal delay in that L2 semantic representations may be activated slower than L1 semantic representations. This temporal delay hypothesis would therefore predict that L2 words can activate the emotional meanings of words but this may not take place as fast as in L1 words. Such delay may provide an alternative account for the perceived lack of emotional potency of L2 words when compared to L1 words.

Duyck and Brysbaert (2004) have shown that L1 words may not always have stronger or faster links to the semantic system, but that also L2 words can produce rapid and early semantic access. Duyck and Brysbaert (2004, 2008) found that translation of number words from L2 to L1 can result in a similar number magnitude effect as when numbers are translated from L1 to L2. In other words, larger numbers take longer to translate than smaller numbers in both of bilinguals' languages. This view that word forms from bilinguals' two languages can activate semantic representations equally fast is also supported by studies such as that of Altarriba and Mathis (1997), who demonstrated Stroop interference in monolinguals even after a single learning session of L2 colour words.

Duyck and Brysbaert (2004) have proposed that words with well-confined meaning that largely overlap across languages, such as number words, are likely to form strong connections with the semantic system very rapidly. Words, which have more diffuse meaning and possess more language-specific connotations, such as abstract words, are likely to have weaker connections with the semantic system. This view is reflective of the distributed conceptual feature model of bilingual semantic memory (De Groot, 1992), which assumes that word forms in bilinguals' two languages are associated with a set of distributed features in the semantic system. Concrete words in L1 and L2 are believed to map onto largely the same set of features whereas abstract words are likely to share smaller number of shared features. Evidence for this comes from the observation that abstract words often do not have close translation equivalents across languages, and that cognates and concrete words are translated faster than abstract words and non-cognates (Kroll & De Groot, 1997). As the level of concreteness could potentially influence the findings, this lexical factor was controlled for in the present thesis by including it as a covariate in the analyses where data for this was available.

In conclusion, several models of monolingual and bilingual visual recognition have been put forward. These models suggest that emotional meaning of words can influence the speed at which they are recognised. Furthermore, L1 words may have higher resting level activation, and stronger connections to the semantic system than L2 words, and as a consequence they may activate the emotional meanings more rapidly and reliably than L2 words. This effect may be influenced further by the degree of overlap in semantic features across L1 and L2 words. However, as none of these models explicitly discuss the way emotional content may be processed, theories of emotion are considered next. These theories have the potential to clarify the way emotional content in single words are recognised and the way it can influence word processing in L1 and L2.

1.6. Emotion and language

1.6.1. Definition of emotion

It is important to acknowledge that the term emotion in itself is highly problematic. As discussed by Russell (2003), emotion as a word does not have a translation equivalent in all languages, no neurological basis has been found to group various emotion-related processes together, and it has been difficult to establish boundaries for what does and what does not constitute an emotion. Importantly, emotions have been shown to vary substantially from one individual to another as well as change over time and according to the context (Kuppens et al., 2009).

Many emotion researchers presently view emotion as a psychobiological and cultural adaptation mechanism that is multicomponential and a dynamic process (Kuppens et al., 2009). This definition of emotion contrasts with earlier research that has considered emotion as a unitary, monolithic entity, or a set of isolated, homogenous emotions such as anger, fear or joy. Scherer (2005, p. 314) has defined emotion as "an episode of massive, synchronous recruitment of mental and somatic resources to adapt to, or cope with, a stimulus event that is subjectively appraised as being highly pertinent to the needs, goals, and values of the individual". Thus, emotion can be seen as a reaction to significant events that prepares action readiness and different types of action tendencies and that involves many components and evolves over time (Scherer, 2009).

Three major theoretical approaches incorporate the current investigation in emotion: the discrete or basic emotions approach, the dimensional/ core affect approach and the appraisal approach. Each of these approaches will be discussed in turn, as they can all provide some useful insights into the way emotional content of visually presented words is processed.

1.6.2. The basic emotions approach

The basic emotions approach assumes that people across cultures are able to recognise and express a limited number of discrete, universal emotions, including fear, anger, disgust, sadness and enjoyment (Ekman, 1993). Such emotions have a biological basis as they are considered to have served an adaptive function in the evolution. While the existence of such discrete emotions is now contested (e.g. Russell, 2009), this research has highlighted the role of biology in human emotions. Relevant for the present investigation is especially the research on fear as the response to negative word stimuli can be interpreted as a form of fear-response.

Fear-learning has been extensively studied by Öhman and colleagues, who have shown that there are certain categories of stimuli for which people show a biological preparedness to develop a fear-response (Öhman, 2009). These categories of stimuli are relevant from an evolutionary adaptation point of view, and include stimuli from the physical, non-living worlds (e.g. open spaces), stimuli from the living animal world of one's own species (e.g. angry faces), as well as stimuli from the living animal world of other species (e.g. snakes) (Öhman, 2009). Responses to the latter two categories of stimuli can be seen as grounded in two behavioural systems; the predatory defence and social submissiveness systems. Thus, people develop a fear-response to stimuli more readily, if the stimuli represent a threat for the individual's survival than those that do not (e.g. flowers, smiling faces).

Research on the neural basis for fear-response has suggested an important role for amygdala in fear-learning. The direct connections from the sensory system via thalamus to amygdala, as well as efferent pathways from the amygdala to the sensory system, enable the effective perception of and the integration of defence responses to fear-related stimuli (LeDoux, 2000; Öhman, 2009). Such defence responses include defensive behaviours (e.g. freezing), activation of the sympathetic nervous system (e.g. increase in heart rate), endocrine responses (hormone release), alteration in pain sensitivity (analgesia) and reflex expression (fear-potentiated startle and eye blink responses) (LeDoux, 2000).

It seems plausible that humans have a general biological preparedness for learning associations between neutral stimuli and a fear response, although such learning in regard to words is unlikely to involve category-specificity in the way that people learn a fear response to snakes or angry faces. A learnt threat response to words seems to account particularly well people's responses to swear words and other taboo words: The use of these words is likely to be reprimanded in the childhood, and they often occur in a context of threat from other people. Therefore a fear response triggered, for example, by an angry facial expression may be associated with the word used. The evidence from emotional Stroop studies seems to support this idea, as negative and taboo words have been found to slow down colour-naming. Such slowing effect has been interpreted to be due to the threatening content of those words, which diverts the individual's attention away from the task at hand (e.g. Algom, Chajut & Lev, 2004).

In respect to learning a fear-response to words in L1 and L2, it could be argued that L1 words are more frequently encountered in contexts where fear-learning may occur. For example, if L1 is learnt in the early childhood and L2 acquired later in life, bilinguals are more likely to have been disciplined in L1 but not in L2. This differential learning history would lead L1 negative and taboo words to produce a stronger fear response than is the case in L2. It could be also predicted that extensive immersion in the L2 environment will lead to the association of negative and taboo L2 words with threat and thus will over time start producing a similar fear-response as L1 words.

Therefore increasing proficiency that is based on the use of language in the natural environment could lead L2 to be perceived as equally emotional as L1.

1.6.3. The core affect approach

An alternative approach to the study of emotion is the investigation of the way lay people categorise and label emotional states. Taking this approach, Russell (1980) developed the Circumplex Model of Affect, which states that emotion language can be described primarily through a two-dimensional space. Such space consists of two axes indicating bipolar dimensions of pleasure-displeasure and arousal-sleep. These dimensions are often also referred to as emotional valence and emotional arousal, respectively. For example, the concept 'happy' would be located at the extreme end of the emotional valence dimension indicating high level of pleasure, and intermediate in the arousal dimension. 'Bored' would be located towards the displeasure end of the emotional valence dimension, and towards the sleepy end of the arousal dimension. Thus, Russell found that all emotion labels fall in a circular fashion around the two axes. This model echoes the earlier research of Osgood, Suci and Tannenbaum (1957), which used the semantic differential method. Participants were asked to evaluate the connotative meaning of words along a number of bipolar dimensions (e.g. good – bad, warm - cold), and factor analyses were then conducted to establish, which semantic dimensions best accounted for the variation across words. The results from this and subsequent investigations have shown that evaluation (emotional valence) and activity (arousal) account for most of the variably (Russell, 1980). Other dimensions have also been found to predict such variability (Russell, 1980, also see Scherer, 2009 for criticism). However, the application of these two dimensions has proven to be useful in emotion research.

This approach has been influential in the investigation of emotions, as it enables the grouping of emotional stimuli into a smaller number of categories (e.g. positive, negative and neutral words, or low, intermediate and high-arousal words). Furthermore, there is a substantial amount of neuroscientific evidence to support a neural basis for the emotional valence dimension. The research on the functional anatomy of human affective processes has identified two basic affective systems: the approach and withdrawal systems (Davidson & Irwin, 1999). The approach system underlies appetitive behaviour, generating positive emotions associated with approach-related behaviour, such as enthusiasm, joy and pride. The withdrawal system supports withdrawal behaviour associated with avoiding an aversive source of stimuli, and generating withdrawal-related emotions such as fear and disgust. These two systems appear to be based on partially separable neural circuits, with left prefrontal cortical areas being associated with positive emotional states and thus the approach system, and right prefrontal areas associated with negative affective states and hence the withdrawal system (Davidson & Irwin, 1999).

In terms of emotional word processing, the core affect approach provides an organising framework whereby all words can be seen as located in a two-dimensional space. Thus, any word can be described in terms of the degree to which they are positively or negatively valenced and being emotionally arousing. As positive and negative affective states can been seen as reflecting the activation of different neural circuits, it is possible to make predictions about the potential impact of positive and negative words. As suggested by *the homeostatic neurobiological model of emotion*, emotional feelings and behaviours may be neurobiologically differentiated by their roles in the enrichment and expenditure of physical and mental energy (Craig, 2005). The left forebrain has been found to be involved with the re-representation of the parasympathetic nervous system, which is responsible for the relaxation, appetitive behaviour, and, importantly, with the processing of positive emotional content. The right forebrain on the other hand has been demonstrated to re-represent the sympathetic nervous system activity, which is involved in responding to threatening stimuli, producing increases in physiological arousal, and is predominantly associated with processing of negative emotional content (Craig, 2005).

The representation of positive and negative meaning of words may be partly explained through this homeostatic neurobiological model of emotion: Positive words may be associated with appetitive behaviour and consequently involve the re-representation of the parasympathetic nervous system. Thus, positive words are more likely to be associated with relaxation rather than arousal (e.g. holiday), although there are clearly exceptions to this (e.g. sex). Negative words (e.g., terrorism) on the other hand are likely to be associated with expenditure of physical and mental energy, and therefore are related to physiological arousal. Exceptions for this also seem to apply, as for example the word 'boredom' implies a negative but low arousal state.

In order to understand the representation of emotional meaning of words in L1 and L2, it could be suggested that words in L1 and L2 may differ from each other along the two dimensions. As a consequence L1 negative words may appear as more negative than L2 translation equivalents, or the words may be perceived to be equally negative, but L1 words may be viewed as more arousing than L2 words. Similarly, bilinguals may respond to the positive valence of words to a greater degree in L1 than in L2. Such hypotheses can be tested through behavioural measures that are sensitive to emotional valence (e.g. the emotional Stroop and lexical decision task). Emotional arousal on the other hand can be measured either behaviourally (e.g. through comparing responses to high and low arousal words) or through measuring physiological arousal produced by the words in L1 and L2 (e.g. measuring the level of skin conductance).

1.6.4. The appraisal approach

Scherer (2005, 2009) has developed the component process model, which is a type of appraisal model. At the heart of the model are four appraisal objectives against which events are evaluated. These objectives are 1) the appraisal of relevance (i.e. whether the event is novel, relevant for a person's goals, and the intrinsic pleasantness of the event), 2) the appraisals of the implications of the event (i.e. what is the probability of the consequences to occur, whether the event is discrepant from one's expectations, whether the event is conducive or obstructive to reaching one's goals, and how urgently a person needs to act), 3) how well a person can cope with the event (i.e. who was responsible for the event, what was the reason for the event to occur, whether a person has control over the event, how much power one has to exert control over the event, and whether the individual is able to adjust to the consequences of the event), and 4) what is the normative significance of the event (i.e. whether the event is consistent with an individual's internal standards and social norms, values and beliefs about justice or moral principles).

The appraisal objectives are manifested in a recursive, temporally unfolding process of stimulus evaluation checks, which determine the motivational change and action tendencies, as well as physiological response patterns and motor expression. They are also understood to take place at different levels of processing (i.e. low-level neural circuits, as well as the schematic, association and conceptual levels). Thus, the initial relevance checks are likely to be fast, automatic and unconscious, while the following appraisal checks are likely to occur at an increasingly conscious level and in a liberate fashion.

Scherer (2005, 2009) further suggests that the labelling of the emotional events through language enables self-regulation and communication of the emotional events. Such labels may be partly based on sometovisceral feedback, i.e. the perception of bodily changes, but Scherer also suggests that appraisal configurations, core relational themes and action tendencies may play a role in the way emotional events are categorised. He also finds that cultural factors, such as the vocabulary available, affect this labelling process (Scherer, 2009).

The overall emotional experience according to the component process model is based on interaction between the appraisal system, physiological responses, motivational changes and motor expression. A central representation of the event will be formed based on all the different components of the emotion regulation system. This enables to conscious feeling of emotion and serves to monitor and regulate the other component processes (Scherer, 2009). As a consequence the component process model does not assume a limited number of discrete emotions, but that people may potentially experience infinite number of different emotion episodes. While there are important individual differences in terms of the quality of emotions experienced, the process through which such emotions emerge are shared across individuals (Scherer, 2009).

From the point of view of emotional word processing, the comprehension of emotional meaning in verbal stimuli would thus emerge through the appraisal of the relevance of the word stimuli to the individual (i.e. the novelty of the words, their relevance for a person's goals, and the intrinsic pleasantness of the words), the appraisals of the implications of encountering those words, how well a person can cope with the emotional content that was communicated and what is the normative significance of the verbal material. The latter is likely to be important for taboo words specifically, as the use of these words is perceived to be socially undesirable in many contexts.

Scherer's model would also imply that the appraisal of words may be based on biological preparedness to respond to threatening content. Furthermore, it requires a learnt response that occurs automatically and below conscious awareness. Further processing of emotional words can also occur at a conscious, conceptual level involving effortful processing. The appraisal of the emotional content may produce somatic changes (e.g. physiological arousal), which in turn may add colour to the emotional experience produced by the words. The appraisal may then lead to changes in individual's action tendencies and motor expression. The integration of these different components (i.e. unconscious and conscious appraisals, somatic changes, action tendencies and motor expression) will then enable a conscious experience of the emotional significance of those words. As the emotional episodes are believed to unfold over time, the emotional experience is likely to change when the significance of the words are recursively appraised.

When it comes to processing emotional content of words in L1 and L2, differences between the two languages can potentially emerge at several different levels. It may be that L1 and L2 words are initially appraised differently in terms of their novelty, personal relevance and intrinsic pleasantness. Further, the implications of those words may differ in terms of the extent the individual appraises the emotional meaning to have consequences to their goals, how urgently they should respond to the stimuli, and how discrepant the words encountered are from the individual's expectations. L1 and L2 may also diverge in the way they are appraised in regard to how well the person can cope with the language encountered, what kind of significance the words have on the individual's self-perception, and how they relate to the individuals personal values as well as social norms. Furthermore, the words in L1 and L2 may produce different action tendencies, motor expression and physiological responses.

This model provides a complex system within which emotional word processing can be understood. It helps to better understand why different studies have produced conflicting findings: It is apparent that the different studies have tapped into different aspects of the emotion system. For example, emotional Stroop task could be hypothesised to measure the initial appraisal of intrinsic pleasantness, involving largely an automatic and fast response to the negative valence of word stimuli. The self-reported emotionality of L2 in contrast is likely to involve the integration of information from all the four stages of appraisal, as well as the activation of the autonomic nervous system and other components of the emotion system. As a consequence the self-reported experience and responses observed on a behavioural task may not be in conflict, but instead they can be understood in this framework to be measuring different aspects of the emotion system.

1.7. Aims of the thesis

As discussed above, previous cognitive psychological research on the processing of emotional content in L1 and L2 have produced mixed findings. While bilinguals dominant in L1, and who have acquired L2 after the early childhood, have frequently reported experiencing L1 as more emotional than L2, experimental findings have not always found greater emotionality effects in L1 when compared to L2. Such findings have been difficult to interpret due to the lack of a detailed theoretical model of emotional language processing, and because of some methodological limitations in previous studies. As a consequence the first aim of the present thesis is to consider emotional word processing of bilinguals' L1 and L2 in the theoretical framework that consists of three main approaches in emotion research; the basic emotions approach, the dimensional/ core affect approach and the appraisal approach. In the present thesis emotion is understood as a psychobiological and cultural adaptation mechanism that is multicomponential and a dynamic process (Kuppens et al., 2009). Thus, different techniques are used to tap into the different components of the emotion system. The emotional/ taboo Stroop and lexical decision tasks are expected to measure the early, fast and largely unconscious appraisals of intrinsic pleasantness and the potential threat for the individual. These are complemented with psychophysiological methods in order to measure the somatic changes associated with emotional responses. Thus, the skin conductance recording is used in order to measure physiological arousal associated with emotional processing of words. Furthermore, since the emotional response is viewed as unfolding in time, the event related potential recording is applied in order to tap into the subcomponents of this process.

The second aim of the present thesis is to address some of the methodological limitations of previous studies. The extent that bilinguals have been immersed in L2 environment influences the speakers' proficiency and thus their language preference in expressing emotions such as anger (e.g. Dewaele, 2006). As a consequence the present investigation focuses on bilinguals who have acquired their second language after the early childhood and are less proficient in L2 than L1. This is expected to make it more likely that differences, if present, will be observed between bilinguals' L1 and L2. Moreover, some of the studies have failed to control for lexical factors that may have contributed to the findings. As a consequence normative ratings along five dimensions (emotional valence, emotional arousal, offensiveness, familiarity and concreteness) for British English and Finnish were collected and applied where appropriate. Also, other normative ratings were applied where available to further control for lexical factors (incl. word form frequency and word length).

1.8. Organisation of the thesis

In Chapter 2 the collection of affective norms for 210 British English and Finnish nouns is reported. Furthermore, it is demonstrated that the core affective dimensions of emotional valence and arousal generalise well across languages. This supports the methodological approach taken in the present thesis, where the bilinguals' responses to the emotional valence and arousal in L1 and L2 words were investigated.

In Chapter 3 a lexical decision experiment with Finnish-English bilinguals is reported. This experimental task was selected as it has been extensively used in visual word recognition research. This task has also been applied in behavioural and electrophysiological studies investigating the impact of emotional content in single word recognition. As a consequence the use of this method enables the comparison of the present findings with those from the monolingual literature. Furthermore, an affective lexical decision task without priming has not been used in bilinguals previously, and therefore it can provide interesting new findings concerning the speed at which emotional content is activated in L1 and L2. This study also addresses the question whether the level of proficiency and linguistic differences may have contributed to the findings by examining the responses of more and less proficient bilinguals, and through comparing native English speakers' and Finnish-English bilinguals' responses to English words.

Chapter 4 reports a lexical decision study with German-English bilinguals who were immersed in L2 environment. Furthermore, in order to establish differences in the extent that L1 and L2 words activate the emotional meanings of words, event related brain potentials (ERPs) were recorded. Native German speakers rather than Finnish speakers were investigated as the ERP technique requires a large set of stimuli per category of words. To be able to control for a range of lexical factors, more extensive normative databases were required. Such databases are not available for Finnish words as yet, while these are available for German and English. Therefore German rather than Finnish words were used and consequently German-English bilinguals were recruited in this study.

In Chapter 5 a comparison of native English and Greek-English bilinguals' behavioural responses to and autonomic arousal during an emotional and taboo Stroop experiment is described. The emotional and taboo Stroop method was selected as it has been applied previously with Finnish-English and Spanish-English bilinguals, yet no differences between L1 and L2 in those studies were found (Eilola et al., 2007; Sutton et al., 2007). It was assumed that the lack of differences may have been due to some methodological factors. Those methodological issues were addressed in the present study. Furthermore, it was proposed that even though the behavioural measure did not show differences between L1 and L2, it was possible that the level of autonomic activation may have been different in response to L1 and L2. This assumption is supported by the process component model, according to which the appraisal of intrinsic pleasantness and the autonomic activation are distinct components of the emotion system (Scherer, 2009). The latter may not be necessary for an emotional state to occur, but it can add vividness to the emotional experience. As L1 and L2 are often reported to differ in the extent that they appear emotionally potent, it was expected that the two could be different in the degree that they are associated with the autonomic arousal.

Chapter 6 comprises of a summary of the key findings of the thesis. The methodological limitations are then considered, and the theoretical as well as practical implications of the present research discussed.

Chapter 2. Affective Norms for 210 British English and Finnish Nouns

2.1. Introduction

The aim of the present study was to collect affective ratings for 210 British English and Finnish nouns, including taboo words. The norms were collected with 135 native British English and 304 native Finnish speakers, who rated the words according to their emotional valence, emotional charge, offensiveness, concreteness, and familiarity. The ratings of British English and Finnish speakers were compared in order to establish the degree to which the emotional connotations, perceived familiarity and concreteness generalise across languages. The affective ratings were also compared to those of American English speakers presented in the Affective Norms for English Words database (ANEW, Bradley & Lang, 1999) and the Janschewitz' (2008) database for taboo words. The results showed that the affective ratings were strongly correlated across languages. These norms were used in the selection of word stimuli for the study reported in Chapter 3, and to control for the impact of familiarity and concreteness of the English word stimuli in the study reported in Chapter 5. The normative ratings are presented in Appendix 2.1, and can be also accessed online at http://brm.psychonomic-journals.org/content/supplemental (Eilola & Havelka, 2010).

2.1.1. The need to establish affective norms for different languages

Emotional connotations of words influence single word processing in important ways; a wide range of studies have reported differences between neutral and emotionally charged words, including the impact of emotionality on attention (e.g. Williams, Mathews & MacLeod, 1996), speed of processing (e.g. Kuchinke et al., 2005), accuracy of word detection (e.g. Ortigue et al.,

2004) and memory (e.g. MacKay & Ahmetzanov, 2005). Within the domain of emotionality, emotional valence (sometimes referred to as evaluation, pleasure or positivity) and arousal (also referred to as intensity, activity, activation or emotional charge) have been identified as the key dimensions in explaining variation between emotional and neutral words (e.g. Kissler, Assadollahi & Herbert, 2006; Osgood, Suci & Tannenbaum, 1957; Russell, 1991). Since word stimuli are used in a wide range of experiments, there has been an increasing need to establish norms for those emotional characteristics of the stimuli in order to control for and manipulate them.

One of the most frequently used databases for emotional valence and arousal for English words is Affective Norms for English Words (ANEW; Bradley & Lang, 1999), which provides normative ratings of pleasure, arousal, and dominance for 1034 English words collected with American English speakers. Emotional connotations of words, however, have been shown to vary from one culture to another (Triandis & Osgood, 1958) as well as between languages (Pavlenko, 2008). As a consequence it is possible that the ratings for words representing the same concepts in different languages or indeed in variations of the same language (i.e. British English) may differ from those provided in the ANEW. For that reason databases providing affective ratings have been developed in other languages, such as German (Berlin Affective Word List, BAWL; Võ, Jacobs & Conrad, 2006), and Spanish (Redondo, Fraga, Padrón & Comesaña, 2007). However, affective ratings for Finnish words are not currently available, nor have the ratings of British English speakers been compared with those provided in the ANEW. The collection of affective norms for Finnish words is important, as the majority of bilingual research has been conducted amongst bilinguals whose first and second language belong to the same language group (Dutch and English), or have many linguistic features in common due to the influence of Latin (Spanish and English). Finnish is not related to either of the aforementioned languages, and a large part of the vocabulary is orthographically as well as phonologically distinct from those languages. As a consequence the study of Finnish-English bilinguals enables the use of word stimuli, which share many semantic features but are orthographically and phonologically different. This can be informative as it is not clear to what extent the similarities across bilinguals' two languages may influence the emotional responses to L1 and L2.

As discussed in Chapter 1, the differences between languages, emotional connotations can vary between bilingual speakers' two (or more) languages. Bilingual speakers dominant in L1 have been found to perceive taboo and swearwords to be stronger in their emotional force in L1 than L2 (Dewaele, 2004). Furthermore, Harris, Ayçiçeği and Gleason (2003) have reported greater physiological arousal associated with aurally presented taboo words as well as childhood reprimands, presented both visually and aurally, in the speakers' first language (L1; Turkish) when compared to their second, later acquired language (L2; English). These differences between bilingual speakers' two languages, however, may be due to either the speakers' language learning history or differences between the two languages in their concepts. Grabois (1999), for instance, has shown that associations to words such as love, fear and happiness vary from one language to another; monolingual Spanish and monolingual English speakers were found to produce different types of associations to the above words, English speakers preferring symbolic and metaphorical associations, whereas Spanish speakers used terms related to sensory cues. In order to disentangle the contributions of language-specific effects from those of language learning history, more needs to be known about the emotional characteristics of words in each language used in bilingual research. Furthermore, as highlighted by Grosjean (1998), development of databases for word-pairs from different languages would potentially help to avoid inconsistent and conflicting findings.

2.1.2. The collection of affective norms for taboo words

Taboo words represent a distinctive category of words (Van Lancker & Cummings, 1999), which are often considered to be some of the most arousing linguistic stimuli. They can be defined as a set of words, the use of which is likely to be avoided and potentially reprimanded in many social settings, and which include terms referring to bodily products, body parts and sexual acts, as well as ethnic and racial insults, profanity, vulgarity, slang and scatology (Jay, 1992, 2000). Taboo words have been found to influence attentional processes as demonstrated by slower colour identification in a taboo Stroop task both in monolingual (MacKay et al., 2004) and bilingual (Eilola, Havelka & Sharma, 2007) settings. Taboo words have also been reported to influence memorability of linguistic material; they are better remembered than neutral words (Hadley & MacKay, 2006; Jay, Caldwell-Harris & King, 2008), while the immediate recall of words preceding and succeeding taboo words in a rapid serial visual presentation (RSVP) context is reduced (MacKay et al., 2004). The recall and recognition advantages for taboo words have also been reported in bilinguals both in their first and second languages (Ayçiçeği & Harris, 2004), although the emotional force associated with taboo words may be reduced in L2 (Dewaele, 2004).

There is also evidence to suggest that taboo words may involve a specialised neural mechanism; in many neurological pathologies, such as severe aphasia, swearing can be one of a small set of linguistic abilities that remain intact (Van Lancker & Cummings, 1999). The opposite has also been reported, where a brain damage into right hemispheric basal ganglia resulted in the inability to swear (Speedie, Wertman, Ta'ir & Heilman, 1993). Thus, taboo words are likely to be of interest not only as a vehicle in studying emotional processes but also in highlighting the differential neural mechanisms involved in processing taboo and non-taboo language.

In a recent study, Janschewitz (2008) collected normative ratings of personal use, familiarity (the use of the word in general), offensiveness (inappropriateness of the word from the point of view of the rater), tabooness (inappropriateness of the word to society at large), emotional valence, arousal and imageability for a set of 92 taboo words as well as 92 positive, 92 negative and 184 neutral words. These ratings however, were collected with American English speakers, and thus may not be fully generalisable to other linguistic contexts as languages differ substantially in what is considered to be taboo (Jay, 2000). A corpus has been developed providing the frequency data for spoken British English (The Lancaster Corpus of Abuse; McEnery, Baker & Hardie, 2000). However, this database does not incorporate affective or concreteness ratings for those words. The present normative ratings include affective ratings as well as ratings of familiarity and concreteness for 34 taboo words from British English and Finnish.

Both negative and taboo words are likely to be rated highly arousing and very negative in their valence. Taboo words however, by definition, differ from negative words in the sense that the use of these words is perceived as undesirable and offensive in many social situations. Several studies have investigated such offensiveness across English words (Jay, 1992), suggesting that this dimension may be effective in distinguishing between words that are perceived to be taboo and those that are merely negative in their valence. The collection of normative emotional ratings that include offensiveness as an additional dimension will therefore facilitate the comparison of different studies using taboo words, as previously studies have either used ad hoc ratings for the word stimuli (e.g. MacKay et al., 2004 used obscenity ratings) or no ratings have been provided to describe the offensiveness (or obscenity) of the words used (e.g. Anderson, 2005). It is also of interest to what extent this set of taboo words are perceived to be equally offensive across linguistic contexts.

In summary, a collection of ratings for English and Finnish words is important in several ways: The affective norms collected with American English speakers may not be fully applicable for British English and studies using words from languages other than English. No normative ratings for Finnish words in terms of their emotional characteristics have been published as yet and therefore compiling a database which represents British English-Finnish word pairs can aid stimulus selection in monolingual and bilingual research with speakers of Finnish and English. Furthermore, no affective database for taboo words is available for British English or Finnish. When bilingual speakers are studied using word stimuli from two different languages, the words ought to be matched along as many dimensions as possible to minimise the effects of lexical differences.

Among others, these dimensions include emotional valence, arousal and, in the case of taboo words, also offensiveness.

2.1.3. The aims of the present study

The first aim of the present research was to collect affective ratings for a set of 210 British English and Finnish nouns, including 34 taboo words. Ratings for concreteness and familiarity were also included, as these have been found to influence word processing in important ways (e.g. Altarriba, Bauer & Benvenuto, 1999; Gernsbacher, 1984) and will therefore provide additional information about the words presented here. The second aim was to perform cross-linguistic comparisons among the ratings given by native British English, Finnish and American English speakers in order to see how universal affective ratings for single words are. The third aim was to investigate the extent to which affective characteristics concur across American English, British English and Finnish taboo words. The ratings for British English and Finnish from the present study were therefore compared with those from the Affective Norms for English Words database (Bradley & Lang, 1999) and taboo word norms collected by Janschewitz (2008), representing affective norms for American English. Finally, the fourth aim was to establish, whether offensiveness ratings would differentiate effectively between negative and taboo words as previous research suggests that offensiveness ratings may be important in distinguishing taboo words (Jay, 2000).

2.2. Method

2.2.1. Participants

Three hundred and four native Finnish speakers, 220 females and 84 males, aged 16 - 45 years (M = 17.4, SD = 2.71) and 135 native English speakers, 105 females and 30 males, aged 16 - 35 years (M = 18.7, SD = 2.29) participated in the study. Participants were recruited at the Upper

Secondary Schools of Kauhava, Kurikka, Ilmajoki, Nurmo, Seinäjoki and Vaasa, in Finland, and the University of Kent, Canterbury, and Mid-Kent College, Chatham, in the United Kingdom. Undergraduate students at the University of Kent received a credit towards a course requirement for their participation, other participants were volunteers.

2.2.2. Materials

A computer-based questionnaire was used, where participants gave the ratings using individual PCs in a classroom setting in the presence of a researcher. The participants were randomly assigned one of the two versions of the questionnaire: They were either asked to rate the 210 words in terms of their familiarity (the extent given words occur in everyday language either in written or spoken form), emotional valence (how positive or negative the words are), and emotional charge (how strong an emotional charge the words evoke), or familiarity, offensiveness (how offensive the words are perceived to be), and concreteness (how concrete or abstract the words are perceived to be). Consequently, 135 native Finnish speakers and 81 native English speakers gave emotional valence and emotional charge ratings, while 155 native Finnish and 54 native English speakers gave offensiveness and concreteness ratings. In the current study, the term 'emotional charge' rather than 'arousal' was used, as it could be translated into Finnish in the most unequivocal way.

The questionnaire was split into two in order to avoid exhaustion to affect participants' responses. Familiarity ratings always preceded the other two rating tasks, as the research suggests that encountering the words previously is likely to affect their familiarity (e.g. Ratcliff, Hockley & McKoon, 1985), while there is currently no evidence for the affective ratings to be influenced by the preceding rating tasks (Landau & Gunter, 2009). The order of the other two ratings was counterbalanced across participants.

The words were chosen using the following criteria: They were all nouns, not inflected and in singular form. As much as possible, compound words and cognates were avoided. Furthermore, the English words had to be translatable into Finnish unambiguously. The latter criterion was especially of concern when taboo words were selected as words considered taboo vary considerably between languages and cultures. The set of 34 taboo words included in this study contains mainly words referring to sexual acts, body parts, bodily products and insults as these had counterparts in both English and Finnish. The words were selected to represent neutral, positive and negative words using ANEW (Bradley & Lang, 1999) as a guideline. All 210 words were translated from English to Finnish by a Finnish-English bilingual and back-translated by another Finnish-English bilingual. There was a high level of agreement between the translators in regard to the correspondence between the sets of English and Finnish words.

2.2.3. Procedure

Each participant was allocated a PC connected to the internet and given a unique user number which enabled them to access the questionnaire on the University of Kent, Canterbury (UK) website. If their connection was terminated before they had completed the study, this unique user number enabled them to return back to the study without losing the responses they had already given. A researcher was present throughout the study to provide verbal instructions and help with any technical problems. The rating session lasted approximately for one hour, all participants completing the ratings without having breaks in the middle.

The questionnaire started with instructions and a consent form. Participants were unable to proceed unless they ticked a box indicating their consent. At this point participants were also warned that some of the words were extremely offensive in nature and requested not to proceed if they did not wish to be exposed to this type of material. None of the participants, however, refused to take part in the study for this reason. After giving their consent, participants were asked to indicate their age, gender, native language and nationality.

Participants were told they would be presented with a list of words and that their task was to rate them along three dimensions assigned to them (familiarity, emotional valence and emotional charge, or familiarity, offensiveness and concreteness). At the beginning of each section, they were given instructions with examples and the opportunity to practise using the scale. They were also told that there were no right and wrong answers; the best answer would reflect their true opinion about the word. The use of the entire scale was encouraged, but at the same time the participants were told not to worry about how many times they had used any particular rating.

2.2.3.1. Instructions for rating familiarity

The familiarity instructions were as follows: "This dimension involves rating how often the given word occurs in everyday language either in written or spoken form. How often do you use the given word in your speech? How often do you hear other people using the given word in their speech? How often do you see the given word in a written form, or use it yourself in writing? For example, the word *football* could be rated as occurring in everyday language very often, whereas the word *memsahib* could be rated as never occurring in everyday language."

2.2.3.2. Instructions for rating emotional valence

The emotional valence instructions were as follows: "This dimension requires you to estimate how positive or negative the given word is. This will be rated on a scale from "very negative" to "very positive". For example, the word *revolting* could be rated as very negative, whereas the word *bookshelf* could be rated as neutral."

2.2.3.3. Instructions for rating emotional charge

The emotional charge instructions were the following: "This dimension involves indicating the strength of the emotional charge elicited by the word. For example, the word *panelling* could be rated as having no emotional charge, whereas the word *ecstatic* could be rated as having a very high emotional charge."

2.2.3.4. Instructions for rating offensiveness

The offensiveness instructions were as follows: "This dimension requires you to rate how rude, obscene or upsetting the word is; how inappropriate the word would be for polite interaction. For example, the word *pantomime* could be rated as not at all offensive, whereas the word *fuckhead* could be rated as very offensive."

2.2.3.5. Instructions for rating concreteness

The concreteness instructions were as follows: "This dimension involves rating to what extent the word represents an object, animate being, action or other phenomenon that can be perceived directly by the senses. If the word refers to something that can be perceived via the senses it is considered to be a concrete word, if it cannot then it is considered to be an abstract word. For example, the word *radiator* could be rated as very concrete, whereas the word *logic* could be rated as very abstract."

2.2.3.6. The scale used

A visual analogue scale, a fully sliding scale that was anchored from the two ends, was used. A pointer was located at the extreme left of the scale, which participants could move by clicking it with the mouse and dragging it along the scale. The program used converted the responses to a score from 0 to 9. Ten words were presented on each page, the order of the words being randomly assigned. In order to avoid missing data, participants were unable to proceed from one page to another without moving each pointer. The scale for familiarity ranged from 0 (never) to 9 (very often), for emotional valence from 0 (very negative) to 9 (very positive), for emotional charge from 0 (no emotional charge) to 9 (very high emotional charge), for offensiveness from 0 (not at all offensive) to 9 (very offensive), and for concreteness from 0 (very concrete) to 9 (very abstract).

2.3. Results and Discussion

Ratings of emotional valence, emotional charge, offensiveness, familiarity and concreteness for 210 British English and Finnish nouns are presented in Appendix 2.1.

Previous research has shown that the relationship between emotional valence and arousal is best described as a U-shaped curve, where highly negative and highly positive items are perceived to be most arousing, while items with low negative or positive rating are perceived to be least arousing (e.g. Bradley & Lang, 1999; Kissler et al., 2006; Redondo et al., 2007). As a consequence, the quadratic effect of emotional valence on emotional charge was studied. A regression analysis was conducted with Emotional Valence as an independent and Emotional Charge as dependent factor. The quadratic relationship was highly significant in each language; $R = .872$, $p < .001$ in English, and $R = .840$, $p < .001$ in Finnish, explaining 76% and 71% of the variance, respectively (see Figure 2.1). The present norms thus represent both high and low-arousal words from both positive and negative ends of the valence continuum as well as words which are moderately or low arousing but neutral in their valence. This replicates the pattern reported previously and supports the view that the current ratings are highly reliable and comparable to previously established word norms.

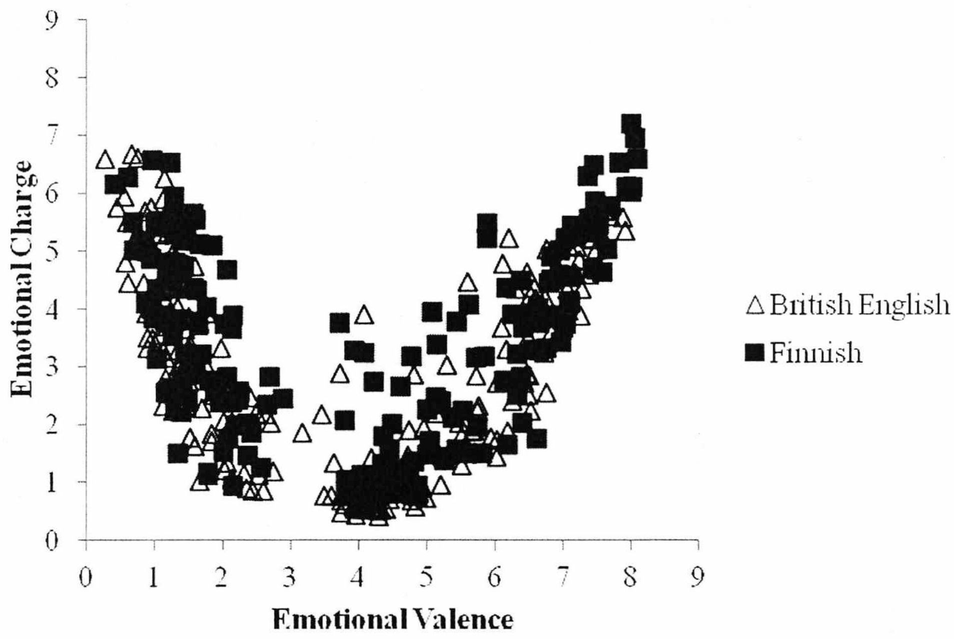

Figure 2.1. The relationship between emotional valence and emotional charge for British English and Finnish words

Previous studies have reported strong correlations between the emotional valence and arousal ratings collected with American English and Spanish speakers (r = .92 between emotional valence, and r = .75 between emotional arousal ratings; Redondo et al., 2007), as well as American English and Canadian English speakers (r = .86 between emotional valence, and r = .63 between emotional arousal ratings; Whissell, 2008). It was therefore of interest to what extent the ratings for British English and Finnish words would be related to each other as well as to those for American English words presented in ANEW (Bradley & Lang, 1999). The ANEW provides norms for 159 of the words included in the present study, and these were subsequently entered into a linear correlation analysis.

The results of the analysis showed highly significant and strong correlations between British English and Finnish in regard to all five dimensions (emotional valence, emotional charge, offensiveness, concreteness and familiarity) (see Table 2.1). Emotional valence and emotional arousal ratings for British English and Finnish were also strongly correlated with those for American English words available in the ANEW (Bradley & Lang, 1999). The correlations among the three languages to emotional charge appeared to be somewhat reduced relative to emotional valence ratings. Furthermore, between British English and Finnish, there was also slightly lower agreement in regard to concreteness and familiarity than was the case in regard to emotional valence and offensiveness. These findings are in line with previous studies in that the perceived emotional valence of single words appears to generalise well across different languages, but the level of emotional charge shows greater variability (Redondo et al., 2007; Whissell, 2008). The results also suggest that the extent to which the words are used in everyday language, i.e. their familiarity, is more language specific than the other lexical characteristics studied here.

Taboo words are often assumed to be some of the most potent emotional verbal stimuli, yet affective norms for these words have been lacking until very recently. A set of normative ratings have been collected for 92 taboo words with American English speakers (Janschewitz, 2008), but no such ratings have been available for British English and Finnish. The aim of the present study was therefore to collect norms for British English and Finnish taboo words in regard to their emotional valence, emotional charge and offensiveness, as well as to establish to what extent these ratings would be comparable among American English, British English and Finnish.

Table 2.1

Linear Correlations between American English, British English and Finnish Ratings

	American English[a]		British English[b]
	British English	Finnish	Finnish
Emotional Valence	.97***	.96***	.98***
Emotional Charge	.67***	.62***	.92***
Offensiveness	-	-	.96***
Familiarity	-	-	.72***
Concreteness	-	-	.93***

Note. [a]American English ratings available in the ANEW (Bradley & Lang, 1999); $N = 159$. [b]British English and Finnish ratings collected in the present study; $N = 210$. $^{***}p < .001$ (two-tailed).

Twenty four words were present in both our and Janschewitz' word lists and were thus included in the linear correlation analysis. Emotional valence, emotional charge and offensiveness ratings were found to be strongly correlated across the three languages (see Table 2.2). The emotional charge ratings were found to be somewhat less strongly correlated than emotional valence ratings. This was especially true for the correlation between American English and Finnish emotional charge ratings, which was substantially lower than the one between American English and British English. This finding suggests that emotional charge (arousal) is likely to vary more across languages than emotional valence and offensiveness ratings for taboo words. However, it is also possible that the reduction of correlation among American English, British English and Finnish ratings along the emotional charge dimension was partly due to the use different terms: In the ANEW the instructions for rating emotional arousal used terms such as 'excited vs. calm', and 'aroused vs. unaroused'. In the present study the terms 'no emotional charge vs. very high emotional charge' was used, as it was considered to be less ambiguously translatable from English to Finnish. While this term was well understood by the participants, the wording of the instructions may have contributed in part to the reduced correlation among American English, British English and Finnish ratings.

Table 2.2

Linear Correlations between American English, British English and Finnish Ratings for Taboo Words

		American English		British English
		British English	Finnish	Finnish
Emotional Valence[a]	Valence[b]	.89***	.85***	.93***
Emotional Charge[a]	Arousal[b]	.68***	.51*	.84***
Offensiveness[a]	Offensiveness[b]	.93***	.79***	.86***
	Tabooness[b]	.88***	.80***	
Familiarity[a]	Personal Use[b]	.61**	.25	.45*
	Familiarity[b]	.56**	.24	
Concreteness[a]	Imageability[b]	-.78***	-.65***	.82***

Note. [a]Dimensions used in the present study. [b]Dimensions used in Janschewitz' (2008) study. $N = 24$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$ (two-tailed).

Both Janschewitz' (2008) and the present study also included ratings for the concreteness/ imageability and familiarity. This enabled us to further explore the extent to which taboo words are perceived similarly in American English, British English and Finnish along these two dimensions. A linear correlation analysis of concreteness ratings revealed a strong relationship between American English, British English and Finnish ratings. British English ratings of familiarity were found to be moderately correlated with those provided by Finnish speakers and strongly correlated with American English ratings of personal use and familiarity. The familiarity ratings given by Finnish participants, however, did not show a statistically significant correlation with American English ratings.

