Chapter 10

When is a First Language More Emotional? Psychophysiological Evidence from Bilingual Speakers

CATHERINE L. HARRIS, JEAN BERKO GLEASON and AYŞE AYÇIÇEĞI

Introduction

This chapter will review recent studies measuring physiological aspects of bilinguals' emotional response to stimuli presented in speakers' first and second language. We also introduce a new theory, 'the emotional contexts of learning theory', developed to account for findings from existing studies of bilingualism and emotion. We then evaluate the data consistent with this theory, the new predictions it makes, and the overall prospects for integrating psychophysiological research with cross-linguistic and cross-cultural research.

The connections between emotion and cognition have been increasingly studied over the past decade (e.g. Damasio, 1994, 1999; LeDoux, 1996, 2002; Panksepp, 1998). Less attention has been paid to the emotional correlates of language. One arena in which emotional concomitants of language are keenly felt is in bilingual speakers' sense that there is greater emotional arousal associated with their first language compared to their second language. Intuitions like these have been documented in the writings of bilingual authors (Pavlenko, 1998), testimonials of patients undergoing psychotherapy (Altarriba & Santiago-Rivera, 1994; Santiago-Rivera & Altarriba, 2002; Schrauf, 2000), and in laboratory studies (Anooshian & Hertel, 1994; Ayçiçeği & Harris, 2004; Bond & Lai, 1986; Marian & Neisser, 2000; Schrauf & Rubin, 1998). However, investigation of personal emotional experiences, such as which language feels more emotional, has traditionally been assumed to lie outside the scope of scientific research.

The cognitive sciences have avoided studying emotion and subjective experience for several reasons: (1) the origins of the cognitive revolution

emphasized the computational metaphor (Gardner, 1985); (2) until the late 20th century, logic and reasoning were still regarded as the essence of human cognition; and (3) early cognitive scientists wanted to uncover the universals of human thought, with subjective experience seen as an idiosyncratic and distracting overlay on these universals. Such abstract and cerebral constructs were also key parts of the revolution within linguistics inspired by Chomsky (1965), as illustrated by the well-known concepts of language universals, the language acquisition device, the autonomy of syntax hypothesis, and the competence/performance distinction.

The priority of these conceptual orientations is reduced among contemporary students of language and cognition (Gazzaniga, 1999). Current research emphasizes understanding neural mechanisms, not abstract computational architecture (e.g. O'Reilly & Munakata, 2000). Pattern recognition and evolutionarily derived motivations are assumed to underlie the greater part of human thought and action. Because cognitive science has been broadened to include both animal behaviour and the evolutionary roots of human thought and behaviour, emotion is now regarded as essential to human cognition. Breakthrough books of the 1990s include Damasio's (1994) treatise on the crucial role of emotion in decision making, and Panksepp's (1998) textbook on affective neuroscience. Philosophers have joined forces with experimental psychologists to theorize about why conscious experience has the subjective qualities that it has (e.g. O'Regan & Noe, 2001). The embodiment movement has emphasized how cognitive processing draws on bodily movements (Barsalou, 2003). Contemporary linguistic theorists have argued that semantics and even some aspects of grammar draw on speakers' experience of the physical world (Lakoff & Johnson, 1999).

This 'emotion revolution' has occurred most strongly for cognition; it has made few inroads into psycholinguistics and even fewer into bilingualism. Cognitive scientists have pursued a monolingual agenda, meaning that when the emotion–language connection is studied, monolingual speakers are the typical research participants (a noteworthy exception being Schumann's 1997 work on the motivational basis for second language acquisition). One reason researchers are cautious about studying bilingual speakers is that language-learning histories are highly variable across bilinguals. The myriad factors at play in second language acquisition (SLA) include age of acquisition, naturalistic versus classroom learning, and the personal meaning that learning a language has for an individual. Variables such as these and the subjective nature of emotional experience can be seen as obstacles to scientific research on the perceived emotionality of a first versus a second language.

The view that subjective experience is too inconsistent to yield identifiable causal factors has become outdated, however. Subjective experience

– the felt quality of a specific experience – can be highly similar across individuals. This is true of two key sensory experiences that have been intensely studied by scientists: taste and pain. Indeed, the starting point for the current research is an aspect of emotional responsiveness that is fairly uniform: bilingual speakers report usually experiencing greater emotional intensity when using swear words or taboo words in their first (or dominant) language compared to their second language (L2) (Dewaele, 2004).

We also argue against the claim that accounting for individuals' emotional experience would involve too many factors. Contemporary science frequently deals with phenomena with multiple causes, and multifactorial data sets are common. Multiple regression can be used to study many predictors at once. Furthermore, it is useful to identify the relative strength of causal agents, to learn which are close to being universal, and which are subject to individual variation.

Emotional experience need not be viewed as inherently subjective and unquantifiable. The current paper documents how subjective accounts of emotional experience can be fruitfully studied in the laboratory using psychophysiological techniques. One can investigate the general factors associated with language that hold true across most individuals (e.g. early age of acquisition, naturalistic learning context), and also examine factors likely to vary across individuals, to determine why a specific language comes to be experienced as highly emotional.