Familiarity is known to be an important factor in influencing word processing (e.g. Gernsbacher, 1984). In the context of taboo word processing the role of familiarity ratings are even more pronounced as frequency indices based on written materials are likely to underestimate the occurrence of this category of words in everyday life. This has lead to spoken language corpora to be developed for taboo words (e.g. McEnery et al., 2000). The ratings of familiarity in the context of the present study, however, made it possible to compare the perceived occurrence of taboo words in everyday language among American English, British English and Finnish words.

American English and British English familiarity ratings were found to be moderately correlated. Finnish ratings, however, were only weakly related to British English familiarity ratings and no significant correlation was found between Finnish and American English ratings. This highlights the possibility that although taboo words are perceived similarly in their emotional valence and offensiveness, their use in everyday life may vary substantially from one language to another. As a consequence it is important to match them along this dimension when comparing responses to taboo words in different languages, especially as word frequency norms based on written language may be less accurate indicators of the extent people encounter these words in everyday life.

The question whether the additional affective dimension of offensiveness would effectively differentiate between negative and taboo words was also addressed. In order to directly compare negative words and taboo words in respect to their offensiveness, independent groups t-tests were carried out separately for British English and Finnish words. All words rated 3.0 or less in their valence on a scale from 0 to 9 were included in the analysis as representing negative words. Taboo words included insults, as well as words referring to sexual acts, body parts, and bodily products. The analyses showed that taboo words were rated as significantly more offensive than negative words both in English [taboo, $M = 3.8$, negative, $M = 1.0$; $t(39.06) = 9.41$, $p < .001$], and in Finnish [taboo, $M = 4.7$, negative, $M = 1.4$; $t(39.48) = 11.58$, $p < .001$].

Previous research has shown that although taboo words do not differ from negative non-taboo words in their valence, they are rated overall as more arousing (Janschewitz, 2008). This has been interpreted to imply that the strong emotionality of taboo words comes from the high level of arousal they elicit. The comparison of emotional valence and emotional charge of taboo words in the present study, however, showed that negative words were perceived as more negative in their valence than taboo words [negative $M = 1.3$; taboo $M = 1.8$; $t(45.20) = 3.09$, $p < .01$, in English; negative $M = 1.4$; taboo $M = 2.0$; $t(40.25) = 3.10$, $p < .01$, in Finnish]. Negative words were also rated stronger in emotional charge than taboo words both in English [negative $M = 4.0$; taboo $M = 2.7$; $t(89) = 4.33$, $p < .001$] and Finnish [negative $M = 4.3$; taboo $M = 2.8$; $t(88) = 5.48$, $p < .001$]. Thus, although socially undesirable in their connotations, taboo words are not necessarily perceived to be as negative and arousing as some extremely negative, non-offensive words (e.g. cancer, death). This finding supports the view that it is offensiveness rather than valence or arousal that sets the taboo words apart from negative words.

In conclusion, the importance of developing affective norms for words in different languages is demonstrated by the differences observed between words in different languages in their emotional connotations (Pavlenko, 2008). The ratings presented here will provide a useful database for researchers using emotionally charged words in monolingual or bilingual studies with British English and Finnish participants. Furthermore, the comparisons of American and British

English as well as Finnish affective ratings show that emotional valence and offensiveness generalise well across the variations of the same language as well as the different languages. Words from different languages, however, may be less similarly perceived when it comes to their emotional charge, concreteness and familiarity. The lack of correlation between Finnish and American English ratings of familiarity in particular suggests that the everyday use of words in different languages may vary significantly. As a consequence it is important to collect normative ratings including affective dimensions as well as familiarity and concreteness for the languages studied, as the norms collected for one language may not generalise to others.

Chapter 3. Lexical Decision Performance in Finnish-English Bilinguals and Native English Speakers

3.1. Introduction

The present chapter reports two experiments. The aims of Experiment 1 were to investigate the impact of emotional connotations on visual word recognition in bilinguals' first (L1) and second (L2) language, and to examine the role of proficiency in influencing the potential differences observed between L1 and L2. The aims of Experiment 2 were to establish whether the observed differences between L1 and L2 may have been accounted for by differences between languages rather than bilinguals' knowledge of L1 and L2, and whether familiarity with the orthographic form may have contributed to the findings in Experiment 1.

Seventy-six native Finnish speakers with different levels of proficiency in L2 (English) (Experiment 1), and 34 native English speakers (Experiment 2), were recruited in this study. The participants carried out lexical decisions to neutral, positive, negative and taboo words presented in Finnish and English (Experiment 1), or only to English words that were presented either in upper or mixed case (Experiment 2). The results showed that taboo words systematically interfered with responses in all participants; no differences between L1 and L2 were found. Positive and negative words were found to facilitate responses in L1, but such effect was not observed in L2 (Experiment 1). Negative words were found to slow down responses in L2 in less proficient bilinguals, but RTs for those words were not found to differ from neutral words in more proficient bilinguals (Experiment 1) or native speakers of English (Experiment 2). The presentation type (upper or mixed case) did not affect the emotionality effects in native English speakers (Experiment 2).

The results suggest that extremely negative connotations (i.e. taboo content) of words can be accessed fast and influence bilinguals' responses to the same degree both in L1 and L2 irrespective of their level of proficiency. Such finding seems to be in contrast with the Revised Hierarchical Model of bilingual memory (Kroll & Stewart, 1994), which assumes that L2 words have a weaker connection to the semantic system than L1 words. The findings also indicated that positive connotations of words may have a reduced facilitating effect on word recognition in L2 when compared to L1. However, this effect requires further investigation. Less proficient bilinguals' responses to L2 negative words were substantially influenced by their lack of knowledge of those words, suggesting a potential bias in language learning towards positive and neutral materials and away from negative materials. Such lack of knowledge of negative vocabulary may in part account for bilinguals' experience of reduced emotionality of L2 when compared to L1.

3.1.1. The impact of emotional content on word recognition

The lexical decision task, introduced by Rubenstein, Garfield, and Millikan (1970), is a test of the latency of lexical access, i.e. the time it takes the word recognition system to retrieve information from the mental lexicon relevant for processing a single word. Typically, a letter string is presented on the computer screen, and the participant is required to press one of two keys to indicate whether the string of letters is a real word or not. The categorisation of the stimuli as valid lexical items or non-words is believed to involve judgements about familiarity and does not necessarily require complete identification of the word stimuli (Atkinson & Juola, 1973; Balota & Chumbley, 1984; Grainger & Jacobs, 1996). Yet, semantic factors such as the emotional content of words can modulate the speed at which words are recognised (e.g. Ortigue et al., 2004), as will be discussed below.

A number of different experimental designs have been used in lexical decision studies investigating the impact of affective content on word processing. These include studies with very brief (e.g. 150 ms) versus longer (until response is made, or up to 2000 ms) duration of presentation, central versus hemifield presentation of the stimuli, choice versus go/no-go lexical decision tasks, and use of primes or not. Several previous studies have also combined psychophysiological techniques with the behavioural task to establish the physiological and neural correlates associated with the processing of words' emotional content (e.g. Calvo & Eysenck, 2008; Kanske & Kotz, 2007; Kousta, Vinson & Vigliocco, 2009; Ortigue et al., 2004). In the current study the focus is on lexical decisions on words that are presented for a relatively long duration, with a central presentation, without priming of the target stimuli and using a choice rather than a go/no-go design. Therefore the literature reviewed here will primarily concentrate on studies that have similar research designs, as the research design can substantially affect the pattern of responses found and the subsequent theoretical implications. However, findings from studies with different designs are discussed where they have direct relevance to the present study. Furthermore, in the present chapter the focus is primarily on the behavioural findings, while more attention will be drawn to the electrophysiological findings in Chapter 4.

A number of studies have failed to find emotionality effects in a lexical decision task (e.g. MacKay et al., 2004; Siegle, Ingram & Matt, 2002). However, in these studies a relatively small number of word stimuli were used, and several lexical characteristics were not controlled for. Studies that have used larger numbers of stimuli and controlled for a wider range of lexical factors have found the positive valence of words to facilitate lexical decision performance. For example, Kuchinke et al. (2005) conducted two lexical decision studies, a pilot behavioural experiment and an imaging study combining behavioural task with an fMRI recording. Twenty native German speakers were recruited to each experiment. The stimuli consisted of neutral, positive and negative words, with 50 words in each category, and a set of 150 nonwords. Word stimuli were matched for frequency, number of letters and syllables, number and frequency of orthographic neighbourhood, and imageability, but not for emotional arousal. The words were presented centrally for 500 ms in a random order.

Both experiments showed faster response latencies for positive when compared to neutral words, while negative words were not found to differ from neutral words. The fMRI data also showed differences between positive and negative words in the pattern of cortical activations; positive words were associated with greater activation of anterior pre-frontal cortex, while negative words resulted in distinct activations in the right dorsolateral pre-frontal cortex. As these areas have been previously associated with semantic processing, Kuchinke et al. concluded that positive and negative emotional valence associated with single words are differentially represented in the cognitive system. Furthermore, their findings support the view that positive, but not negative valence consistently facilitates word recognition process.

Negatively valenced words have produced mixed results; some studies have found them to facilitate (e.g. Kanske & Kotz, 2007), others to inhibit responses (Algom, Chajut & Lev, 2004). Some studies have also found no difference on behavioural measures between neutral and negative words (e.g. MacKay et al., 2004). Larsen, Mercer and Balota (2006) have suggested that the emotionality effects observed in studies such as that of Algom et al. (2004) may have been confounded by lexical factors that were not controlled for. Key lexical features contributing to lexical decision performance include word form frequency (i.e. the number of times the word form occurs per million entries in a database based on written sources), familiarity (i.e. perceived frequency at which a word is encountered and used in everyday life), word length in number of letters, and orthographic neighbourhood size (i.e. the number of words into which a single word can be transformed by changing one letter in the word while leaving the word otherwise unchanged) (Balota, Cortese, Sergent-Marshall, Spieler & Yap, 2004). Therefore subsequent analyses have often controlled for a wider range of lexical factors in order to establish the contribution of emotional valence on word recognition when the lexical factors are either controlled or included in the analyses as covariates.

Estes and Adelman (2008) reported a study where they analysed 1034 words available at the Affective Norms for English Words database (ANEW; Bradley & Lang, 1999) using the lexical decision data from the English Lexicon Project (ELP; Balota et al., 2002). They included a wide range of lexical factors as covariates in their analysis in order to establish the unique contribution of emotional valence on words recognition speed. These lexical factors consisted of word form frequency, word length in number of letters and syllables, contextual diversity (i.e. the number of distinct documents in which a word occurs), orthographic neighbourhood, and emotional arousal.

Estes and Adelman (2008) found that emotional valence significantly predicted the lexical decision speed; lexical decisions were slower in response to negative than to positive words. Their results also suggested that the relationship between emotional valence and word recognition speed was categorical rather than linear; the most negatively valenced words were not responded to slower than negative words with less extreme negative valence. This was also true for positively valenced words; the most positively rated words were not responded to faster than the positive words with less positive valence. When emotional valence was analysed as a categorical rather than a linear predictor, the difference between positive and negative words in terms of response latency was 15 ms. However, this effect accounted for only a small amount of the overall variability. Estes and Adelman (2008) therefore concluded that the evidence supports the automatic vigilance hypothesis (Pratto & John, 1991), i.e. that humans preferentially attend to negative stimuli. Thus, words are categorised fast either as positive or negative, and such categorisation affects lexical decision speed.

Larsen, Mercer, Balota and Strube (2008) conducted a similar analysis of lexical decision performance to emotional words, but also included emotional arousal in addition to emotional valence as a factor in the analysis. Their results confirmed the finding of Estes and Adelman (2008) that negative valence has a small but significant slowing effect on lexical decision times.

Furthermore, they found a significant cubic effect for negativity, which was further moderated by emotional arousal: The greatest amount of slowing in lexical decision performance was found for negative words that were low or moderate in arousal, while such effect virtually disappeared for highly arousing negative words. Thus, they argued that the effect of emotional valence is not categorical, as not all negative words produce the same level of interference relative to positive words.

The finding of Larsen et al. (2008), however, appears to be counterintuitive: It could be expected that the most emotionally arousing negative words would be responded to slower rather than faster when compared to less arousing negative words, the results from taboo Stroop studies supporting this view (e.g. Eilola et al., 2007). Furthermore, even though the studies of Estes and Adelman (2008) and Larsen et al. (2008) controlled for a wide range of lexical factors, they used a word list that included words from different grammatical classes (i.e. verbs, adjectives and nouns). Yet, there is increasing evidence to suggest that grammatical class plays a role in word recognition (e.g. Kauschke & Stenneken, 2008; Vigliocco, Vinson, Arciuli & Barber, 2008) and that grammatical class may interact with the emotional valence (Dietrich et al., 2001). Larsen et al. recognised that future research ought to apply content analysis in order to analyse specific features of negative words that predict this slowing effect, as different types of negative words may produce different behavioural effects. Subsequent research has further investigated factors that may be contributing to the emotionality effects in word recognition, including the role of word form frequency, emotional arousal and concreteness.

3.1.2. The impact of word form frequency on the emotionality effects

Kuchinke, Võ, Hofmann and Jacobs (2007) considered the combined impact of emotional valence and word form frequency on word processing using a lexical decision task in combination with pupillary response recording (i.e. a measure of the peak pupil dilation or constriction following the stimulus presentation). Twenty-six native German speakers were presented with 60 positive, 60 negative and 60 neutral words as well as 180 nonwords. The three categories of words were further divided into low frequency (frequency count equivalent to or less than 10 per million) and high frequency words (frequency count equivalent to or more than 30 per million). Half of the words were nouns, the other half were verbs. The word lists were matched for number of letters and syllables, number of orthographic neighbourhood, and imageability but not for emotional arousal.

Kuchinke et al.'s (2007) results showed faster response latencies for positive than neutral words with high frequency words, but no difference between negative and neutral words. For low frequency words, both positive and negative words produced faster RTs than neutral words. This pattern of results was also replicated by Scott et al. (2009) in native English speakers. However, the faster RTs for negative than neutral words in the low word frequency condition could have been explained as a speed–accuracy trade-off, as Kuchinke et al. found higher error rates for negative than neutral words. Scott et al. did not report the error rate analyses and therefore it is not clear whether the negative words genuinely facilitated lexical decisions for low frequency words.

These findings seem to suggest that the heterogeneous findings produced by previous lexical decision studies in regard to negative words may have been due to the fact that some studies have used words of lower or higher frequency. Furthermore, negative words that are less frequently encountered may facilitate word recognition, while words with higher levels of frequency may not produce detectable differences from neutral words in a lexical decision task.

Kuchinke et al. (2007) failed to find emotionality effects in the pupillary responses, although lower word frequency was found to result in higher peak dilations. One possible explanation for this may be that while they controlled for a wide range of lexical characteristics, their study did not consider the role of emotional arousal in affecting the behavioural pattern observed. It may be that the words used in their study were relatively low in their emotional arousal, which may have limited the physiological responses as measured with pupillometry. Furthermore, the differences in response latencies to low and high frequency negative words could have been due to differences in their level of emotional arousal. Scott et al. (2009), however, selected the positive and negative words in regard to their emotional arousal, so that both of these word categories were above 6 in their arousal as rated on a scale from 1 (low arousal) to 9 (high arousal). Therefore it is unlikely that the different behavioural effects produced by positive and negative words were due to different levels of arousal for positive and negative words. These results thus indicate that the processing of negative words that have lower resting level activation may show greater facilitation due to their emotional content than is the case with higher resting level activation.

3.1.3. The impact of emotional arousal on word recognition

The two explanations of emotionality effects, the negativity bias hypothesis (Cacioppo & Gardner, 1999) and the model of motivated attention and affective states (Lang, Bradley & Cuthbert, 1990, 1997) were tested by Kousta, Vinson and Vigliocco (2009). They challenged previous research that has indicated a negativity bias, whereby negative stimuli either capture attention fast due to automatic vigilance (Pratto & John, 1991) or due to withholding attention for longer when compared to neutral and positive stimuli. They point out that those studies have often failed to control for a number of lexical characteristics, and that the word stimuli studies may have been drawn from a limited set of items resulting a bias in the findings. As a consequence they collected emotional valence and arousal ratings for 1200 words randomly selected from a larger pool of items, the English Lexicon Project. These words were combined with the set of words from ANEW (Bradley & Lang, 1999). Thus, this enabled them to carefully match a set of 40 positive, 40 negative and 40 neutral words along ten lexical factors: concreteness, imageability, age of acquisition, familiarity, log frequency, orthographic neighbourhood, number of letters, number of syllables, number of morphemes and mean positional bigram frequency. Furthermore, positive and negative words were matched for arousal, but neutral words were less arousing than the emotionally valenced words.

Seventy-nine native English speakers carried out lexical decisions on these words. The words and non-words were presented in a fully randomised order at the centre of the screen for 2000 ms or until the response was given. The word was preceded by a fixation cross for 400 ms and followed by an inter-stimulus interval of 1000 ms. Participants responded to both words and non-words using a key-press. Kousta et al. (2009) found significantly faster response times for both positive and negative words when compared to neutral words. They also reported a trend of a higher level of accuracy for emotionally valenced when compared to neutral words. When they conducted a large-scale regression analyses on the larger set of 1446 words, they found that emotional valence accounted for the variability in reaction times and accuracy levels even when the effect of emotional arousal was accounted for. However, emotional arousal did not explain variance beyond and above of emotional valence.

These findings suggest that both positive and negative words have a processing advantage over neutral words. Such findings lend support for the model of motivated attention and affective states, which suggests that neither the appetitive/ approach system nor the aversive/ withdrawal system is dominant. Instead, attention is captured and held by motivationally significant stimuli when compared to neutral stimuli (Lang et al, 1990, 1997). Such emotionality effect is primarily explained by the emotional valence of the words rather than emotional arousal. These findings provide an important contribution to the field in demonstrating that when other important lexical factors are controlled for, emotional valence does facilitate the word processing. However, in their study negative words did not include extremely negative words such as taboo words (e.g. slut) or insults (e.g. idiot). The effect of extremely negative words was directly addressed by Carretié et al. (2008).

Carretié et al. (2008) studied 28 native Spanish speakers' responses to 10 highly positive (compliments), 10 highly negative (insults), and 10 neutral adjectives, as well as 30 nonwords. The emotionally charged words were matched for arousal. All the three word categories were further matched for frequency of use and number of syllables. The letter-strings were presented centrally for 650 ms, and both words and nonwords were responded to with a key-press. Faster RTs to compliments than neutral adjectives and slower RTs to insults than the other two word categories were found. These findings contrast with the previous findings (Estes & Adelman, 2008; Larsen et al., 2008) in that highly emotionally arousing negative words were found to significantly slow down responses both in relation to neutral and positive words. Moreover, the results support the view that words from specific grammatical classes and with high levels of arousal may influence word recognition to a different degree.

Carretié et al. (2008) proposed that two mechanisms may be involved when emotionally charged words are processed. Emotional content may facilitate the initial lexical access, thus speeding up the word recognition, while negative valence of words may slow down the responses due to the threatening content. Consequently positive words are responded to faster in a lexical decision task as their emotional content facilitates the lexical access. Negative words, however may not differ from neutral words, as they are affected both by the facilitating effects of emotional content and slowing effect of the threat inherent in these words. However, highly negative words, such as insults, can produce a slowing effect given that the words are highly emotionally arousing. This may explain why an inconsistent pattern has been found in regard to negatively valenced stimuli in lexical decision studies, apart form the lack of control over lexical factors. It also demonstrates that negative valence does influence lexical processes even though these effects are not always manifested in reaction times as a difference from neutral words.

3.1.4. The impact of concreteness on the emotionality effects

Kanske and Kotz (2007) further investigated the effects of emotionality and concreteness on visual word processing. They conducted two lexical decision experiments, but only the results from Experiment 1 are discussed here, as in Experiment 2 participants responded only to nonwords. Thirty German native speakers performed lexical decisions to 40 neutral, 40 positive and 40 negative nouns, as well as 120 nonwords by responding to both words and nonwords. All words were matched for frequency and word length. Negative and positive words were also matched for emotional arousal. Words of a particular valence consisted of words of lower and higher levels of concreteness and were mixed with one of the two lists of neutral words. The level of concreteness was matched across the lists in such a way that words with a high level of concreteness were matched with each other, and words with a low level of concreteness were matched with each other. The words were presented either to the left of right hemifield for a duration of 200 ms.

Faster reaction times for both positive and negative words when compared with neutral words were found. Furthermore, positive words were responded to faster than negative words. RTs were shorter for concrete than abstract words, and for words presented in the right when compared to the left hemifield. Emotionality and concreteness were also found to interact in that the difference between positive and negative words was only significant for concrete words but not for abstract words (Kanske & Kotz, 2007).

These results demonstrate that, in addition to the word form frequency, emotional arousal and grammatical class, also the level of concreteness of word stimuli can modify the emotionality effects observed in a lexical decision task, more concrete words showing greater facilitation for positive than negative words. The results also replicate what was found previously, that negative words in some circumstances can in fact facilitate rather than interfere with single word recognition (Kuchinke et al., 2007; Scott et al., 2009; Kousta et al., 2009).

3.1.5. The impact of emotional content on word recognition in bilinguals

In the context of bilingual speakers, only one study has investigated the impact of emotional content on word recognition using a lexical decision paradigm. Altarriba and Canary (2004) studied English monolinguals and Spanish-English bilinguals for whom English was their dominant language. Participants were asked to perform lexical decisions on English words and nonwords which were primed by unrelated, low-arousal or highly arousing English words. Fifteen prime-target pairs were used, where emotional valence of the prime and the target were matched. Prime-target pairs of different valence were analysed together. High and low-arousal words were matched for frequency, word length and association strength.

The aim of Altarriba and Canary's (2004) study was to investigate whether native and non-native speakers of English would differ in the extent to which the emotional arousal of the prime words would influence the speed of lexical decisions to the target words. The results showed a significant priming effect in both languages; emotional arousal facilitated lexical decisions in both high and low-arousing conditions when compared to the unrelated condition. However, this facilitation was more pronounced in the monolingual speakers than the bilingual speakers of English. Altarriba and Canary suggested that the arousal associated with word stimuli exerts different effects for bilinguals when compared to monolinguals and therefore indicates that the emotion lexicon is represented differently in bilingual and monolingual speakers.

While Altarriba and Canary's (2004) findings suggest that there may be differences between L1 and L2 words in the strength of their connections with emotional representations, their findings are not conclusive. First, no interaction between the two groups of participants (monolingual English and Spanish-English bilinguals) and the word types (unrelated and emotionally arousing words) was found. Furthermore, the level of arousal (low or high arousal) did not have a significant effect on the lexical decision speed; both low and high arousing words produced similar levels of priming. Therefore it is not possible to exclude the alternative explanation that the facilitation produced by emotionally arousing primes was due to semantic priming rather than facilitation due to the emotional content of the words. Moreover, Altarriba and Canary's study did not differentiate between responses to words with positive and negative valence. It is possible that a different pattern of results may have been found if negative and positive words were examined separately. Another limitation of an affective priming paradigm is that it is not possible to establish to what extent the emotional content of the target word influences the speed of processing independently of the emotional effect of the prime. The use of a lexical decision task without priming enables the observation of incidental processing of the affective content as the participant is not asked to consider the meaning of the word. Importantly, this kind of experimental design focuses on the processing of the emotional word itself, rather than looking at the extent the emotional words are interconnected with each other. As a consequence in the present study a lexical decision task without priming was applied, as this enables the examination of the impact of the emotional content of words on the speed at which they are recognised as legal lexical forms.

3.1.6. The aims of the present study

The first aim of the present study was to investigate whether emotional content (emotional valence and offensiveness) influence visual word recognition in bilinguals' L1 and L2 to a different degree. The Revised Hierarchical Model of bilingual memory (Kroll & Stewart, 1994) would suggest that L2 has a weaker connection to the semantic system than L1, and as a consequence the semantic features of L2 words would be less likely to have an impact on the word recognition in L2 than L1. BIA+ (Dijkstra & Van Heuven, 2002) also assumes that L2 words may have lower resting level activation, and as a consequence they are recognised slower. From this follows that L2 words are likely to activate the word semantics later than L1 words, leading to a reduced effects of word semantics on the word recognition process. Thus, these two models would predict that positive words in L1 will be recognised faster than neutral words, and L1 taboo words are likely to produce slower RTs than L1 neutral words. L1 negative words may be recognised faster than L1 neutral words, although it is also possible that no differences between these word categories will be found, as the previous findings have been inconsistent in this regard (e.g. Kousta et al., 2009). In L2, similar emotionality effects may be observed, but these effects are expected to be reduced when compared to L1.

The research of Duyck and Brysbaert (2008), however, would suggest that words that share a large number of semantic features can activate word semantics to the same degree in L1 and L2. Thus, it is possible that no differences between L1 and L2 will be found, considering that the words in the present study were selected in such a way that they would closely correspond to each other across languages.

The level of proficiency at which L2 is spoken is likely to influence the extent to which L1 and L2 differ in their emotional impact. For example, Harris et al. (2006) found that the less proficient bilingual speakers' skin conductance responses to L2 childhood reprimands were reduced when compared to L1, while those with high level of proficiency did not show such difference. Therefore, the second aim of the present study was to compare more and less proficient bilinguals' responses to emotionally charged words in L2 in order to establish the extent to which the level of proficiency in L2 affects the pattern observed. It was expected that more proficient bilinguals would show facilitation from both L1 and L2 positive words (e.g. beauty), but less proficient participants would not show such an effect. As negative words (e.g. rage) have been found to show a mixed pattern of results, it was of interest whether they would produce facilitation or interference in bilingual speakers' first and second language.

As discussed in Chapter 2, taboo words (e.g. slut) are considered to be one of the most emotionally evocative word stimuli. Considering that interference from negative words has been primarily observed when highly negative words were used (Carretié et al., 2008), the present study also included taboo words as word stimuli. It is possible that interference will be observed in response to taboo words, while negative words will not differ from neutral words in their response latencies.

While the word stimuli used in the present study were carefully selected to represent translation equivalents in Finnish and English, and were matched along a number of dimensions, it is possible that the differences between Finnish and English may contribute to the pattern found rather than reflecting differences between bilingual speakers' L1 and L2 in their emotionality. Therefore native English speakers' responses to the English words were investigated in Experiment 2. This enables the direct comparison of native and non-native speakers' responses to the same set of words.

Lexical decision performance is expected to be more difficult in bilinguals' L2, as the resting level activation may be lower for L2 than L1 words (Coltheart et al., 2002). As a consequence it is likely that bilinguals will be slower at deciding over the legitimacy of the lexical form in L2 than is the case with the native speakers. It may be that L2 speakers make more use of the grapheme-morpheme conversion route (Coltheart et al., 2002) than native speakers who are likely to access the word form via the lexical route instead. Such different strategies of processing words may influence the extent to which the word semantics affect the lexical decision process. As a consequence a modification of the lexical decision task was introduced for the native speakers of English: They were also asked to respond to English words that were presented in a mixed case format (e.g. bLiSs). Case mixing has been previously found to slow down word recognition, as it is not possible for the participants to read the words holistically (e.g. Mayall, Humphreys, Mechelli, Olson & Price, 2001). This can be explained in the context of the Dual Route Cascaded model (Coltheart et al., 2001): Mixed case words will be processed using the grapheme-morpheme conversion system as the orthographic form of the word is unfamiliar. It was therefore of interest whether such modification of the task would result in a more similar pattern of responding in native speakers as observed in non-native speakers of English.

3.2. Experiment 1

3.2.1. Method

3.2.1.1. Participants

Participants were 76 native Finnish speakers, recruited at the University of Helsinki, University of Tampere, and Upper Secondary School of Seinäjoki, Finland. They were given a reward equivalent of €3, a partial course credit or they were entered into a draw for a €20 voucher. Four of the participants were excluded from the analyses because of having learnt English before the age of 6 years (n = 3) or reporting a language disability (n =1). Consequently, 72 participants were included in the further analyses. They were aged 16-57 years (M = 23.0, SD = 7.40), 58 of them female and 14 male.

The participants were administered a modified version of the Li, Sepanski and Zhao's (2006) Language History Questionnaire (summary of the results is presented in Appendix 3.1). Participants were split into two groups according to their self-reported proficiency: They were considered more proficient, if they reported at least 'good' skills in reading, writing, speaking and understanding spoken English. Thus, their self-rated proficiency was 5, or higher for each skill on a scale from 1 (very poor skills) to 7 (native-like skills). Furthermore, those who reported not knowing 15 per cent or more of the words used in the experiment were considered as less proficient. Thus, 32 participants were categorised as more proficient (25 females and 7 males), and 40 as less proficient (33 females and 7 males).

The participants had started learning English between 6 and 13 years of age. More proficient bilinguals had started learning English on average at the age of 9.1 years (SD = 0.93) and less proficient bilinguals at the age of 8.7 years (SD = 1.22). This difference was not statistically significant; $t(70) = 1.41$, $p > .05$. Both more and less proficient participants reported having better skills in L1 (Finnish; M = 6.9 and M = 6.7, respectively) than in L2 (English; M = 5.7 and M = 4.5, respectively); $F(1, 70) = 405.9$, $p < .001$, $MS_e = 1.038$. More proficient participants also reported significantly better skills in L2 than did less proficient participants; $F(1, 70) = 32.35$, $p < .001$, $MS_e = 1.038$. All participants lived in Finland at the time of the study. Their immersion in an English-speaking environment was limited, as only 21.9 per cent of the more proficient participants and 7.5 per cent of the less proficient participants had spent more than 6 months in an English-speaking environment. Although most of the participants said they encountered English on a daily basis through films and music (90.6 per cent of the more proficient, and 89.7 per cent of the less proficient participants), they were less likely to use English on a daily basis when interacting with other people. Of the more proficient participants, 56.3 per cent reported using English for at least 30 minutes each day in socialising, while 37.5 per cent of the less proficient participants indicated this.

3.2.1.2. Word stimuli

Four lists of English and Finnish translation equivalents consisting of 20 words each were selected according to their emotional content (see Appendix 3.2). Neutral (e.g. phase), positive (e.g. glory), negative (e.g. rage) and taboo words (e.g. slut) in each language differed significantly from each other in their emotional valence; $F(7, 159) = 384.39$, $p < .001$ (see Table 3.1 for means). As an exception, English taboo words were equally negative as English and Finnish negative words; Finnish taboo words were slightly less negatively valenced than English and Finnish negative words and English taboo words.

Table 3.1

Means (and Standard Deviations) for Word Length, Familiarity, Emotional Valence, Emotional Charge, Offensiveness and Concreteness for English and Finnish Word Stimuli

	Neutral		Positive		Negative		Taboo	
	English	Finnish	English	Finnish	English	Finnish	English	Finnish
Word Length	5.5 (1.67)	5.7 (2.32)	5.4 (1.14)	5.7 (1.60)	5.4 (1.64)	5.6 (1.28)	4.7 (1.26)	5.5 (0.89)
Familiarity	3.3 (1.16)	3.7 (1.11)	3.7 (1.07)	4.0 (1.12)	3.6 (0.90)	3.4 (0.63)	4.7 (1.23)	3.2 (1.56)
Emotional Valence	4.4 (0.72)	4.7 (0.54)	6.8 (0.46)	6.9 (0.85)	1.1 (0.34)	1.3 (0.34)	1.6 (0.43)	1.8 (0.58)
Emotional Charge	1.4 (0.86)	1.7 (1.07)	4.2 (1.05)	4.6 (1.31)	4.8 (1.24)	5.0 (0.90)	2.8 (0.90)	2.7 (0.76)
Offensiveness	0.3 (0.11)	0.4 (0.15)	0.3 (0.12)	0.4 (0.15)	1.1 (0.60)	1.2 (0.45)	4.9 (1.27)	5.3 (1.25)
Concreteness	3.4 (1.77)	3.2 (1.82)	4.4 (2.08)	3.9 (2.04)	4.3 (1.44)	4.0 (1.33)	3.5 (1.20)	2.1 (1.04)

All words were matched listwise for the number of letters; $F(7, 159) = 0.78$, $p > .05$. Furthermore, neutral, positive and negative words in each language were matched for their familiarity; $F(5, 119) = 1.16$, $p > .05$, and concreteness; $F(5, 119) = 5, 119) = 1.6$, $p > .05$, using the affective norms for English and Finnish words database (Chapter 2; Eilola & Havelka, 2010). English neutral, positive and negative words were also matched in regard to their word form frequency; $F(3, 59) = 1.09$, $p > .05$, log frequency; $F(2, 59) = 1.29$, $p > .05$, neighbourhood size; $F(2, 59) = 1.17$, $p > .05$, and bigram frequency; $F(2, 59) = 1.59$, $p > .05$, using the CELEX Lexical Database, Release 2 (1995).

English taboo words were more familiar than English neutral words, as well as Finnish negative and taboo words. Finnish taboo words did not differ from the other word categories in this respect. Finnish taboo words were more concrete than Finnish and English positive and negative words, but English taboo words did not differ from the other word categories along this dimension (see Appendix 3.2 for the full list of the word stimuli). In order to further control for the effect of familiarity on the RTs, this factor was entered into the by items analysis of variance as a covariate.

Positive and negative words had significantly higher ratings of emotional charge than neutral and taboo words, but these word categories did not differ from each other. Taboo words were also significantly different from neutral words, the latter having the lowest ratings of emotional charge. Taboo and negative words were more offensive than neutral and positive words. While there was no significant difference between neutral and positive words, taboo words were more offensive than negative words.

Nonwords were created from the words used in the present study by changing 1 or 2 letters in the middle of each word, a consonant replacing a consonant and a vowel replacing a vowel. Subsequently 160 words and 160 nonwords were used in the study. All the words were nouns, and pseudohomophones as well as cognates were avoided.

3.2.1.3. Design

A 2 X 2 X 4 mixed design was used where Language (English, Finnish) and Word Type (neutral, positive, negative and taboo) were used as within-subjects factors, and Level of Proficiency (higher and lower) as a between groups factor.

The words were presented in blocks where words from only one emotional category were included in each block. The blocked design was selected as previous research of emotional Stroop effects has shown that emotional words can have an effect on the RTs of the words following the (i.e. a carry-over effect, or slow effect). As a consequence, mixing words from different emotional categories may eliminate or even reverse the emotionality effects) (McKenna & Sharma, 2004). Such slow effects can in part account for the mixed findings reported in lexical decision literature. Whether slow effects occur also in a lexical decision task has not been systemtically investigated. However, it seem possible that more robust effects of emotionality may be observed when blocked rather than mixed design is used.

The participants were presented with words in two different languages, Finnish and English. These languages were presented in consecutive sessions, so that all word lists from each one of the languages were presented together. The order in which these languages appeared was counterbalanced so that half of the participants were presented the English word lists first and for the other half the Finnish word lists were presented first. The words were divided into two lists of 10 words, so that each participant was presented with each word only once either in Finnish or in English, i.e. if one word appeared in English, its translation equivalent was not presented to the participant. These lists were counterbalanced across participants. Thus, eight blocks of words were presented overall consisting of 20 trials each (10 words and 10 nonwords), each trial being presented in a random order. The order of the blocks was counterbalanced using a Latin square design.

The words were presented in font size 20 using a Toshiba Satellite Pro 1.50 GHz laptop PC, running Windows XP SP2 with E-Prime Version 1.1.4.6. The responses were given using index fingers by pressing the key 'z' if the stimulus presented was a real word and key 'm', if the stimulus was a nonword.

3.2.1.4. Procedure

Participants completed one practice session consisting of 12 words and 12 nonwords in each language. The Finnish practice session preceded the Finnish experimental blocks, and the English practice session took place prior to the English experimental blocks. Instructions on the screen were given in the language in which words were presented in that blocks involving Finnish words were accompanied with Finnish instructions and blocks involving English words were accompanied with English instructions. The experimenter communicated with the participants only in Finnish.

On each trial, a fixation cross was presented for 500 ms, after which a single word or non-word appeared on the screen, replacing the cross. The letter-string remained on the screen until a response was made, or up to 2000 ms. If the participant had not responded within this time duration, a screen appeared asking the participant to try to respond faster. This setup was identical for both the practice and experimental sessions.

At the start of the experiment participants were instructed to identify whether the string of letters appearing on the screen was a real word or not in the given language as quickly and as accurately as possible. It was emphasised that both speed and accuracy were important. Participants gave the responses by pressing one of two keys ('z', 'm') on the keyboard, 'z' indicating a word and 'm' indicating a nonword using index fingers from each hand. In conjunction with acquiring participants' informed consent they were also informed that some of the words were offensive in nature and that both Finnish and English words would be used. Other information about the nature of the words was not given at the start of the experiment.

After the experiment participants were given a language history questionnaire, including a list of all of the word stimuli in English. They were asked to identify those words the meaning of which they did not know or were unsure of. More proficient participants reported knowing between 69 and 80 out of the 80 English words (M = 75.8, SD = 2.67). Less proficient participant knew between 56 and 78 out of the 80 English words (M = 67.5, SD = 5.92).

3.2.2. Results

Mean RTs were used in the analysis for response latencies. Response times less than 400 ms and greater than 1600 ms were considered as outliers and excluded from the RT analyses. On average, 1.0 per cent of RTs were discarded (see Table 3.2). Nonwords were also left out from the analyses. The reaction time data was first analysed by subjects (F_1) in a two-way analysis of covariance with Language (Finnish, English) and Word Type (neutral, positive, negative and taboo) as within-subjects factors and Proficiency as a covariate. Thus, Proficiency was initially treated as a continuous factor, which was based on the mean score of self-rated proficiency in reading, writing, speaking and understanding spoken L2 (English). Both error rates and RTs were then entered into a three-way mixed factorial analysis of variance with Language (L1, L2) and Word Type (neutral, positive, negative and taboo) as within subject factors, and Level of Proficiency (more and less proficient) as a between groups factor in order to establish the source of potential proficiency effects.

A further three-way mixed factorial analysis of variance by items (F_2) was conducted with Level of Proficiency and Language as within-subject factors and Word Type as a between-subjects factor. The impact of word length, familiarity and concreteness were assessed by including these factors as covariates in the 2 (Level of Proficiency) X 4 (Word Type) by items analysis of covariance for each language (English and Finnish) separately. The Greenhouse-Geisser epsilon was used to correct the degrees of freedom where the assumption of sphericity was violated. Bonferroni adjusted post hoc tests were conducted to identify the sources of differences between conditions and groups of participants.

3.2.2.1. Analysis of errors

The average error rate for the participants was 5.9 per cent (see Table 3.2 for error rates according to word type, language and the level of proficiency). The main effect of Level of Proficiency was significant [$F_1(1, 70) = 14.11$, $p < .001$, $MS_e = 0.011$; $F_2(1, 76) = 24.39$, $p < .001$, $MS_e = 0.004$]. More proficient participants made significantly less errors ($M = .043$) than less proficient participants ($M = .076$). The main effect of Language was also significant; [$F_1(1, 70) = 95.38$, $p < .001$, $MS_e = 0.009$; $F_2(1, 76) = 26.22$, $p < .001$, $MS_e = 0.019$]. More errors were made in response to L2 (English) ($M = .098$) than L1 (Finnish) words ($M = .021$).

The Language X Level of Proficiency interaction [$F_1(1, 70) = 21.01$, $p < .001$, $MS_e = 0.009$; $F_2(1, 76) = 31.85$, $p < .001$, $MS_e = 0.004$] showed that less proficient participants made more errors than more proficient participants in response to English words ($M = .132$ and $M = .063$, respectively), but there was no difference between the two groups in their error rates in response to Finnish words ($M = .019$ and $M = .023$, respectively).

The main effect of Word Type [$F_1(2.20, 153.97) = 63.76$, $p < .001$, $MS_e = 0.007$; $F_2(3, 76) = 6.23$, $p < .001$, $MS_e = 0.032$] indicated that, overall, responses to taboo words produced the highest error rates ($M = .128$), followed by negative words ($M = .060$). These were significantly different from error rates to positive words ($M = .025$) and neutral words ($M = .025$) in the analysis by subjects. In the analysis by items, only taboo words resulted in a significantly higher level of errors than neutral and positive words.

Table 3.2

Outliers and Error Rates for Emotionally Charged and Neutral Finnish and English Words in More and Less Proficient Bilinguals

		More proficient		Less proficient	
Language	Word Type	Outliers(%)	Errors(%)	Outliers(%)	Errors(%)
L1 (Finnish)	Neutral	0.6	2.5	1.0	0.5
	Positive	3.1	0.9	1.2	1.7
	Negative	1.6	0.9	1.2	0.5
	Taboo	0.9	4.7	0.5	5.0
L2 (English)	Neutral	1.9	1.9	0.3	5.3
	Positive	0.6	0.9	0.5	6.3
	Negative	0.3	8.4	1.0	14.0
	Taboo	0.3	14.1	0.8	27.2

The Word Type X Level of Proficiency interaction [$F_1(2.20, 153.97) = 4.40$, $p < .05$, $MS_e = 0.007$; $F_2(3, 76) = 4.01$, $p < .05$, $MS_e = 0.004$] further showed that less proficient participants made more errors to positive ($M = .040$) and taboo words ($M = .161$) than did more proficient participants ($M = .009$ and $M = .094$, respectively).

Language X Word Type interaction [$F_1(1.96, 137.01) = 25.94$, $p < .001$, $MS_e = 0.009$; $F_2(3, 76) = 5.54$, $p < .01$, $MS_e = 0.019$] showed that in L1 (Finnish) more errors were made in response to taboo words ($M = .048$) when compared to all the other word types (neutral $M = .015$, positive $M = .013$, and negative $M = .007$), although this difference was only significant in the analysis by items. In L2 (English), more errors were made to negative ($M = .112$) and taboo words ($M = .207$) than to neutral ($M = .036$) and positive words ($M = .036$). However, only L2 taboo words were significantly different from L2 neutral and positive words in the analysis by items. While the analysis by subjects suggested that more errors were made in response to all word categories in L2 than in L1, the analysis by items indicated that, overall, more errors were made only in response to negative and taboo words in L2 when compared to those word types in L1.

Language x Word Type X Level of Proficiency interaction was only significant by items but not by subjects [$F_1(1.96, 137.01) = 2.12$, $p > .05$, $MS_e = 0.009$; $F_2(3, 76) = 3.70$, $p < .05$, $MS_e = 0.004$]. This analysis showed that less proficient participants made more errors to L2 positive, negative and taboo words when compared to more proficient participants, but there were no significant differences between the two groups in their error rates to L2 neutral words or any of the L1 word categories.

The inclusion of word length, familiarity and concreteness in the analysis by items for English words showed a significant main effect of Proficiency [$F_2(1, 73) = 6.30$, $p < .05$, $MS_e = 0.006$] and interaction between Proficiency and Word Type [$F_2(3, 73) = 5.78$, $p < .01$, $MS_e = 0.006$]; less proficient bilinguals made more errors to L2 negative and taboo words when compared with more proficient bilinguals. The main effect of Word Type also remained significant [$F_2(3, 73) =$

9.77, $p < .001$, $MS_e = 0.035$]; more errors were made in response to taboo words than any other word type. The same analysis for Finnish words revealed no main effect of Proficiency [$F_2(1, 73) = 0.24$, $p > .05$, $MS_e = 0.001$], Word Type [$F_2(3, 73) = 0.86$, $p > .05$, $MS_e = 0.010$, nor interaction between Proficiency and Word Type [$F_2(3, 73) = 1.32$, $p > .05$, $MS_e = 0.001$].

In summary, the complex pattern of error rates is primarily accounted for by the tendency for less proficient participants to make more errors to negative and taboo words than more proficient participants. Both groups of bilinguals also made more errors in response to taboo words than other word types in L2.

3.2.2.2. Analysis of response latencies

The RTs according to language, word type and the level of proficiency are presented in Table 3.3. The 2 (Language) X 4 (Word Type) within-subjects ANCOVA with Proficiency as a covariate revealed a significant main effect of Proficiency [$F_1(1, 74) = 30.41$, $p < .001$, $MS_e = 27844.28$], as well as an interaction between Language and Proficiency [$F_1(1, 74) = 11.84$, $p < .01$, $MS_e = 9503.27$], Proficiency and Word Type [$F(2.31, 170.66) = 5.11$, $p < .01$, $MS_e = 4201.92$] and Proficiency, Language and Word Type [$F_1(2.66, 196.64) = 3.77$, $p < .05$, $MS_e = 3855.60$]. The main effects of Language [$F_1(1, 74) = 23.27$, $p < .001$, $MS_e = 9503.72$] and Word Type [$F_1(2.63, 170.66) = 10.91$, $p < .001$, $MS_e = 4201.92$] as well as the interaction between the two were significant [$F_1(2.66, 196.64) = 5.43$, $p < .01$, $MS_e = 3855.60$]. The impact of proficiency was therefore investigated further by entering Level of Proficiency as a categorical between-subject variable into the analysis.

Table 3.3

Mean Reaction Times to L1 (Finnish) and L2 (English) Emotional and Neutral Words in More and Less Proficient Bilinguals

Language	Word Type	RT(ms)	*SE*	Difference[1]	RT(ms)	*SE*	Difference
		More proficient[2]			Less proficient[3]		
Finnish	Neutral	593.9	13.87	-	636.7	12.41	-
	Positive	568.1	13.55	-25.8	604.8	12.12	-31.9
	Negative	561.4	14.39	-32.5	614.0	12.87	-22.7
	Taboo	610.2	15.85	16.3	687.7	14.18	51.0
English	Neutral	627.7	13.93	-	696.8	12.46	-
	Positive	609.9	14.60	-17.7	680.2	13.06	-16.6
	Negative	648.6	19.29	20.9	745.8	17.26	49.0
	Taboo	671.0	19.50	43.4	772.7	17.44	75.9

Note. [1]Difference between the RT for the word type minus the neutral condition. [2]$N = 32$, [3]$N = 40$.

The 2 (Proficiency) X 2 (Language) X 4 (Word Type) analysis of variance showed significant main effects of Level of Proficiency [$F_1(1, 70) = 21.51, p < .001, MS_e = 31028.06$; $F_2(1, 76) = 271.54, p < .001, MS_e = 1529.99$] and Language [$F_1(1, 70) = 65.33, p < .001, MS_e = 11283.81$; $F_2(1, 76) = 62.15, p < .001, MS_e = 8079.53$]. More proficient participants (M = 611.35) were faster overall when compared to less proficient participants (M = 679.86), and L1 words (M = 609.6) were responded to faster when compared to L2 words (M = 681.6).

The Language X Level of Proficiency interaction was significant only in the analysis by items but not by subjects [$F_1(1, 70) = 0.05, p > .05, MS_e = 11283.81$; $F_2(1, 76) = 19.13, p < .001, MS_e = 2139.44$]; while both more and less proficient participants were significantly slower when responding to L2 (English) than L1 (Finnish) words, this difference was more pronounced for less proficient ($M_{\text{difference}}$ = 88.1 ms) than for more proficient participants ($M_{\text{difference}}$ = 55.9 ms).

The main effect of Word Type [$F_1(2.40, 168.03) = 34.47, p < .001, MS_e = 4351.94$; $F_2(3, 76) = 8.02, p < .001, MS_e = 14258.09$] further showed that across the two groups of participants and the two languages positive valence of the word stimuli facilitated responses (M = 615.8) when compared to neutral (M = 638.8), negative (M = 642.46) and taboo words (M = 685.4). This effect, however, was significant only in the analysis by subjects. The responses to taboo words were significantly slower than those for all three other word categories in both analyses by subjects and by items. Negative words (M = 642.5) did not differ from neutral words.

The Level of Proficiency X Word Type interaction [$F_1(2.40, 168.03) = 2.95, p < .05, MS_e = 4351.94$; $F_2(3, 76) = 4.78, p < .01, MS_e = 1529.99$] indicated that participants with higher level of proficiency did not show significant differences between neutral (M = 610.8 ms) and other three word types (positive: M = 589.0 ms, negative: M = 605.0 ms, taboo: M = 640.6 ms). However, they responded with slower reaction times to taboo words when compared to positive and negative words in the analysis by subjects. The analyses by items showed a significant difference between taboo and the other three word types. Less proficient participants were faster when responding to positive words (M = 642.5 ms) when compared to neutral words (M = 666.8 ms) in the analysis by subjects. Their responses to taboo words (M = 730.2 ms) were also significantly slowed down when compared to neutral, positive and negative words (M = 679.9 ms) both in the analyses by subjects and by items. Less proficient participants were also slower in responding to negative when compared to positive words, although this difference was significant in the analysis by subjects but not by items.

The Language X Word Type interaction was significant only in the analysis by subjects but not by items [$F_1(2.69, 188.51) = 7.14$, $p < .001$, $MS_e = 4100.19$; $F_2(3, 76) = 2.52$, $p > .05$, $MS_e = 8079.53$] (see Table 3.4). The Language X Word Type X Level of Proficiency interaction was not significant [$F_1(2.69, 188.51) = 0.21$, $p > .05$, $MS_e = 4100.19$; $F_2(3, 76) = 1.35$, $p > .05$, $MS_e = 2139.44$]. The post hoc analysis showed that L1 taboo words significantly slowed down lexical decisions when compared to positive and negative words. Furthermore, L1 positive and negative words facilitated lexical decisions when compared to neutral and taboo words, but positive and negative words did not differ from each other. In L2, both negative and taboo words slowed down the responses, but positive words did not differ significantly from neutral words.

A further analysis with word length, familiarity and concreteness as covariates did not change the pattern observed in response to L1 (Finnish) words. The analysis for L1 (Finnish) words did not show significant main effect of Proficiency [$F(1, 73) = 0.14$, $p > .05$, $MS_e = 1043.21$] nor interaction between Proficiency and Word Type [$F(3, 73) = 0.50$, $p > .05$, $MS_e = 1043.21$]. The main effect of Word Type was significant [$F(3, 73) = 5.14$, $p < .01$, $MS_e = 5610.62$]; taboo words resulted in longer RTs than positive and negative words, but they did not differ from neutral words.

The analysis of L2 (English) words by items showed significant main effects of Proficiency [$F(1, 73) = 6.84$, $p < .05$, $MS_e = 2210.25$] and Word Type [$F(1, 73) = 13.15$, $p < .001$, $MS_e = 11000.96$] as well as an interaction between Proficiency and Word Type [$F(3, 73) = 7.96$, $p < .001$, $MS_e = 2210.25$]. The responses were significantly slower to taboo words than any other word type, and less proficient participants were slower overall than more proficient participants. The interaction indicated that while more proficient participants were slower in responding to taboo words when compared to neutral and positive words, less proficient participants were slower also in responding to negative words.

Table 3.4.

Mean Reaction Times to L1 (Finnish) and L2 (English) Emotionally Charged and Neutral Words in Finnish-English Bilinguals

	Finnish			English		
Word Type	RT(ms)	SE	Difference[1]	RT(ms)	SE	Difference[1]
Neutral	615.3	9.31		662.2	9.34	
Positive	586.5	9.90	-28.8^{***}	645.1	9.80	-17.1
Negative	587.7	9.65	-27.6^{**}	697.2	12.94	35.0^{*}
Taboo	649.0	10.63	33.7^{**}	721.9	13.08	59.7^{***}

Note. [1]Difference between the RT for the word type minus the neutral condition. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

In summary, positive words were associated with faster reaction times, and lower levels of errors than negative and taboo words. Such a pattern suggests that the overall facilitation by positively valenced word stimuli was not due to a speed-accuracy trade-off.

Furthermore, this trend for positive words to speed up lexical decisions was found to be significant only in L1 but not in L2. Taboo words resulted in the most consistently slower responses across the two groups of participants and the two languages. While negative words facilitated responses in L1, they were found to interfere with lexical decisions in L2. The slower responses to negative and taboo words in L2 were also associated with significantly higher error rates in response to these words, such a pattern being more pronounced in less proficient participants.

3.2.2.3. Analysis of bilinguals' knowledge of L2 words

Following the lexical decision task, all participants completed a language history questionnaire, which also asked them to identify those L2 (English) words the meaning of which they did not know or were unsure of. This made it possible to identify the categories of words that were less familiar to the participants and as a consequence were more likely to make errors and respond to more slowly. The proportion of L2 words not known by the participants were therefore analysed using a 2 X 4 mixed factorial analysis of variance with Word Type (neutral, positive, negative and taboo) as a within-subjects factor and Level of Proficiency (more and less proficient) as a between groups factor. The Greenhouse-Geisser epsilon was used to correct the degrees of freedom where the assumption of sphericity was violated. Bonferroni adjusted post hoc tests were conducted to identify the sources of differences between conditions and groups of participants.

The proportion of L2 words not known are presented in Table 3.5. The analysis revealed a main effect of Proficiency; $F(1, 70) = 54.88$, $p < .001$, $MS_e = 0.014$. The less proficient participants identified significantly more words that they did not know ($M = 15.7$ per cent) overall than did more proficient participants ($M = 5.2$ per cent). The main effect of Word Type was also significant; $F(1.65, 115.76) = 105.02$, $p < .001$, $MS_e = 0.011$. The highest proportion of words not known was in the taboo word list (M = 24.3 per cent), followed by negative words (M = 9.3 per cent). These lists were significantly different from neutral (M = 3.9 per cent) and positive words lists (M = 4.2 per cent), which did not differ from each other.

Table 3.5

Mean Percentage of L2 Emotional and Neutral Words Not Known by More and Less Proficient Participants

	More proficient		Less proficient	
Word Type	*M*(%)	*SE*	*M*(%)	*SE*
Neutral	0.5	0.01	7.4	0.01
Positive	1.7	0.01	6.6	0.01
Negative	2.0	0.02	16.6	0.01
Taboo	16.6	0.02	32.0	0.02

The interaction between Word Type and Proficiency was also significant; $F(1.65, 115.76) = 8.16$, $p < .01$, $MS_e = 0.011$. More proficient participants indicated that they did not know the meaning of larger number of taboo words when compared to all the other word types. There were no other differences between word types for more proficient participants. Less proficient participants, however, indicated not knowing significantly more negative and taboo words, when compared to neutral and positive words, taboo words also differing significantly from negative words. There was no difference between neutral and positive words. This finding replicates the pattern observed in the error rates to L2 negative and taboo words, where less proficient participants made more errors both to negative and taboo words, while more proficient participants only made more errors to L2 taboo words.

Considering that significant differences between conditions and groups of participants were found, it is possible that some of the effects observed in the reaction time data were driven by the knowledge of the word stimuli used. As a consequence responses to words that participants reported of not knowing were removed from the RT data and additional analyses of the behavioural data were conducted both by subjects and by items. The results did not reveal any important changes in the pattern found, apart from Language X Word Type interaction in the analysis by items, which now reached statistical significance; $F(3, 76) = 2.98$, $p < .05$, $MSe = 6434.82$. The Bonferroni adjusted post hoc tests for the analysis by items revealed the same pattern as observed before: In L1, RTs to taboo words ($M = 661.77$) were significantly slower than to positive ($M = 585.84$) and negative words ($M = 588.05$), but did not differ from neutral words ($M = 615.48$). In L2, taboo words ($M = 740.42$) were responded to significantly slower than neutral ($M = 658.89$) and positive words ($M = 642.97$), but there was no significant difference between taboo and negative words ($M = 702.51$).

3.2.3. Discussion

The results showed a trend for both positive and negative words to facilitate lexical decisions in L1. However, this effect was only significant in the analysis by items and therefore strong conclusions cannot be drawn from these findings. In L2, there was also a trend for positive words to facilitate lexical decisions. However, this effect was much reduced when compared to L1, and was not significant in analysis either by subjects or by items. Negative words, however, were found to produce slower rather than faster responses in L2. This effect was more pronounced in less proficient bilinguals. Taboo words were found to slow down responses in both more and less proficient bilinguals. No three-way interaction was found, however, which indicates that although less proficient speakers were substantially slower and made more errors to L2 (English) negative and taboo words, this pattern was also present in more proficient bilinguals, although to a lesser extent. The slower lexical decisions to negative and taboo words were paralleled by higher error rates and reporting of not knowing greater number of negative and taboo words. Therefore it appears that the slower responses to L2 words are best explained by bilinguals' poorer knowledge of those words.

3.3. Experiment 2

The results from Experiment 1 suggest that, in L1, positive and negative words tend to facilitate lexical decisions, while this may not be the case in L2. Although a number of lexical characteristic were controlled for, it possible that the differences observed may have been due to differences between Finnish and English words along dimensions not accounted for in the present study. As a consequence, Experiment 1 was replicated with a sample of native English speakers with some modifications in order to establish whether a similar pattern of errors and response latencies would be observed in native speakers of English in response to the English words, as was found in native Finnish speakers.

It was expected that native English speakers will show facilitation from positive words, as this has been observed systematically in a number of studies previously (e.g. Kuchinke et al., 2005). It was not clear whether negative words would speed up, slow down or not differ from neutral words, as negative words have produced inconsistent results in previous studies (e.g. Carretié et al., 2008). Taboo words were expected to slow down the responses, as in Experiment 1 such a pattern was apparent both in L1 and L2. Carretié et al.

(2008) have also suggested that only highly arousing negative stimuli will result in slower responses in a lexical decision task.

In order to simulate Experiment 1 in a monolingual context, an additional modification to the research design was introduced. While all the words in Experiment 1 were presented in upper case, in Experiment 2 half of the words were presented in mixed case format (e.g. bLiSs). This was motivated by the consideration that L2 words are likely to be orthographically less familiar to bilingual speakers when compared to L1 words. Thus, bilinguals are slower overall in processing L2 words. Such slowing down may change the way emotional content affects lexical decisions as previous research suggests that negative words with lower frequency may show facilitation of lexical decisions, but this may not be the case with high frequency negative words (Kuchinke et al., 2007).

In the monolingual context, the use of mixed case presentation will make it more difficult for the participants to read the words due to their unfamiliar orthographic form. Thus, it could be expected that native English speakers will be slower in responding to mixed case when compared to upper case words. Furthermore, it may be that such slowing down of word recognition may results in a pattern observed in Finnish-English bilinguals when responding to L2 words. Therefore the aim of Experiment 2 was to directly compare native and non-native English speakers' responses to English words, as this would help to avoid the issues of translation equivalency. Furthermore, native English speakers responses to words presented in upper and mixed case were compared in order to see whether the unfamiliarity with the orthographic form would modify the extent to which the emotional content of the word stimuli would affect lexical decisions.

3.3.1. Method

3.3.1.1. Participants

Participants were 34 native English speakers, recruited at the University of Kent, Canterbury, United Kingdom. They were given a partial course credit for their participation. They were aged 18-30 years (M = 19.1, SD = 2.17), 26 females and 8 males.

3.3.1.2. Design and materials

A 2 (Presentation Type) X 4 (Word Type) within-subjects design was used. The same set of word stimuli were used as in Experiment 1, except that Finnish words were excluded. Furthermore, half of the words were presented in a mixed case (some of the letters were in upper and some in lower case letters, e.g. bLiSs). Thus, participants completed four blocks of words (neutral, positive, negative and taboo) presented in upper case, and the other four in a mixed case format. The order of the presentation type was counterbalanced across participants. The words presented in upper case were not repeated in mixed case. The lists of words presented in upper and mixed case were also counterbalanced across participants.

3.3.1.3. Procedure

The same procedure was followed as in the Experiment 1. The participants were also told that half of the words would be presented in a mixed case format.

3.3.2. Results: Emotionality effects in native English speakers according to the presentation type

Mean RTs were used in the analysis for response latencies. Response times less than 400 ms and greater than 1600 ms were excluded from the reaction time analyses. On average, 1.9 per cent of the RTs were removed from the analyses (see Table 3.6). Furthermore, nonwords were not included in the analyses. The data was first analysed by subjects (F_1) in a within-subjects analysis of variance with Presentation Type (upper case, mixed case) and Word Type (neutral, positive and negative) as within subject factors. This was followed by analysis by items (F_2), with Presentation Type as a within-subjects factors and Word Type as a between-subjects factor. Furthermore, the impact of word length, familiarity and concreteness were assessed by including these factors as covariates in the analysis by items. The Greenhouse-Geisser epsilon was used to correct the degrees of freedom where the assumption of sphericity was violated. Bonferroni adjusted post hoc tests were conducted to establish the significant differences between experimental conditions.

3.3.2.1. Analysis of errors

The overall error rate was 6.1 per cent (see Table 3.6). The main effects of Presentation Type [$F_1(1, 33) = 5.92$, $p < .05$, $MS_e = 0.005$; $F_2(1, 76) = 1.58$, $p > .05$, $MS_e = 0.010$] and Word Type [$F_1(2.10, 69.38) = 5.20$, $p < .01$, $MS_e = 0.012$; $MS_e = 0.006$; $F_2(3, 76) = 1.50$, $p > .05$, $MS_e = 0.018$] were significant in the analysis by subjects, but not in the analysis by items. More errors were made in response to words presented in mixed case ($M = .071$) than in upper case ($M = .051$). Furthermore, more errors were made in response to neutral ($M = .062$) and taboo words ($M = .094$) when compared to positive words ($M = .031$). Negative words ($M = .059$) did not differ from the other word types in regard to the error rates. The Presentation Type X Word Type interaction was not significant [$F_1(3, 99) = 1.01$, $p > .05$, $MS_e = 0.004$; $F_2(3, 76) = 0.26$, $p > .05$, $MS_e = 0.010$]. The analysis including word length, familiarity and concreteness as covariate showed no significant main effect of Presentation Type [$F(1, 73) = 0.07$, $p > .05$, $MS_e = 0.010$], Word Type [$F(3, 73) = 1.48$, $p > .05$, $MS_e = 0.016$], nor interaction between Presentation Type and Word Type [$F(3, 73) = 0.42$, $p > .05$, $MS_e = 0.010$].

Table 3.6

Mean Percentage of Outliers and Errors for Emotional and Neutral Words According to Presentation Type in Native English Speakers

Presentation Type	Word Type	Outliers(%)*	Errors(%)
Upper Case	Neutral	4.1	4.4
	Positive	2.6	1.5
	Negative	2.4	5.6
	Taboo	1.2	9.1
Mixed Case	Neutral	1.5	7.9
	Positive	1.2	4.7
	Negative	1.8	6.2
	Taboo	0.3	9.7

3.3.2.2. Analysis of response latencies

The main effects of Presentation Type [$F_1(1, 33) = 15.26$, $p < .001$, $MS_e = 6865.84$; $F_2(1, 76) = 19.04$, $p < .001$, $MS_e = 2699.71$] and Word Type [$F_1(1.61, 53.25) = 9.39$, $p < .001$, $MS_e = 11326.60$; $F_2(3, 76) = 4.60$, $p < .01$, $MS_e = 7240.90$] were significant (see Table 3.7). The Presentation Type X Word Type interaction was not significant [$F_1(3, 99) = 0.62$, $p > .05$, $MS_e = 3271.14$; $F_2(3, 76) = 0.35$, $p > .05$, $MS_e = 2699.71$]. Overall, native English speakers were slower at responding to words presented in mixed case (M = 640.6 ms) rather than in upper case (M = 601.3 ms). Taboo words (M = 659.5 ms) resulted in longest response latencies that were significantly different from positive (M = 590.3 ms) and negative (M = 611.4 ms), but not from neutral words (M = 622.60 ms). Positive words were responded to faster overall, but this effect was significant only in the analysis by subjects but not by items. Negative words (M = 611.4 ms) did not differ from neutral words in the analysis by subjects, while none of the differences between negative and other word types reached significance in the analysis by items.

The analysis including word length, familiarity and concreteness as covariate showed no significant main effect of Presentation Type [$F(1, 73) = 0.13$, $p > .05$, $MS_e = 2758.43$], nor interaction between Presentation Type and Word Type [$F(3, 73) = 0.50$, $p > .05$, $MS_e = 2758.43$]. The main effect of Word Type [$F(3, 73) = 10.85$, $p < .001$, $MS_e = 4859.63$] showed that native English speakers responded to taboo words with significantly longer RT when compared to all the other word types.

Table 3.7

Mean Reaction Times for Emotional and Neutral Words According to Presentation Type for Native English Speakers

Presentation Type	Word Type	RT*(ms)*	*SE*	Interference/ Facilitation[1]
Upper Case	Neutral	596.9	12.66	-
	Positive	577.6	11.93	-19.3
	Negative	591.8	14.43	-5.1
	Taboo	639.0	20.48	42.1
Mixed Case	Neutral	648.3	20.12	-
	Positive	603.0	15.81	-45.4
	Negative	631.0	13.70	-17.3
	Taboo	680.0	23.23	31.7

Note. $N = 34$. [1]Interference/facilitation was calculated as the difference between the RT for the word type minus the neutral condition.

3.3.3. Results: Comparisons between native and non-native English speakers

In order to directly compare native and non-native English speakers' responses to English words, the data was first analysed by subjects (F_1) in a 2 X 4 mixed analyses of variance with Word Type (neutral, positive, negative and taboo) as a within-subjects factor and Language Background (native, non-native) as a between groups factor. This was followed by analysis by items (F_2) with Language Background as a within-subjects factor and Word Type as a between-subjects factor. Mean RTs were used in the analysis for response latencies. Response times shorter than 400 ms and longer than 1600 ms were treated as outliers and thus excluded from the analyses. On average, 1.6 per cent of RTs were removed from the analyses (see Table 3.8). The Greenhouse-Geisser epsilon was used to correct the degrees of freedom where the assumption of sphericity was violated. Bonferroni adjusted post hoc tests were conducted to establish the significant differences between experimental conditions. Only the responses to upper case words in native English speakers were analysed.

Table 3.8

Mean Percentage of Outliers and Errors for Emotional and Neutral Words in Native and Non-native English Speakers

Language Background	Word Type	Outliers(%)	Errors(%)
Native[1]	Neutral	4.1	4.4
	Positive	2.6	1.5
	Negative	2.5	5.6
	Taboo	1.2	9.1
Non-native[2]	Neutral	1.0	3.8
	Positive	0.6	3.9
	Negative	0.7	11.5
	Taboo	0.6	21.4

Note. [1]$N = 34$, [2]$N = 72$.

3.3.3.1. Analysis of errors

The overall error rate was 7.6 per cent. The main effect of Language Background was significant [$F_1(1, 104) = 13.81$, $p < .001$, $MS_e = 0.017$; $F_2(1, 76) = 18.45$, $p < .001$, $MS_e = 0.005$] (see Table 3.8). Non-native speakers ($M = .101$) made more errors than was the case with native speakers ($M = .051$).

The main effect of Word Type was also significant [$F_1(2.03, 211.22) = 35.19$, $p < .001$, $MS_e = 0.012$; $F_2(3, 76) = 5.56$, $p < .01$, $MS_e = 0.023$]. Overall, the analysis by subjects showed that more errors were made in response to negative ($M = .086$) and taboo words ($M = .153$) when compared to neutral ($M = .041$) and positive words ($M = .027$). In the analysis by items, only taboo words produced more errors when compared to neutral and positive words.

The Word Type X Language Background interaction was significant both in the analysis by subjects and by items [$F_1(2.03, 211.22) = 8.47$, $p < .001$, $MS_e = 0.012$; $F_2(3, 76) = 5.81$, $p < .01$, $MS_e = 0.005$]. The post hoc tests showed that non-native speakers made significantly more errors to negative and taboo words when compared to native speakers. Furthermore, non-native speakers made significantly more errors to taboo words when compared to neutral and positive words, but neutral and positive words did not differ from each other. The analysis by subjects also showed a trend for non-native speakers to make more errors to taboo than negative words and more errors in response to negative when compared to neutral and positive words. Native speakers were also found to produce fewer errors to positive words when compared to taboo words, but this was only significant in the analyses by subjects.

3.3.3.2. Analysis of response latencies

The mean RTs are presented in Table 3.9. The analysis showed an overall main effect of Language Background [$F_1(1, 104) = 25.45$, $p < .001$, $MS_e = 26212.61$; $F_2(1, 76) = 153.37$,

$p < .001$, $MS_e = 1925.35$]. Native speakers ($M = 601.3$) were significantly faster than non-native speakers ($M = 686.3$) in responding to the English words.

Table 3.9

Mean Reaction Times for Emotional and Neutral Words in Native and Non-native English Speakers

Language Background	Word Type	RT(ms)	*SE*	Interference/ Facilitation[1]
Non-native[2]	Neutral	666.1	9.67	-
	Positive	649.0	9.84	-17.1
	Negative	702.6	12.84	36.5***
	Taboo	727.5	14.18	61.4***
Native[3]	Neutral	596.9	14.06	-
	Positive	577.6	14.32	-19.3
	Negative	591.8	18.69	-5.1
	Taboo	639.0	20.64	42.1

Note. [1]Interference/facilitation was calculated as the difference between the RT for the word type minus the neutral condition. [2]$N = 34$, [3]$N = 72$, $^{***}p < .001$.

The main effect of Word Type was also significant [$F_1(2.56, 265.85) = 17.70$, $p < .001$, $MS_e = 5415.15$; $F_2(3, 76) = 4.40$, $p < .01$, $MS_e = 9146.11$]. Overall, participants showed slower response latencies to taboo words ($M = 683.3$ ms) than neutral words ($M = 631.5$ ms). This effect was significant only in the analysis by subjects, although the analysis by items showed a similar trend (p = .071). Positive (M = 612.2 ms) and negative words (M = 644.0 ms) did not differ significantly from neutral words. The differences among positive, negative and taboo words were significant in the analysis by subjects, in that positive words were responded to faster than negative words, which also produced faster responses than taboo words. In the analysis by items, only the difference between taboo and positive words was significant. This pattern of findings was also replicated when only the words non-native speakers knew were included in the analysis for this group of participants.

When word length, familiarity and concreteness were included as covariates in the analysis by items, the main effect of Language Background did not reach statistical significance [$F(1, 73) = 3.31$, $p > .05$, $MS_e = 1871.25$]. The main effect of Word Type [$F(3, 73) = 12.01$, $p < .001$, $MS_e = 6430.08$] and the interaction between Word Type and Language Background [$F(3, 73) = 3.23$, $p < .05$, $MS_e = 1871.25$] were significant. The Bonferroni corrected post hoc tests showed that taboo words produced slower RTs than all the other word types. This slowing effect was observed for both native and non-native speakers. Although not statistically significant, non-native speakers showed a trend also for negative words to produce slower RTs than neutral and positive words (p = .105 and p = .117, respectively). Such trend was not present for native English speakers.

The Language Background X Word Type interaction was only significant by items but not by subjects [$F_1(2.56, 265.85) = 1.86$, $p > .05$, $MS_e = 5415.15$; $F_2(3, 76) = 3.23$, $p < .05$, $MS_e = 1925.35$]. Native English speakers' responses to taboo words were significantly slower than those to positive words, while non-native speakers RTs to taboo words were significantly longer when compared to neutral and positive words.

In summary, native speakers were found to be faster and make fewer errors than non-native speakers. Although there was a trend for non-native speakers to respond slower to negative when compared to neutral words, with no difference in native speakers, this effect did not come out significant in the overall analysis of variance. Both native and non-native speakers were found to respond faster to positive words when compared to taboo words. Surprisingly, positive words were not found to differ significantly from neutral words although there was a trend for positive words to facilitate responses.

3.4. General Discussion

3.4.1. Lexical decisions to taboo words in monolingual English speakers and Finnish-English bilinguals

The most robust finding of the present study is the systematic slowing down in response to taboo words both in Finnish-English bilinguals' responses to L1 and L2, in less and more proficient bilinguals, as well as native English speakers' responses to English words. This effect remained significant even when word length, familiarity and concreteness were controlled for, and was observed across different presentation types in native English speakers. This result concurs with the findings of Carretié et al. (2008), who found that highly emotionally arousing words (i.e. insults) slow down lexical decisions. This effect can be interpreted as a learnt fear-response as taboo words are often encountered in highly negative emotional situations, and therefore strong association between these words and a fear-response is established. Taboo words are likely to be recognised faster than neutral words as emotionally valenced words have been found to be processed faster than neutral words (e.g., Kousta et al., 2009). However, this will not lead to faster reaction times to taboo words as the highly negative content may also capture and hold attention. As the attentional resources are diverted away from the task at hand (i.e. deciding over the legality of the lexical form), the responses are in fact slower for taboo than neutral words (Carretié et al., 2008).

The language history questionnaire revealed that the Finnish-English bilinguals were less likely to know taboo words than the words from the other three categories in L2. This is likely to account for the high error rates observed to these words in L2. However, slower lexical decisions to taboo words were found even when RTs to words that were not known were excluded from the analysis. Thus, it would appear that highly emotional content is accessed fast and automatically also in L2. This finding replicates what has been found previously in a taboo Stroop study where bilingual speakers were found to slow down in the colour-identification task as much in L1 as in L2 (Eilola et al., 2007).

The slowing effect for taboo words contrasts with the previous study by MacKay et al. (2004), who did not observe differences between neutral and taboo words in a lexical decision context. However, in their study a relatively small number of taboo words were used (12 taboo words were included in the analysis) and they were mixed randomly with the neutral words. In the present study a somewhat larger number of taboo words (20 items) were used and the words from different categories were presented in separate blocks. The latter research design has been found to result in stronger inhibition effects in emotional and taboo Stroop tasks. This is due to the fact that the negative content in a single word has a "carry-over effect", i.e. the threat inherent in negative and taboo words has a greater impact on the words following them than they have on the response latency of the items themselves (McKenna & Sharma, 2004). Thus, it may be that in the present study, some of the slowing effect observed was found due to the difference in research design that may be more sensitive in detecting slowing effects to threatening linguistic stimuli.

3.4.2. Positive valence of words may facilitate L1 but not L2 word recognition

The key aim of the present study was to establish whether bilingual speakers may process emotional words differently in their first and second language as measured in facilitation and/ or inhibition by emotionally charged words when compared to neutral words. The results suggest that there may be some differences, although the evidence from the present study is not conclusive. The Finnish-English bilinguals showed facilitation from positive words in their first language, but this effect was not significant in their second language. However, the facilitation effect in L1 was only found in the analysis by subjects but not by items. Furthermore, a similar trend for positive words to facilitate lexical decisions was found in native English speakers. Yet, this effect was not statistically significant either in the analysis by subjects or by items. Thus, it would appear that the present study may have been lacking in statistical power due to smaller number of stimuli per condition than has been used in studies that have found a significant effect of positive valence (e.g., Kuchinke et al., 2005). In future studies a larger set of word stimuli ought to be used in order to increase statistical power and consequently increase the likelihood that genuine emotionality effects will be found.

The fact that this effect has been consistently found in previous studies lends support for the interpretation that the finding was not driven by other lexical factors. Such facilitation of visual word recognition can be explained in the context of the model of motivated attention and affective states (Lang et al., 1990, 1997), which suggests that the processing of both positive and negative stimuli are allocated additional attentional resources when compared to neutral stimuli due to their biological salience. The process component model (Scherer, 2009) would further suggest that this effect is based on the first appraisal check, that of intrinsic pleasantness, which in part contributes to the experience of a stimulus as emotional. The intrinsic pleasantness appraisal is assumed to be fast and automatic, and to occur within the first few hundred milliseconds after the stimulus presentation (Scherer, 2009). Thus, the emotional meanings of words are activated rapidly, resulting in an increased allocation of attentional resources to the stimuli and hence faster word recognition.

Importantly, the activation of emotional meaning of the words may be faster in L1 than L2, as suggested by BIA+ (Dijkstra & Van Heuven, 2002), leading to a greater facilitation of lexical decisions in L1 than L2 as observed here.

3.4.3. Lexical decisions to negative words in Finnish-English bilinguals

Negative words were also found to produce a different pattern in bilingual speakers' L1 and L2. In L1 they facilitated lexical decisions, but inhibited the responses in L2. Specifically, the less proficient participants were found to be slower in recognising L2 negative words as lexically legal, while more proficient bilinguals' responses to L2 negative words did not differ from neutral words. The facilitation from negative valence concurs with findings from a previous study where negative words were found to facilitate visual word recognition when a wide range of lexical factors were controlled for (Kousta et al., 2009). Thus, although this effect in the present study was not significant in the analysis by items, it is in line with what has been reported by other researchers.

The finding that response latencies tended to be slower rather than faster in L2 are likely to accounted for by the bilinguals' lack of knowledge of those words. The results from the language history questionnaire supports this view as Finnish-English bilinguals, and especially those with a lower level of proficiency, knew fewer of the negative than positive and neutral words in L2. These findings highlight an important factor in contributing to the bilinguals' often perceived emotional distance from their second language: It is possible that in a formal educational setting the topics discussed tend to be neutral or positive in their emotional valence, while topics with more negative emotional content are mostly avoided. This may result in a bias towards knowing wider vocabulary and having better integrated semantic associations to neutral and positive words in L2 when compared to negative vocabulary in that language. While on the basis of the present study it is not possible to draw strong conclusions, this question would warrant further investigation. This interpretation is supported by research that has shown people to be generally biased towards processing positive information in that positive material is likely to be more elaborated and better interconnected in the cognitive system than is the case with negative material (e.g., Isen, 1985; Ashby, Isen & Turken, 1999).

The lack of facilitation from negative valence in native English speakers to negative words is surprising as it could have been expected that similar facilitation that was observed in Finnish-English bilinguals to L1 negative words would have been found also for native English speakers. This lack of facilitation from negative English words was also found in more proficient Finnish-English bilinguals. Previous studies have reported such findings for high frequency negative words (Kuchinke et al., 2007; Scott et al., 2009). Thus, the facilitation from negative words is not always observed and in this regard the present findings are in line with some previous findings. Carretié et al.'s (2008) have explained this through two mechanisms that are involved when negative words are processed: Negative words are recognised faster due to the processing advantage for all emotional stimuli, yet the negative content also interferes with the task at hand as attentional resources are diverted away from the lexical decision process due to the threat implied by the negative words. As a consequence negative words may not show the same level of processing advantage as positive words do. It is not clear, however, why the facilitation was found for Finnish but not English words despite a number of lexical characteristics were controlled for (i.e. word length, familiarity and concreteness). It may be that the lack of statistical power in the present study may account for such discrepant findings, as discussed above.

3.4.4. The impact of proficiency on the emotionality effects

The present study also set out to investigate the impact of proficiency in L2 on the processing of emotional words. Previous studies such as that of Harris (2004) have shown that bilinguals with a higher level of proficiency and earlier onset of second language acquisition show more limited differences between L1 and L2 in the emotional arousal they elicit. As a consequence the present study directly compared bilinguals who were either less or more proficient in their second language. The lexical decision performance demonstrated that the less proficient participants were slower and less accurate in L2 especially in response to negative and taboo words than was the case with more proficient participants.

The direct comparison between native speakers and non-native speakers of English further supported this finding: Non-native speakers were generally slower and less accurate than native speakers. This was primarily due to poorer performance in response to negative and taboo stimuli. Thus, the lower level of proficiency is reflected especially in the lack of knowledge of negative and taboo words, but does not appear to result in the lack of emotional engagement altogether with the stimuli. Indeed, it seems that an extremely negative content of words is salient also in L2. This finding is in keeping with the research arguing for a language non-selective access in bilingual memory, i.e. words from both L1 and L2 are stored in one lexicon rather than two separate lexicons (e.g. Dijkstra & Van Heuven, 2002) and that L2 words can form strong connections to the word semantics early on (e.g. Duyck & Brysbaert, 2008). Furthermore, this also argues against the Revised Hierarchical Model (Kroll & Stewart, 1994), which suggests that L2 words are substantially less capable of activating the semantic representations of L1 words. The findings from the present study would indicate that the negative valence, once associated with the word form, can be activated rapidly and influence L2 word processing.

3.4.5. The impact of orthography on lexical decision in English monolinguals

The role of orthographic familiarity in contributing to the findings in non-native speakers was also examined in the present study. The responses in native English speakers to mixed case words showed that even though there was a trend for positive and negative words to facilitate lexical decisions more in the mixed case condition, this effect was not statistically significant. Native English speakers' responses were slowed down overall due to the need to use the grapheme-phoneme conversion system (GPC; Coltheart et al., 2001) for the word recognition. Yet, the extreme emotional content of taboo words had a similar impact on the word processing irrespective of the presentation type. Thus, the differences between L1 and L2 could not be accounted for by the possibility that bilinguals' are less familiar with L2 word forms. It is more likely that Finnish-English bilinguals had not established form-to-meaning mappings for the emotional words in L2, and this primarily produced the observed differences between L1 and L2.

3.4.6. Summary of the findings

In conclusion, the present findings suggest that an extreme negative (i.e. offensive) content is accessed early and rapidly in bilinguals' second language. Yet, positive valence showed a reduced influence on visual word recognition in L2 when compared to L1. This suggests that positive linguistic material may be less integrated in the cognitive system in bilinguals who have started learning L2 after the early childhood and have relatively limited experience of immersion in L2. Such lack of integration of positive content could be explained by the greater salience of extremely negative when compared to positive material for an individual. This interpretation draws from research on fear-learning, which suggests that humans have a biological preparedness for forming associations between neutral stimuli and a fear-response when the two events occur in temporal proximity (e.g., Öhman, 2009).

Thus, bilinguals may acquire the extreme negative content of words early on in L2 learning, while the positive valence of words may be associated with L2 words more gradually. The bilinguals' slower and less accurate responses to L2 negative and taboo words may be due to their limited knowledge of negative vocabulary. Thus, a bias towards positive and away from negative vocabulary in formal educational setting may also contribute to the limited perceived lack of emotional impact in the second language. In order to establish whether this indeed is the case, further studies with less proficient bilinguals ought to be conducted.

3.4.7. Limitations of the present study

The main limitation of the present study was the number of items participants responded to. The studies that have found significant facilitation effects from positive and negative words in a monolingual setting have used twice as many word stimuli. As a consequence some of the effects that were observed were significant only in the analysis by subjects. The reason for the limited number of items used was due to the need to match the words across four categories of words, including taboo words, and across two languages. This posed some serious constraints, considering that the normative ratings available at the moment include only 210 words overall. Larger normative databases are now available for German words (BAWL-R; Võ et al., 2009), and as a consequence the study reported in Chapter 4 investigated German-English bilinguals using a larger set of word stimuli. Furthermore, taboo words were excluded from the follow-up study, as they can be difficult to match with other word categories due to their low word form frequency but high familiarity. Taboo words also tend to be short, which makes it more difficult to match these words with the other word types. Furthermore, it is challenging to match taboo words across languages, as they tend to be culture specific and thus share a smaller number of semantic features (Jay, 2000). It is also possible that the highly offensive nature of taboo words may limit the extent emotionality effects will be observed in response to the other emotionally charged words.

The present study focused solely on the behavioural effects of emotional content in bilingual word recognition. However, it is possible that differences between L1 and L2 will be observed in psychophysiological measures even in the absence of behavioural differences. This is also supported by research that has found indications of differential processing for negative when compared to neutral words in the absence of behavioural effects (Carretié et al., 2008). Considering that Carretié et al.'s (2008) research suggested two different mechanisms affecting negative word processing, response latencies may not always differ from neutral words for this set of stimuli. Therefore in the follow-up study the lexical decision task was complemented with the event-related potential recording, as this provides a measure of the time course of word processing and an index for the semantic access.

The extent to which Finnish-English bilinguals knew the L2 words stimuli was found to provide important additional information about the reasons why the pattern of errors and response latencies were observed. This suggests that all studies looking at the differences between L1 and L2 word processing ought to collect information also about participants' knowledge of the word stimuli. The limitation of the method of assessment used here, however, was that it did not consider the degree to which the words were familiar to the participants. Therefore in the study reported in Chapter 4 participants were asked to rate their familiarity with the word stimuli on a seven-point scale. Furthermore, familiarity ratings were also given for L1 words to enable direct comparison of familiarity between the word stimuli in each language.

Chapter 4. German-English Bilinguals' ERP Responses to Emotional Words in a Lexical Decision Task

4.1. Introduction

The aim of the study reported in the present chapter was to continue the investigation of emotional word processing in L1 and L2 using the lexical decision task combined with event related brain potential recording (ERPs). Twenty German-English bilinguals were presented with neutral, positive and negative words in L1 (German) and L2 (English). Faster RTs were found in response to L1 words when compared to L2 words. In L2, positive valence was found to facilitate word processing while negatively valenced words produced equivalent RTs to neutral words. Surprisingly, no facilitation or interference from emotional words were observed in L1. Analysis of event-related potentials revealed in general more positive-going wave for L2 when compared to L1, indicating increased effort in making lexical decisions in the second language. Furthermore, a reduced N400 for emotional words relative to neutral words was found in L2 but not in L1. This N400 result suggests that while establishing the lexicality of L2 words is more effortful and time consuming than doing the same in L1, the affective valence for L2 words can facilitate this process. The present findings provide further support to the view that, at least in proficient late bilinguals immersed in L2 environment, emotional content of words is accessed rapidly and can influence the speed at which bilinguals respond to those words.

4.1.1. Emotional word recognition research applying ERP recording

Studies applying event-related potential (ERP) recording to the investigation of emotional word recognition in monolinguals has demonstrated that the emotional content of words can modulate several different stages of visual word processing (e.g. Kissler et al., 2005). This approach has the advantage of providing a measure of real-time brain activity at the level of milliseconds (Luck, 2005). Furthermore, ERPs enable the investigation of the emotionality effects even in the absence of behavioural effects (Luck, 2005). This is important, because behavioural indices, such as the lexical decision speed, are composite measures of several stages underlying word recognition and decision making processes. Therefore it can be difficult to establish on the basis of response latencies, which stages of processing were influenced by the emotional content of words. This is especially problematic in situations were behavioural measures do not indicate a difference between an emotional and neutral condition as is sometimes the case with negative words (Carretié et al., 2008). In the context of emotional word recognition in bilinguals' two languages, several studies have failed to detect differences between L1 and L2 in response latencies (e.g. Eilola et al., 2007; Sutton et al., 2007). This may be due to the lack of such differences, or because of the limitations of such measures in detecting subtle emotionality effects. The ERP technique has the potential of tapping into subprocesses involved in emotional word recognition, and can therefore be useful in providing further understanding of the way emotional content is processed in L1 and L2.

As highlighted in Chapter 1, the current models of visual word recognition do not provide a sufficient framework within which to explain emotional word processing. As a consequence it was suggested that emotion research, largely conducted with non-linguistic stimuli, can be useful in helping to understand the effects of emotional content of word recognition. The dimensional approach has suggested that the positive and negative emotional content of words is associated with the affective systems of approach and withdrawal (Davidson & Irwin, 1999), and that the emotional valence rather than emotional arousal seems to be the most important predictor of behavioural effects in emotional word recognition (Kousta et al., 2009). Such view concurs with the component process model of emotion, which assumes that the initial appraisal of the event's intrinsic pleasantness occurs early on (i.e. within 100-200 ms) after stimulus presentation (Scherer, 2009). This appraisal has been suggested to occur fast, automatically and largely at a non-conscious level. While such early appraisal of the stimulus contributes to the experience of a word as emotional, the further appraisals that occur at an increasingly conscious level play also an important part together with other components of the emotion system (e.g. autonomic arousal and action tendencies) (Scherer, 2009). Thus, the early modulations of ERPs (< 300 ms) that has been observed probably relate to the fast and automatic aspects of emotional word processing, while the late effects (> 300 ms) are likely to reflect more conscious processing of emotional content (Kissler, Assadollahi & Herbert, 2005).

The findings reported in Chapter 3 suggest that an extremely negative content influences visual word recognition to the same degree in L1 and L2, but somewhat less negative content and positive content may have weaker influence on L2 word recognition than is the case with L1 words. This reduced influence of emotional content may be due to the lower baseline activation level for L2 words, which may result in slower activation of word semantics in L2 than L1. As no studies comparing ERPs for bilinguals' L1 and L2 in the context of emotional word recognition has been reported to date, the present investigation is exploratory in nature. It is possible that differences between L1 and L2 may occur at different stages of word recognition, from the initial categorisation of words as emotional around 150 ms (Ortigue et al., 2004), semantic access around 250 ms (Kissler, Herbert, Peyk & Junghofer, 2007), to the semantic integration around 400 ms, and further elaboration around 500 ms after the word presentation (Kanske & Kotz, 2007).

In the following, findings from the ERP studies directly relevant for the present chapter are outlined. These studies have addressed the issues of whether emotional content modulates ERPs early on or late during the word recognition, the effects of tasks used in the experiments, and the role of concreteness, grammatical class, word form frequency and arousal on emotionality effects observed in ERPs.

4.1.2. Early effects of the emotional content on visual word recognition

One study that revealed very early effects of emotionality on word processing was conducted by Ortigue et al. (2004). They studied native French speakers' responses to eight emotional and eight neutral nouns and 96 nonwords. Emotional words included both positive and negative words, and they were matched with neutral words for frequency. As each word was presented three times, 24 word-nonwords pairs and 24 nonword-nonword pairs were used in the study overall. Each pair was presented very rapidly with presentation duration of 13 milliseconds. The words and nonwords were presented to the right and left hemifield. The participants carried out lexical decisions indicating whether a word was present by pressing a key according to the side of the visual field they believed the word had appeared in.

The behavioural results revealed a higher rate of accuracy for emotional words and words that were presented to the right visual field, when compared to neutral words and words presented to the left visual field (Ortigue et al., 2004). A greater emotionality advantage was found for emotional words presented to the left visual field. Response latencies also demonstrated a processing advantage for emotional over neutral words, with emotional words being responded to faster irrespective of the hemifield. The analysis of ERPs for the first 250 ms post-stimulus period revealed a significant difference between emotional and neutral words at the 100-140 ms time window, which largely corresponds to the N1-P1 complex. The source of this activation difference was estimated to be localised at the right-hemispheric extra-striate cortex. Evidence such as this is intriguing, as it suggests that emotional content in word stimuli is processed pre-consciously, as conscious processing of word meaning has been associated with P3 (i.e. the third positive going wave after stimulus presentation) and N400 (i.e. negative-going wave around 400 ms after stimulus presentation) components (Halgren & Marinkovic, 1995). Furthermore, the semantic access is considered to occur around 250 ms, while the structural processing of words is believed to take place around 150 ms after word presentation (e.g., Kissler et al., 2007). Thus, the emotionality effects occurring early on in the word processing may reflect the categorisation of the stimuli as emotional even before other word meanings have been accessed.

4.1.3. Emotionality effects during the later stages of visual word processing

Evidence for emotionality-related allocation for cognitive resources at the later stages of processing has been also shown in several studies, including that of Herbert, Kissler, Junghöfer, Peyk and Rockstroh (2006). They asked native German speakers to carry out covert evaluation of emotional significance of 60 highly arousing pleasant and 60 highly arousing unpleasant adjectives as well as 120 neutral adjectives. Participants were also instructed to memorise the words for a memory test. The words were presented for 5 seconds while ERPs were recorded. They found larger P2 and P3 for emotional words when compared to neutral words. A larger LPC (i.e. late positive complex, usually measured from 500 ms onwards after stimulus presentation; also referred to as late positive potential, LPP) was also found for positive words, but negative words were not found to differ from neutral words.

The authors concluded that both pleasant and unpleasant adjectives received more attention than neutral words during the earlier stages of word recognition, but only pleasant adjectives were elaborated further at the later stage of processing (Herbert et al., 2006). Furthermore, they interpreted the findings in the context of processing asymmetry theory for positive and negative stimuli (Cacioppo, 2004). This theory suggests that at lower levels of arousal, a processing bias towards positive stimuli is detected (i.e. "positivity off-set"). At higher levels of arousal, however, negative words receive greater processing advantage over positive stimuli (i.e. "negativity bias") (Cacioppo, 2004). Such tendency is based on the two motivational systems directing approach and withdrawal behaviour (outlined in Chapter 1) (Davidson & Irwin, 1999). The pleasant and unpleasant word stimuli used in Herbert et al.'s study were rated as highly arousing, and matched along this dimension across the two categories. However, the authors suggest that word stimuli are likely to be less emotionally arousing than pictorial stimuli, and as a consequence positivity off-set rather than negativity bias was observed in this study. They also highlight the impact of the stage of processing on the observed effects. It appears that at early stages of stimulus registration the processing is influenced more by the level of emotional arousal rather than valence of the stimuli, while at the later stages of processing there may be an advantage for positively valenced stimuli over negative and neutral ones (Herbert et al., 2006).

4.1.4. Task effects in ERP studies investigating emotional word processing

The task used has also been found to influence the processing stage at which emotionality-related modifications of ERPs are observed. Fischler and Bradley (2006) used pleasant and unpleasant low and high arousal words as well as neutral words (30 in each category) that were matched according to their length, frequency and imagery ratings. Seven different experimental tasks were used. Participants were asked to evaluate the pleasantness (pleasant, unpleasant or neutral) and emotionality (emotional vs. unemotional) of the words, read them silently, carry out semantic categorisation (tools, articles of clothing or neither) or a lexical decision task (response was given only to nonwords). Furthermore, evaluation of the coherence of adjective-noun phrases (coherent vs. incoherent) and short sentences were carried out. In the semantic categorisation task, 30 words representing tools and 30 representing articles of clothing were presented together with the critical items. In the noun-phrase and sentence comprehensions tasks emotional words were combined with another words or a short sentence. In the first five tasks words were presented centrally for 175 milliseconds, while the presentation duration in the last two tasks was 250 ms.

The results showed that the task influenced the point at which ERPs for emotional and neutral words were seen to diverge. In the pleasantness evaluation task, Fischler and Bradley (2006) observed relatively late diverging effects at around 450 milliseconds. In contrast, when emotionality (emotional, unemotional) ratings were given, diverging ERP effects between emotional and neutral words were observed earlier at 300 ms and continuing in the N400 region and late positive potential (450-650 ms time window). For silent reading tasks significant difference between emotional and neutral words was found in the LPP component, both positive and negative words producing greater positivity than neutral words. The semantic categorisation task was found to produce larger LPP only for negative words when compared to neutral words. When a lexical decision task was employed, where responses only to nonwords were given, no significant differences between emotional and neutral words were found. The phrase-comprehension task revealed significant emotionality effects both at the 350-450 ms time window, at LPP (450-600 ms) as well as at the slow wave window (600-750 ms). Finally, the sentence comprehension task revealed significant emotionality effects at 350-450 ms time window when ERPs to the first word of the sentence was analysed, and at 450-650 ms window when ERPs to the second word of the sentence was examined.

These experiments show that emotionality effects can be systematically observed across different experimental settings in the later ERP components (300 ms after stimulus presentation). However, both attention to word meaning and the kind of tasks used were found to modify the electrophysiological responses observed with emotionally charged words. Tasks that involved deeper semantic processing produced significant ERP modulations, while in the lexical decision task no emotionality effects were found. Furthermore, the timing of the ERP effects was influenced by the experimental task used: Differences between emotional and neutral words were found to occur earlier when participants were asked to consider the emotionality of the word stimuli when compared to tasks that involved other kind of semantic analysis. In order to focus on ERP findings that are most likely to predict the kind of ERP effects that will be observed in the present study, studies that have used similar research design are considered next.

4.1.5. The impact of concreteness on the emotionality effects

As discussed in Chapter 3, Kanske and Kotz (2007) conducted two experiments in order to study early and late effects of emotionality and concreteness on visual word recognition. In Experiment 1, German native speakers made lexical decisions to neutral, positive and negative words, as well as nonwords by responding to both words and nonwords, while in Experiment 2 the participants were only asked to respond to the nonwords (i.e. a go/no-go task). Words of a particular valence consisted of words of lower and higher levels of concreteness and were mixed with one of the two lists of neutral words. The set of stimuli consisted of German words and were presented either to the left of right hemifield for 200 milliseconds.

Behavioural results from Experiment 1 showed faster reaction times for both positive and negative words when compared with neutral words. Positive words were also responded to faster than negative words. Concrete words were found to facilitate responses when compared to abstract words, and words presented in the right hemifield resulted in faster responses than words presented to the left hemifield. Emotionality and concreteness were also found to interact in that the difference between positive and negative words was only significant for concrete but not for abstract words (Kanske & Kotz, 2007). These results demonstrate that emotional content of single words can facilitate lexical processing as observed in faster reaction times to positive and negative when compared to neutral words. However, these effects are more likely to be observed for concrete than abstract emotionally charged words. The findings concur with the results reported in Chapter 3. Furthermore, other studies have also found a facilitation effect for both positive and negative words, although some of the studies have found the facilitating effect from negative content only for low frequency words (Kuchinke et al., 2005; Scott et al., 2009).

The electrophysiological data from Experiment 1 showed emotionality effects in all three ERP components examined; P2 (210-300 ms), N400 (390-590 ms), and late positive complex (LPC; 590-750 ms). Larger P2 amplitude was associated with positive when compared to neutral words, but no difference between negative and neutral words was observed. P2 was also found to be larger for the words presented in the right hemifield. N400 was found to be larger for neutral when compared to positive and negative words, and for concrete words when compared to abstract words. Emotionality, concreteness and region also interacted in this time window; concreteness and emotionality effects were found to be stronger on anterior sites than posterior electrode locations. Emotionality also interacted with hemifield in that the effects were found to be stronger for words presented in the right hemifield when compared to those presented in the left hemifield.

Kanske and Kotz (2007) found a larger LPC for positive and negative than neutral words. The main effect of concreteness was also found, showing larger LPC amplitudes for abstract than concrete words. Furthermore, concreteness interacted with region, the effect of concreteness being larger on the anterior and right hemispheric areas than posterior and left hemispheric sites. These results only partly concur with those of Herbert et al. (2006), as in their study both positive and negative words were found to produce larger P2, but only positive words resulted in increased LPC. However, this difference in findings is likely to be due to the different tasks used.

In Experiment 2, Kanske and Kotz (2007) found no emotionality or concreteness effects on the P2 component. N400 was found to be larger for concrete than abstract words. The emotionality effect did not reach significance, but emotionality interacted with concreteness in that LPC was larger for concrete negative than concrete neutral words. Concrete positive words did not differ from concrete neutral words. Emotionality effect was not found for abstract words. These results demonstrate that emotionality effects are found when a choice-lexical decision task is used (Experiment 1), but these effects can be reduced or even eliminated when participants are required to respond only to non-words (Experiment 2). This would help to explain why Fischler and Bradley (2005) failed to find emotionality effects when lexical decision task was employed, as they only used a go/no-go design.

This study also showed that emotionality effects can be found in the N400 component. Such finding is in agreement with the results from Fischler and Bradley's (2005) study where modulations to ERPs were most consistently observed from around 400 ms after stimulus presentation onwards. Kanske and Kotz (2007) explained the reduction of N400 for positive and negative words to be an indication of facilitated processing of these two word categories when compared to neutral words. This is consistent with the behavioural results of faster reaction times to emotional when compared to neutral words, as well as past research that has found smaller N400 amplitudes for words higher in lexical frequency (Van Petten & Kutas, 1990). They also suggested that larger N400 for concrete words demonstrated differences in the activation of semantic networks, concrete words activating more semantic context and thus eliciting larger N400. However, their interpretation is somewhat in contrast with the finding that concrete words are processed more efficiently, as larger N400 was also considered to indicate more effortful processing of the stimuli.

4.1.6. The impact of grammatical category on the emotionality effects

Schacht and Sommer's (2009) have reported an ERP study examining the time course of visual processing of emotionally charged and neutral verbs in a choice lexical decisions task (Experiment 1). Native German speakers were presented neutral, positive and negative words as well as nonwords. The letter-string was presented at the centre of the screen until the response was given. Participants were asked to respond both to words and nonwords. Schacht and Sommer carried out the segmentation of ERP amplitudes according to visual inspection of measures of global field power (GFP; the overall ERP activity across the scalp at any given moment) and global map dissimilarity (GMD; the dissimilarity between scalp topographies of adjacent time points and the relatively stable topographies indicating continued processing within similar brain areas). The transition times were used to establish nine time windows from 0 to 954 ms, which were then analysed.

Behavioural data showed faster reaction times both to positive and negative when compared to neutral words. The effect of emotionality on ERPs was found in the 368-488 ms time window; both positive and negative words produced greater negativities than neutral words at parieto-occipital electrode sites. Schacht and Sommer (2009)'s findings suggest that emotional arousal of the stimuli in a lexical decision task context influence word processing after lexical access has taken place. They also suggest that the relatively late onset of the observed emotionality effect may be due to the category of words used; Schacht and Sommer used verbs in their study while most previous studies have involved nouns or adjectives. They propose that processing of verbs may differ from that of nouns and adjectives because of their syntactic and semantic differences, including earlier age of acquisition and greater ease of memorising nouns than verbs. Consequently, nouns, due to their greater familiarity, may result in faster lexical access and consequently earlier emotion-related resource allocation than is the case with verbs.

4.1.7. Word form frequency influences the early stages of emotional word processing

Scott, O'Donnell, Leuthold and Sereno (2009) have studied the role of word frequency on the processing of emotionally charged and neutral words. Native English speakers carried out lexical decisions to six categories of words that varied in their valence (neutral, positive and negative) and frequency (high and low) while ERPs were recorded. The letter-strings were presented centrally until response was given, and participants were instructed to respond both to words and nonwords. All word lists were matched for length and frequency.

Scott et al. (2009) found that behavioural responses were significantly faster for positive and negative words when compared to neutral words. Positive words also showed a trend to be responded to faster than negative words, although this difference was only marginally significant. Importantly, an interaction between emotionality and word frequency was found indicating that both positive and negative words facilitated lexical decisions when compared to neutral words when the words had a low frequency of occurrence. In the case of high frequency words, only positive words were responded to faster than neutral words, but neutral and negative words did not differ from each other. The results confirm what was found previously by Kuchinke et al. (2005) that low frequency negative words are more likely to show facilitation of lexical decisions, but high frequency negative words may not differ in their behavioural effects from neutral words.

Scott et al. (2009) examined four ERP components: P1 (80- 120 ms), N1 (135-180 ms), early posterior negativity (EPN; 200-300 ms), and P300 (300- 450 ms). They also further examined the P300 peak latency. The results showed smaller P1 amplitude for HF negative words when compared to HF positive and HF neutral words, but no main effect of emotionality was found for LF words. Emotionality and word frequency were found to interact in respect to N1: LF negative words were associated with greater N1 than LF neutral words, while both HF positive and HF negative words elicited larger N1 amplitudes. EPN was also found to be modulated by emotionality of the words in that both positive and negative words showed larger EPN amplitudes than neutral words. However, this effect was present for high-frequency but not for low-frequency words. No emotionality effects were found on P300 amplitude or latency. The results reveal very early effects of emotionality on word processing in a lexical decision context as well as interactions between emotionality and word frequency. Interestingly, significant ERP modulations were found for high frequency negative words very early during the word form detection, yet these words were not found to differ from neutral words in the behavioural data. This result may be explained by findings from Carretié et al.'s (2008) study discussed next.

4.1.8. ERP correlates for processing extremely emotional words

Carretié et al. (2008) investigated highly positive and negative stimuli (compliments and insults) as well as neutral adjectives in a lexical decision context while recording ERPs. The letter-strings were presented centrally for 650 ms, and both words and nonwords were responded to with a key-press. On the behavioural level, Carretié et al. (2008) found faster RTs to compliments than neutral adjectives, and insults were responded to slower than the other categories of words. Both P2 (235-275 ms) and LPC (520-800 ms) were examined, but no emotionality effects on P2 amplitude or latencies were found. This finding concurs with Schacht and Sommer's (2009) findings, but not with those of Kanske and Kotz (2007). It remains unclear why emotionality effects in the P2 component are not always detected.

Carretié et al. (2008) also found that both LPC amplitudes and latencies were modulated by the emotional content of the words: Larger amplitudes were found for compliments and insults than neutral adjectives. Furthermore, insults resulted in longer LPC latencies than neutral adjectives and compliments. The origin of this LPC effect was suggested to be the superior parietal lobe/ precuneus. Similarly larger LPC amplitudes were also found in the study conducted by Kanske and Kotz (2007).

The research of Carretié et al. (2008) seems to indicate that negative valence does influence lexical processes even though these effects are not always manifested in reaction times as difference from neutral words. Carretié et al. (2008) have suggested that the negative words may be detected faster than neutral words. However, due to the threatening content of those words they may also capture and hold attention, while this is not the case with positive words. As a consequence the initial facilitated detection of negative words may not result in faster responses as their capacity to capture attention disrupts the later processing stages involved in responding to the letter string. When extremely negative words are used, however, behavioural effects can be observed as these words are likely to hold the attention for longer and therefore produce greater interference to the lexical decision performance. This suggests that early modulations of ERPs can be found for negative words, but such effects may not be manifested as difference in reaction times when compared to neutral words unless the words are extremely negative, such as insults and taboo words.

4.1.9. The rationale of the present study

The findings from the studies to date suggest that the measurement of ERPs may reveal differences in the processing of emotional and neutral words at several different time epochs. Although very early effects (< 300 ms) have been reported (Scott et al., 2009), the emotional content of words appears to show more consistent effect at the later stages of the word processing (> 300 ms). Furthermore, these emotionality effects can be found when a choice lexical decision task is used, and can be observed even in the absence of behavioural effects for negative words. Therefore in the present study the lexical decision task was complemented with event-related potential recording. It was of interest whether differences between L1 and L2 would be found in ERPs, and if such differences would be found, whether they would emerge at earlier or later stages of the word recognition process.

The research into emotional word processing in monolingual populations seems to indicate that emotionality effect can be observed in P2, N400 and LPC when a choice lexical decision task is used. P2 is believed to correspond to initial semantic access, while N400 has been associated with the integration of the word with its semantic context (e.g. Kissler et al., 2005). LPC is believed to be associated with continued processing of the word meaning (Kissler et al., 2005). Currently it is not clear however, which processing stages may differ between L1 and L2. Previous studies (e.g. Ayçiçeği-Dinn and Caldwell-Harris, 2009) seem to indicate that the later stages where associations to the words are activated may be involved. This is based on the idea, that L2 primarily differs from L1 in the extent that it has been used in different emotional contexts (Harris et al., 2006). Therefore a smaller number of emotionally charged associations are activated when L2 is used, leading to a perception of reduced emotional impact. As a result it is expected that differences between L1 and L2 as a function of their emotional content would be observed at N400 and LPC time windows rather than in P2.

The extent to which bilingual speakers are familiar with the word stimuli in their second language may differ from that of native speakers, and is also contingent on the level of proficiency of the bilinguals. In the study reported in Chapter 3 participants were asked to identify those word stimuli they did not know or the meaning of which they were unsure of. However, such an approach does not allow taking into account the extent to which they may be familiar or unfamiliar with the words. As a consequence in the present study the participants were asked to rate how familiar they were with the word stimuli on a seven-point scale in order to get more detailed understanding of the extent they encounter the words used in the study. Furthermore, in the study reported in Chapter 3, the bilingual participants were not explicitly asked how emotional they thought the L2 words were. Such ratings can potentially give better understanding of whether those stimuli are actually perceived to have different levels of emotional impact in each language. Therefore in the present study participants were also asked to rate the emotionality of the word stimuli on a seven-point scale.

It was anticipated that lexical decisions to L1 positive words will be faster when compared to neutral words, as this has been consistently reported in previous studies (e.g. Kuchinke et al., 2005) as well as in the study reported in Chapter 3. Such facilitation effect may be reduced or eliminated in L2 as this is what was found in Finnish-English bilinguals. Negative words, however, have not been found to produce consistent results, and therefore it is possible that negative words will not differ from neutral words in L1. However, this category of words may be sensitive to differences between L1 and L2 as a different pattern was found in native Finnish speakers to negative words in L1 and L2.

In order to enable the comparison of findings between the present study and the one reported in Chapter 3, a lexical decision task was used. The words were presented in blocks according to the emotional category, as this was the design used in Chapter 3. Such design may be more sensitive in detecting emotionality effects for negative words, as negative content of word stimuli can have an impact on the processing of not only the word itself but also the words following it (e.g. McKenna & Sharma, 2004).

4.1. Method

4.1.1. Participants

Twenty-six native German speakers were recruited in this study and were paid £15-£20 for participation depending on the duration of the study. Six participants were excluded from the analysis due to being Luxembourgish-German bilinguals (n = 2), or because of an insufficient artefact-free EEG trials for EEG averaging were obtained (n = 4). The remaining participants were 19-28 years of age (M = 24.1, SD = 3.06), 14 female and 6 male. The participants were administered a modified version of the Li, Sepanski and Zhao's (2006) Language History Questionnaire (summary of the results is presented in the Appendix 4.1). All the participants had started learning English at or after the age of 6 years (M = 10.0, SD = 2.30) and had lived in an English-speaking country on average for 3.9 years (SD = 3.35). Eighteen participants indicated strong preference for right hand, one showed no preference and one indicated left hand preference according to the Edinburgh Handedness Inventory (Oldfield, 1971).

4.1.2. Design and materials of the lexical decision task

A 2 (Language; English and German) X 3 (Word Type; neutral, positive and negative) within-subjects design was used.

Three lists of English words, consisting of 40 words each, were selected according to their emotional content (see Appendix 4.2). Neutral (e.g. avenue) (M = 5.7, SD = .67), positive (e.g. bliss) (M = 7.5, SD = .57) and negative (e.g. agony) (M = 2.6, SD = .66) words, $F(2, 119) = 607.78$, $p < .001$, were selected using the Affective Norms for English Words (ANEW) database (Bradley & Lang, 1999). All words were translated from English to German by a German-English bilingual, thus forming another three lists of word stimuli. The emotional valence of German words was established using ratings from the Berlin Affective Words List (BAWL; Võ, Jacobs & Conrad, 2006). German neutral (M = .6, SD = .72), positive (M = 1.9, SD = .43) and negative (M = -1.9, SD = .52) words were also significantly different from each other in their emotional valence, $F(2, 119) = 459.25$, $p < .001$ (see Table 4.1).

Table 4.1

Mean and Standard Deviations of Word Length, Frequency and Emotional Valence for English and German Words

Language	Word Type	Length *M (SD)*	Frequency[1] *M (SD)*	Valence[2] *M (SD)*
English	Overall	6.0 *(1.5)*	34.2 *(36.3)*	
	Neutral	5.8 *(1.4)*	37.9 *(45.0)*	5.7 (0.7)
	Positive	6.0 *(1.5)*	35.9 *(32.9)*	7.5 (0.6)
	Negative	6.1 *(1.5)*	28.9 *(29.4)*	2.6 (0.7)
German	Overall	6.0 *(1.3)*	39.6 *(39.3)*	
	Neutral	5.9 *(1.2)*	38.8 *(42.0)*	0.6 (0.7)
	Positive	6.2 *(1.5)*	45.6 *(39.2)*	1.9 (0.4)
	Negative	6.0 *(1.2)*	34.5 *(36.5)*	-1.9 (0.5)

Note. [1] Word form frequencies are based on the CELEX frequency counts (per million) for English and German (Baayen, Piepenbrock & van Rijn, 1993). [2] The emotional valence is based on the Affective Norms for English Words (ANEW) database (Bradley & Lang, 1999) and the Berlin Affective Words List (BAWL; Võ, Jacobs & Conrad, 2006).

The German translations were matched groupwise with English words in their length; $F(5, 239) = .40$, $p = .849$, and frequency ratings; $F(5, 239) = .835$, $p = .526$. The word length varied from 4 to 10 letters. The CELEX frequency counts for English and German words (Baayen, Piepenbrock & van Rijn, 1995) were used to establish the occurrence of each word in the respective languages. Forty nonwords were created by changing one or two letters in each word, a vowel replacing a vowel and a consonant replacing a consonant.

The words and nonwords were presented in blocks with one category of words in each block and each block consisting of words from only one language (English or German). Thus, six blocks of words were presented each consisting of 80 trials. The trials were presented in a random order. The order of the blocks with different types of words was counterbalanced using a Latin square design. The order in which the languages appeared was counterbalanced so that half of the participants were presented with the English word lists first and for the other half the German word lists were presented first.

The words and nonwords were presented centrally in capital letters using font face Courier New, size 18. The experiment was conducted with a PC running Windows XP SP3 with E-Prime Version 1.1.4.4. Each letter-string was preceded by a fixation cross at the centre of the screen for 500 ms. The letter-string then replaced it and remained until a response was made, or up to 2000 ms. If no response was given within the 2000 ms period, a screen appeared asking the participant to respond faster. After this screen, or once the response was made, the letter-string disappeared from the screen and was followed by a new fixation cross after an interval of 500 ms. This setup was identical for both the practice and experimental sessions. Participants completed one practice session prior to both the English and the German experimental part of the study in the respective languages. The practice phases consisted of 24 stimuli, 12 words and 12 nonwords. Furthermore, the instructions on the computer screen were presented in English for the English part of the study and in German for the German part of the study. The experimenter communicated with the participants in English.

The experimental phase followed the practice sessions after a short break. Participants were instructed to decide as quickly and as accurately as possible whether the string of letters presented on the screen was a real word or not in the particular language (English or German). Responses were made by pressing one of two keys on the keyboard indicating "word" or "nonword" with left and right index fingers. In conjunction with acquiring participants' informed consent they were also informed that both English and German words would be used. Other information about the nature of the words was not given at the beginning of the experiment.

4.1.3. Design, materials and procedure of the emotionality and familiarity rating tasks

Once the participants had completed the lexical decision task, they were asked to rate the word stimuli first according to their emotionality and then according to their familiarity. Thus, the same set of 240 words was used as in the lexical decision study. The words from the three different categories (neutral, positive and negative) were presented in a fully randomised order. The order in which the languages appeared was counterbalanced so that half of the participants were presented with the English word list first and for the other half the German word list was presented first.

The words were preceded by a fixation cross at the centre of the screen for 500 ms. The letter-string then replaced it and remained on the screen for 1500 ms. After this, a seven-point scale from 1 (not at all emotional) to 7 (extremely emotional) was displayed on the screen for the emotionality ratings task. For the familiarity rating the scale used ranged from 1 (not at all familiar) to 7 (extremely familiar). Numbers 1 to 7 on the key board were used for giving the response. No time limit was set for the response, and the participants were told they could complete the ratings at their own pace. This setup was identical for both the practice and experimental sessions. Participants completed four practice trials prior to giving ratings for the English and the German words. Furthermore, the instructions on the computer screen were presented in English for the English part of the study and in German for the German part of the study. In the emotionality rating task, participants were instructed to consider how emotional the words are. In the familiarity rating task they were asked to consider how often they see the words in writing or hear them used in spoken language as well as how often they use the words themselves in writing or in speech. They were also told that there were no right and wrong answers in this part of the study, but that the best answer was one that reflected their personal views most. After the rating tasks, participants were asked to fill in the Edinburgh Handedness Inventory (Oldfield, 1971) and a modified version of the language history questionnaire by Li, Sepanski and Zhao (2006).

4.1.4. Electrophysiological recording and analysis

EEG data were recorded (average reference) from 19 Ag-AgCl electrodes (Fp1, Fps, F7, F3, Fz, F4, F8, T7, C3, Cz, C4, T8, P7, P3, Pz, P4, P8, O1, O2) mounted in an elastic cap (Easy Cap QA40). In addition, two ear-clip electrodes were used to record activity from earlobes (A1 and A2) for later off-line re-referencing. Two Ag-AgCl electrodes were placed above and below the participants' left eye to record vertical eye movements and blinks. All electrode locations were first cleaned with isopropyl-alcohol (70%) before an abrasive electrolyte gel (Abralyt) was used to gently remove any dead skin cells and to conduct the electrical activity. Interelectrode impedance was typically below 5 kOhm and never exceeded 10 kOhm.

EEG and EOG signals were amplified using Quickamp 72 amplifier and Brain Vision Recording software (version 1.02). The data were continuously recorded with a sample rate of 250 Hz and a bandpass filter of 0.1 and 40 Hz (24 dB). EEG data were corrected for vertical eye movements and blinks using the Gratton and Coles (1989) method as implemented in the BrainVision analysis software. Recordings were then re-referenced to a mathematically simulated linked ears reference and a lowpass filter of 30 Hz (24dB roll-off) was applied.

For each individual separate ERPs were calculated for neutral, positive and negative words in each language. The means were based on an average of 32 segments, ranging from 16 to 40 segments. The numbers of segments for each word category were not found to differ significantly from each other. As previous research has shown ERP effects in the P2, N400 and LPC, separate analyses were conducted for the three components.

4.2. Results

4.2.1. Lexical decision data

Mean RTs were used in the analysis for response latencies. Response times less than 400 ms and greater than 1600 ms were treated as outliers and consequently excluded from the analysis. On average, 1.2 per cent of responses were discarded (see Table 4.2). Furthermore, nonwords were not included in the analyses. The data was first analysed by subjects (F_1) in a two-way analysis of variance with Language (L1, L2) and Word Type (neutral, positive and negative) as within subject factors, and subsequently by items (F_2) using a univariate analysis of variance with Language and Word Type as fixed factors. These analyses were then extended by including Proficiency as a covariate in the analysis by subjects in order to establish the potential modulating role of language competence on the pattern observed. An overall score of self-rated L2 proficiency was obtained by calculating the mean for the competence in reading, writing, speaking and comprehending spoken L2. Finally, the potential language order effect was analysed by entering Language Order as a between-subjects factor both in the analysis by subjects and by items. The Greenhouse-Geisser epsilon was used to correct the degrees of freedom where the assumption of sphericity was violated. Bonferroni adjusted post hoc tests were conducted to establish the significant differences between experimental conditions.

4.2.1.1. Analysis of errors

The average error rate was low (M = .044, SE = *.008*). The main effect of Word Type was significant only by subjects but not by items [$F_1(2, 38) = 5.12$, $p < .05$, $MS_e = .001$; $F_2(2, 117) = 1.52$, $p > .05$, $MS_e = 0.25$]. Bonferroni adjusted post hoc tests showed that positive words (M = .034) were associated with less errors than neutral words (M = .054). (This could not be explained as a speed-accuracy trade-off, as shorter response latencies were associated with lower error rate; see Tables 4.2 and 4.3). Negative words (M = .046) did not differ significantly from the two other word categories. The main effect of Language [$F_1(1, 19) = 1.77$, $p > .05$, $MS_e = 0.002$; $F_2(1, 117) = 1.19$, $p > .05$, $MS_e = 0.005$] was not significant. The interaction between Language and Word Type was significant in the analysis by subjects but not by items [$F_1(2, 38) = 4.68$, $p < .05$, $MS_e = .001$; $F_2(2, 117) = 0.91$, $p > .05$, $MS_e = 0.23$]. The post hoc tests showed that more errors were made in response to English negative words when compared to German negative words. While in German there were no significant differences between word types in their error rates, in English significantly less errors were made in response to positive than neutral words.

Table 4.2

Mean Percentage of Outliers and Errors for Emotional and Neutral Words in German and English

	German		English	
Word Type	Outliers(%)	Errors(%)	Outliers(%)	Errors(%)
Neutral	1.3	4.9	1.9	5.9
Positive	0.6	3.6	1.2	3.1
Negative	1.1	3.1	0.9	6.0

4.2.1.2. Analysis of response latencies

The analysis showed significant main effect of Language [F_1 (1, 19) = 14.88, $p < .01$, $MS_e = 2056.22$; F_2 (1, 117) = 4.58, $p < .001$, $MS_e = 3243.64$]. The main effect of Word Type was significant in the analysis by subjects, and approached significance in the analysis by items [F_1(1.55, 29.43) = 6.51, $p < .01$, $MS_e = 1183.90$; F_2 (2, 117) = 2.80, $p = .065$, MS_e = 5013.35]. Overall the bilinguals responded faster to L1 (German) words ($M = 636.1$) than to L2 (English) words ($M = 668.0$). Furthermore, positive words ($M = 638.0$) resulted in faster reaction times than neutral ($M = 659.7$) and negative words ($M = 658.5$), but negative words did not significantly differ from neutral words. A significant interaction between Language and Word Type was also found; [F_1(2, 38) = 6.68, $p < .01$, $MS_e = 947.45$; F_2 (2, 117) = 4.58, $p < .05$, $MS_e = 3243.64$]. It revealed faster reaction times for positive words when compared to neutral and negative words when participants responded to English words, but not when they responded to German words (see Table 4.3).

Table 4.3

Means Reaction Times for Emotional and Neutral Words in German and English

Language	Word type	RT(ms)	*SD*	Interference/ Facilitation[1]
German	Neutral	638.8	104.27	
	Positive	636.3	102.24	-2.5
	Negative	633.2	93.15	-5.7
English	Neutral	680.6	102.01	
	Positive	639.7	87.87	-40.9*
	Negative	683.8	111.05	3.2

Note. $N = 20$. *$p < .01$. [1]Interference/facilitation was calculated as the difference between the RT for the word type minus the neutral condition.

A further analysis of response latencies was conducted where RTs to words rated as "not at all familiar" were excluded from the data. The results showed significant main effects of Language [$F_1(1, 19) = 16.55$, $p < .01$, $MS_e = 1922.36$; $F_2\ (1, 117) = 18.03$, $p < .001$, $MS_e = 3360.71$] and Word Type [$F_1(1.50, 28.55) = 7.33$, $p < .01$, $MS_e = 1208.23$; $F_2\ (2, 117) = 3.33$, $p < .05$, $MS_e = 5089.54$]. The Language X Word Type interaction was also significant [$F_1(1.46, 27.80) = 7.91$, $p < .01$, $MS_e = 1172.31$; $F_2\ (2, 117) = 4.89$, $p < .01$, $MS_e = 3360.71$]. The post hoc tests revealed that lexical decisions to English words were significantly slower than those to German words overall. Across the two languages, RTs to positive words were faster than those for negative words. This effect was not significant in the analysis by items. The interaction replicated the pattern reported above: responses to neutral and negative words were significantly slower in English than in German, while such difference was not present in response to positive words in the two languages.

4.2.1.3. Analysis of the proficiency effects

The inclusion of Proficiency as a covariate in the two-way within-subjects analysis of variance showed no main effect of Proficiency [$F(1, 18) = 0.24$, $p > .05$, $MS_e = 56969.67$], nor interactions between Proficiency and Word Type [$F(2, 36) = 0.34$, $p > .05$, $MS_e = 1231.45$], or Proficiency, Language and Word Type [$F(1.52, 27.28) = 0.74$, $p > .05$, $MS_e = 1267.79$]. However, the Proficiency X Language interaction was significant [$F(1, 18) = 14.52$, $p < .01$, $MS_e = 1201.20$]. The inclusion of Proficiency as a covariate also resulted in the loss of the main effect of Word Type [$F(2, 36) = 0.19$, $p > .05$, $MS_e = 949.76$] and the interaction between Language and Word Type [$F(1.52, 27.28) = 1.47$, $p > .05$, $MS_e = 1267.79$]. It appears that Proficiency failed to emerge as a significant modulator of the emotionality effects. Yet the inclusion of this factor in the analysis renders the key main and interaction effects non-significant. Such pattern of results indicates that the outcome can be explained through the loss of power, as in the present sample there were only 20 participants. Thus, this potential impact of proficiency on the emotionality effects ought to be investigated in future studies with a larger sample size. The Proficiency X Language interaction is interesting, yet it will not be discussed further as it is not relevant for the present study.

4.2.1.4. Analysis of the language order effects

The three-way analysis of variance showed no main effect of Language Order [$F_1(1, 18) = 0.02$, $p > .05$, $MS_e = 57641.32$; F_2 $(1, 117) = 1.34$, $p > .05$, $MS_e = 2155.26$], neither was Language Order found to interact with Word Type [$F_1(2, 36) = 0.09$, $p > .05$, $MS_e = 962.83$; F_2 $(2, 117) = 0.18$, $p > .05$, $MS_e = 2155.26$] or Language and Word Type [$F_1(1.53, 27.47) =$

0.36, $p > .05$, $MS_e = 1285.14$; F_2 (2, 117) = 0.63, $p > .05$, $MS_e = 2117.94$]. Only significant interaction found was that between Language Order and Language [$F_1(1, 18) = 6.90$, $p < .05$, $MS_e = 1569.04$; F_2 (1, 117) = 19.15, $p < .001$, $MS_e = 2117.94$]. The Bonferroni corrected post hoc tests showed that when English words were presented first, English words were responded to slower (M = 680.8 ms) than German words (M = 629.9 ms) overall. When German words were presented first, there were no significant differences in the overall response times between the two languages (German M = 642.3 ms; English M = 655.8 ms). This suggests that there may have been a general practice effect, which benefited performance in the language that was less well known. However, it is notable that the order in which the languages were presented did not affect the overall pattern of responses to emotional and neutral words in each language: The main effect of Language [$F_1(1, 18) = 19.49$, $p < .001$, $MS_e = 1569.04$; F_2 (1, 117) = 19.36, $p < .001$, $MS_e = 6732.44$], and the Language X Word Type interaction [$F_1(1.53, 27.47) = 6.45$, $p < .01$, $MS_e = 1285.14$; F_2 (2, 117) = 3.46, $p < .05$, $MS_e = 6732.44$] were significant, and showed the same pattern of differences between conditions as observed in the analyses reported above: English words were responded to slower than German words overall. Moreover, positive words were found to facilitate lexical decisions relative to neutral and negative words in English but not in German. Similarly to the analysis excluding Language Order, the present results showed a significant main effect of Word Type only in the analysis by subjects but not by items [$F_1(2, 36) = 6.20$, $p < .01$, $MS_e = 962.83$; F_2 (2, 117) = 1.88, $p > .05$, $MS_e = 10324.64$]; overall positive words were responded to faster than negative words.

4.2.1.5. Analysis of emotionality ratings

A two-way analysis of variance with Language (L1 and L2) and Word Type (neutral, positive and negative) as within-subject factors was conducted on mean ratings. The

Greenhouse-Geisser epsilon was used to correct the degrees of freedom where the assumption of sphericity was violated.

The analysis showed a significant main effect of Word Type; $F(2, 38) = 93.63$, $p < .001$, $MS_e = 0.459$. Bonferroni post hoc tests revealed that positive ($M = 3.92$) and negative words ($M = 4.48$) were rated as more emotional than neutral words ($M = 2.47$). Negative words were also rated as significantly more emotional than positive words. The main effect of Language; $F(1, 19) = 1.02$, $p > .05$, $MS_e = 0.254$, and the interaction between Language and Word Type; $F(2, 38) = 1.70$, $p > .05$, $MS_e = 0.043$, were not found to be significant. This suggests that the emotionality ratings were very similar across the bilingual speakers' two languages (see Table 4.4 for mean ratings).

Table 4.4

Mean Ratings of Emotionality and Familiarity for Emotionally Charged and Neutral Words in German and English

		Emotionality		Familiarity	
		M	*SE*	*M*	*SE*
German	Neutral	2.4	0.14	4.4	0.25
	Positive	3.9	0.15	4.8	0.20
	Negative	4.5	0.18	4.3	0.27
English	Neutral	2.6	0.17	4.2	0.19
	Positive	4.0	0.16	4.7	0.17
	Negative	4.5	0.20	4.0	0.22

4.2.1.6. Analysis of familiarity ratings

A two-way analysis of variance with Language (L1 and L2) and Word Type (neutral, positive and negative) as within-subject factors was conducted on mean ratings. The Greenhouse-Geisser epsilon was used to correct the degrees of freedom where the assumption of sphericity was violated.

The analysis showed a significant main effect of Word Type; $F(2, 38) = 28.94$, $p < .001$, $MS_e = 0.145$. Bonferroni post hoc tests revealed that positive words ($M = 4.8$) were perceived to be more familiar than neutral ($M = 4.3$) and negative words ($M = 4.1$). Neutral and negative words did not differ from each other. The main effect of Language was not significant; $F(1, 19) = 2.46$, $p > .05$, $MS_e = 0.545$. The interaction between Language and Word Type, however, was significant; $F(2, 38) = 4.95$, $p < .05$, $MS_e = 0.041$. The Bonferroni adjusted post hoc tests revealed that although there were no differences between the familiarity ratings between L1 and L2 in respect to neutral and positive words, negative words were rated as slightly less familiar in L2 (see Table 4.4 for mean ratings).

These results suggest that familiarity with the word stimuli may have contributed to the findings. As a consequence a one-way analysis of variance by items for RTs was conducted separately for each language with Word Type (neutral, positive, negative) as a between-subjects factor and Familiarity as a covariate. The RTs were not affected by their perceived familiarity in German [Familiarity $F(1, 116) = 1.29$, $p > .05$, $MS_e = 3650.00$] or English [$F(1, 116) = 0.81$, $p > .05$, $MS_e = 4604.90$]. The main effect remained non-significant for German words [$F(2, 116) = 0.14$, $p > .05$, $MS_e = 3650.00$], whilst for English words the main effect of Word Type was still found to be significant after controlling for the effect of familiarity [$F(2, 116) = 6.53$, $p < .01$, $MS_e = 4604.90$]. The Bonferroni corrected post hoc tests confirmed the pattern observed that positive words produced significantly faster RTs than neutral and negative words.

4.2.2. Analysis of event-related potentials

Figure 4.1 displays the grand average ERPs for neutral, positive and negative words in L1 (German) and L2 (English) for the midline electrode positions. Other electrode positions did not show any additional effects. The mean numbers of EEG trials that contributed to these ERP waveforms were 32.1 for L1 negative, 32.7 for L1 positive, 32.8 for L1 negative, 31.0 for L2 neutral, 31.8 for L2 positive, and 31.8 for L2 negative. Visual inspection of the waveforms for the three word types (neutral, positive and negative) in L1 (German) and L2 (English) showed that there was a trend for L1 neutral words to produce a greater negativity in the 200-300 ms time window (P2) at frontal and central electrode positions. This trend was not visible in L2. Furthermore, in the 300-450 ms time window (incorporating the N400), L2 positive and negative words seem to show a reduced negativity when compared to neutral words, while this did not appear to be the case in L1. Finally, in the 450-600 ms time window (corresponding to the late positive complex; LPC), the L1 positive and neutral words seem to be associated with greater positivity than negative words, while such a pattern is not apparent in L2.

To test these observations, mean amplitudes of the identified time windows were subjected to 2 (Language; L1 and L2) x 3 (Word Type; neutral, positive and negative) x 3 (Anterior/ Posterior Position; frontal, central and parietal) x 3 (Laterality; left, mid and right) repeated measures analysis of variance. If interactions with the factors Language and Word Type were found, these were followed up by Bonferroni adjusted post hoc tests to examine the differences in processing of L1 and L2 and the word type effects that may be specific to one of the bilinguals' two languages.

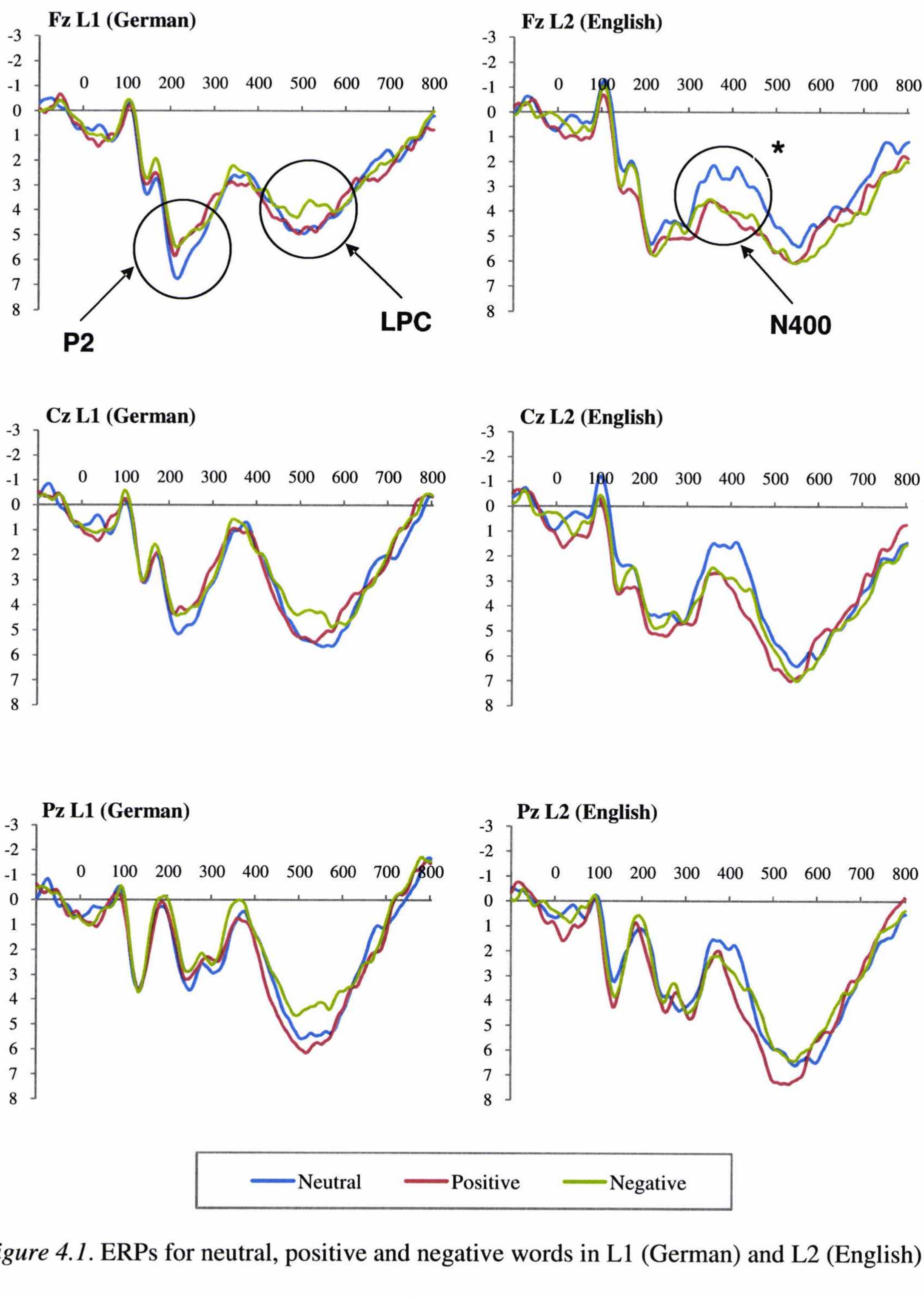

Figure 4.1. ERPs for neutral, positive and negative words in L1 (German) and L2 (English)

4.2.2.1. P2

The P2 was measured as the mean amplitude in the 200-300 ms time window (see Figure 4.1). Neither the main effect of Language [$F(1, 19) = 2.94$, $p > .05$, $MSE = 24.44$], or Word Type [$F(1.77, 33.59) = 0.33$, $p > .05$, $MS_e = 33.59$], nor the interaction between the two were found to be significant [$F(1.99, 37.82) = 2.72$, $p > .05$, $MS_e = 7.78$]. While the visual inspection of the wave form would suggest an interaction between Language, Word Type and Anterior/Posterior Position, this effect was not found to be significant [$F(1.86, 35.28) = 0.82$, $p > .05$, $MS_e = 3.92$]. Significant interactions however were found for Language, Anterior/Posterior Position and Laterality [$F(3.30, 62.70) = 2.93$, $p < .05$, $MS_e = .16$], and for Word Type and Laterality [$F(2.98, 56.57) = 3.30$, $p < .05$, $MS_e = .66$].

The Bonferroni adjusted post hoc tests of Language, Anterior/Posterior Position X Laterality interaction revealed that L2 words were associated with greater positivity at the central electrode position in the left hemisphere ($M = 5.07$) when compared to L1 ($M = 4.29$). The post hoc analysis of Word Type X Laterality interaction further showed that neutral words produced a greater positivity in the left hemisphere ($M = 4.57$) when compared to the right hemisphere ($M = 4.03$) ($p < .05$). Thus, although some differences between L1 and L2 were observed in this time window, these differences did not appear to be related to the emotionality of the word stimuli in each language. Furthermore, no clear indication of the differential processing of neutral and emotionally charged words was found.

4.2.2.2. N400

The N400 was quantified as the mean amplitude in the 300-450 ms time window. The main effect of Language [$F(1, 19) = 10.23$, $p < .01$, $MS_e = 20.78$] was significant: German words were associated with a larger N400 ($M = 2.44$) than English words ($M = 3.33$). The main effect of Word Type [$F(1.57, 29.78) = 1.76$, $p > .05$, $MS_e = 21.75$], and interaction between Language and Word Type, however, did not reach significance [$F(1.87, 35.48) = 2.28$, $p > .05$, $MS_e = 16.70$]. The interactions among Language, Anterior/Posterior Position and Laterality [$F(3.05, 57.94) = 2.75$, $p = .05$, $MS_e = 0.24$], as well as among Language, Word Type, Anterior/Posterior Position and Laterality [$F(4.83, 91.78) = 2.33$, $p = .05$, $MS_e = 0.25$], however, were found to be marginally significant. The post hoc tests of Language, Anterior/Posterior Position X Laterality interaction showed an overall larger N400 for L1 than L2 words across all central and parietal electrode locations.

The Language, Word Type, Anterior/Posterior Position X Laterality interaction was further analysed by first comparing the differences among word types between languages followed by comparisons between word types within languages. The comparisons between languages revealed significant differences between L1 and L2 positive and negative words, but no differences were present in regard to neutral words: L1 positive words were associated with a more negative-going wave when compared to L2 in the left frontal area, across all electrode positions in the central area and midline and right parietal areas. L1 negative words were also associated with more negativity when compared to L2. These effects were observed across all central electrode positions as well as midline and right parietal areas.

The comparisons between word types within each language showed no significant differences in L1 (see Figure 4.2). In L2, however, negative words were associated with significantly smaller N400 when compared to neutral words in midline and right frontal areas as well as the right central area (see Figure 4.3). There was also a trend for L2 positive words to produce smaller N400 when compared to neutral words in the midline frontal area ($p = .053$). These results demonstrate a differential impact of the emotional content on processing single words in L1 and L2; while no differences between the different categories of words were found in L1, L2 showed significantly smaller N400 for emotionally charged words. As there was no difference between L1 and L2 to neutral words, this difference cannot be explained as general increased level of activation for L2 words in this time window. It is also notable that the emotionality effects for positive and negative words showed different kind of distribution, negative words showing reduced N400 associated with frontal midline and right hemispheric areas while positive words showed reduced N400 solely on the frontal midline electrode site.

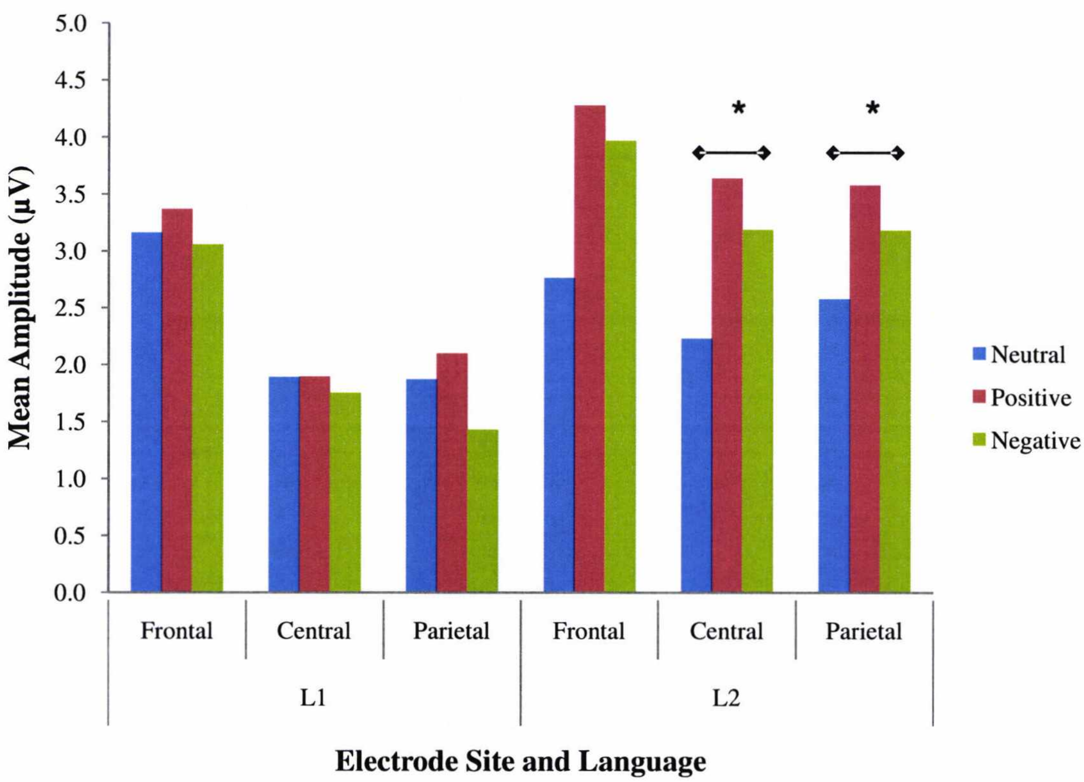

Figure 4.2. Mean amplitudes in the 300-450 ms time window for neutral, positive and negative words in L1 (German) and L2 (English) for frontal, central and parietal electrodes in midline positions

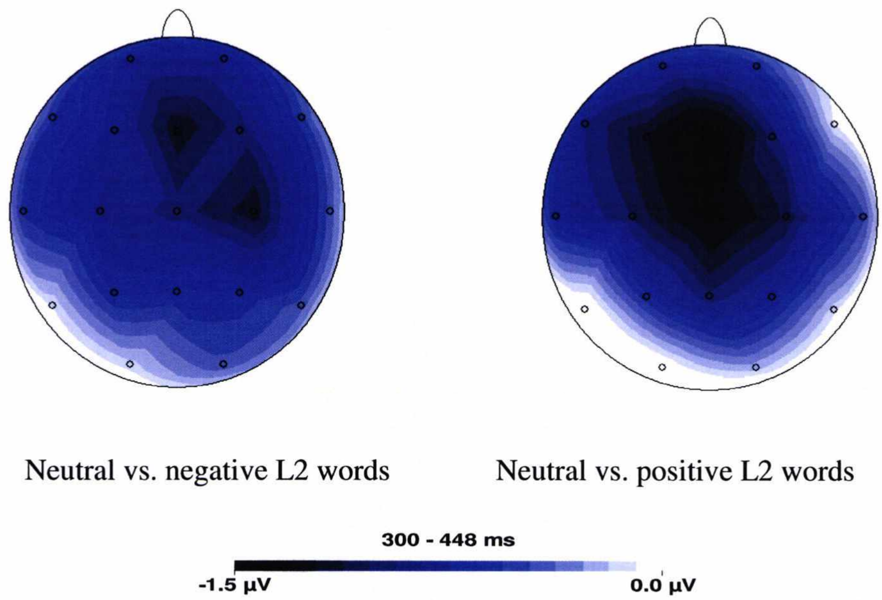

Figure 4.3. Topographic maps for the difference between neutral and emotionally charged words in L2 in the 300-450 ms time window; neutral words were associated with a more negative going wave

4.2.2.3. LPC

LPC was quantified as the mean amplitude in the 450-600 ms time window. The main effect of Language [$F(1, 19) = 4.74$, $p < .05$, $MS_e = 27.00$], was significant: English words were associated with a greater positivity ($M = 5.60$) overall than German words ($M = 4.69$). The main effect of Word Type [$F(1.84, 34.93) = 1.03$, $p > .05$, $MS_e = 28.58$], and interaction between Language and Word Type, however, did not reach significance [$F(1.56, 29.59) = 1.44$, $p > .05$, $MS_e = 28.80$]. A significant Word Type X Anterior/Posterior interaction was found [$F(2.29, 43.46) = 3.45$, $p < .05$, $MS_e = 3.52$]. The Bonferroni corrected post hoc test showed that positive words ($M = 5.87$) were associated with larger LPC in the posterior areas when compared to negative words ($M = 4.83$, $p = .050$). No other comparisons were significant. These results demonstrate that the processing of L2 words overall were associated with greater positivity than L1, but this difference was not related to the emotionality of the stimuli. The effect of emotionality was observed in this time window in that positive words showed greater recruitment of processing resources than negative words across the two languages.

4.3. Discussion

4.3.1. Lexical decision performance

The aim of the present study was to investigate the impact of emotional content of L1 and L2 on word recognition in the respective languages by combining the lexical decision method with ERP recording. The behavioural results showed an overall advantage for L1 words; L1 words were responded to faster than L2 words. This finding supports the assumption that the bilinguals were L1 dominant, as those words were recognised as legal lexical forms faster than was the case with L2 words. This observation is in line with the BIA+ model (Dijkstra & Van Heuven, 2002), which assumes that in unbalanced bilinguals L1 words have a higher resting level activation due to their higher familiarity when compared to L2 words.

Surprisingly, positively valenced words were found to facilitate the word recognition in L2, but not in L1. This facilitation effect in L2 concurs with the findings from native Finnish speakers, who showed a trend for faster reaction times in L2 for positive words (Chapter 3). In native Finnish speakers this effect did not research significance, possibly due to the lack of statistical power. Alternatively, the stronger facilitation from positive words in the present study was due to the more extensive experience of immersion in L2 environment of German-English bilinguals than was the case in Finnish-English bilinguals. This would have lead to a higher level of proficiency, and, importantly, stronger and more numerous associations between L2 words and emotional events. The behavioural results of the present study therefore support the view that in highly proficient bilinguals, positive valence is accessed rapidly in L2 and can bring the RTs on par with L1 lexical decision speed. This finding is in contrast with the Revised Hierarchical Model of bilingual memory (Kroll & Stewart, 1994), which suggests that L2 has weaker links to the semantic system and as a consequence word semantics have less of an effect on L2 word processing than is the case with L1 words.

The lack of facilitation from L1 positive words is unexpected, considering that the most consistently reported effect of emotionality has been facilitation from positive words in L1 (e.g. Kuchinke, 2005). Furthermore, in the lexical decision study with Finnish-English bilinguals, behavioural effects were also observed in L1 (Chapter 3). An important difference between the present study and the one reported in Chapter 3 was that with Finnish-English bilinguals the translation equivalents were either presented in L1 or L2, but not in both languages, as was the case in the current study. Moreover, a larger number of word stimuli were presented to German-English speakers than Finnish-English bilinguals. Thus, it may be that the repetition of translation equivalents and the larger number of words used may have attenuated the emotionality effects in L1, where lexical decisions are easier to carry out. The words used were also relatively high in their word form frequency (on average above 30 per million), which is known to facilitate lexical decisions further.

The analysis of order effects did not reveal any impact of this factor on the observed emotionality effect. As a consequence the order in which the words were presented in is unlikely to account for the lack of emotionality effects in L1. In important factor may have been, however, that in the current study, as well as in the one reported in Chapter 3, the words were presented in blocks according to the emotional category. While this experimental design was expected to be more sensitive for detecting emotionality effects, blocking of the words also enables the participants to anticipate the emotional category the words are likely to represent. This may have had a greater impact on the lexical decision performance in the present study, as a larger number of word stimuli were used, and the translation equivalents were repeated across languages. In order to address this issue, an alternative research design ought to be applied where the words from the different emotional categories would be mixed. Also, it would be preferable not to repeat the translation equivalents within the same experimental session.

The negative valence of words was not found to facilitate or interfere with lexical decisions in either of the bilinguals' languages. This finding contrasts with the results from the study with Finnish-English bilinguals, where facilitation was found from negative words in L1 and interference in L2 in less proficient speakers. Previous investigations examining the effects of negative valence on lexical decisions have reported mixed findings. Some researchers have suggested that negative valance in found to facilitate responses when the stimuli used have lower word form frequency (Kuchinke et al., 2005, Scott et al., 2009). In the present study the words used were of relatively high in their frequency, and this may therefore explain why no facilitation was observed in L1. In the study with Finnish-English bilinguals, interference from negatively valenced L2 words were found in less proficient but not in more proficient bilinguals (Chapter 3). In the current study the bilinguals were high in their level of proficiency. As a consequence the findings from the present study and the one reported in Chapter 3 are in agreement. In order to investigate the impact of negative valence of L1 and L2 words further, words with lower level of word form frequency could be applied. Alternatively, negative words with a stronger negative content (e.g. insults), or those from other grammatical categories (i.e. verbs and adjectives) could be used as stimuli.

4.3.2. Emotionality and familiarity ratings

The bilinguals' ratings of perceived emotionality of the words showed that the words in L1 and L2 were considered to be equally emotional. This finding is surprising, as it could have been expected that L1 words would have been viewed as more emotional than L2 words. However, similar results were reported by Harris et al. (2003), who found that Turkish-English bilinguals gave very similar pleasantness ratings to neutral, positive, negative and taboo words in their L1 and L2. It appears that proficient bilinguals do not view single words in L1 and L2 to be different in their emotional content. This is an important finding, as previous studies have assumed that the perceived greater emotionality of L1 when compared to L2 extends to the perception of emotional words as more emotional in L1 than L2.

The familiarity ratings revealed that positive words were perceived to be more familiar to the speakers than neutral and negative words in both L1 and L2. This is an interesting findings considering that all word lists were matched for word form frequency. This perceived greater familiarity could potentially associated with the facilitation effect observed for positive words. Previous studies that have reported faster lexical decisions to positive words have not collected familiarity ratings for the word stimuli, and therefore it is not possible to compare these findings with existing literature. The perceived greater familiarity with positive words, however, could be explained by the previous research that has shown positive material to be better elaborated and interconnected than negative material in the cognitive system (e.g. Isen, 1985). Such greater elaboration may underlie the greater familiarity with the positive words when compared to neutral and negative words.

Negative words in L2 were considered by the bilinguals to be slightly less familiar then negative words in L1. This concurs with the findings from the study reported in Chapter 3, which showed that Finnish-English bilinguals knew fewer negative and taboo words than neutral and positive words. However, in the present study this lack of familiarity was not reflected in slower responses or higher error rates for the negative words when compared to neutral words. This is probably due to the fact that the participants in the present study were highly proficient and had been immersed in the L2 environment for an extended period of time. As a result their knowledge of the negative words was sufficiently good so as not to result in interference relative to neutral words in the lexical decision task.

4.3.3. P2

The ERP data showed no effect of emotionality on P2. This concurs with the findings of Schacht and Sommer (2009), who did not observe such early effects of emotionality either. However, the studies that have reported emotionality effects in comparably early time windows have focused on the early posterior negative (EPN) component, measured on posterior electrodes (e.g. Scott et al., 2009). In the present study such posterior effects were not visible. Furthermore, the early effects of emotionality have been more frequently observed in experiments using silent reading and rapid serial visual presentation (RSVP) (e.g. Kissler, Herbert, Winkler & Junghöfer, 2009). These variations in experimental designs may account for the fact that the early effects were not found in the present study.

An overall greater positivity was found for L2 when compared to L1. This suggests that L2 received more cognitive resources early on than did L1. The fact that the bilinguals responded slower to L2 than L1 words overall would imply that the greater resource allocation was due to the greater effort required to establish the lexical legality of L2 than L1 words. Such explanation is in keeping with the BIA+ model (Dijkstra & Van Heuven, 2002), which assumes that L2 words have a lower resting level activation than L1 words due to their lower level of familiarity. This leads to slower activation of the lexical representations and subsequently longer lexical decision latencies.

4.3.4. N400

Language was found to modulate N400 component, L1 eliciting larger N400 than L2. The greater overall negativity for L1 seems surprising, as this is often associated with increase in cognitive resource allocation. The behavioural effect shows, however, that the lexical decision task required more and not less resources in L2, as the RTs overall were slower in L2 than in L1. Similar findings, however, were reported by Midgley, Holcomb and Grainger (2009), who found larger posterior N400 for L1 than L2 in less proficient bilinguals when a silent reading task was used. They suggested that this may be due to the fact that L2 words are less interconnected with each other than L1 words, resulting in a smaller orthographic neighbourhood for L2 than L1 words. This interpretation seems plausible as smaller orthographic neighbourhood has been found to produce a reduced N400 effect (Holcomb, O'Rourke & Grainger, 2002).

Midgley et al. (2009) also proposed that the L1 words may be more interconnected with the semantic network than L2 words. A greater number of semantic associations may produce larger N400 effects, as concrete words have been found to be associated with a larger negative wave than abstract words (e.g. Kounios & Holcomb, 1994). Thus, the larger N400 for L1 could be due to either the fact that the L1 words are more interconnected with each other, or because they form stronger and more numerous links with the semantic representations. Both of these factors would facilitate lexical decision in that language, a phenomenon observed on a behavioural level. The present findings showed a larger N400 in the central and parietal areas, thus being in agreement with the findings of Midgley et al. (2009), who found an increased N400 for L1 in the posterior areas.

The difference between L1 and L2 in N400 time window was further found to interact with the emotionality of the words. Surprisingly, no differences between emotional and neutral words were found in L1, while in L2 negative words elicited smaller N400 than neutral words in midline and frontal electrode sites as well as the right central area. There was also a trend for positive words to produce smaller N400 when compared to neutral words, although this was only marginally significant. This finding is in partial agreement with the behavioural data in that facilitation from positive words was only observed in L2 but not in L1. However, the reduced N400 for negative words was not reflected in the response latencies. Such lack of facilitation or interference from negative valence has been explained by Carretié et al. (2008) to be accounted for by two different processing mechanisms associated with negative stimuli, as discussed in Chapter 3. Thus, negative words may be allocated more processing resources, resulting in faster recognition of these words. The threatening content of negative words also captures and holds attention, which can leading to slower responses than is the case with positive words. As a consequence, no difference may be observed between negative and neutral words in reaction times.

This result concurs with the findings of Schacht and Sommer (2009) who found significant differences between emotional and neutral words in this time window. However, their results reflected this effect as a greater negativity for positive and negative words when compared to neutral words in the parieto-occipital sites. Furthermore, their results were observed in L1 while in the present study the effect of emotionality in this time window was only present in L2. A number of factors could account for the differences between the two studies: One possible reason for these differences is that Schacht and Sommer (2009) used verbs in their study while in the present investigation nouns were used as stimuli; verbs have been previously found to differ from nouns and adjectives in their processing time course (e.g. Kauschke & Stenneken, 2008; Kissler et al., 2007). Furthermore, Schacht and Sommer presented words from the three different categories (positive, negative and neutral) randomly in the same block, while in the present study the words were blocked by category. As N400 has been found to reflect the extent to which the context (usually a sentence context) helps the individual to predict the perceptual and semantic features of items that are likely to appear (Kutas & Federmeier, 2000), facilitation from semantically related items (i.e. positive and negative words) may have lead to the reduction of N400 for L2 positive and negative words. Such pre-activation of the semantic memory is believed to facilitate recognition of the item, a pattern that was indeed found in L2 positive words. However, the semantic category effect would be expected to emerge in both languages, not only in L2. Thus, it appears that the findings cannot be solely explained as a consequence of semantic relatedness.

It seems likely that a critical factor in contributing to the present findings is that the participants were immersed in L2 context at the time of the study, and had spent on average four years in the L2 environment. This is likely to change the resting level activation of L1 and L2 words, and therefore a different pattern of activation may be observed when compared to monolinguals studied in L1 environment as was the case in all the previous studies. In order to establish the impact of immersion in L2 environment, a follow-up study ought to be conducted investigating German-English bilinguals' responses while they are immersed in L1 environment.

4.3.5. LPC

The LPC showed a significant modulation by language; L2 words elicited a larger positive wave also in this time window when compared to L1. An emotionality effect was also observed, showing somewhat larger LPC for positive than negative words in posterior areas. Language was not found to modulate the emotionality effect. The increased LPC for positive than negative words concurs with the observations of Herbert et al. (2008) as well as Kissler et al. (2009). As the late positive wave has been associated with cognitive processing load due to sustained attention, stimulus evaluation, or memory encoding (Kok, 1997), it appears that positive words were allocated more cognitive resources at later stages of words processing than was the case with negative words.

Herbert et al. (2008) have also suggested that the increased processing resources allocated to positive words may be due to positive words being mood-congruent and have greater personal relevance. The mood-congruency hypothesis suggests that items congruent with the present mood are processed faster than those incongruent with individuals' mood. Furthermore, healthy, non-depressive people have been found to hold bias towards pleasant information, and consider it more personally relevant, than unpleasant information. This results in facilitated processing for positive items overall for individuals with a positive mood, as well as deeper evaluation, encoding and memory for pleasant when compared to unpleasant and neutral stimuli due to personal relevance (e.g. Deldin, Keller, Gergen & Miller, 2001). These effects are demonstrated as larger LPC for pleasant than unpleasant words, although this bias may be reflected already at N400 (Herbert et al., 2008). Thus, in the context of the present study it could be suggested that the words in both L1 and L2 received further processing resources when compared to negative words at later stages of word processing. As L2 had already benefited from facilitated processing at an earlier stage as reflected in reduced N400, L2 positive words were found to produce faster reaction times than L2 neutral and negative words. Although L1 words also received additional processing resources at LPC, the absence of facilitation at N400 may have reduced this effect. As a consequence faster reaction times were only observed in L2 but not in L1.

In summary, the results revealed a surprising pattern: Differences between L1 and L2 in their affective processing were observed in N400 component. However, the emotional content was found to influence the processing of L2 but not L1 emotional words. The timing of the effect would suggest that the differences between L1 and L2 emotional word processing emerged once the semantic access has taken place, not before. It seems that L2 emotional word processing was facilitated relative to L2 neutral words, while such effect was not found for L1 words. The larger positive wave observed in P2 and LPC for L2 words together with the observed longer response latencies for L2 than L1 imply that establishing the legitimacy of the lexical entry required more resources than was the case in L1. This confirms that the bilinguals were indeed L1 dominant, and therefore eliminates the alternative explanation that the emotionality effect observed in N400 for L2 could have been due to bilinguals' dominance in L2. It is not clear, however, to what degree the immersion in L2 environment affected their responses. It may be that the German words would show significant emotionality effects if the participants were within the L1 language context. The present study is the first one to contrast bilingual speakers' ERP responses to L1 and L2 emotional words. Thus, further research addressing the different factors contributing to the present findings need to be conducted.

Chapter 5. Behavioural and Physiological Responses to the Emotional and Taboo Stroop Tasks in Native and Non-native Speakers of English

5.1. Introduction

The aim of the present chapter is to examine whether differences between native and non-native speakers' responses will be found in their behavioural and physiological responses to English neutral and emotional words when emotional and taboo Stroop tasks are applied. Skin conductance levels (SCLs) of 32 native and 31 non-native English speakers were measured during emotional and taboo Stroop tasks. Significantly slower response times to negative and taboo words when compared to neutral words were found in both groups of participants, but positive words were not found to differ significantly from neutral words. No differences between native and non-native speakers in their behavioural responses were present: The pattern of interference from negative and taboo words was found to be identical in L1 and L2. SCLs, however, did reveal differences between the native and non-native participants: Native English speakers showed significantly higher SCLs during negative and taboo word blocks when compared with neutral and positive word blocks. This difference was not observed in non-native speakers, although there was a trend for higher SCLs to occur during the taboo word block when compared to the positive word block. This suggests that, although the two groups responded in a very similar manner on a behavioural level, the level of arousal produced by the negative and taboo words for native English speakers was greater than that for non-native speakers.

5.1.1. Combining emotional and taboo Stroop tasks with skin conductance recording

As discussed in Chapter 1, studies using self-reports of emotional force (e.g. Gonzales-Reigosa, 1976; Dewaele, 2004), discussion of embarrassing topics (Bond & Lai, 1986), comparison of the emotionality of autobiographical memories (Schrauf, 2000), as well as the measurement of physiological arousal in response to words and short phrases (e.g. Harris, Ayçiçeği & Gleason, 2003) seem to suggest that L1 can be more emotional for the bilinguals than L2. However, not all of the findings from studies investigating the emotional impact of L1 and L2 depict such clear pattern, as some studies have found greater emotionality effect on L2 than L1 (e.g. Ayçiçeği & Harris, 2004, Chapter 4) or no difference at all (e.g. Eilola, Havelka & Sharma, 2007; bilinguals' responses to taboo words in Chapter 3). These contradictory results seem to have emerged in studies using single emotional words rather than short phrases or more complex linguistic materials.

Research evidence focusing on the processing of emotionally laden words draws from studies looking at the impact of emotionality on L1 and L2 word memory (Anooshian & Hertel, 1994; Ayçiçeği & Harris, 2004; Ayçiçeği -Dinn & Caldwell-Harris, 2009), automatic evaluation of L1 and L2 words (Altarriba & Canary, 2004), the psychophysiological responses to linguistic stimuli in bilinguals' two languages (Harris, 2004; Harris, Ayçiçeği & Gleason, 2003; Harris, Gleason & Ayçiçeği, 2006), and the impact of emotional content of L1 and L2 words on attention (Eilola et al., 2007; Sutton, Altarriba, Gianico & Basnight-Brown, 2007). The strongest evidence to date for the greater emotional arousal produced by L1 when compared to L2 words seems to come from the study by Harris et al. (2003), who found reduced autonomic arousal in bilinguals' L2 when compared to L1. It has been suggested that autonomic arousal is an independent component contributing to the vividness of emotional experience of an event (Scherer, 2009). Therefore it seems plausible that increased physiological arousal to L1 when compared to L2 words can be found even when the behavioural responses indicate similar appraisal of emotional content (Eilola et al., 2007). Such difference in emotional arousal associated with L1 and L2 may in part account for the perceived lack of emotional impact of L2. The aim of the present study was therefore to extend the research of Eilola et al. (2007) and Harris et al. (2003, 2006) by combining emotional and taboo Stroop tasks with skin conductance recording. The difference sources of evidence motivating the present investigation will be considered below. These are followed by an outline of the specific aims of the current study.

5.1.2. The impact of emotionality on L1 and L2 word memory

Anooshian and Hertel (1994) were the first to ask whether emotional content of single words would differentially influence the strength of the memory trace produced by L1 and L2 words. They proposed that the close relationship between the acquisition of the first language and emotional exchanges in infancy results in the first language to become associated with greater number of emotional episodes than the second, later acquired language. The words in L1 will therefore develop more connections with the semantic network and consequently enable a more elaborate processing when encountered than L2 words. Emotional words may be also more strongly associated with each other in L1 than L2, thus facilitating inter-item connections when lists of words are studied. Both of these factors would therefore facilitate encoding of and later retrieval of those items. The performance in a recall task, however, is likely to depend also on the task performed on those words during the encoding phase, as there is a wealth of evidence suggesting that the depth of processing affects subsequent recall of words (e.g. Craik & Tulving, 1975). Three different tasks were therefore applied, each participant engaging in only one of them.

Anooshian and Hertel (1994) studied fluent English-Spanish and Spanish-English bilinguals who had acquired L2 at the age of 8 years or later. Participants were asked to rate 18 emotional (5 negative, 13 positive) and 18 neutral words in regard to their ease of pronunciation, emotional intensity, and activity associated with the words. After the rating task a surprise recall task was administered. The researchers found that emotional words were better recalled than neutral words in L1, but L2 did not show this advantage. Their results also showed that the rating task performed influenced subsequent recall in L1 but not in L2; words rated for ease of pronunciation in L1 were less frequently recalled than those rated for emotional intensity or activity. Language background, i.e. whether bilinguals had acquired English or Spanish as their first language, did not influence their performance. These results therefore supported the view that encoding of L1 words is facilitated by the emotional content of those words, but this is not the case in L2. Moreover, processing of the word meaning significantly benefited the retrieval of L1 words, while the memorability of L2 words was not enhanced by semantic processing to the same extent.

This study was extended by Ayçiçeği and Harris (2004), who divided negative and positive words into separate categories, and included childhood reprimands (e.g. Shut up!) as well as taboo words into the research design. The stimuli were presented both visually and aurally and participants were asked to rate the words according to their unpleasantness. Half of the participants were administered a surprise free recall task while the other half completed a recognition task. Fluent Turkish-English bilinguals who had acquired English at or after the age of 12 years and lived in the United States took part in the study.

The results from Ayçiçeği and Harris' (2004) study revealed that the recall condition showed a significantly better retrieval of taboo words when compared to neutral words. Unexpectedly, positive words and childhood reprimands were significantly better recalled than neutral words in L2, but not in L1. Instead, negative words were less likely to be remembered than neutral words in L1, but this was not the case in L2. These findings indicate that there was in fact a stronger emotionality advantage in L2 than in L1. The results from the recognition task further confirmed that L2 seemed to benefit more from the emotionality of the word stimuli. In both languages recognition memory scores were higher for positive and taboo compared to neutral words, but in L2 this advantage was observed for negative words as well. Ayçiçeği and Harris' results thus contradict what was found by Anooshian and Hertel (1994), as emotionality of word stimuli showed substantial impact on retrieval both in L1 and L2 and this impact was more pronounced in L2.

These conflicting findings can be attributed to a number of differences between research designs, including distinction between different types of emotional words, and participants' lower level of L2 proficiency in the latter study. Ayçiçeği and Harris (2004) further suggested that stimuli with negative connotations may not produce such unpleasant mood in L2 as they do in L1. This may have enabled more elaborate processing of those stimuli, as bilinguals are not as motivated to avoid thinking about them. Consequently negative stimuli produced stronger memory traces in L2 than in L1. This, however, does not explain why positive words were better recognised in L2 than in L1, or why taboo words produced equally strong emotion-memory advantage in both languages. Ayçiçeği and Harris (2004) therefore concluded that L2 words may not always be less emotional than L1 words.

In order to further examine the factors influencing the retrieval of emotionally charged words in L1 and L2, Ayçiçeği-Dinn and Caldwell-Harris (2009) manipulated the level of processing of the stimuli. The participants were fluent Turkish-English bilinguals who lived in Turkey at the time of the study and thus were immersed in a Turkish-speaking rather than English-speaking environment. They had started regular study of English at the age of 12-13 years. The same set of stimuli was used as in the previous experiment. The level of processing was varied by asking the participants to carry out one of the four tasks: letter-counting, association production, backward and forward translation, or rating the emotional intensity of the words. A surprise recall task was then administered.

Ayçiçeği-Dinn and Caldwell-Harris (2009) found higher level of recall for childhood reprimands in L2 than in L1 across all tasks, while negative words did not differ from neutral words in either language. Letter-counting and word-association tasks did not lead to differences between L1 and L2 although there was a significant emotionality advantage in both languages. When the translation task was used, taboo and positive words were significantly better recalled than neutral words in L2 but not in L1. Only the emotionality-rating task resulted in better recall of emotionally charged words when compared to neutral words in L1, but this was not the case in L2.

The results demonstrate that bilinguals do process the emotional content of the words to the level that can facilitate the encoding and subsequent retrieval of the linguistic material. However, the extent that this takes place appears to depend on the kind of task the bilinguals are involved with. Ayçiçeği-Dinn and Caldwell-Harris (2009) suggested that in a task where bilinguals are not required to process the meaning of the word stimuli, the influence of emotionality is equivalent in L1 and L2. As the emotional content of the words and phrases is processed automatically and without conscious effort in this type of task, the emotional content has only a small but reliable impact on the encoding process in both languages. When the emotional content of the material is made salient, however, L1 may show greater benefit from the stronger and more numerous associations amongst words, phrases and the semantic system.

5.1.3. Automatic evaluation of L1 and L2 words

An alternative approach to studying emotionality of words in bilinguals' two languages was taken by Altarriba and Canary (2004). They studied the early automatic processing of emotional arousal in L1 and L2 by comparing monolingual English speakers' and Spanish-English bilinguals' performance in an affective priming task. The participants were asked to perform lexical decisions on words which were primed by unrelated, low-arousal and high-arousal words. Both prime and target words only appeared in English. It was of interest whether L1 and L2 speakers of English would differ in the extent the emotional arousal of the prime words would influence the speed at which lexical decisions were made to the target words.

The results showed significant priming effect in both languages; emotional arousal facilitated lexical decisions in both high and low-arousing conditions when compared to the unrelated condition. However, this facilitation was more pronounced in L1 speakers than L2 speakers of English. The bilingual participants studied were dominant in L2, which could explain why emotional arousal associated with the prime words was accessed rapidly and thus affected the subsequent target-word processing. As L2 is associated with fewer emotionally arousing experiences it may not activate the prime-related concepts as effectively as is the case with L1 speakers. Consequently some priming is observed, but the overall effect is reduced. Alternatively, Altarriba and Canary (2004) suggested that this difference in the level of priming could have been due to differences in the L1 and L2 speakers' lexical representations: Monolinguals had knowledge only of emotional words in one language, while bilinguals have lexical representations in two languages. The emotionally arousing primes may have activated related lexical representations in both L1 and L2 in bilingual participants, resulting in greater competition between related lexical entries. This could have limited the extent arousing primes were able to facilitate the target words in bilinguals.

Overall, evidence from the memory and affective priming studies suggest that emotional connotations are accessed in both L1 and L2. Differences between L1 and L2 have also been demonstrated, yet they do not support the view that L1 words and phrases always produce stronger emotional responses than L2. Various behavioural indicators seem to produce different patterns of emotionality effect. Due to limited amount of research in this area it is not clear, however, when one or the other of the bilingual's two languages will benefit more from the emotional content of the words and when no differences are observed. It appears that the extent that the emotional connotations of the stimuli are intentionally processed is one contributing factor. While different tasks used in the experimental research are differentially affected by the emotionality of word stimuli, it could be assumed that the emotional stimuli may produce systematic increases in physiological arousal across different experimental settings. As a consequence a more direct measure of emotional response, skin conductance recording, has been applied to study differences between L1 and L2 words in the extent they produce emotional arousal in the bilingual speaker.

5.1.4. Skin conductance, emotional responses and language

The recording of electrodermal activity (EDA) is considered to be one of the most sensitive physiological measures of emotional and cognitive activation (Hugdahl, 2001). Electrodermal monitoring is based on the functioning of the eccrine sweat glands, which are distributed over large part of the body surface, but are especially numerous in the palms of the hands. The activation of autonomic nervous system in response to threat cues in the environment increases this sweat gland activity (Andreassi, 2000). This results in greater water content on the skin surface, which facilitates electrical conductivity. The electrodermal activity is controlled by several brain areas, including the cortex, reticular formation, hypothalamus, hippocampus and amygdala (Andreassi, 2000). The limbic structures specifically have been identified as being involved in the emotion-related EDA (Boucsein, 1992). There is now extensive evidence to demonstrate amygdala's involvement in learning fear-response to previously neutral stimuli (e.g. LeDoux, 2000) likely to be involved the learning of fear-response to words with threatening content.

Skin conductance can be measured by passing a small direct current across two electrodes placed on the skin. When voltage is kept constant, skin conductance is measured as changes in the strength of the current (Hugdahl, 2001). Although several different components of skin conductance can be measured, the skin conductance response (SCR) is the most frequently used in the study of specific changes in physiological arousal in relation to stimuli presented. SCR occurs 1-1.5 seconds after stimulus presentation and can last for up to 2-6 seconds. Another index of emotional arousal is the skin conductance level (SCL), which is recorded over an extended period of time and indicates changes in the overall level of activation rather than temporary changes in response to a specific stimulus. The magnitude of SCR and SCL can vary between 0 and 30 μmhos (Boucsein, 1992).

Craig (2005) has put forward a neurobiological model of emotions, which suggests that subjectively experienced feelings and emotions are based on higher-order re-representations of homeostatic afferent activity in the human brain. Homeostasis refers to all the neurobiological processes that serve to maintain an optimal balance in the physiological state of the body. The mechanism underlying homeostatic regulation is based on the functioning of the autonomic nervous system, which comprises of the sympathetic and parasympathetic systems. These systems operate in a reciprocal fashion, so that in most cases if one is activated the other one is deactivated (Craig, 2005).

Research evidence has demonstrated that the forebrain is strongly lateralised in terms of processing positive and negative emotions: The left forebrain has been linked with positive affect and the right forebrain with negative affect (e.g. Davidson & Irwin, 1999). This lateralisation is believed to be based on the organisation of the homeostatic system, and the functioning of the sympathetic and parasympathetic components of the peripheral nervous system: The sympathetic nervous system that produces increased arousal and thus energy expenditure is re-represented in the right hemisphere, while the parasympathetic system that underlies relaxation, nourishment and thus energy enrichment is re-represented in the left-hemisphere. More specifically Craig (2005) has identified anterior insula in the left and right hemispheres as the location where such re-representation is likely to take place. Thus, the conscious feelings of positive or negative affect are based on the integration of information from the body about the homeostatic state it is in. From this follows that negative affect is likely to be associated with the increase in physiological arousal, while positive affect is more likely to be associated with reduction in such arousal. This should be detectable as increases and decreases in skin conductance: Higher levels of arousal and hence a higher level of skin conductance would be expected during the presentation of negative word stimuli, and reduction or no increase in arousal and thus a lower or equivalent level of skin conductance would be anticipated during positive stimulus presentation when compared to the neutral stimulus condition.

5.1.5. Physiological responses to linguistic stimuli in bilinguals' two languages

This electrophysiological measure has been applied to studying the level of emotional arousal during the processing of L1 and L2. Harris, Ayçiçeği and Gleason (2003) measured skin conductance responses in Turkish-English bilinguals. The participants had acquired English after the age of 12 years and lived in the United States at the time of the study. The participants were asked to rate the pleasantness of neutral, positive, aversive (negative) and taboo words as well as childhood reprimands. The stimuli were presented both visually and aurally.

Higher SCRs in L1 than L2 to taboo words were recorded when they were presented aurally, and for childhood reprimands when presented both visually and aurally. Yet, no significant differences in electrodermal activity between languages were found for visually presented taboo words or for positive and aversive words presented visually and aurally. Interestingly, the unpleasantness ratings provided by the participants were very similar across L1 and L2 suggesting that although these bilinguals were aware of the emotional connotations of the L2 taboo words and reprimands, they did not respond to them with equally high levels of arousal as they did to L1 taboo words and reprimands. Based on these findings Harris et al. (2003) suggested that physiological arousal mediates emotional experience: They proposed that the reduced autonomic responsiveness to the emotional content of L2 words and phrases may underlie bilinguals' introspective experience that L2 is lacking in emotional force compared to L1.

In a follow-up study Harris (2004) studied the possibility that emotional force of L2 may depend on the age of acquisition and proficiency of the bilinguals. Two groups of Spanish-English bilinguals were studied, who were either early or late learners of English. The early learners were self-reported balanced or English dominant bilinguals. They were exposed to English at or before the age of seven years and considered themselves to be equally or more fluent in English when compared to Spanish. The late learners had started learning English around the age of 8 years, and moved to an English speaking country after the age of 12 years. They were self-reported Spanish dominant bilinguals as they rated themselves as more proficient in Spanish than in English. Their self-rated proficiency in English was lower than in the group of early learners of English. The critical stimuli consisted of taboo words, reprimands, endearments and insults in Spanish and English. A mixture of neutral, positive and negative words was used as a baseline condition. The stimuli were presented both visually and aurally, and unpleasantness ratings were carried out while skin conductance responses were measured.

Harris (2004) found equivalent, increased skin conductivity to taboo words in early and late bilinguals in response to both L1 and L2. However, the late learners of English also showed significantly higher SCRs in response to childhood reprimands in L1 but not in L2. Auditory stimuli in general were found to elicit greater SCRs only in early learners of English. The unpleasantness ratings provided by the two groups of bilinguals were equivalent, apart from L1 childhood reprimands that were rated as less pleasant than L2 childhood reprimands by late learners of English. Thus, for early bilinguals no difference between L1 and L2 were found in their emotional strength, while for the late bilinguals childhood reprimands in their first language were stronger in terms of the ratings given and the arousal they produced than was the case with L2 equivalents. Harris (2004) concludes that the data does not support the strong variant of the hypothesis that L1 is more emotional than L2. Instead she suggests that L1 is perceived to be more emotional than L2, if it is the more proficient language.

Harris, Gleason and Ayçiçeği (2006) have subsequently proposed the emotional contexts of learning theory. According to this view differences in emotionality of L1 and L2 depend on the age of acquisition, i.e. whether L2 was learnt before or after the age of seven years, and the level of proficiency of the speaker. Thus, general decline in emotional responsiveness to L2 will be observed when the age of acquisition has occurred later and the level of proficiency is lower than that in L1. Accordingly there are two situations where bilinguals would be expected to show similar emotional reactions to the two languages: when bilinguals are equally proficient in L1 and L2, or when L2 is more proficient than L1.

The findings of Harris et al. (2003) and Harris (2004) also imply that differences between L1 and L2 are more likely to be detected when threat-related stimuli are used, as only taboo words and childhood reprimands produced significant differences between bilinguals' two languages. Furthermore, auditory stimuli may be more emotionally evocative than visual words and phrases, and thus might more readily reveal differences between L1 and L2 in their emotional strength. This is likely to be based on the language learning history, whereby language is first learnt within the auditory domain, and only later in written form. Thus, auditory linguistic stimuli may more rapidly activate emotional associations and those associations may be more numerous than ones associated with the written language. This view is supported by studies with monolinguals; electrophysiological responses, although reliably detected, tend not to be as large for visually presented emotionally laden words as they are for emotionally evocative pictorial and face stimuli (e.g. Kissler, Assadollahi & Herbert, 2006).

There are some questions however, that remain unclear. One of them is why Harris et al. (2003) did not observe differences between neutral and positive or neutral and negative words in either language, nor were there differences between L1 and L2 in respect to visually presented positive, negative and taboo words (Harris et al., 2003) as well as insults and endearments (Harris, 2004). According to the emotional contexts of learning theory, differences between L1 and L2 would be predicted, as the bilinguals were late learners of L2 and reported lower level of proficiency in this language.

It is possible that the task used may have influenced the kinds of emotional responses that were detected. In an unpleasantness rating task participants' attention is explicitly directed toward the emotional significance of those words and phrases. Harris (2004) reported that participants were urged to think about the meaning of the word or phrase the full 10 seconds that they had time to give their response. Thus, the bilinguals would have had sufficient time to translate the word or phrase from L2 to L1 and consequently activate the emotional associations linked with L1. Reduction in the time available for conscious, intentional processing of the words' emotional significance could help to accentuate the differences between L1 and L2 words. If L2 words have weaker connections to the semantic system it could be expected that the activation of emotional connotations will take longer and may not produce physiological arousal to the same extent as would be the case if more time was available for the word processing. One experimental paradigm extensively used to study more automatic, incidental processing of the emotional content of single word stimuli is the emotional Stroop task.

5.1.6. Emotional and taboo Stroop tasks

The Stroop effect is based on the finding that when participants are asked to name the colour of the ink of words and nonwords, the response time is on average 260 ms longer for colour words that contradict the ink colour than it is for strings of Xs (Stroop, 1935). This demonstrates that even when participants are trying to ignore the meaning of the word, the meaning is processed automatically, affecting other, less automatic cognitive processes taking place at the same time, i.e. processes required for the colour naming.

Further research using this colour-naming method has demonstrated that unpleasant words (e.g. war) interfere with colour-naming more than neutral words (e.g. leaf) (MacKay et al., 2004). This phenomenon was identified as the emotional Stroop effect, although the accuracy of this term has since been disputed as it has been demonstrated that the slowing down of naming occurs only in the case of negative words, but not when positive words are used (McKenna & Sharma, 1995). A modification of this is the taboo Stroop effect, which involves naming the ink-colour of taboo words (e.g. wanker) instead of other emotionally charged words. It has been suggested that the taboo Stroop effect produces a similar interference effect to the emotional Stroop task (MacKay et al., 2004).

The different levels of interference between positive and negative words have been explained through a more general mechanism responding to all types of threats. Algom, Chajut and Lev (2004) compared the classical Stroop effect with the emotional Stroop effect, and found that the interference observed in the emotional Stroop task occurs also when participants are asked to read the words rather than identify the colour of emotionally charged or neutral words, whereas this is not the case with the classical Stroop task. They propose that a preattentive system which processes information fast, automatically and in parallel is responsible for the temporary freezing of ongoing activity when a threat-stimulus is detected. This global resource theory of emotion and attention explains also the taboo Stroop effect. MacKay et al. (2004) acknowledged that the resources taken up by emotional reaction might have consequences for memory formation. Indeed, the taboo words were found to be better remembered in a surprise recall test followed by the taboo Stroop task (MacKay et al., 2004).

Although the underlying mechanisms causing the emotional and taboo Stroop effects are still being investigated, the research clearly suggests that emotional and taboo Stroop methods have the capacity to detect differences between words implying threat and those that do not. It could be predicted that L1 words are likely to activate the semantic system to a greater extent, including the threatening content of the stimuli, than L2 words. Consequently they would also produce greater interference of colour-naming than L2 words. However, this is not what has been observed.

5.1.7. Emotional and taboo Stroop effects in bilinguals

Eilola, Havelka and Sharma (2007) applied the emotional and taboo Stroop tasks in investigating the impact of emotional words in late bilinguals' first and second language. The participants had learnt Finnish as their first language and had started learning English at or after the age of seven years. All the participants had spent some time in an English-speaking country, but at the time of the study they lived in Finland and were therefore immersed in a Finnish-speaking environment. Participants were presented with neutral, positive, negative and taboo words both in Finnish and in English and were asked to press one of four keys on a response box to indicate the colour in which the words were written. They were explicitly instructed to ignore the meanings of the words. The results showed significantly slower reaction times to negative and taboo words when compared to neutral words, while positive words did not differ from neutral words. No difference between L1 and L2 was found. This suggests that when negative content of words is processed incidentally, it has equivalent impact on the behavioural response in the speaker's first and second language.

Similar research design was used by Sutton, Altarriba, Gianico and Basnight-Brown (2007). The participants were Spanish-English bilinguals, who had learnt to speak English around the age of 5 years, and reported greater proficiency in their L2 (i.e. they were English-dominant bilinguals). They were presented with neutral and negative words, and instructed to press one of two keys on the keyboard depending on the colour in which the words was printed in. They found significant interference from negative words in both L1 and L2. This pattern concurs with the findings of Eilola et al. (2007) in that bilinguals seem to process the emotional content of words automatically in both languages. In addition, Sutton et al. (2007) reported a trend for a stronger interference by negative words in L2 (English) than in L1 (Spanish). As participants indicated in a self-report English to be their dominant language, the authors propose that this trend could be explained by the higher level of proficiency in L2 than L1. However, the interaction between the word type (neutral and negative) and language (L1 and L2) was not found to be significant. Thus, further research investigating the emotional Stroop effect in bilinguals is required to establish whether less interference from emotionally charged words will be associated with the reduction of the level of proficiency in one of bilinguals' languages.

5.1.8. Combining emotional Stroop with skin conductance recording

The emotional Stroop task has been combined previously with the skin conductance recording in monolingual speakers. Segerstorm (2001) studied high and moderate optimists as well as pessimists in regard to their attentional bias towards positive, negative and concern-related words (academic words) when compared to neutral words using emotional Stroop task in combination with skin conductance recording. She found significant interference from positive and negative words. However, skin conductance did not show an overall emotionality effect. Emotionality was found to interact with optimism; the SCR rates for emotional stimuli were elevated in pessimists and high optimists, but did not differ in moderate optimists. Negative words were found to produce higher SCR rates than positive words in both groups, but this effect was more pronounced in pessimists. These results suggest that both positive and negative words can be associated with increased electrodermal activity in an emotional Stroop task, but this effect is much reduced for positive words when compared to negative words.

5.1.9. The aims of the present study

The present study sets out to address two questions that remain unclear. The first question is whether the equivalence of interference in emotional and taboo Stroop task will be replicated when the responses of native and non-native speakers to the same language are compared. This approach has the advantage that it overcomes the problem with translation equivalency of words in L1 and L2. Although the study reported in Chapter 2 suggests that emotional words are perceived very similarly in terms of their emotional valence and emotional arousal across languages, it is possible that some differences between word stimuli from two different languages exist that may contribute to the findings. Therefore replicating the emotional and taboo Stroop experiment using words only from one language will help to address the question whether differences may be observed in terms of the emotionality of the language if native and non-native speakers are compared. In their studies, Eilola et al. (2007) and Sutton et al. (2007) presented words from bilinguals' first and second language, while in the present study the participants will be therefore responding to words only from one language, English. This approach makes it possible to address also another limitation in the previous studies: It is possible that the repetition of the emotionally charged words in L1 and L2 may have lead to habituation in and consequently reduced the impact of those words. If this was the case, higher levels of interference may be observed from negative and taboo words when the words are presented only in one language. This research design may also be more sensitive in detecting differences between L1 and L2, if such differences exist. Furthermore, according to Harris et al. (2006), differences between the emotionality of L1 and L2 could be expected if L2 has been learnt later and spoken at a lower level of proficiency than L1. Consequently in the present study will focus on responses to L2 of participants who are still dominant in their L1.

The second key question addressed here is whether different levels of autonomic arousal in response to L1 and L2 words are likely to account for the perceived differences in the emotionality of L1 and L2 in the absence of behavioural differences. Harris et al. (2003) have reported significant differences between L1 and L2 in the levels of skin conductance, an indicator of autonomic arousal associated with emotional activation. These differences were observed when the pleasantness of aurally and visually presented childhood reprimands and aurally presented taboo words were rated. The ratings to L1 and L2 stimuli did not differ from each other, suggesting that differences in arousal do not necessarily require differences in the understanding of the denotative meaning of the stimuli. Therefore it could be expected, that even in the absence of differences between L1 and L2 in behavioural responses to emotional and taboo Stroop tasks, emotionally charged words may be associated with different levels of autonomic arousal in L1 and L2 measured by skin conductance levels (SCL).

5.2. Method

5.2.1 Participants

The sample consisted of 39 native English speakers and 33 Greek-English bilinguals. The participants were recruited at University of Kent (UK) and were either volunteers, received a partial credit for an undergraduate psychology course or £3 reward. Seven English speakers and two Greek-English bilinguals were excluded from the analysis due to artefacts (e.g. coughing), because of inadequate recording, or high error rate (more than 10% errors overall). Consequently, 32 native English speakers (7 males and 25 females) and 31 non-native speakers (9 males and 22 females) were included in the analysis. Mean age of native English speakers was 23.5 years (SD = 6.37), and Greek-English bilinguals 23.4 years (SD = 3.10). All the participants had normal or corrected to normal vision.

All non-native speakers reported Greek as their first language. They had all started learning English at or after the age of 6 years (M = 8.4, SD = 1.91). The non-native speakers were administered a modified version of the Li, Sepanski and Zhao's (2006) Language History Questionnaire (see Appendix 5.1). The bilingual participants rated their proficiency in reading, writing, speaking and comprehension of L1 and L2 using a 7-point scale (1 = very poor, 7 = native-like). A two-way analysis of variance (ANOVA) with Language (English and Greek) and Language Skill (reading, writing, speaking and comprehension) as within-subjects factors indicated that Greek-English bilinguals were significantly more proficient in Greek (M = 6.8) than in English (M = 5.7); $F(1, 30) = 102.35$, $p < .001$, $MS_e = .806$. At the time of testing all non-native speakers were university students at an undergraduate or graduate level at the University of Kent, UK, immersed in an English language environment and attending courses that require good command of English. Therefore, while dominant in their L1 (Greek), the bilingual participants can be considered to be proficient users of their L2 (English).

5.2.2. Design and materials

A 2 X 4 mixed factorial design was used with Language Background (native and non-native English speaker) as a between groups factor and Word Type (neutral, positive, negative and taboo) as a within-subjects factor.

The word stimuli were the same as the English stimuli used by Eilola, Havelka and Sharma (2007). Four lists of English words, consisting of 20 words each, were selected according to their emotional content (see Appendix 5.2). Affective Norms for English Words (ANEW) database (Bradley & Lang, 1999) was used to select neutral (e.g. kettle) (M = 5.4), positive (e.g. warmth) (M = 7.6) and negative (e.g. rape) (M = 1.9) words, $F(2, 59) = 550.03$, $p < .05$. These words were matched groupwise in frequency, $F(5, 119) = 1.87$, $p = .11$, using the CELEX Lexical Database, Release 2 (1995). The words selected also did not differ in Kucera and Francis frequency, HAL log frequency, mean lexical decision time and mean naming time based on the database in the English Lexicon Project (Balota et al., 2002). Taboo words were selected using Familiarity (0 = not at all familiar, 9 = very familiar), Emotional Valence (0 = very negative, 9 = very positive), Emotional Charge (0 = no emotional charge, 9 = very high emotional charge) and Offensiveness ratings (0 = not at all offensive, 9 = very offensive) for British English (Chapter 2; Eilola & Havelka, 2010).

A series of one-way ANOVAs were carried out to identify any differences between the word types. These ANOVAs incorporated Word Type (neutral, positive, negative and taboo) as the independent variable and Familiarity, Emotional Valence, Emotional Charge and Offensiveness as the dependent variables. Bonferroni correction was used for post hoc tests.

The results showed a significant main effect of Familiarity; $F(3, 79) = 6.80, p < .001$. While neutral ($M = 3.0$), positive ($M = 3.5$) and negative words ($M = 3.1$) did not differ from each other in their familiarity, taboo words ($M = 4.5$) were rated as significantly more familiar than neutral and negative words. The main effect of Emotional Valence was also significant; $F(3, 79) = 301.00, p < .001$. Negative words were rated as most negative ($M = 1.0$), followed by taboo words ($M = 1.8$). Neutral words were rated as intermediate in their valence ($M = 4.3$), and positive words were rated as the most positive ($M = 6.9$). The main effect of Emotional Charge (arousal) was significant; $F(3, 70) = 61.63, p < .001$. Neutral ($M = 0.7$) words were significantly lower in their emotional charge than positive ($M = 4.2$), negative ($M = 4.7$), and taboo words ($M = 3.0$), $p <. 001$. Taboo words were lower in emotional charge than positive and negative words, and there was no significant difference between positive and negative words. Significant main effect of Offensiveness revealed that taboo words ($M = 4.5$) were rated as more offensive than the other three words types; $F(3, 79) = 87.60, p < .001$. Negative words ($M = 1.4$) were also found to differ significantly from neutral ($M = 0.21$) and positive words ($M = 0.23$). There was no significant difference between neutral and positive words.

The experimental design was based on procedures used in previous research on emotional Stroop (e.g., McKenna, 1986, McKenna & Sharma, 1995, Sharma & McKenna, 2001). Each word was presented once in each of the four print colours (red, blue, green and yellow). The words were presented in blocks with one category of words in each block. Thus, four blocks of words were presented each consisting of 80 trials. Each trial was presented in a random order with one restriction: the same word or colour did not repeat itself on consecutive trials. The order of the blocks with different types of words was counterbalanced using a Latin square design.

5.2.3. Procedure

5.2.3.1. Emotional and taboo Stroop tasks

Participants completed two practice sessions where they identified the colour of 80 meaningless six-digit letter stings (e.g. CRXTHR) which were presented in font size 20 using a PC, running Windows 2000 with E-Prime Version 1.1.4.1. The experimental phase followed the practice sessions after a one minute break.

The letter-string remained on the screen until a response was made, at which point the next stimulus appeared after an interval of 32 ms. This setup was identical for both the practice and experimental sessions. Participants were instructed to ignore the meanings of the words and report the ink colour as quickly and as accurately as possible. Responses were made by pressing one of the four buttons (using index and middle fingers) on the key board each indicated with colour labels. In conjunction with acquiring participants' informed consent they were also informed that some of the words are extremely offensive in nature (i.e. swear words). Other information about the nature of the words was not given at the start of the experiment.

5.2.3.2. Measurement of the skin conductance level

Prior to the attachment of the electrodes, participants were asked to wash their hands using soap and warm water, and to dry them carefully afterwards. Ag-AgCl electrodes (0.6 cm in diameter) were placed on the participant's distal phalanges of the fourth and fifth finger in the left hand. An electrode gel (Parker Laboratories Signa Gel) was used on the electrodes to increase skin conductance. Skin conductance was recorded using Biopac Student Lab PRO 3.7.

Participants were instructed to take a comfortable position so that they would not need to adjust their position during the study. They were asked not to move their legs, take deep breaths, cough, bite their lip or tongue, or speak during the study. At the start of the experiment participants were asked to take one deep breath and then relax and wait for a sound signal given by the experimenter before starting the first practice session. They were instructed to stop after each section of the study and wait until the experimenter gave them the next sound signal indicating that they could proceed to the next part of the study. The break in between each session was one minute long. One minute silent phase preceded the first practice session.

After participants had completed all six sessions, the electrodes were removed and participants debriefed. The non-native participants were administered a language history questionnaire at the end of the study.

5.2.4. Analysis of the skin conductance level

In experimental studies using electrodermal monitoring, skin conductance responses are measured in relation to specific stimuli presented. Electrodermal reactions have relatively long latencies; the rise time for an SCR is 1-2 seconds and it takes 4-8 sec for the SCR to return to baseline (Hugdahl, 2001). As a consequence the inter-stimulus interval needs to be at least 6 seconds long for SCRs to be reliably measured. The emotional Stroop effect, however, is substantially affected by time pressure: Sharma and McKenna (2001) have found that the emotionally charged words significantly slowed down the response times relative to neutral words when the stimuli were presented 32 ms after the response was given but not when the presentation interval was 240 ms or longer. This experimental design does not therefore enable the measurement of SCRs that are linked to specific stimuli. The skin conductance level (SCL) in contrast can be recorded over an extended period of time and indicates changes in the overall level of activation rather than temporary changes in response to a specific stimulus. Therefore SCLs for the duration of each block of emotionally charged and neutral words were measured and the blocks were separated by one-minute silent phase in order to avoid carry-over effects from one block to another. The mean level of conductance was then calculated for each block separately, and these scores were entered into an analysis of variance.

5.3. Results

5.3.1 Analyses conducted

Response times less than 300 ms and greater than 3000 ms were treated as outliers and thus excluded from the RT analyses. On average, 0.2 per cent of RTs were discarded (see Table 5.1). The data was first analysed by subjects (F_1) in a two-way mixed factorial analysis of variance with Language Background (native, non-native) as a between-subjects factor and Word Type (neutral, positive, negative and taboo) as within-subjects factor. This was followed by a two-way mixed factorial analysis of variance by items (F_2) with Language as a within-subjects factor and Word Type as a between-subjects factor.

These analyses were extended by including Proficiency as a covariate in the analysis by subjects of non-native speakers' responses. The level of proficiency was obtained by calculating the mean score of the self-rated ability to read, write, speak and comprehend spoken L2. Finally, the impact of word length, word form frequency (Celex Lexical Database Release 2, 1995), familiarity and concreteness (Eilola & Havelka, 2010) were assessed by including these factors as covariates in the analysis by items. The analyses of variance were carried out on median response times. The Greenhouse-Geisser epsilon was used to correct the degrees of freedom where the assumption of sphericity was violated. Bonferroni adjusted post hoc tests were conducted to identify the sources of differences between conditions and groups of participants.

Table 5.1

Outliers and Error Rates for Emotional and Neutral Words in Native and Non-native Speakers of English

	Native English[a]		Non-native English[b]	
Word type	Outliers(%)	Errors(%)	Outliers(%)	Errors(%)
Neutral	0.1	3.4	0.3	2.2
Positive	0.0	4.0	0.4	2.3
Negative	0.1	3.4	0.5	2.3
Taboo	0.0	4.0	0.5	3.0

Note. $N^a = 32$, $N^b = 31$.

5.3.2. Analysis of errors

The average error rate was low ($M = .037$, $SE = .004$, in native English speakers; $M = .024$, $SE = .004$, in non-native speakers of English) (see Table 5.1). The main effect of Language Background was significant [$F_1(1, 61) = 5.07$, $p < .05$, $MS_e = .002$; $F_2(1, 76) = 47.43$, $p < .001$, $MS_e = .000$], indicating that native speakers of English made significantly more errors than non-native speakers. The main effect of Word Type [$F_1(3, 183) = 2.62$, $p >$

.05, $MS_e = .000$; $F_2(3, 76) = 1.53$, $p > .05$, $MS_e = .000$], and the interaction between Language Background and Word Type [$F_1(3, 183) = 0.53$, $p > .05$, $MS_e = .000$; $F_2(3, 76) = 0.49$, $p > .05$, $MS_e = .000$] were not found to be significant.

The analysis including Proficiency as a covariate did not reveal significant effects of the level of L2 competence [Proficiency $F(1, 29) = 1.06$, $p > .05$, $MS_e = 0.002$; Word Type X Level of Proficiency $F(3, 87) = 0.13$, $p > .05$, $MS_e = 0.000$]. The main effect of Word Type was also non-significant [$F(3, 87) = 0.23$, $p > .05$, $MS_e = 0.000$].

The analysis by items including Word Length, Word Form Frequency, Familiarity and Concreteness as covariates showed that when these factors were controlled for, the difference between native and non-native speakers in their error rates remained significant [Language Background $F(1, 72) = 4.21$, $p < .05$, $MS_e = .000$]. This analysis also revealed a significant main effect of Word Type [$F_1(3, 72) = 3.29$, $p < .05$, $MS_e = .000$] with taboo words ($M = .039$) resulting in higher levels of errors than negative words ($M = .028$) overall.

5.3.3. Analysis of response latencies

The mean RTs are presented in Table 5.2. The main effect of Language Background was significant in the analysis by items but not by subjects [$F_1(1, 61) = 1.40$, $p > .05$, $MS_e = 46179.97$; $F_2(1, 76) = 29.11$, $p < .001$, $MS_e = .409.19$]: Non-native speakers ($M = 757.8$ ms) responded with longer latencies overall than native speakers of English ($M = 725.8$ ms). Furthermore, the main effect of Word Type indicated significant differences in response latencies between the different categories of words [F_1 (2.19, 133.29) = 25.17 , $p < .001$, $MS_e = 3337.95$; $F_2(3, 76) = 41.48$, $p < .001$, $MS_e = 735.75$].

Table 5.2

Mean Reaction Times for Emotional and Neutral Words in Native and Non-native Speakers of English

	Native English[a]			Non-native English[b]		
Word type	RT (ms)	*SE*	Interference	RT (ms)	*SE*	Interference
Neutral	698.2	18.82		728.8	19.12	
Positive	703.6	18.77	5.4	736.6	19.07	7.8
Negative	736.7	20.26	38.5^{**}	769.0	20.59	40.2^{**}
Taboo	764.8	23.54	66.6^{***}	796.74	23.91	67.9^{***}

Note. $N^a = 32$, $N^b = 31$. Interference is the difference in RT for the word type minus the neutral condition; $^{**}p < .01$, $^{***}p < .001$.

Bonferroni corrected post hoc tests showed that the latencies for negative (M = 752.9 ms) and taboo (M = 780.8 ms) words were significantly longer than those of neutral (M = 713.5 ms) and positive words (M = 720.1 ms). Taboo words were also found to result in longer response latencies than negative words. There was no significant difference between neutral and positive words. The interaction between Language Background and Word Type was not found to be significant [$F_1(2.19, 133.29) = .01$, $p > .05$, $MS_e = 3337.95$; $F_2(3, 76) = 0.81$, $p > .05$, $MS_e = 409.19$].

The analysis including Proficiency as a covariate did not reveal significant effects of the level of L2 competence [Proficiency $F(1, 29) = 0.18$, $p > .05$, $MS_e = 67232.42$; Word Type X Level of Proficiency $F(1.97, 57.03) = 0.25$, $p > .05$, $MS_e = 5240.33$]. However, the inclusion of this factor reduced the main effect of Word Type into non-significance [F(1.97, 57.03) = 0.47, $p > .05$, $MS_e = 5240.33$]. Thus, it appears that the addition of this variable may have reduced the statistical power and as a consequence no emotionality effects were observed. This is the most likely explanation as the sample of non-native speakers consisted of 31 participants.

The analysis by items including Word Length, Word Form Frequency, Familiarity and Concreteness as covariates showed no significant main effect of Language Background [$F(1, 72) = 0.01$, $p > .05$, $MS_e = 384.53$] nor Language Background X Word Type interaction [$F(3, 72) = 0.94$, $p > .05$, $MS_e = 384.53$]. The main effect of Word Type remained significant [$F(3, 72) = 41.02$, $p < .001$, $MS_e = 704.34$]. The Bonferroni corrected post hoc tests showed the same pattern of RTs as reported above; negative and taboo words were associated with significantly slower RTs than neutral and positive words, but neutral and positive words did not significantly differ from each other. The difference between negative and taboo words was also significant, with taboo words producing the slowest RTs.

5.3.4. Analysis of skin conductance levels

The mean level of skin conductance during each block was used in the analyses. First, a two-way analysis of variance was conducted, with Language Background (native and non-native English speaker) as a between-groups factor and Word Type (neutral, positive, negative and taboo) as a within-subject factor. The analysis was further extended by including Proficiency was a covariate in the analysis. Greenhouse-Geisser correction was used where the assumption of sphericity was violated. Bonferroni corrected post hoc tests used to test the differences between conditions.

Table 5.3

Mean Skin Conductance Levels in Native and Non-native Speakers of English during Emotional and Neutral Word Blocks

	Native English[a]			Non-native English[b]		
Word type	SCLs(μmhos)	*SE*	Difference	SCLs(μmhos)	*SE*	Difference
Neutral	12.43	0.70		12.27	0.71	
Positive	12.62	0.69	0.19	12.05	0.70	-0.22
Negative	13.24	0.65	0.81**	12.33	0.66	0.06
Taboo	13.38	0.75	0.95**	12.63	0.76	0.36

Note. $N^a = 32$, $N^b = 31$. Difference score was calculated by deducting the SCL during neutral condition from SCLs during each emotional condition. $^{**}p < .01$.

The mean levels of skin conductance during each block of words are presented in Table 5.3. The main effect of Language Background was not significant [$F(1, 61) = .28$, $p > .05$, $MS_e = 59.25$], suggesting that the overall levels of skin conductance did not differ between the two groups. The main effect of Word Type, however, showed that the mean levels of skin conductance differed significantly depending on the types of words participants responded to [$F(2.61, 158.99) = 10.24$, $p = < .001$, $MS_e = 1.08$]. Bonferroni corrected post hoc tests showed that during negative (M = 12.79 μmhos) and taboo word block (M = 13.00 μmhos) the level of skin conductance was significantly higher than during positive (M = 12.15 μmhos) and neutral word blocks (M = 12.35 μmhos), but there was no significant difference between neutral and positive word blocks nor between negative and taboo word blocks. The interaction between Language Background and Word Type was found to be marginally significant [$F(2.61, 158.99) = 2.34$, $p = .085$, $MS_e = 1.08$].

As our a priori hypothesis was that native speakers may show higher levels of skin conductance in responses to emotionally charged words when compared to non-native speakers, the effect of Word Type was further analysed for each language separately. The analyses showed that there was a significant main effect of Word Type in native English speakers [$F(3, 93) = 8.99$, $p < .001$, $MS_e = 1.13$], but in non-native speakers of English the effect did not research significance [$F(2.43, 72.77) = 2.44$, $p = .084$, $MS_e = 0.92$]. Bonferroni corrected post hoc tests confirmed that in native English speakers negative and taboo words produced higher mean levels of skin conductance than positive and neutral words, but positive and neutral words did not differ from each other. Negative and taboo words were not found to differ in the levels of skin conductance they produced either. Although there was a trend for non-native speakers to respond with higher levels of skin conductance to taboo words when compared to positive words, this difference was not statistically significant ($p = .17$).

The analysis assessing the impact of the level of competence of non-native speakers on their electrodermal responses during the emotional and taboo Stroop task showed no significant main effect of Proficiency [$F(1, 29) = 2.12$, $p > .05$, $MS_e = 44.0$], Word Type [$F(2.43, 70.34) = 0.05$, $p > .05$, $MS_e = 0.95$], nor interaction between Proficiency and Word Type [$F(2.43, 70.43) = 0.13$, $p > .05$, $MS_e = 0.95$].

5.4. Discussion

5.4.1. Interpretation of the behavioural findings

The first aim of the present study was to establish whether differences in the level of emotional and taboo Stroop interference would be found when native speakers' and non-native speakers' responses were compared. The results showed that the greatest interference was produced by taboo words, followed by negative words. Positive words were not found to differ from neutral words in their response latencies. Furthermore, no differences in the pattern of interference were found between the two groups of participants.

These results replicate the previous findings that words implying threat influence the attentional processes to the same extent in L1 and L2 (Eilola et al., 2007; Sutton et al., 2007). This effect appears to generalise across different linguistic backgrounds as in the current study the non-native speakers had learnt Greek as their first language while previous studies had investigated native Finnish (Eilola et al., 2007) and native Spanish speakers (Sutton et al., 2007). It is also notable that the bilinguals studied here were unbalanced but proficient speakers of English as they all studied at a university in the UK requiring good language skills. Furthermore, they were immersed in an English speaking environment, unlike Finnish-English bilinguals studied previously. Despite these differences in language background, very similar pattern of interference was observed.

The fact that fast activation of word semantics was found in L2 is also in line with research showing that not only L1 but also L2 word forms can automatically access their underlying semantic representation very quickly (e.g. Duyck & De Houwer, 2008). This finding therefore contradicts the Revised Hierarchical Model (Kroll & Stewart, 1994), which proposes a weaker link from L2 lexicon to the semantic system when compared to L1. In stead, it appears that the threat content associated with negative and taboo words is equally strongly activated in L2 and L1, and this emotionally salient information disrupts the colour-identification performance to the same degree in L1 and L2.

In this study native speakers were compared with non-native speakers, while in the previous studies bilinguals' responses were compared when they performed the emotional and taboo Stroop tasks in their two languages. The results confirmed that the pattern of interference is similar when two groups of participants responded to the words stimuli only from one language rather than two. However, a significant difference between negative and taboo words was also observed, a finding that has not been reported previously (Eilola et al., 2007). It may be that the repetition of the word stimuli in two languages may have resulted in some habituation to taboo words, but when each category of words was encountered only once, the taboo words were perceived as more distinctive and thus slowed down the colour-identification performance to a greater extent.

5.4.2. Interpretation of the psychophysiological findings

Previous studies have demonstrated that bilingual speakers frequently report their second language to be less emotionally evocative in comparison to their first language (e.g. Dewaele, 2004). The second aim of the current study was therefore to investigate whether different levels of autonomic arousal in response to L1 and L2 words are likely to account for these perceived differences in the emotionality of L1 and L2 in the absence of behavioural differences. The results showed a significant increase in skin conductance level in native speakers of English for negative and taboo words when compared to neutral words, but positive words were not found to differ from neutral words. This pattern is very similar to the one found in the behavioural data: Slower responses to negative and taboo words were also associated with higher physiological arousal. This increase in skin conductance, however, was not observed in non-native speakers of English. Despite of showing significant levels of interference from negative and taboo words on behavioural level, their skin conductance responses did not differ significantly between emotionally charged and neutral words.

The results from skin conductance recording suggests that even though the second language speakers access the word semantics fast and automatically, the emotional connotations of those words are not produce higher levels of autonomic arousal. This is the first study to compare skin conductance levels relating to emotional Stroop interference in bilinguals. The pattern observed corresponds to Harris et al.'s (2003) findings in that second language speakers seem to access the denotative meanings of the emotionally charged words in L2, but do not respond to their connotative meanings (i.e. emotional arousal associated with the words) to the same extent as they do in L1.

Harris et al. (2006) have explained this difference between L1 and L2 in their capacity to produce increased physiological arousal through the emotional contexts of learning theory: The first language is acquired in naturalistic contexts and therefore becomes associated with numerous emotional events, while the second language is often learnt and used in school or professional environment where emotional control is emphasised. As a result, L2 will be associated with less extreme emotional experiences and may not have the same capacity to produce strong emotional arousal in the bilingual speaker. Indeed, Harris et al. (2003) reported that during debriefing the bilingual speakers had found that they "felt nothing" when pronouncing or hearing L2 taboo words, possibly because of the reduced autonomic arousal produced by these words (Harris et al., 2003).

The level of proficiency is also believed to contribute to this reduced physiological responsiveness: Harris (2004) found that bilinguals who were less proficient in L2 than L1 showed a difference between their first and second language in the extent that they evoked increased arousal. However, such difference was not found in balanced bilinguals. As a consequence the impact of proficiency in L2 was also assessed in the present study. No significant effect of the level of competence was found. This was probably due to lack of statistical power, as the sample included only 31 participants. Furthermore, there may not have been sufficient variability within the group in terms of their levels of proficiency, and therefore no effect of this factor on the behavioural or psychophysiological data was found. A future study could aim to address this question more systematically by recruiting a larger sample of participants with larger differences in their levels of L2 competence. Furthermore, it would be also of interest to study participants with no experience of immersion in L2 environment, as to date all studies conducted have included bilinguals with some or relatively extensive immersion in L2.

5.4.3. Interpretation of the divergence of behavioural and psychophysiological findings

Previous research indicates that subjective descriptions of emotional arousal and the strength of the physiological response to the same linguistic stimuli measured using skin conductance recording do not necessarily converge: In the Harris et al. (2003) study, bilingual speakers rated taboo words and childhood reprimands as equally unpleasant in L1 and L2, but showed higher levels of arousal to those words and phrases in L1 than L2. In the present study such lack of convergence was observed at two levels. Firstly, positive and negative words were used that had been previously rated as equivalent in their perceived emotional charge. Yet, significantly higher levels of skin conductance were measured in response to negative than positive words. This pattern of reduced arousal to positive words has been also reported previously with monolingual participants (Segerstrom, 2001). Therefore it appears that increased physiological arousal as measured with skin conductance recording is more pronounced for threat-related stimuli than to positive words stimuli with the same levels of perceived emotional arousal.

The difference between negative and positive word stimuli could be based on different neural mechanisms underlying the processing of emotional content with negative and positive valence. This view is supported by the homeostatic neurobiological model of emotion, which states that emotional feelings and behaviours may be neurobiologically differentiated by their roles in the enrichment and expenditure of physical and mental energy (Craig, 2005). The differences between positive and negative stimuli would be therefore based on the asymmetric re-representations of the homeostatic system in the forebrain: The left forebrain has been found to be involved with the re-representation of the parasympathetic nervous system, which is responsible for the relaxation, appetitive behaviour, and importantly, with the processing of positive emotional content. The right forebrain on the other hand has been demonstrated to re-represent the sympathetic nervous system activity, which is involved in responding to threatening stimuli, producing increases in physiological arousal, and is predominantly associated with processing of negative emotional content (Craig, 2005). Thus, although positive and negative words are evaluated as equally emotionally charged, they are associated with different neurobiological processes leading into different physiological responses.

Secondly, the bilinguals appear to access the semantics of emotional words fast and automatically even when they have started learning the second language after the early childhood. Yet, the semantic activation of L2 word meanings does not seem to lead to similar increases in autonomic activation as is the case in L1. This result concurs with previous research, which suggests that bilingual speakers' perception of L2 as less emotional than L1 may be partly explained by the reduced physiological responsiveness associated with that language (Harris et al., 2003). The mechanisms underlying such difference have not been investigated as yet. Therefore future research ought to address the questions how emotional connotations of words are learnt, and what is the neural architecture underlying the processing of emotional content in language.

5.4.4. Evaluation of the present study

The limitation of the emotional and taboo Stroop tasks is that participants are explicitly asked to ignore the meanings of the words. Furthermore, the task does not require the processing of the word meaning, as responses are made to the visual features of the words (i.e. the print colour). Previous research seems to suggest that deeper processing of word meaning may result in differences being observed between L1 and L2 (Ayçiçeği-Dinn & Caldwell-Harris, in 2009). As a consequence future studies should apply methods such as emotionality rating or semantic decision tasks as such methods involve deeper processing of the meaning of the words. The evaluation of the emotionality of words was found to produce expected differences between L1 and L2 when bilinguals' incidental recall and recognition of emotional words were investigated (Aycicegi-Dinn & Caldwell-Harris, 2009).

Another consideration is the bilinguals' level of proficiency. Previous research seems to suggest that differences between L1 and L2 may be only observed in less proficient L2 speakers (Harris, 2004). In the present study Greek-English bilinguals could be considered as highly proficient bilinguals, as they were living at the time of the study in the United Kingdom and carrying out undergraduate or postgraduate studies in English. Therefore the direct comparison of more and less proficient bilinguals would make it possible to establish whether lower level of proficiency will reveal differences between L1 and L2 emotional word processing in the absence of such differences in more proficient bilinguals.

Chapter 6. Discussion

6.1. The aims of the present thesis

A number of studies have been published over the last ten years testing the hypothesis that bilingual speakers perceive emotional content in L2 differently from L1 (e.g. Harris et al., 2006). This assumption draws from a wide range of sources, such as clinical studies, investigations in psycholinguistics, and self-reports of bilinguals (e.g. Dewaele, 2004). Such research evidence seems to concur that L1 is perceived to be more emotionally immediate and expressive than later acquired languages, although this is probably modified by factors such as level of proficiency, age of acquisition and context of second-language learning (e.g. Harris et al., 2006; Pavlenko, 2006). It has been proposed that bilinguals who have acquired their second language after the early childhood, are less proficient in L2 than L1, and who have limited experience of immersion in L2, are more likely to perceive L2 as less emotional than L1 (Harris et al., 2006, Pavlenko, 2006). This has been explained through the lack of associations between L2 and emotional experiences that would enable stronger links to develop between L2 and the semantic system (Santiago-Rivera & Altarriba, 2002).

While the bilingual models of word processing do not make explicit assumptions about the way emotional content of words is processed, it is often assumed that emotional content is an aspect of the word semantics. The Revised Hierarchical Model of bilingual memory (Kroll & Stewart, 1994) suggests that L2 has weaker links to the semantic system than L1, and as a consequence L2 lexical representations do not activate word meanings as fast and reliably as L1 lexical forms. This model would therefore assume that L2 words are not able to activate emotional content of words to the same degree as L1 words do. Another model of bilingual word processing is the BIA+ (Dijsktra & Van Heuven, 2002). This model assumes that L2 words may have a lower resting level activation than L1 words, and as a consequence L2 words and their meanings may be activated slower than is the case in L1. However, if the resting levels for L2 words are similar to L1 words, they can be activated equally rapidly and thus also access the word semantics fast.

Studies using an experimental approach in examining the emotionality effects of L1 and L2 in relation to memory, attention, automatic evaluation of emotional content, and physiological arousal have produced mixed results (e.g. Altarriba & Canary, 2004; Ayçiçeği & Harris, 2004; Eilola et al., 2007; Harris et al., 2003). Some studies appear to support the view that greater associations between L1 word forms and the semantic system result in deeper memory trace for those words, when compared to L2 (Anooshian & Hertel, 1994), and that highly emotionally evocative linguistic stimuli produce higher levels of physiological arousal in L1 than L2 (Harris et al., 2003). Yet many studies have failed to find differences between L1 and L2 (e.g. Eilola et al., 2007) or found that sometimes L2 may be more emotional than L1 (Ayçiçeği & Harris, 2004). The question that needs to be addressed therefore is what the source of the subjective experience of differences between L1 and L2 may be, and why this difference is not always found. The aim of the present investigation was therefore to extend the existing research into emotional word processing in L1 and L2, and attempt to identify some of the factors that may be contributing to the perceived greater emotionality of L1 when compared to L2.

As discussed in Chapter 1, the mixed findings from studies investigating emotionality of bilinguals' L1 and L2 have been difficult to explain partly because of methodological limitations in some of the investigations. However, the lack of a wider theoretical framework that would help to understand the way emotional language is processed is also partly contributing to this. It was suggested that theoretical models from emotion research could provide such framework. Specifically, the basic emotions approach, the dimensional/ core affect approach and the appraisal approach were introduced and applied to emotional word processing. Furthermore, understanding emotion as a dynamic, multicomponential system (e.g. Kuppens et al., 2009) can help to understand the existing findings better.

In the present thesis, implicit behavioural and psychophysiological measures were applied into studying emotional word processing in bilinguals' L1 and L2. The behavioural measures (i.e. lexical decision task, emotional and taboo Stroop tasks) were assumed to measure early, fast and automatic processing of emotional content. It was proposed that responses to negative and taboo words may be based on fear-learning (e.g. Öhman, 2009), which results in the association of word forms to threatening events. As a consequence those words will produce behavioural and physiological changes similar to a fear response to other, non-linguistic stimuli (e.g. angry faces). Such responses include freezing and activation of the sympathetic nervous system (e.g. increased sweating) (LeDoux, 2000). Evidence from emotional Stroop literature, for instance, seems to support this view (e.g. MacKay et al., 2004).

The dimensional approach has played a central role in providing a theoretical and methodological underpinning for the electrophysiological research conducted on emotional word recognition in monolinguals. The evidence from this literature suggests that emotional valence (i.e. how positive or negative a words is perceived to be) is the most important predictor of behavioural effects observed for emotional words. The findings have shown that emotionally valenced words are recognised faster and more reliably than neutral words (e.g. Kousta et al., 2009). The positive valence of words particularly has been reliably associated with faster word recognition when compared to neutral words (e.g. Kuchinke et al., 2005). Responses to negative words appear to be influenced by a number of factors, and as a consequence less consistent findings have been reported. When it comes to extremely negative (offensive) words (e.g., insults, taboo words), this emotional content is found to slow down responses across different tasks (e.g. Algom et al., 2004).

The appraisal approach can further elucidate the emotional word processing. According to the component process model (Scherer, 2009), emotion is best understood as a complex system that serves an adaptive function. Emotion is a response to an event that is significant for the needs, goals and values of the individual, and which involves the recruitment of both mental and physiological resources (Scherer, 2005). According the component process model, emotional words can be viewed as stimuli than are appraised recursively in a temporally unfolding sequence. Four stages of appraisal can be distinguished, whereby the words are first appraised for their relevance for the individual, including their novelty, intrinsic pleasantness and goal-relevance. The following stages involve the appraisal of the implications of encountering the words, individual's ability to cope with the situation where the words are encountered, and the normative significance of the linguistic content. These stages are assumed to occur at different levels of consciousness, with the early stages occurring automatically and largely on an unconscious level, while the following stages are carried out in a more intentional, conscious fashion. The overall conscious experience of emotionality of the words incorporates the outcome of the appraisals, which are integrated with other components contributing to the emotional experience. The other components include the somatic changes (e.g. activation of the sympathetic nervous system), motivational changes and motor expression (Scherer, 2009).

The component process models can be used to explain some of the inconsistent findings from research concerning the perceived emotionality of L1 and L2, and the different patterns observed in experimental studies. Firstly, the studies that are based on self-reports are likely to measure the overall, conscious experience of emotionality of L1 and L2, while the experimental studies have measured some subcomponents of the emotion system. For example, Ayçiçeği-Dinn & Caldwell-Harris (2009) found that when the experimental tasks involved incidental processing of emotional content of words in L1 and L2 (e.g., carrying out a letter-counting task), equivalent emotionality effect on memory were found. However, when the bilinguals were asked to consider the emotionality of the words, L1 words were recognised and recalled better than L2 words. Thus, the different tasks involved different levels of appraising the emotional content of words, and subsequently lead to a different pattern of recall in L1 and L2.

Considering the choice of research methods in the present thesis (i.e. the lexical decision task, emotional and taboo Stroop tasks, ERP and skin conductance recording), the processing of emotional content of L1 and L2 words could be expected to be incidental and occur largely at an unconscious level. Thus, the behavioural effects could be primarily addressed to the early stages of appraisal (e.g. appraisal of intrinsic pleasantness). The event-related potential recording was expected to provide temporal information about the stages at which emotional processing of L1 and L2 words is likely to diverge. Furthermore, the skin conductance recording was assumed to tap into the autonomic arousal components of emotion, by providing an index of physiological arousal during emotional word processing in L1 and L2. Therefore, the aim of the thesis was to establish whether in bilinguals who have started learning L2 after the early childhood, and who are less proficient in L2 than L1, show differences between L1 and L2 in the impact of emotional content on word processing at the early stages of appraisal, as well as in their physiological responses. In the following the results of the studies reported in Chapters 2-5 are summarised. This is followed by a discussion of the implications of the findings.

6.2. Summary of the Findings

6.2.1. The need for normative ratings for emotional content of words in different languages

Some of the previous research results may have produced inconsistent results because of limited control over lexical factors that may have contributed to the findings. When studying emotional properties of single words, normative ratings for words used are needed in order to establish the level of emotional valence and emotional arousal of those words. Other important lexical factors that should be controlled for include word form frequency, familiarity, word length and orthographic neighbourhood size. It has been also shown that concreteness may interact with emotionality of words, and therefore this factor should be considered. While affective norms are now available for American English (ANEW; Bradley & Lang, 1999), German (BAWL; Võ, Jacobs & Conrad, 2006) and Spanish (Redondo, Fraga, Padrón & Comesaña, 2007), no such ratings had been published for Finnish. Furthermore, it was not clear to what extent norms collected with American English speakers would be applicable for British English speakers. As a consequence the first aim of the present investigation was to acquire affective norms for British English-Finnish word pairs. The norms were collected for 210 nouns, including 34 taboo words. The words were rated by native British English and native Finnish speakers along five dimensions; emotional valence, emotional arousal, offensiveness, concreteness and familiarity. The collection of these norms enabled the selection of the word stimuli for the subsequent studies.

6.2.2. Differences between L1 and L2 may emerge due to the lack of overlap across semantic features of words in different languages

The collection of the affective ratings made it also possible to consider another question of concern: To what extent do the affective connotations of translation equivalents from different languages and from versions of the same language (i.e. American and British English) concur? Some previous studies have highlighted some important differences in emotion vocabulary across languages (e.g. Russell, 1991). If emotional words in different languages hold very different kinds of emotional connotations, the comparisons between bilinguals' L1 and L2 are highly problematic, as it would not be possible to establish to what extent differences between bilinguals' responses to L1 and L2 were due to the fact that one was acquired earlier and spoken with greater proficiency, or whether the words in the respective languages differed substantially in their emotional content. Therefore the collection of affective ratings for translation equivalents enabled the examination of the extent that emotional valence, emotional charge and offensiveness of those words were viewed similarly or differently in the respective languages.

The normative ratings for British English and Finnish words were therefore compared with each other, as well as with the ratings for American English words presented in ANEW (Bradley & Lang, 1999). The results showed highly agreement among American English, British English and Finnish speakers in regard to the emotional valence, emotional charge and offensiveness of the words included in this study. The agreement among the three languages in respect to the emotional charge of the words studied appeared to be somewhat reduced relative to emotional valence ratings. Such patterns have also been found in previous studies (Redondo et al., 2007; Whissell, 2008), suggesting that while there is relatively high agreement in regard to the emotional valence of the translation equivalent, there may be somewhat more variability in respect to the extent a word is perceived to be emotionally arousing.

The level of agreement over the perceived concreteness and familiarity of the words was also assessed for British English and Finnish. The results showed slightly lower agreement in regard to the perceived concreteness and familiarity than was the case in regard to emotional valence and offensiveness. For taboo words, the perceived familiarity was found to differ substantially between American English and Finnish. These findings suggest that the extent to which the words are used in everyday language, i.e. their familiarity, may be more language specific than the other lexical characteristics studied here. This highlights a potentially important factor contributing to the differences between languages in the way they express emotions and use emotionally charged language: It may be that an important difference between languages is not only the fact that there may not be translation equivalents for some concepts, but that when they exist, the concepts are used to a greater or lesser extent in communication. Such frequency of usage contributes to the extent that concepts share semantic features, as difference in everyday life usage indicates less shared features. Following Duyck and Brysbaert's (2008) argument, such concepts in L2 may have weaker access to the semantic system than would be the case with translation equivalents with highly similar frequency of usage in everyday language. This question of the frequency at which different emotion and emotionally charged words are used in different languages would warrant further investigation.

6.2.3. The role of offensiveness in processing taboo words

The question whether the additional affective dimension of offensiveness would effectively differentiate between negative (e.g. war) and taboo words (e.g. slut) was also examined. Previous research has shown that although taboo words do not differ from negative non-taboo words in their valence, they are rated overall as more arousing (Janschewitz, 2008). This has been interpreted to imply that the strong emotionality of taboo words comes from the high level of arousal they elicit. However, the comparison of emotional valence and emotional charge of taboo words in the present study showed that although negative words were perceived as more negative in their valence than taboo words, negative words were rated stronger in emotional charge than taboo words. Thus, although socially undesirable in their connotations, taboo words are not necessarily perceived to be as negative and arousing as some extremely negative, non-offensive words (e.g. cancer, death). This finding supports the view that it is offensiveness rather than valence or arousal that sets the taboo words apart from negative words. Such a finding will help to interpret the results from studies using taboo words as stimuli, as they are likely to be responded to differently from negative words due to different neural mechanisms underlying the processing of these two categories of words (Van Lancker & Cummings, 1999).

6.2.4. Emotional word recognition in L1 and L2

The emotional word recognition was measured using the lexical decision task in Finnish-English and German-English bilinguals, and the emotional and taboo Stroop tasks in native and non-native English speakers (Greek-English bilinguals). The results from the lexical decision study with Finnish-English bilinguals' suggested that the emotional content of taboo words is accessed fast and influences visual word recognition both in L1 and L2. Consistent interference from taboo words were found both in more and less proficient bilinguals. The positive valence of words, however, was found to facilitate lexical decisions more in L1 than L2. Such reduced impact of positive content on word processing may indicate that L2 positive words had weaker connections to the semantic system. However, due to somewhat limited statistical power in this experiment, this effect was only observed in the analysis by subjects. As a consequence no strong conclusions can be drawn from this finding.

Finnish-English bilinguals responses to negative words were also found to different between L1 and L2. In L1, negative words were found to facilitate word recognition. Such facilitation effect concurs with previous studies (e.g. Kousta et al., 2009). In L2, responses to negative word were not found to differ from neutral words in the more proficient bilinguals. In less proficient bilinguals, L2 negative words resulted in significantly slower lexical decisions when compared to L2 neutral words. However, the slower processing of negative word stimuli in L2 than L1 was likely to be due to the lack of knowledge of this category of words. Such an interpretation was supported by the finding that bilinguals reported of not knowing the meanings of a greater number of negative than positive or neutral L2 words. This was also true, and even more pronounced, for taboo words. Therefore it appears that one factor contributing to the bilinguals feeling of detachment from L2, and the lack of emotional potency in L2, may be the fact that bilinguals have a more limited and less integrated vocabulary relating to negative than neutral and positive concepts. The lack of immersion in an L2 language environment, where negative and threatening events can be associated with the given language, may partly account for such limited competence in respect to negative vocabulary. The bias towards positive and neutral topics in language education and professional working environment is likely to further contribute to this. As effective communication in L2 requires also the ability to understand and express negative emotions, this finding has potentially important implications for language education.

The research with German-English bilinguals revealed a surprising pattern of responses: These bilinguals did not show any impact of the emotional content on visual word recognition in L1, but in L2 the positive valence of words facilitated their performance. Negative words did not show facilitation or interference when compared to neutral words.

The facilitating effect of positive valence is the most consistently reported emotionality effect in monolingual emotional word processing literature (e.g. Kuchinke et al., 2005). Therefore it is surprising that such effect was not found in L1. It is possible that the extensive immersion of these bilinguals in L2 environment would have helped them to develop strong links between L2 lexical representation and the semantic system, and as a consequence L2 word processing was influenced by the positive emotional content. In order to understand why no emotionality effects were found in L1, further studies ought to be conducted, where a number of factors potentially contributing to these findings would be controlled for (e.g. the extent of immersion in L2, blocking vs. mixing of emotional words, and the repetition of translation equivalents in the same experimental session).

The L2 (English) negative words were not found to influence visual word recognition in more proficient Finnish-English bilinguals, nor in German-English speakers. This effect is somewhat difficult to explain, as previous studies with monolinguals have found inconsistent results. Carretié et al. (2008) have explained this through two different mechanisms affecting negative word processing: They have suggested that negative valence initially facilitates words recognition, as all emotionally valenced words received greater attentional resources when compared to neutral words. However, negative words also capture and hold attention, which lead to slower responses to these words. As a consequence, no difference between neutral and negative words may be found in behavioural responses, while the impact of negative valence can be observed in electrophysiological indices (i.e. ERPs). Other explanations of the way positive and negative valence differentially affect visual word recognition. However, the interest in the investigation of emotional word processing is still relatively recent, and as a consequence clear understanding of the mechanisms involved is still lacking.

The emotional and taboo Stroop study with native and non-native speakers of English showed, that negative and taboo words interfered with the colour identification to the same degree in both groups of participants. This findings replicated previous findings (Eilola et al., 2007, Sutton et al., 2007) that the threatening content of words diverts attentional resources away from the on-going task to the same degree in L1 and L2. Thus, the findings from this study, as well as the results from the lexical decision study with Finnish-English speakers, suggest that the negative content of L2 words is accessed fast and diverts attentional resources to the processing of those words. This effect seems to be especially robust when it comes to taboo words. Such finding is in contrast with the Revised Hierarchical Model of bilingual memory (Kroll & Stewart, 1994) that assumes weaker links between L2 and the semantic system. It appears that at least some categories of words (i.e. negative, offensive and concrete words) form strong links to the semantic system also in unbalanced bilinguals (Duyck & Brysbaert, 2008).

It is important to acknowledge, however, that the methods used here were unlikely to capture all kinds of semantic processing. Indeed, as discussed above, the techniques applied were likely to tap into the early, automatic appraisal of relevance, rather than involve more conscious, effortful processing of the word meanings. Therefore the results merely suggest that the initial appraisal of L2 words is carried out fast and automatically, and have similar behavioural outcome in L1 and L2. However, it is possible that L1 and L2 are processed differently at the later stages. As a consequence it would be important to apply research methods that engage such further stages of appraisal in order to establish whether differences between L1 and L2 emotional words will emerge.

6.2.5. Does the level of proficiency influence the extent affective content modulates word recognition in L2?

Another factor that is believed to contribute to the extent that differences between L1 and L2 may be observed in their emotional processing is bilinguals' level of proficiency (e.g. Harris, 2004; Harris et al., 2006). Therefore more and less proficient participants were compared with each other to establish whether less proficient bilinguals will show reduced responsiveness. Although the word stimuli were matched along familiarity and word length, it may be that Finnish and English words differed in some ways that may contribute to the pattern of findings. To overcome this problem of translation equivalency, Finnish-English bilinguals' responses to English words were directly compared to those of native English speakers. Furthermore, German-English speakers' responses can be considered in this context as they had the most extensive immersion in L2 environment.

The comparisons between less and more proficient bilinguals, and native and non-native speakers showed that native speakers were faster than non-native speakers, and more proficient were faster than less proficient speakers overall in responding to the English words. Less proficient were also more error-prone than more proficient speakers, and non-native speakers made more errors than native speakers. The most robust difference seemed to emerge in the responses of less proficient speakers to negative and taboo words. The less proficient speakers showed the strongest interference from negative and taboo words, which seemed to be accounted for by their lack of knowledge of the meaning of those words. The use of mixed case word presentation in native speakers did not alter the pattern of responding to emotionally charged words. Similarly to non-native speakers, their responses were slowed down overall when compared to the upper-case word presentation condition. This was interpreted to indicate that non-native speakers' slower responses to the negative and taboo words were not merely due to unfamiliarity with the orthographic form of negative words, but was likely to be due to the lack of form-to-meaning mapping in those participants.

As discussed above, German-English speakers showed a significant facilitation from positive words in L2, while this effect was not significant in Finnish-English speakers. Thus, it would appear that the higher level of proficiency of German-English speakers had resulted in stronger connections between L2 lexical representation and the semantic system. Due to the methodological limitations of the experiment with Finnish-English speakers, this question ought to be investigated further. It would be important to examine the responses of bilinguals at the early stages of L2 acquisition in order to see whether positive and negative valence may be associated with L2 lexical representations to a different degree.

6.2.6. Can differences between affective word processing of L1 and L2 be detected at the level of cortical activity?

The aim of the study reported in Chapter 4 was to investigate the impact of emotional content of L1 and L2 on word recognition in the respective languages as measured through even-related potentials. This electrophysiological method enables the tracing of cognitive resource allocation in the cortex for word processing at the level of milliseconds (Luck, 2005). While the temporal resolution of event-related potentials is very high, they do not enable exact localisation of the source of such activity (Luck, 2005). This method can be informative, however, about the time course of word processing. Thus, it was of interest whether differences between emotional words processing in L1 and L2 could be detected in the extent that cognitive resources are allocated for the respective languages. Furthermore, this study aimed at addressing the question whether such differences occur relatively early on, at the level of word form identification, or later when semantic access and integration takes place.

The German-English bilinguals showed a reduced N400 for L2 positive and negative words, but no emotionality effects were found in L1. This partly mirrored the behavioural results, which showed facilitation from positive valence in L2, but no emotionality effects in L1. This finding suggests that the differences between L1 and L2 occurred at the level of semantic integration rather than earlier during the word form identification. Although the reduced N400 for negative words was not reflected in the behavioural responses, it does not imply that there was no processing advantage for these words. As discussed above, two different mechanisms may be involved in processing negative words, which is why negative words may not show difference from neutral words in the behavioural measure, but can be seen to modulate ERPs.

The lack of emotionality effect in German-English bilinguals' L1 is surprising as previous studies with monolinguals suggest that emotional content of single words can modulate ERPs at both early and later stages of word processing (e.g. Kissler et al., 2006). However, no studies applying this method with bilinguals have been reported to date and as a consequence it is not possible to compare these findings with other research. It is possible that the results from the present study are partly accounted for by the high level of proficiency and immersion of the bilinguals in L2. In part they may be also explained by some methodological factors, such as blocking of words according to their emotional category. Therefore the follow-up studies ought to control for these different factors. The results suggest, however, that in highly proficient bilinguals the words are appraised in terms of their emotional content early on, and such appraisal affects the further processing of these words.

6.2.7. Do L1 and L2 differ in the level of physiological arousal they elicit?

Two previous studies that applied emotional and taboo Stroop tasks in studying differences between bilinguals' L1 and L2 in terms of their emotionality found no differences between L1 and L2. Two potential limitations for these studies were considered. It may be that the presentation of the word stimuli first in one language followed by the presentation in the other may lead to an overall reduction in the extent that the words lead to attentional capture. It may be that participants became habituated to the emotional content of the stimuli during the course of the study. Alternatively, it may be that word semantics, including the emotional content, can be accessed early and rapidly also in L2, as suggested by Duyck and Brysbaert (2008), as well as the experiments reported in Chapters 3 and 4. As a consequence both L1 and L2 will show equivalent levels of interference of the on-going task (i.e. colour-identification). However, the emotional content may activate the sympathetic system to different degrees in native and non-native speakers of that language. This interpretation is supported by findings of Harris et al. (2003), who found higher levels of physiological arousal as measure in skin conductance responses (SCRs) to L1 than L2 childhood reprimands. Scherer (2009) has also suggested that the somatic response associated with an emotional event is not necessary for an emotion to occur, but can increase the perceived intensity of the experience. Thus, the appraisal of emotional content and the physiological responses associated with the stimuli may be dissociated to some degree. As a consequence, native and non-native speakers' skin conductance levels were measured during emotional and taboo Stroop tasks.

The results replicated previous findings in that negative and taboo words produced significant interference when compared to neutral words, and that this pattern was equivalent in native and non-native speakers of English. These results indicate that L2 word forms have equally rapid access to the semantic system as do L1 words (e.g. Duyck & De Houwer, 2008). A significant increase in skin conductance level in native speakers of English in response to negative and taboo words when compared to neutral words was also found, yet this increase in skin conductance was not observed in non-native speakers of English. It appears that although the second language speakers access the L2 words' emotional content fast and automatically, the emotional connotations of those words are not associated with higher levels of autonomic arousal.

The pattern observed corresponds to Harris et al.'s (2003) findings in that second language speakers seem to access the denotative meanings of the emotionally charged words in L2, but do not respond to their connotative meanings (i.e. emotional arousal associated with the words) to the same extent as they do in L1. Harris et al. (2006) have explained this through the emotional contexts of learning theory: The first language is acquired in naturalistic contexts and therefore becomes associated with numerous emotional events, while the second language is often learnt and used in school or professional environment where emotional control is emphasised. As a result, L2 will be associated with less extreme emotional experiences and may not have the same capacity to produce strong emotional arousal in the bilingual speaker. Indeed, during debriefing the bilingual speakers had reported "feeling nothing" when pronouncing or hearing L2 taboo words, possibly because of the reduced autonomic arousal produced by these words (Harris et al., 2003).

The present study also indicates that subjective descriptions of emotional arousal and the level of physiological arousal measured using electrodermal monitoring do not necessarily fully converge: In the Harris et al. (2003) study, bilingual speakers rated taboo words and childhood reprimands as equally unpleasant, but showed higher levels of arousal to those words and phrases in L1 than L2. In the present study positive and negative words were used that had been previously rated as equivalent in their perceived emotional charge. However, significantly higher levels of skin conductance were measured in response to negative than positive words. This pattern of reduced arousal to positive words has been also reported previously with monolingual participants (Segerstrom, 2001). Therefore it appears that increased physiological arousal as measured with skin conductance recording, is more pronounced for threat-related stimuli than to positive words stimuli with the same levels of perceived emotional arousal. The difference between negative and positive word stimuli could be based on different neural mechanisms underlying the processing of emotional content with negative and positive valence (Craig, 2005).

In conclusion, bilinguals appear to access the semantics of emotional words fast and automatically even when they have started learning the second language after early childhood. Yet, the semantic activation of L2 word meanings does not seem to lead to similar increases in autonomic activation as is the case in L1. The limitation of the emotional and taboo Stroop task is that participants are explicitly asked not to attend to the meanings of the words, and the task itself does not require processing of the word meaning. Thus, the word semantics are likely to be activated to a lesser extent than if the task would require the participants to attend to the meaning of the words. Therefore it is possible that differences between L1 and L2 may be detected, when an alternative behavioural task is applied that required to consideration of the meaningfulness of the word stimuli. Indirect evidence from a memory study by Aycicegi-Dinn and Caldwell-Harris (2009) indicated that deeper level of processing of words may reveal differences between L1 and L2 that may not be observed in tasks requiring shallow word processing.

6.3. Implications of the Findings and Future Directions for Research

The present findings suggest that when the early evaluation of words as positive or negative is measured using implicit techniques, bilinguals show a rapid access to word semantics both in their first and second language. This effect seems to be evident particularly in highly proficient, unbalanced bilinguals' responses to extremely negative (offensive) words. Duyck and Brysbaert (2008) have suggested that L2 words form strong connections with the semantic system early at least in the case of words that share a lot of features across the two languages. The words used in the set of studies reported here were selected specifically in order to have a high overlap in their affective characteristics. Therefore it is possible, that if words with limited amount of overlap across languages were used, such high similarity would not be observed. Yet, this would also make it very difficult to compare bilinguals' responses to L1 and L2, as the differences would be due to differences between the languages themselves rather than the order at which they were acquired, or the level of proficiency at which they were spoken. An alternative research design could be adopted however, where native and non-native speakers were compared in their responses to words that share only a small number of features across the bilinguals' L1 and L2. Duyck and Brysbaert (2008) have suggested that abstract words are likely candidates, as they are often more language-specific. Altarriba and Bauer (2004) have further shown that emotion words (i.e. words that refer directly to emotions; e.g. happy, sad) are perceived to be more abstract than abstract non-emotion words. Therefore future research could focus on the processing of specific emotion words in native and non-native speakers, in order to establish whether reduced numbers of shared features would indeed result in differences in L1 and L2 word processing.

Another interesting finding rising from the present research is the observation that especially less proficient bilinguals may not know negative vocabulary in L2 as well as neutral and positive vocabulary in that language. This phenomenon has not been previously investigated, but would concur with research showing that bilinguals may feel that they cannot express anger equally well in L2 as in L1 (Dewaele, 2006). This phenomenon has been assumed to be due to weaker connections from L2 to the semantic system (e.g.

Santiago-Rivera & Altarriba, 2002). The present investigation, however, suggests that the differences between L1 and L2 are unlikely to be due to slower and less reliable activation of word semantics by L2 words. Rather, it is likely that once the form-to-meaning mapping has occurred, the word semantics are rapidly accessed. Therefore some of the differences between L1 and L2 may be accounted for by the limitations in bilinguals' vocabulary specifically pertaining to negative material. Such interpretation concurs with the findings from self-reports (e.g. Pavlenko, 2006), which have shown that bilinguals with a high level of proficiency in L2 may not find L1 to be more emotionally expressive than L2.

In conclusion, the present investigation suggests that L2 words can activate the emotional content associated with these words fast and relatively early during the word recognition process. Psychophysiological evidence, however, indicated that L2 may result in somewhat reduced physiological arousal than L1. Such reduced responsiveness may be contributing to the perceived lack of emotional immediacy in L2. Differences that were found in response to L1 and L2 may also be produced by the lack of knowledge of negative vocabulary in L2. Such a finding has important implications for language education, as effective communication in L2 requires the ability to understand emotional meanings communicated through language and the competence in expressing both positive and negative emotions.

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Appendix 2.1

Normative Ratings of Emotional Valence, Emotional Charge and Offensiveness for 210 British English and Finnish Nouns

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
abuse	solvaus	0.69	0.81	1.33	1.17	5.19	2.93	3.81	2.70	2.36	2.92	1.95	2.48
acceptance	hyväksyntä	6.58	1.71	6.82	1.69	3.88	2.74	4.51	2.55	0.20	0.36	0.38	0.67
accident	onnettomuus	1.65	1.24	1.11	1.15	3.71	2.65	5.41	2.53	0.52	1.17	0.87	1.50
ache	särky	2.04	1.49	1.65	1.37	2.60	2.54	3.78	2.78	0.25	0.33	0.54	1.15

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
achievement	saavutus	7.49	1.29	6.65	1.75	5.04	2.69	3.77	2.74	0.32	0.85	0.35	0.82
adventure	seikkailu	6.16	1.86	6.26	1.73	3.30	2.71	3.91	2.62	0.22	0.44	0.29	0.45
affection	hellyys	7.61	1.25	7.93	1.41	5.69	2.78	6.11	2.73	0.20	0.27	0.24	0.30
agony	tuska	0.76	0.78	1.02	1.27	5.15	2.81	5.49	2.82	0.73	1.17	1.08	1.58
agreement	sovinto	6.51	1.56	6.79	1.90	2.84	2.52	4.45	2.80	0.22	0.42	0.27	0.43
alley	kuja	3.50	1.43	4.05	1.42	0.77	1.17	1.13	1.45	0.22	0.40	0.30	0.65

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
anger	kiukku	1.15	1.03	2.07	1.53	6.25	2.49	4.67	2.99	1.16	2.01	0.95	1.44
anxiety	ahdistus	1.59	1.51	1.02	0.95	4.74	2.88	5.48	2.78	0.39	0.67	1.19	1.84
appliance	laite	4.26	1.28	4.29	1.44	0.72	1.15	0.77	0.98	0.15	0.14	0.32	0.72
army	armeija	3.46	2.18	4.08	1.96	2.18	2.35	3.24	2.55	0.32	0.69	0.43	0.96
arse	perse	2.15	1.73	2.89	1.97	2.06	2.40	2.44	2.52	3.29	2.66	4.29	2.73
art	taide	5.68	1.76	5.72	1.99	1.89	2.28	3.16	2.74	0.26	0.53	0.28	0.49

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
asshole	persläpi	1.35	1.34	1.26	1.12	3.01	2.71	2.53	2.71	5.21	2.73	5.92	2.41
baby	vauva	6.53	1.68	7.13	1.67	4.23	2.94	5.44	2.81	0.34	0.84	0.55	1.39
barrel	tynnyri	3.80	1.61	4.12	1.54	0.62	1.04	0.89	1.34	0.22	0.52	0.78	1.40
bastard	äpärä	1.34	1.46	1.50	1.54	3.29	2.64	2.87	2.67	5.11	2.89	5.81	2.54
beauty	kauneus	7.26	1.64	6.96	1.67	3.90	2.65	4.59	2.69	0.39	1.17	0.41	0.84
bed	sänky	6.50	1.90	6.55	1.88	2.51	2.84	3.29	2.76	0.18	0.21	0.48	0.94

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
beer	olut	4.96	2.09	4.77	2.36	1.93	2.20	3.18	2.60	0.35	0.58	0.78	1.44
bint	urpo	2.08	1.68	2.37	1.75	1.34	1.65	2.01	2.29	2.54	2.94	4.19	2.69
bitch	narttu	1.45	1.39	1.26	1.38	3.66	2.68	3.52	2.93	4.89	2.68	6.21	2.67
bliss	onni	6.74	2.31	8.03	1.37	3.89	3.20	6.11	2.66	0.18	0.20	0.24	0.33
blossom	kukoistus	5.93	1.75	6.38	1.78	1.78	2.22	2.82	2.39	0.18	0.20	0.27	0.33
book	kirja	4.82	1.89	5.38	1.75	1.06	1.52	2.11	2.46	0.23	0.40	0.25	0.46

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
bowl	kulho	4.13	1.46	4.50	1.24	0.53	0.67	0.83	1.25	0.20	0.20	0.24	0.32
bread	leipä	4.99	1.45	6.20	1.78	0.74	1.15	1.65	2.00	0.17	0.15	0.22	0.28
brother	veli	6.59	2.00	7.18	1.72	4.18	3.17	5.25	2.96	0.16	0.20	0.25	0.43
cabinet	kamari	3.99	1.43	4.59	1.72	0.62	1.24	1.07	1.46	0.15	0.13	0.51	1.00
cancer	syöpä	0.55	0.94	0.81	0.87	5.93	2.69	5.16	2.66	1.62	2.42	1.32	1.90
car	auto	5.31	1.71	5.53	1.82	1.49	1.94	2.22	2.18	0.38	1.24	0.23	0.30

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
cell	solu	2.53	1.84	4.25	1.60	1.12	1.59	0.89	1.26	0.30	0.69	0.36	0.72
chair	tuoli	4.40	1.30	4.86	1.34	0.55	0.89	0.94	1.25	0.15	0.13	0.23	0.26
cock	kyrpä	1.87	1.65	2.24	2.08	2.57	2.48	2.56	2.67	4.22	2.90	5.46	2.91
column	pylväs	4.05	1.52	4.13	1.42	0.60	1.06	0.79	1.05	0.14	0.13	0.37	0.75
comfort	mukavuus	7.09	1.64	7.58	1.23	3.96	2.94	4.65	2.82	0.20	0.30	0.30	0.73
computer	tietokone	4.95	1.70	5.02	1.81	0.91	1.24	1.48	1.85	0.18	0.26	0.27	0.34

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
confidence	luottamus	7.05	1.59	7.50	1.46	4.34	2.79	5.55	2.68	0.23	0.42	0.34	0.70
content	sisältö	5.47	2.34	4.47	1.24	2.03	2.49	1.05	1.54	0.19	0.18	0.34	0.73
core	ydin	3.92	1.61	3.88	1.61	0.59	0.82	0.99	1.26	0.16	0.16	0.34	0.60
corner	nurkka	3.96	1.46	3.85	1.43	0.43	0.56	0.81	1.04	0.16	0.20	0.37	0.70
corridor	käytävä	4.22	1.36	4.32	1.27	0.54	0.83	0.91	1.16	0.17	0.17	0.25	0.45
cottage	mökki	4.88	1.74	6.13	1.64	0.81	1.35	2.75	2.56	0.19	0.40	0.31	0.65

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
crap	ruikku	1.70	1.33	1.35	1.46	2.27	2.29	1.50	2.05	2.63	2.41	4.28	2.90
crime	rikos	0.89	0.88	1.31	1.25	3.32	2.76	3.81	2.64	1.30	2.09	1.21	1.79
cunt	pillu	0.84	1.20	2.07	2.12	4.45	3.52	2.81	2.94	7.92	1.87	5.85	2.93
damn	pahus	2.50	1.62	2.38	1.55	2.19	2.17	2.01	2.20	1.42	2.25	1.57	2.00
danger	vaara	1.20	1.35	1.63	1.53	5.32	2.80	4.32	2.71	0.89	1.90	0.64	1.27
death	kuolema	0.66	1.17	0.97	1.16	6.68	2.63	6.57	2.55	1.19	2.18	1.54	2.08

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
debt	velka	1.12	1.09	1.81	1.42	3.29	2.86	2.75	2.42	0.73	1.39	1.05	1.75
depression	masennus	1.04	1.16	0.89	0.88	5.51	2.90	4.99	2.95	0.77	1.22	1.24	1.77
desire	halu	6.12	1.91	5.89	1.90	4.79	2.85	5.48	2.88	0.20	0.42	1.10	1.59
destruction	tuho	1.24	1.32	1.16	1.07	3.96	2.94	4.36	2.57	0.69	1.07	1.28	1.95
dick	mulkku	1.87	1.60	1.41	1.33	2.51	2.36	2.77	2.62	4.46	2.78	6.22	2.52
disappointment	pettymys	1.27	1.10	1.41	1.24	4.98	2.64	5.18	2.78	0.65	1.03	1.06	1.79

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
discomfort	vaiva	1.51	1.27	1.90	1.45	3.87	2.59	2.60	2.16	0.52	1.02	0.90	1.43
doctor	lääkäri	5.67	2.15	5.15	1.82	1.88	2.10	2.37	2.02	0.42	1.36	0.34	0.83
door	ovi	4.22	1.32	4.78	1.34	0.64	1.07	0.79	0.99	0.16	0.17	0.29	0.55
dream	uni	6.50	1.76	7.10	1.70	3.93	2.69	4.10	2.74	0.36	1.06	0.29	0.53
elevator	hissi	4.12	1.45	4.67	1.50	0.83	1.52	0.88	1.34	0.14	0.12	0.24	0.32
engine	moottori	4.05	1.45	4.60	1.38	0.63	0.98	1.20	1.58	0.18	0.26	0.26	0.45

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
enjoyment	nautinto	7.39	1.48	7.46	1.34	5.23	2.77	6.48	2.47	0.21	0.26	0.68	1.15
exercise	liikunta	6.27	1.84	6.75	1.83	2.39	2.47	3.32	2.71	0.16	0.14	0.31	0.53
fabric	kangas	4.32	1.47	4.69	1.41	0.52	0.85	1.02	1.45	0.16	0.14	0.27	0.52
faggot	hintti	1.16	1.19	1.44	1.49	2.80	2.71	3.23	2.84	5.45	2.80	6.59	2.38
family	perhe	7.70	1.29	7.82	1.38	5.61	3.19	6.53	2.43	0.47	1.55	0.21	0.23
fart	pieru	2.32	1.60	2.42	1.79	1.15	1.60	1.87	2.13	2.06	2.27	3.24	2.61

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
father	isä	6.48	2.36	7.35	1.86	4.65	3.09	6.30	2.82	0.21	0.28	0.19	0.19
fear	pelko	1.13	1.30	1.56	1.22	5.89	2.48	5.64	2.84	0.47	0.77	0.83	1.45
field	kenttä	4.46	1.63	4.57	1.32	0.70	1.19	0.97	1.44	0.15	0.18	0.28	0.50
filth	saasta	1.26	1.06	1.30	1.12	2.23	2.16	2.28	2.38	1.97	2.33	3.41	2.62
flag	lippu	4.15	1.58	5.04	1.43	0.94	1.50	1.72	2.02	0.30	1.05	0.26	0.43
food	ruoka	6.43	1.76	6.98	1.69	2.72	2.78	3.43	2.73	0.28	0.91	0.26	0.48

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
fragrance	tuoksu	5.52	1.91	6.64	1.68	1.28	1.82	4.01	2.81	0.13	0.10	0.31	0.63
fraud	petos	1.35	1.19	0.95	0.99	2.32	2.22	4.87	2.68	1.01	1.93	1.99	2.60
freedom	vapaus	7.58	1.76	7.47	1.48	5.24	2.85	5.32	2.57	0.25	0.41	0.28	0.43
friend	ystävä	7.92	1.20	8.08	1.32	5.36	2.96	6.59	2.36	0.32	1.21	0.23	0.38
fuck	vittu	1.65	1.73	2.04	1.98	3.76	2.82	3.74	3.17	5.69	3.05	6.05	2.81
funeral	hautajaiset	0.86	0.97	1.28	1.30	5.70	3.11	5.93	2.70	1.09	1.98	1.03	1.55

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
gift	lahja	6.72	1.98	7.05	1.64	3.25	2.69	3.73	2.74	0.16	0.15	0.23	0.31
git	typerys	1.83	1.48	1.92	1.44	1.84	1.93	2.66	2.27	3.41	2.64	3.71	2.70
glass	lasi	4.07	1.37	4.73	1.39	0.71	1.02	1.12	1.50	0.21	0.33	0.25	0.41
glory	kunnia	6.75	1.91	6.18	1.96	4.18	2.86	4.36	2.79	0.31	0.66	0.35	0.59
grave	hauta	1.17	1.26	1.76	1.71	3.69	2.93	4.03	2.76	0.52	0.92	1.00	1.57
grief	murhe	1.19	1.45	1.30	1.12	5.46	2.89	4.82	2.80	0.66	1.37	0.95	1.79

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
guilt	syyllisyys	1.29	1.25	1.66	1.51	4.86	2.90	5.13	2.69	0.63	1.24	1.11	1.70
habit	tapa	3.64	1.71	4.35	1.40	1.34	1.64	1.30	1.55	0.47	1.14	0.67	1.38
hammer	vasara	3.60	1.55	4.23	1.32	0.77	1.07	0.75	0.97	0.45	1.33	0.28	0.46
hate	viha	0.76	1.03	1.24	1.36	6.60	2.44	6.52	2.51	2.77	2.78	1.50	2.01
hell	helvetti	0.96	1.24	1.27	1.36	3.50	2.83	4.37	2.84	1.92	2.57	3.91	2.97
holiday	loma	6.83	2.11	7.65	1.69	3.59	2.89	5.04	2.71	0.19	0.18	0.22	0.27

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
honesty	rehellisyys	7.38	1.82	7.51	1.63	4.60	2.97	5.46	2.50	0.28	0.73	0.39	0.82
honey	hunaja	5.50	1.62	5.44	1.72	1.80	2.12	1.56	1.97	0.20	0.22	0.28	0.50
hope	toivo	7.07	2.10	7.34	1.53	5.10	2.77	5.34	2.62	0.19	0.42	0.25	0.38
horror	kauhu	1.34	1.34	1.85	1.54	4.36	2.89	5.09	2.98	0.70	1.31	0.74	1.22
hospital	sairaala	3.74	2.34	3.93	2.19	2.89	2.63	3.28	2.37	0.26	0.48	0.45	0.86
hostage	panttivanki	0.90	1.01	1.12	1.15	3.51	2.77	3.89	2.81	0.79	1.48	1.12	1.68

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
house	talo	5.25	1.71	5.75	1.71	1.40	1.93	1.97	2.26	0.14	0.10	0.25	0.33
illness	sairaus	1.15	0.93	1.19	1.08	3.80	2.55	4.82	2.63	0.74	1.34	1.15	1.78
improvement	parannus	6.75	1.85	6.88	1.75	2.56	2.58	3.90	2.67	0.27	0.72	0.32	0.55
industry	teollisuus	3.75	1.75	3.83	1.77	0.77	1.19	1.03	1.22	0.20	0.25	0.36	0.68
inhabitant	asukas	3.85	1.60	4.66	1.23	0.77	1.20	1.04	1.29	0.44	1.24	0.25	0.34
injury	vamma	1.51	1.23	1.60	1.33	3.31	2.49	3.10	2.57	0.34	0.52	1.87	2.26

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
insult	loukkaus	1.31	1.12	1.40	1.37	4.66	2.74	4.65	2.87	1.95	2.52	1.67	2.34
intercourse	yhdyntä	5.60	1.82	5.89	2.09	4.47	2.88	5.22	3.00	1.10	1.83	2.29	2.59
jelly	hyytelö	4.79	1.78	4.12	1.67	0.68	0.97	0.92	1.27	0.20	0.24	0.53	1.14
joke	vitsi	6.48	1.95	6.65	1.63	3.81	2.95	3.27	2.48	0.34	0.75	0.61	1.00
joy	ilo	7.64	1.43	8.00	1.20	5.70	2.61	6.03	2.60	0.19	0.25	0.28	0.52
justice	oikeus	6.59	1.92	6.42	1.71	4.37	2.71	3.68	2.64	0.33	0.53	0.41	0.79

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
kettle	pannu	4.51	1.35	4.48	1.26	0.80	1.14	0.88	1.20	0.16	0.17	0.40	0.77
kiss	suudelma	7.58	1.27	8.01	1.31	5.84	2.66	7.20	2.13	0.36	0.87	0.41	0.71
laughter	nauru	7.88	1.21	7.70	1.38	5.58	2.76	5.78	2.58	0.20	0.38	0.43	1.06
lawn	nurmikko	4.21	1.51	5.59	1.73	0.54	0.77	1.51	1.84	0.14	0.14	0.26	0.48
leader	johtaja	5.14	1.84	4.37	1.50	2.20	2.22	1.79	2.07	0.40	0.88	0.38	0.60
length	pituus	4.28	1.07	4.81	1.44	0.52	0.69	1.35	1.65	0.30	0.79	0.63	1.14

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
level	taso	4.05	1.34	4.24	1.43	0.78	1.40	1.03	1.29	0.17	0.20	0.35	0.75
life	elämä	6.75	1.84	7.33	1.65	5.04	2.92	5.42	2.87	0.20	0.41	0.28	0.44
loneliness	yksinäisyys	1.06	0.93	1.47	1.51	5.28	3.05	5.44	2.80	0.79	1.47	1.19	1.79
loser	häviäjä	1.78	1.42	2.14	1.40	2.98	2.46	3.67	2.54	2.72	2.52	2.13	2.20
loss	menetys	1.24	1.14	1.28	1.39	4.70	3.18	5.61	2.77	0.84	1.80	0.85	1.47
loyalty	uskollisuus	7.19	1.46	7.47	1.66	4.61	2.94	5.86	2.71	0.23	0.35	0.35	0.79

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
machine	kone	3.95	1.37	4.48	1.51	0.53	0.76	0.98	1.24	0.26	0.41	0.30	0.53
malice	ilkeys	1.42	1.56	1.22	1.08	3.14	2.97	4.47	2.81	1.24	2.07	1.82	2.30
medicine	lääke	6.02	2.02	5.16	2.10	1.74	2.00	2.37	2.18	0.17	0.24	0.47	0.85
milk	maito	4.82	1.67	5.82	1.90	0.58	0.75	1.50	1.82	0.19	0.27	0.28	0.61
miracle	ihme	7.27	1.85	6.37	1.90	4.34	2.90	4.50	2.78	0.19	0.26	0.36	0.76
misery	kurjuus	0.93	0.87	1.10	0.98	5.14	2.83	4.30	2.78	0.96	1.69	1.01	1.50

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
moment	hetki	4.72	1.60	5.21	1.43	1.47	2.05	2.40	2.67	0.20	0.43	0.24	0.42
money	raha	6.10	2.10	5.84	1.94	3.67	2.95	3.18	2.59	0.54	1.30	0.61	1.12
mosquito	sääski	2.45	1.56	2.20	1.69	0.85	1.19	1.98	2.43	0.27	0.37	0.68	1.34
mother	äiti	7.42	1.89	8.06	1.27	5.20	3.11	6.94	2.43	0.25	0.79	0.18	0.19
murderer	murhaaja	0.59	1.35	0.70	0.80	5.49	2.71	5.01	2.76	2.79	3.03	2.88	2.81
mushroom	sieni	4.07	1.59	4.05	1.63	0.62	0.84	0.96	1.23	0.34	1.22	0.64	1.18

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
music	musiikki	6.80	1.82	7.39	1.59	3.85	3.08	5.57	2.80	0.20	0.26	0.25	0.37
nature	luonto	6.19	1.89	6.52	1.90	1.88	2.07	3.88	2.70	0.19	0.33	0.28	0.51
nightmare	painajainen	1.37	1.10	1.43	1.13	4.47	2.71	4.75	2.66	0.63	1.13	0.97	1.62
nob	kulli	2.03	1.72	2.13	1.93	2.04	2.23	2.39	2.53	3.89	2.34	5.20	3.07
office	toimisto	4.13	1.73	4.17	1.44	0.78	1.26	0.89	1.23	0.15	0.12	0.26	0.36
opinion	mielipide	5.30	1.73	5.62	1.45	3.04	2.57	4.07	2.72	0.46	1.24	0.43	0.78

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
pain	kipu	1.13	1.18	1.36	1.24	5.44	2.51	4.77	2.66	0.75	1.14	0.73	1.32
part	osa	3.74	1.67	4.23	1.28	0.69	1.11	0.78	1.03	0.18	0.23	0.35	0.54
peace	rauha	7.48	1.71	7.43	1.69	4.69	2.68	4.70	2.89	0.19	0.23	0.30	0.75
perfection	täydellisyys	6.48	2.02	5.08	2.30	3.52	2.71	3.95	2.49	0.24	0.28	0.67	1.14
phase	vaihe	4.02	1.37	4.25	1.39	0.64	1.05	1.06	1.46	0.21	0.54	0.39	0.82
pillow	tyyny	5.20	1.90	6.40	1.70	0.96	1.57	2.03	2.26	0.18	0.19	0.27	0.60

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
piss	kusi	1.83	1.55	2.09	1.54	1.71	2.17	1.75	2.05	3.14	2.35	3.94	2.82
poison	myrkky	1.12	1.09	1.32	1.27	2.31	2.33	2.38	2.20	0.68	1.43	1.00	1.70
pollution	saaste	1.47	1.28	1.39	1.21	2.32	2.28	2.22	2.19	0.73	1.25	1.20	1.82
poverty	köyhyys	1.08	1.42	1.18	1.09	3.97	2.85	4.50	2.67	0.96	1.68	1.74	2.22
prick	kusipää	1.39	1.16	1.27	1.18	2.77	2.55	3.71	3.02	4.92	2.74	6.84	1.98
privacy	yksityisyys	5.71	1.75	5.44	1.90	2.84	2.48	3.79	2.58	0.38	0.93	0.47	0.87

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
profit	tuotto	6.53	1.74	5.26	1.76	2.22	2.33	1.38	1.68	0.28	0.46	0.43	0.84
punishment	rangaistus	1.76	1.87	2.16	1.90	3.92	2.61	3.90	2.61	0.73	1.36	1.05	1.79
pus	visva	1.66	1.40	1.78	1.64	1.02	1.43	1.17	1.68	1.70	2.01	2.70	2.83
pussy	pimppi	2.40	2.20	2.66	2.21	2.47	2.64	2.33	2.58	4.86	2.97	4.73	3.02
quarrel	riita	1.99	1.28	1.28	1.13	3.32	2.65	5.30	2.73	0.60	1.18	1.24	1.82
rage	raivo	0.95	0.82	1.60	1.35	5.76	3.00	5.54	2.94	0.95	1.67	1.29	1.76

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
rape	raiskaus	0.27	0.34	0.42	0.51	6.60	2.38	6.15	2.57	4.64	3.21	3.82	3.06
reality	todellisuus	4.81	1.72	5.15	1.59	2.87	2.76	3.38	2.65	0.40	0.97	0.38	0.77
respect	kunnioitus	7.21	1.68	6.96	1.70	5.08	2.76	5.01	2.52	0.39	0.94	0.32	0.86
reward	palkkio	7.01	1.69	6.33	1.91	3.67	2.73	2.51	2.24	0.22	0.24	0.47	0.90
ridicule	pilkka	1.52	1.29	1.32	1.25	3.38	2.67	3.82	2.58	1.08	1.73	1.81	2.38
route	reitti	4.32	1.21	4.46	1.39	0.54	0.69	0.82	1.07	0.17	0.17	0.27	0.36

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
scrotum	kivekset	2.74	1.74	3.80	1.84	1.19	1.68	2.07	2.16	2.41	2.59	3.05	2.99
security	turvallisuus	6.02	2.00	7.11	1.76	2.72	2.64	4.55	2.81	0.25	0.65	0.25	0.30
selfishness	itsekkyys	1.34	1.21	1.57	1.44	4.04	2.71	4.37	2.61	1.02	1.49	2.04	2.38
shag	pano	4.08	2.46	3.74	2.57	3.91	3.01	3.77	2.94	2.88	2.72	5.00	2.87
shit	paska	1.46	1.53	1.96	1.47	2.51	2.37	2.39	2.51	4.12	2.70	4.74	2.66
sister	sisko	6.32	2.19	7.41	1.63	4.34	3.09	5.42	2.95	0.25	0.62	0.24	0.41

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
size	koko	4.18	1.18	4.45	1.32	1.43	2.08	1.55	1.96	0.53	1.46	0.84	1.50
slapper	hutsu	1.35	1.37	1.03	1.07	3.03	2.49	3.14	3.03	5.04	2.70	6.65	2.51
slaughter	teurastus	0.58	0.77	1.04	1.14	4.81	2.92	4.34	2.83	1.98	2.48	2.35	2.49
slime	lima	2.14	1.52	2.02	1.51	1.06	1.40	1.53	2.01	0.77	1.24	1.70	2.11
slut	lutka	1.07	1.10	0.99	1.28	3.56	2.60	3.84	3.12	5.63	2.71	7.16	2.35
snake	käärme	3.17	1.94	2.25	1.71	1.86	2.20	2.52	2.53	0.49	0.95	0.83	1.46

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
snow	lumi	5.74	1.63	5.01	1.92	2.23	2.53	2.25	2.25	0.16	0.13	0.28	0.51
spider	hämähäkki	2.71	1.61	2.70	1.86	2.02	2.63	2.81	2.70	0.58	1.40	0.61	1.10
sport	urheilu	5.76	1.89	6.33	1.97	2.32	2.57	3.23	2.93	0.21	0.26	0.28	0.46
spray	suihke	4.09	1.41	4.14	1.55	0.61	0.79	0.92	1.13	0.25	0.41	0.33	0.61
square	aukio	4.04	1.40	4.31	1.37	0.54	0.85	0.98	1.32	0.19	0.16	0.30	0.55
statue	patsas	3.90	1.61	4.50	1.30	0.76	1.08	0.89	1.14	0.20	0.32	0.42	1.02

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
stench	löyhkä	1.52	1.39	1.49	1.25	1.77	2.04	2.43	2.34	1.71	2.17	3.26	2.55
street	katu	4.13	1.23	4.50	1.36	0.72	1.05	0.96	1.19	0.20	0.30	0.25	0.33
suicide	itsemurha	0.44	0.50	0.61	0.80	5.75	2.92	6.27	2.61	1.90	2.58	2.32	2.39
swamp	suo	2.61	1.58	3.82	1.69	0.85	1.35	0.99	1.29	0.42	0.85	0.39	0.84
table	pöytä	4.30	1.21	4.87	1.34	0.42	0.59	0.75	0.98	0.26	0.79	0.23	0.33
thrill	elämys	6.20	2.34	7.05	1.59	5.23	2.69	5.22	2.70	0.30	0.69	0.27	0.40

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
time	aika	4.74	1.42	4.50	1.50	1.90	2.42	2.01	2.10	0.21	0.43	0.30	0.49
tit	tissi	2.64	2.12	4.23	2.35	2.17	2.39	2.74	2.56	3.33	2.69	3.53	2.97
torture	kidutus	0.73	1.17	0.69	0.96	5.13	2.91	5.51	2.77	1.97	2.50	2.36	2.49
trash	roska	2.03	1.55	2.38	1.61	1.20	1.68	1.47	1.95	1.36	2.09	1.11	1.89
truth	totuus	7.23	1.49	6.83	1.84	4.85	2.90	4.92	2.87	0.43	1.04	0.55	1.10
tumour	kasvain	0.60	0.67	0.95	1.20	4.45	3.01	4.02	2.85	1.11	2.05	1.05	1.56

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
turd	köntsä	1.79	1.52	2.17	1.74	1.12	1.58	0.94	1.44	2.91	2.41	3.12	2.77
twat	ääliö	1.48	1.22	1.70	1.31	2.97	2.55	3.22	2.56	4.76	2.71	5.23	2.59
unit	yksikkö	3.75	1.58	4.06	1.49	0.47	0.59	0.85	1.14	0.20	0.21	0.28	0.46
urine	virtsa	2.35	1.87	2.56	1.78	0.90	1.59	1.24	1.77	1.24	1.47	2.27	2.46
vehicle	kulkuneuvo	4.52	1.61	5.24	1.61	1.01	1.53	1.43	1.77	0.16	0.16	0.23	0.28
vomit	oksennus	1.58	1.25	1.26	1.58	1.63	1.74	2.64	2.62	1.25	1.47	2.19	2.38

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
wanker	runkku	1.16	1.16	1.16	1.16	3.15	2.62	2.54	2.83	5.51	2.58	6.62	2.49
war	sota	0.81	1.39	1.05	1.54	5.22	2.86	5.52	2.68	1.42	2.07	1.23	2.19
warmth	lämpö	6.97	1.45	7.10	1.52	3.64	2.86	4.14	2.90	0.17	0.21	0.22	0.26
water	vesi	6.03	1.90	6.62	1.78	1.44	1.93	1.74	2.11	0.14	0.15	0.22	0.31
wealth	varallisuus	6.47	1.95	4.62	2.42	2.88	2.61	2.65	2.30	0.67	1.28	0.83	1.34
whore	huora	0.88	0.79	0.88	1.13	3.93	2.67	4.10	3.12	5.78	2.98	7.50	2.02

(continues)

Appendix 2.1 (Continued)

		Emotional Valence				Emotional Charge				Offensiveness			
		English		Finnish		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
wine	viini	5.12	2.12	5.13	1.83	1.60	1.95	2.47	2.26	0.18	0.18	0.38	0.76
wound	haava	1.51	1.18	2.24	1.40	2.74	2.54	2.42	2.14	0.32	0.56	0.55	1.20

Appendix 2.2

Normative Ratings of Familiarity and Concreteness for 210 British English and Finnish Nouns

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
abuse	solvaus	3.42	2.60	1.42	1.45	4.21	2.99	4.51	2.79
acceptance	hyväksyntä	2.75	2.24	2.90	2.22	5.53	2.85	5.74	2.48
accident	onnettomuus	4.51	2.26	3.36	2.39	2.40	2.21	2.37	2.48
ache	särky	4.79	2.37	3.97	2.55	3.59	3.25	3.10	2.73

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
achievement	saavutus	3.71	2.36	3.30	2.24	5.40	2.99	4.48	2.69
adventure	seikkailu	2.91	2.21	2.73	1.95	4.55	3.06	3.75	2.74
affection	hellyys	3.69	2.39	3.36	2.46	5.68	2.96	4.91	2.62
agony	tuska	2.33	2.12	3.19	2.42	5.11	3.11	5.24	2.88
agreement	sovinto	3.68	2.37	2.84	2.11	5.06	2.70	4.58	2.86
alley	kuja	2.45	2.24	2.47	2.18	0.86	1.70	0.58	1.07

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
anger	kiukku	4.11	2.55	3.17	2.26	5.91	3.21	5.12	2.65
anxiety	ahdistus	2.82	2.39	3.21	2.45	6.17	2.84	5.95	2.42
appliance	laite	2.40	2.21	3.39	2.42	1.03	2.03	0.61	1.11
army	armeija	3.38	2.52	4.34	2.67	1.23	1.98	1.03	1.65
arse	perse	5.34	2.73	5.62	2.77	1.99	2.44	0.71	1.24
art	taide	3.13	2.41	3.73	2.62	3.69	3.38	3.50	2.88

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
asshole	persläpi	4.54	2.91	1.49	1.94	3.08	3.01	3.32	2.88
baby	vauva	4.99	2.81	4.49	2.67	0.49	0.78	0.51	1.05
barrel	tynnyri	1.51	1.74	1.69	1.78	0.56	1.16	0.34	0.45
bastard	äpärä	5.30	2.77	1.47	1.87	4.24	3.05	2.77	2.73
beauty	kauneus	4.10	2.59	5.04	2.44	5.58	2.84	5.10	3.01
bed	sänky	7.05	2.15	6.38	2.38	0.39	0.75	0.32	0.40

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
beer	olut	6.28	2.65	4.78	2.80	0.51	0.95	0.40	0.73
bint	urpo	1.22	1.82	2.33	2.53	4.69	3.12	3.67	2.88
bitch	narttu	6.20	2.47	2.10	2.38	4.34	3.00	2.41	2.61
bliss	onni	1.91	1.96	4.24	2.49	6.29	2.81	6.08	2.79
blossom	kukoistus	1.72	1.77	1.45	1.61	2.17	2.64	4.82	2.66
book	kirja	5.69	2.84	6.31	2.63	0.72	1.52	0.40	0.89

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
bowl	kulho	4.01	2.96	2.99	2.25	0.54	1.02	0.31	0.50
bread	leipä	5.76	2.55	6.54	2.48	0.37	0.63	0.37	0.70
brother	veli	5.36	2.89	5.65	2.79	1.03	2.01	0.77	1.48
cabinet	kamari	2.31	2.32	1.47	1.91	0.45	0.93	0.67	1.20
cancer	syöpä	3.61	2.56	3.03	2.49	1.81	2.56	2.00	2.40
car	auto	7.18	1.93	7.26	2.09	0.39	0.98	0.36	0.83

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
cell	solu	2.14	2.09	2.00	1.97	0.91	1.41	1.77	2.33
chair	tuoli	5.28	2.84	5.91	2.57	0.54	1.11	0.37	0.83
cock	kyrpä	4.73	2.85	3.19	2.80	1.96	2.39	0.92	1.61
column	pylväs	1.86	1.80	1.78	1.71	1.45	2.30	0.48	0.95
comfort	mukavuus	3.94	2.58	4.28	2.39	5.56	2.97	4.81	2.69
computer	tietokone	6.85	2.07	6.77	2.16	0.56	1.32	0.33	0.51

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
confidence	luottamus	4.44	2.43	4.10	2.47	6.29	2.84	6.09	2.45
content	sisältö	2.80	2.37	2.93	2.25	4.78	3.15	3.43	2.73
core	ydin	1.90	1.90	2.12	2.02	2.70	2.74	2.52	2.55
corner	nurkka	3.38	2.50	2.99	2.49	0.69	1.17	0.56	1.15
corridor	käytävä	3.46	2.60	4.29	2.64	0.75	1.66	0.52	1.02
cottage	mökki	1.70	1.73	4.11	2.47	0.39	0.72	0.36	0.55

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
crap	ruikku	6.13	2.60	1.50	1.82	3.00	3.08	1.18	1.70
crime	rikos	4.96	2.73	3.52	2.42	3.41	2.82	2.61	2.48
cunt	pillu	3.90	3.25	3.37	2.91	4.05	3.19	0.93	1.69
damn	pahus	4.83	2.89	2.56	2.45	5.51	3.14	5.20	2.84
danger	vaara	3.76	2.58	3.37	2.35	4.70	2.95	4.04	2.58
death	kuolema	3.79	2.73	3.85	2.53	3.24	3.08	3.97	3.08

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
debt	velka	4.68	2.88	3.62	2.47	2.47	2.51	2.52	2.61
depression	masennus	3.76	2.70	3.65	2.60	5.74	2.69	5.18	2.61
desire	halu	2.91	2.33	4.44	2.42	6.41	2.60	5.32	2.57
destruction	tuho	2.38	2.26	2.25	2.00	2.99	2.63	3.58	2.75
dick	mulkku	4.81	2.89	3.09	2.83	1.91	2.34	1.88	2.35
disappointment	pettymys	3.53	2.39	3.18	2.34	6.12	2.62	5.39	2.58

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
discomfort	vaiva	2.56	2.25	3.11	2.29	5.24	3.09	3.55	2.64
doctor	lääkäri	3.94	2.47	4.26	2.48	1.19	2.28	0.49	0.94
door	ovi	5.58	2.72	5.98	2.66	0.32	0.52	0.35	0.60
dream	uni	4.79	2.51	6.29	2.24	5.66	3.15	3.98	2.97
elevator	hissi	2.12	2.12	3.33	2.47	0.51	1.14	0.40	0.69
engine	moottori	2.72	2.22	3.83	2.55	0.53	1.12	0.48	0.91

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
enjoyment	nautinto	3.90	2.63	3.75	2.49	6.53	2.42	4.96	2.84
exercise	liikunta	5.28	2.30	5.96	2.34	1.96	2.28	2.17	2.39
fabric	kangas	2.22	2.12	3.30	2.43	0.41	0.69	0.36	0.55
faggot	hintti	2.50	2.49	3.11	2.83	5.05	3.32	2.62	2.50
family	perhe	6.42	2.41	5.90	2.45	1.64	2.07	1.15	1.66
fart	pieru	4.12	2.78	3.70	2.76	2.39	2.78	1.55	2.31

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
father	isä	4.67	2.92	6.86	2.44	1.25	2.04	0.75	1.53
fear	pelko	3.53	2.46	3.92	2.44	6.29	2.86	5.63	2.59
field	kenttä	3.16	2.52	3.46	2.45	0.60	1.29	0.69	1.13
filth	saasta	3.39	2.55	1.64	1.79	3.48	2.63	2.99	2.57
flag	lippu	1.92	1.93	3.37	2.45	0.79	1.66	0.41	0.74
food	ruoka	7.88	1.67	7.57	1.88	0.87	1.46	0.46	1.00

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
fragrance	tuoksu	2.81	2.14	4.02	2.40	2.32	2.61	2.80	2.85
fraud	petos	2.63	2.19	2.21	1.97	3.60	2.97	4.16	2.78
freedom	vapaus	3.72	2.45	3.58	2.48	6.22	3.03	6.08	2.67
friend	ystävä	7.18	1.97	6.27	2.47	2.61	2.68	1.86	2.31
fuck	vittu	6.77	2.55	6.79	2.81	4.78	2.86	2.44	2.71
funeral	hautajaiset	2.35	2.14	2.31	2.07	1.58	2.00	1.45	2.04

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
gift	lahja	3.37	2.38	3.82	2.41	1.45	2.00	1.04	1.59
git	typerys	2.99	2.50	2.91	2.40	4.57	3.06	3.50	2.75
glass	lasi	5.20	2.81	5.85	2.67	0.75	1.71	0.33	0.41
glory	kunnia	2.13	1.95	2.56	2.08	6.32	2.22	5.79	2.61
grave	hauta	1.83	1.65	2.37	2.19	1.16	1.94	0.82	1.36
grief	murhe	2.63	2.21	2.90	2.26	5.80	2.93	5.09	2.82

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
guilt	syyllisyys	3.43	2.37	2.65	2.11	6.11	2.78	5.53	2.59
habit	tapa	3.54	2.51	3.91	2.59	4.10	3.21	4.25	2.77
hammer	vasara	2.02	2.05	2.48	2.17	0.30	0.40	0.27	0.34
hate	viha	5.03	2.62	4.20	2.50	6.60	2.57	5.46	2.85
hell	helvetti	3.62	2.69	5.31	2.78	6.56	2.76	5.81	2.90
holiday	loma	5.30	2.22	6.24	2.29	2.49	2.58	2.65	2.69

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
honesty	rehellisyys	4.02	2.46	4.00	2.37	6.00	2.73	6.06	2.46
honey	hunaja	3.06	2.60	2.32	2.18	0.77	1.30	0.60	1.31
hope	toivo	3.98	2.47	3.49	2.29	6.85	2.28	6.32	2.41
horror	kauhu	3.15	2.54	3.11	2.33	5.86	2.65	5.43	2.62
hospital	sairaala	3.56	2.47	3.75	2.57	0.49	0.93	0.45	0.83
hostage	panttivanki	1.90	2.03	1.68	1.77	2.43	2.68	1.08	1.61

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
house	talo	6.05	2.64	5.40	2.58	0.86	2.01	0.32	0.40
illness	sairaus	4.00	2.30	4.11	2.47	2.93	2.57	2.72	2.58
improvement	parannus	3.78	2.45	2.33	1.98	5.11	2.92	4.48	2.81
industry	teollisuus	2.33	2.07	3.02	2.42	2.20	2.93	1.96	2.43
inhabitant	asukas	1.54	1.67	3.44	2.46	2.21	2.33	0.76	1.30
injury	vamma	3.22	2.34	2.76	2.17	2.02	2.27	1.57	1.92

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
insult	loukkaus	3.51	2.42	3.00	2.22	5.19	2.97	4.96	2.67
intercourse	yhdyntä	2.98	2.45	2.99	2.49	1.74	2.34	1.33	2.13
jelly	hyytelö	2.23	2.20	1.67	1.75	0.57	1.03	0.50	0.78
joke	vitsi	5.87	2.48	5.49	2.46	5.46	2.71	3.06	2.68
joy	ilo	3.06	2.34	4.95	2.40	5.86	3.10	5.27	2.84
justice	oikeus	2.96	2.31	3.24	2.29	5.97	2.60	5.15	2.72

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
kettle	pannu	5.17	2.87	2.72	2.32	0.51	1.24	0.41	0.88
kiss	suudelma	6.20	2.24	4.39	2.70	1.61	2.27	1.15	1.70
laughter	nauru	4.71	2.81	5.89	2.32	4.07	3.11	2.62	2.72
lawn	nurmikko	2.25	2.18	3.91	2.37	0.50	1.16	0.46	1.09
leader	johtaja	3.44	2.42	3.49	2.54	3.48	3.12	1.21	1.84
length	pituus	3.40	2.45	4.38	2.50	3.01	3.25	1.72	2.31

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
level	taso	3.07	2.49	2.50	2.08	3.43	3.09	2.92	2.77
life	elämä	5.31	2.73	5.77	2.46	5.48	2.86	4.93	3.09
loneliness	yksinäisyys	3.04	2.44	3.38	2.44	6.31	2.66	5.59	2.66
loser	häviäjä	5.12	2.79	2.84	2.23	5.15	2.88	2.72	2.36
loss	menetys	3.28	2.33	2.57	2.09	5.04	2.93	4.94	2.77
loyalty	uskollisuus	3.03	2.42	3.53	2.38	6.29	2.30	6.11	2.49

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
machine	kone	3.39	2.58	4.96	2.66	0.90	1.88	0.48	0.94
malice	ilkeys	1.34	1.60	2.93	2.26	4.87	3.10	5.36	2.75
medicine	lääke	3.95	2.58	4.52	2.49	0.77	1.03	0.64	0.98
milk	maito	5.76	2.60	6.63	2.41	0.30	0.36	0.39	0.67
miracle	ihme	2.28	2.03	3.98	2.59	6.34	2.95	5.72	2.62
misery	kurjuus	2.36	2.03	2.23	2.00	5.67	2.85	5.08	2.59

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
moment	hetki	4.02	2.63	4.41	2.71	5.28	3.12	5.53	2.81
money	raha	7.58	1.96	7.11	2.12	0.93	1.94	0.66	1.17
mosquito	sääski	1.77	1.79	2.68	2.30	0.29	0.31	0.39	0.71
mother	äiti	5.78	2.92	7.70	1.93	1.07	1.96	0.80	1.44
murderer	murhaaja	2.88	2.46	2.61	2.28	2.53	2.87	1.37	1.75
mushroom	sieni	2.89	2.51	2.52	2.32	0.42	0.84	0.41	0.69

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
music	musiikki	7.29	2.13	7.19	2.13	3.42	3.05	2.58	2.66
nature	luonto	3.42	2.59	4.19	2.45	2.80	2.79	1.81	2.31
nightmare	painajainen	3.56	2.30	3.51	2.30	5.29	2.92	4.29	2.98
nob	kulli	4.11	2.98	2.73	2.70	3.09	3.00	0.89	1.67
office	toimisto	3.86	2.66	2.76	2.20	0.62	1.31	0.71	1.27
opinion	mielipide	5.02	2.59	4.87	2.60	6.61	2.45	5.13	2.78

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
pain	kipu	4.43	2.44	4.37	2.51	4.13	3.20	3.16	2.80
part	osa	4.14	2.93	3.72	2.70	2.88	3.10	2.76	2.60
peace	rauha	3.28	2.47	3.63	2.39	6.44	2.62	5.32	2.82
perfection	täydellisyys	3.11	2.37	3.60	2.50	5.85	2.91	6.43	2.48
phase	vaihe	2.47	2.17	3.00	2.30	4.42	3.09	4.73	3.04
pillow	tyyny	4.54	2.50	5.07	2.72	0.36	0.47	0.35	0.65

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
piss	kusi	5.05	2.82	4.29	3.03	1.78	2.42	0.68	1.18
poison	myrkky	1.59	1.63	2.22	2.04	1.15	1.64	1.10	1.56
pollution	saaste	3.53	2.53	2.84	2.41	2.84	2.80	2.01	2.29
poverty	köyhyys	3.10	2.62	3.45	2.40	3.44	2.94	4.13	2.74
prick	kusipää	4.63	2.94	4.67	3.03	4.25	3.04	3.82	2.98
privacy	yksityisyys	3.54	2.46	3.37	2.36	5.14	2.87	5.08	2.81

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
profit	tuotto	3.39	2.46	2.19	1.96	2.73	2.85	2.76	2.57
punishment	rangaistus	3.40	2.41	3.03	2.30	3.87	3.05	3.03	2.44
pus	visva	1.25	1.62	0.63	0.97	0.84	1.52	1.77	2.19
pussy	pimppi	3.47	2.77	1.88	2.30	2.30	2.66	0.90	1.51
quarrel	riita	1.77	1.84	4.46	2.53	3.53	2.83	3.21	2.86
rage	raivo	2.59	2.31	2.69	2.13	5.56	3.07	5.27	2.54

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
rape	raiskaus	2.84	2.54	2.51	2.26	2.66	2.92	1.99	2.47
reality	todellisuus	3.63	2.56	3.38	2.39	6.36	2.82	6.01	2.65
respect	kunnioitus	4.54	2.30	3.14	2.23	6.06	2.87	5.77	2.64
reward	palkkio	3.19	2.30	2.74	2.14	3.62	2.62	1.73	1.99
ridicule	pilkka	1.66	1.76	2.02	1.86	5.25	3.00	4.35	2.75
route	reitti	3.08	2.31	3.21	2.30	2.16	2.63	1.86	2.21

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
scrotum	kivekset	1.50	1.95	2.45	2.37	0.81	1.31	0.50	1.18
security	turvallisuus	3.73	2.38	3.89	2.42	3.50	2.76	5.42	2.62
selfishness	itsekkyys	3.27	2.31	3.05	2.27	6.31	2.44	5.81	2.43
shag	pano	5.30	2.72	3.85	2.90	2.75	2.85	1.97	2.36
shit	paska	6.86	2.43	6.00	2.76	2.65	2.85	1.06	1.67
sister	sisko	5.48	2.68	5.60	2.80	0.91	1.59	0.78	1.48

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
size	koko	4.46	2.57	4.66	2.70	2.49	2.60	2.80	2.65
slapper	hutsu	3.51	2.68	1.96	2.38	4.89	2.79	2.39	2.42
slaughter	teurastus	1.47	1.66	1.56	1.66	2.84	2.74	1.79	2.24
slime	lima	1.22	1.35	2.22	1.91	1.22	1.87	0.82	1.38
slut	lutka	4.34	2.89	2.46	2.64	4.29	3.01	2.77	2.53
snake	käärme	2.04	2.04	2.64	2.21	0.35	0.50	0.44	0.94

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
snow	lumi	2.45	1.98	5.03	2.49	0.57	1.19	0.61	1.02
spider	hämähäkki	3.92	2.37	3.15	2.38	0.30	0.44	0.39	0.69
sport	urheilu	5.88	2.42	5.84	2.56	1.94	2.38	2.13	2.40
spray	suihke	3.14	2.38	2.39	2.12	1.09	1.75	1.01	1.56
square	aukio	2.44	2.31	1.74	1.69	0.84	1.87	1.16	1.82
statue	patsas	1.73	1.77	2.24	2.07	0.67	1.20	0.41	0.62

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
stench	löyhkä	1.86	1.72	1.68	1.69	2.28	2.82	2.29	2.44
street	katu	4.87	2.73	4.56	2.66	0.65	1.26	0.45	0.86
suicide	itsemurha	2.64	2.41	2.64	2.45	3.21	2.91	2.33	2.66
swamp	suo	1.37	1.85	2.03	2.07	1.20	1.86	0.77	1.32
table	pöytä	5.21	2.86	5.70	2.68	0.43	1.06	0.29	0.43
thrill	elämys	2.75	2.14	2.74	2.05	5.88	2.80	5.08	2.75

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
time	aika	7.18	2.29	6.48	2.28	5.08	3.23	5.88	3.02
tit	tissi	4.00	2.89	4.01	2.78	1.66	2.01	0.54	1.12
torture	kidutus	1.80	1.84	2.02	1.91	3.19	2.87	2.79	2.62
trash	roska	2.21	2.35	4.97	2.57	0.90	1.46	0.50	0.73
truth	totuus	4.93	2.41	4.27	2.41	5.73	3.10	5.78	2.75
tumour	kasvain	1.92	2.04	2.11	2.05	1.26	1.88	1.31	1.94

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
turd	köntsä	2.24	2.43	1.04	1.72	1.38	1.89	2.24	2.43
twat	ääliö	5.44	2.82	4.36	2.78	4.68	2.84	3.83	2.84
unit	yksikkö	2.36	2.26	2.23	2.18	1.70	2.51	2.82	2.80
urine	virtsa	1.73	2.05	1.41	1.62	0.79	1.53	0.61	1.08
vehicle	kulkuneuvo	3.48	2.46	2.83	2.31	0.56	1.12	0.41	0.60
vomit	oksennus	2.39	1.94	2.88	2.31	1.00	1.62	0.72	1.39

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
wanker	runkku	5.28	2.83	2.29	2.65	4.36	3.06	3.37	2.82
war	sota	4.14	2.85	3.75	2.70	3.19	2.85	1.84	2.16
warmth	lämpö	3.71	2.56	4.80	2.56	3.99	3.11	2.80	2.72
water	vesi	7.02	1.95	6.85	2.30	0.72	1.34	0.66	1.38
wealth	varallisuus	3.43	2.55	2.75	2.18	3.37	2.77	4.31	2.74
whore	huora	3.67	2.89	3.68	2.97	4.27	3.10	2.64	2.55

(continues)

Appendix 2.2 (Continued)

		Familiarity				Concreteness			
		English		Finnish		English		Finnish	
English	Finnish	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
wine	viini	4.97	2.70	3.58	2.70	0.61	1.28	0.43	0.84
wound	haava	2.11	1.95	3.74	2.48	1.37	1.92	0.66	1.16

Appendix 3.1

Summary of the Finnish-English Bilinguals' Responses to the Language History Questionnaire

Exposure to English

	More proficient		Less proficient	
	M	*SD*	*M*	*SD*
Age at which started to learn English	9.1	0.93	8.7	1.22
Amount of time spent in English-speaking countries (months)	2.3	3.92	1.2	3.42

(continues)

Appendix 3.1 (Continued)

English learnt through classroom instruction or through interacting with people (percentage of participants)

	Classroom instruction		Interacting with people	
	More proficient	Less proficient	More proficient	Less proficient
Not at all	0	0	0	0
Very little	3.1	7.5	12.5	17.5
Some	18.8	17.5	21.9	37.5
Quite a lot	43.8	40.0	46.9	32.5
Mostly	34.4	35.0	18.8	12.5

(continues)

Appendix 3.1 (Continued)

Contexts of learning English other than classroom instruction or through interacting with people (percentage of participants)

	More proficient	Less proficient
Reading books	28.1	12.5
Internet	9.4	2.5
Media (incl. TV, films, radio, music)	43.8	18.8
Travelling	3.1	0
Video games	3.1	2.5
Comics	3.1	0
No response	40.6	70.0

(continues)

Appendix 3.1 (Continued)

Level of proficiency in Finnish and English according to different skills

	More proficient				Less proficient			
	Finnish		*English*		*Finnish*		*English*	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Reading	7.0	0.18	6.0	0.51	6.6	0.80	4.7	1.04
Writing	6.9	0.49	5.5	0.57	6.6	0.78	4.4	0.78
Speaking	7.0	0.18	5.6	0.56	6.8	0.59	4.2	0.95
Listening	6.9	0.53	5.8	0.64	6.7	0.72	4.6	1.03

Note. Language proficiency was rated on a scale from 1 (very poor) to 7 (native-like).

(continues)

Appendix 3.1 (Continued)

Age of acquiring the different skills in English and years studied those skills

	More proficient		Less proficient	
	M	*SD*	*M*	*SD*
Age when first started to…				
speak in English	9.0	1.53	9.1	2.16
read in English	9.0	1.59	9.1	1.15
write in English	9.3	1.14	9.3	1.40
Number of years having learnt to…				
speak in English	13.3	6.27	12.4	6.40
read in English	13.7	6.23	12.3	6.49
write in English	13.4	6.15	12.1	6.59

(continues)

Appendix 3.1 (Continued)

Extent of using Finnish and English in all daily activities combined (mean percentage)

	More proficient		Less proficient	
	M	*SD*	*M*	*SD*
Finnish	81.7	16.07	87.6	22.04
English	15.7	12.10	8.6	11.66

(continues)

Appendix 3.1 (Continued)

Time spent per day on different activities using Finnish and English (in hours)

	More proficient				Less proficient			
	Finnish		English		Finnish		English	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Watching TV and films, listening to radio and music	1.0	0.58	2.0	1.17	1.9	1.32	1.8	1.19
Browsing the internet, reading news papers, magazines and other materials	1.3	0.69	1.2	0.94	1.9	1.16	0.8	0.74
Writing emails and letters	0.7	0.41	0.3	0.29	0.8	0.70	0.6	2.02
Working and/ or studying	3.9	1.93	1.0	1.06	5.3	2.72	1.3	2.92
Socialising	5.3	3.69	0.6	0.61	5.8	3.93	0.3	0.47

(continues)

Appendix 3.1 (Continued)

Language used for different situations (percentage of participants)

	More proficient			Less proficient		
	Finnish	English	Other	Finnish	English	Other
Simple arithmetic	96.9	0	3.1	95.0	2.5	2.5
Dream	78.1	3.1	18.8	90.0	0	0
Express anger and affection	75.0	6.3	18.7	87.5	2.5	10.0

Note. "Other" also includes those participants who indicated using more than one language in the given situations.

(continues)

Appendix 3.1 (Continued)

Language preference in different situations (in percentages)

	More proficient			Less proficient		
	Finnish	English	Other	Finnish	English	Other
At home	81.3	6.3	12.5	87.5	2.5	10.0
At work, school or university	62.5	25.0	12.5	65.0	5.0	30.0
At a party	71.9	12.5	15.6	82.1	2.6	15.3
In general	67.7	12.9	19.4	92.1	0	7.9

Note. "Other" also includes those participants who did not indicate a preference of one language over another.

Appendix 3.2

Word Stimuli for Lexical Decision Task with Finnish-English Bilinguals and Native English Speakers

Neutral		Positive		Negative		Taboo	
English	Finnish	English	Finnish	English	Finnish	English	Finnish
SNOW	LUMI	GLORY	KUNNIA	POVERTY	KÖYHYYS	WANKER	RUNKKU
PHASE	VAIHE	NATURE	LUONTO	RAGE	RAIVO	FART	PIERU
CORE	YDIN	BEAUTY	KAUNEUS	PAIN	KIPU	SLUT	LUTKA
ALLEY	KUJA	GIFT	LAHJA	DEBT	VELKA	BASTARD	ÄPÄRÄ
TIME	AIKA	HOPE	TOIVO	AGONY	TUSKA	COCK	KYRPÄ
LEVEL	TASO	FREEDOM	VAPAUS	GRIEF	MURHE	TURD	KÖNTSÄ
MACHINE	KONE	REWARD	PALKKIO	CANCER	SYÖPÄ	TWAT	ÄÄLIÖ
ROUTE	REITTI	FAMILY	PERHE	HORROR	KAUHU	NOB	KULLI

(continues)

Appendix 3.2 (Continued)

Neutral		Positive		Negative		Taboo	
English	Finnish	English	Finnish	English	Finnish	English	Finnish
CONTENT	SISÄLTÖ	PEACE	RAUHA	ILLNESS	SAIRAUS	PUSSY	PIMPPI
REALITY	TODELLISUUS	BLISS	ONNI	ANXIETY	AHDISTUS	WHORE	HUORA
SIZE	KOKO	BABY	VAUVA	WAR	SOTA	FAGGOT	HINTTI
HABIT	TAPA	JUSTICE	OIKEUS	HATE	VIHA	FUCK	VITTU
ART	TAIDE	TRUTH	TOTUUS	FEAR	PELKO	ASSHOLE	PERSLÄPI
MOMENT	HETKI	THRILL	ELÄMYS	ACHE	SÄRKY	SLAPPER	HUTSU
LENGTH	PITUUS	WARMTH	LÄMPÖ	DEATH	KUOLEMA	ARSE	PERSE
UNIT	YKSIKKÖ	LIFE	ELÄMÄ	CRIME	RIKOS	CUNT	PILLU
PRIVACY	YKSITYISYYS	PROFIT	TUOTTO	FRAUD	PETOS	BITCH	NARTTU
OPINION	MIELIPIDE	WEALTH	VARALLISUUS	DANGER	VAARA	SHIT	PASKA
PART	OSA	BROTHER	VELI	TORTURE	KIDUTUS	GIT	TYPERYS
INHABITANT	ASUKAS	JOY	ILO	DEPRESSION	MASENNUS	PISS	KUSI

Appendix 4.1

Summary of the German-English Bilinguals' Responses to the Language History Questionnaire

Exposure to English

	M	*SD*
Age at which started to learn English	10.0	2.30
Amount of time spent in English-speaking countries (years)	3.9	3.35

(continues)

Appendix 4.1 (Continued)

English learnt through classroom instruction or through interacting with people (percentage of participants)

	Not at all	Very little	Some	Quite a lot	Mostly
Classroom	0	5.0	10.0	25.0	60.0
Interacting with people	0	10.0	15.0	45.0	30.0

Contexts of learning English other than classroom instruction or through interacting with people (percentage of participants)

Reading books, journals, etc.	25.0
Media (incl. TV, films, radio, music)	30.0
Travelling	10.0
No response	34.0

(continues)

Appendix 4.1 (Continued)

Level of proficiency in German and English according to different skills

	German		English	
	M	*SD*	*M*	*SD*
Reading	7.0	0.22	6.1	0.69
Writing	6.8	0.41	5.8	1.07
Speaking	6.9	0.49	5.6	1.54
Listening	7.0	0.00	6.0	1.00

Note. Language proficiency was rated on a scale from 1 (very poor) to 7 (native-like)

(continues)

Appendix 4.1 (Continued)

Age of acquiring the different skills in English and years studied those skills

	M	*SD*
Age when first started to…		
speak in English	9.9	3.42
read in English	10.9	2.48
write in English	10.9	3.03
Number of years having learnt to…		
speak in English	12.6	4.72
read in English	11.4	4.41
write in English	11.1	4.49

(continues)

Appendix 4.1 (Continued)

Main language of instruction at different educational levels (percentage of participants)

	German	English	Other
Primary/ Elementary School	100	0	0
Secondary/ Middle School	95.0	5.0	0
High School	90.0	10.0	0
College/ University	50.0	45.0	5.0

Frequency of using German and English in all daily activities combined (in percentages)

	M	*SD*
German	25.0	30.38
English	59.9	38.14

(continues)

Appendix 4.1 (Continued)

Language preference at different situations (percentage of participants)

	German	English	Other
at home	70.0	25.0	5.0
at work/ school/ university	20.0	65.0	15.0
at a party	35.0	50.0	15.0
in general	60.0	30.0	10.0

Appendix 4.2

Word Stimuli for the ERP Study with German-English Bilinguals

Neutral		Positive		Negative	
English	German	English	German	English	German
ALERT	WARNUNG	ADVANTAGE	VORTEIL	ACCIDENT	UNFALL
ANSWER	ANTWORT	ANGEL	ENGEL	AGONY	QUAL
AUTUMN	HERBST	APPLAUSE	BEIFALL	ASSAULT	ANGRIFF
AVENUE	ALLEE	BIRTHDAY	GEBURTSTAG	COFFIN	SARG
BARREL	TONNE	BLISS	WONNE	CORPSE	LEICHE
BOARD	TAFEL	BRIDE	BRAUT	CRASH	ABSTURZ
BOWL	SCHALE	BROTHER	BRUDER	CRISIS	KRISE
BREAST	BRUST	CAKE	KUCHEN	DANGER	GEFAHR

(continues)

Appendix 4.2 (Continued)

Neutral		Positive		Negative	
English	German	English	German	English	German
CANDY	BONBON	CHAMPION	MEISTER	DEVIL	TEUFEL
CELLAR	KELLER	DELIGHT	FREUDE	FAILURE	VERSAGEN
CLIFF	KLIPPE	DIAMOND	DIAMANT	FEAR	FURCHT
COAST	KÜSTE	DREAM	TRAUM	FEVER	FIEBER
CORD	LEINE	FAME	RUHM	FILTH	DRECK
CROWN	KRONE	FLOWER	BLUME	FRAUD	BETRUG
CUSTOM	SITTE	GARDEN	GARTEN	GARBAGE	ABFALL
DAWN	BEGINN	HEALTH	GESUNDHEIT	GOSSIP	GEREDE
DOLL	PUPPE	HEAVEN	HIMMEL	GRIEF	TRAUER
ELBOW	BOGEN	HOLIDAY	URLAUB	HOSTAGE	GEISEL

(continues)

Appendix 4.2 (Continued)

Neutral		Positive		Negative	
English	German	English	German	English	German
EMPLOYMENT	EINSATZ	HONEY	HONIG	MENACE	DROHUNG
EVENT	VORFALL	HOPE	HOFFNUNG	MISERY	LEID
FLAG	FAHNE	INCENTIVE	ANREIZ	MISTAKE	FEHLER
FORK	GABEL	JOKE	SPAß	NIGHTMARE	ALPTRAUM
FRAGRANCE	PARFUM	LAUGHTER	LACHEN	PAIN	SCHMERZ
MEMORY	ERINNERUNG	MIRACLE	WUNDER	PITY	MITLEID
MISCHIEF	UNFUG	PALACE	PALAST	POVERTY	ARMUT
PAINT	FARBE	PILLOW	KISSEN	PRESSURE	DRUCK
POETRY	POESIE	PUPPY	WELPE	PRISON	GEFÄNGNIS
QUALITY	QUALITÄT	REWARD	LOHN	PUNISHMENT	STRAFE

(continues)

Appendix 4.2 (Continued)

Neutral		Positive		Negative	
English	German	English	German	English	German
RAIN	REGEN	SILK	SEIDE	QUARREL	STREIT
SCISSORS	SCHERE	SNOW	SCHNEE	RAGE	ZORN
SHADOW	SCHATTEN	SONG	LIED	REVOLT	AUFSTAND
SPHERE	KUGEL	SUNSET	ABENDROT	RIDICULE	SPOTT
STOMACH	MAGEN	THRILL	EINFALL	SCAR	NARBE
SWAMP	SUMPF	TRAVEL	REISE	SCREAM	SCHREI
TEACHER	LEHRER	TRUST	VERTRAUEN	SLAP	SCHLAG
THOUGHT	GEDANKE	TRUTH	WAHRHEIT	SLAUGHTER	SCHLACHT
TREE	BAUM	TUNE	MELODIE	THIEF	DIEB
VIRGIN	JUNGFRAU	VACATION	FERIEN	TORTURE	FOLTER

(continues)

Appendix 4.2 (Continued)

Neutral		Positive		Negative	
English	German	English	German	English	German
VOLCANO	VULKAN	VICTORY	SIEG	VICTIM	OPFER
WHISTLE	PFEIFE	WEDDING	HOCHZEIT	WEAPON	WAFFE

Appendix 5.1

Summary of the Non-native English Speakers' Responses to the Language History Questionnaire

	M	*SD*	*Range*
Time of stay in English-speaking countries (in years)	2.5	2.47	0.2 - 10.2
Age when started learning English	8.4	1.91	6 - 14

Self-ratings of proficiency	*Greek*	*English*
Reading	7.0	5.9
Writing	6.6	5.6
Speaking	6.9	5.3
Comprehension	6.9	5.9

	Greek	*English*	*Both*
Choice of language for expressing anger and affection	58%	6%	29%
Language preference in general	65%	13%	19%
Frequency of language use in all daily activities combined	45%	58%	-

Note. The scale used to rate proficiency ranged from 1 = very poor to 7 = native-like.

Appendix 5.2

Word Stimuli for the Emotional and Taboo Stroop Study with Native and Non-native English Speakers

Neutral	*Positive*	*Negative*	*Taboo*
KETTLE	WARMTH	RAPE	FUCK
BARREL	HOLIDAY	SUICIDE	ASSHOLE
FIELD	PEACE	CANCER	SCROTUM
INHABITANT	AGREEMENT	TORTURE	INTERCOURSE
FRAGRANCE	AFFECTION	DEATH	PISS
JELLY	REWARD	LONELINESS	DICK
UNIT	ENJOYMENT	ACHE	COCK
ALLEY	BLISS	VOMIT	BITCH
APPLIANCE	HONEY	PAIN	SHIT
SPRAY	BLOSSOM	SLAUGHTER	PUSSY
MACHINE	GLORY	GRIEF	SLAPPER
HABIT	JOY	ABUSE	DAMN
CORRIDOR	LAUGHTER	AGONY	WHORE
COMPUTER	PERFECTION	DISCOMFORT	CRAP
VEHICLE	MIRACLE	FUNERAL	BASTARD
BOWL	DREAM	HOSTAGE	WANKER

(continues)

Appendix 5.2 (Continued)

Neutral	*Positive*	*Negative*	*Taboo*
ENGINE	COMFORT	RAGE	PRICK
COTTAGE	HOPE	POVERTY	CUNT
LAWN	KISS	LOSER	SLUT
CABINET	THRILL	DEBT	FAGGOT