Assessing Emotional Intensity by Measuring Autonomic Arousal

Our perspective on emotion and language is unique in that our key laboratory technique does not depend on self-report. In our studies we have used skin conductance, which is a well-known psychophysiological measure. Skin conductance amplitudes are, for instance, a component of the polygraph or lie-detector test. In research dating to the mid-20th century, researchers used the term galvanic skin response, or GSR, for this measure, but the preferred contemporary term is electrodermal recording (Boucsein, 1992).

The autonomic nervous system responds to signs of threat by preparing systems of the body to take action (e.g. the fight-or-flight response; Hugdahl, 1995). Part of the overall physical response to danger is sweating of the palms and fingertips, signals that can be quantified by measuring the transient increase in the skin's electrical conductivity. A transient increase that can be time-locked to a specific stimulus is called a *skin conductance response* (SCR). These occur within 1 to 1.5 seconds following presentation of the stimulus, and may last for 2 to 6 seconds.

The phasic amplitude of the SCR is most sensitive to threatening stimuli, but may also index relevance of a stimulus. Thus, even a photograph of the face of an acquaintance, when embedded in a stream of unfamiliar faces, will elicit heightened responsiveness (Channouf & Rouibah, 1997; Tranel *et al.*, 1985). Language studies have shown that reading or hearing taboo words elicits a stronger SCR than reading or hearing neutral words (Bingham, 1943; Gray *et al.*, 1982; Manning & Melchiori, 1974; Mathews & MacLeod, 1985; Mathews *et al.*, 1989). Among monolinguals, emotionally laden words, such as 'cancer' and 'kill', elicit stronger responses than neutral words (Dinn & Harris, 2000). Taboo words in particular are known to activate the amygdala and other brain structures, which mediate the arousal that accompanies detection of threat (LaBar & Phelps, 1998).

Single words (or at most phrases) have been the main type of language studied using the electrodermal technique. The focus of these studies has generally been not so much language itself, but personality and psychiatric variables indexed by language (Barry, 1980; Dinn & Harris, 2000; Grings & Zeiner, 1965; Mathews *et al.*, 1989; Stelmack *et al.*, 1983a,b). Skin conductance has only recently been used to test hypotheses about the interconnections between emotional arousal and the language system. Bowers and Pleydell-Pearce (2004) investigated the emotional consequences of using swear words versus euphemisms. It is commonly accepted that one function of euphemisms is to protect speakers from undesired emotional arousal (Brown & Levinson, 1987). Intuitively, words such as 'death' and 'kill' convey more emotion compared to euphemisms such as 'passed away' and 'collateral damage'. An obvious way to explain the reduced emotion of euphemisms is to propose that direct associations develop between word forms and emotions. However, this contradicts standard models of the lexicon according to which word forms activate abstract, amodal semantic representations (e.g. Levelt, 1989). These abstract conceptual structures then activate relevant meaning structures. In these models, phrases and words with emotional connotations generate emotional arousal indirectly, via these conceptual structures, and language forms themselves do not have direct connections with emotional connotations.

This standard view is plausible and explains a great deal of psycholinguistic research, as reviewed by Levelt (1989). However, it does not explain euphemisms well, because euphemisms are understood to mean the same thing as their emotionally laden counterparts. To make headway in this debate, Bowers and Pleydell-Pearce (2004) measured emotional arousal via skin conductance. Euphemisms for taboo words (e.g. the term 'f-word') elicited weaker SCRs than the taboo words themselves. Bowers and Pleydell-Pearce noted: 'The suggestion that the sounds (and spellings) of words are associated with emotional responses

amounts to the same thing as associating a tone or visual signal with a stimulus that evokes an emotional response' (2004: 5). These authors situated their findings in the context of debates about linguistic relativity – the form of language influences cognitive processing, because word forms can directly activate emotion.

In the next section, we describe our own prior work investigating electrodermal differences elicited by bilinguals' first and second language. In our studies of bilingual individuals, we have focused on sequential bilinguals, with English as the second language. Many of our participants were first immersed in English when they moved to North America to attend university or take jobs as adults. They frequently had formal English instruction in their country of origin, and identify English as their less proficient language. A second category of sequential bilinguals included in our studies immigrated to North America in childhood with their parents. In general, the earlier their age of arrival in an English-speaking community, the more proficient they judged their English to be; this is consistent with other studies of how age of arrival influences proficiency (Birdsong & Molis, 2001; Johnson & Newport, 1989; Moyer, 1999). A third category included in our work consists of bilinguals born in the United States to immigrant parents. They acquired their first language from family members, and their second language (English) from a mixture of peers, family, and school settings at ages 4 to 6 years.

Given our focus on these bilingual acquisition patterns, it is important to add one note about terminology. Many theorists consider a first language to be the language acquired before adulthood that is the speakers' primary or dominant language. In our approach, the term *first language* (or L1) refers to the chronologically first acquired language, even if it is not the language the individual currently knows best or uses most frequently. We will separately note whether participants view their first language to be their most proficient language.

Lacking in the electrodermal literature are systematic manipulations of the variables of interest to psycholinguists. Researchers have not designed experiments to test, for instance, whether SCRs are greater to single words than to words in context, to low-frequency versus high-frequency words, or to the first occurrence of a word or a phrase compared to a later occurrence. Indeed, current state-of-the-art reviews of electrodermal research, such as the chapter by Dawson *et al.* (2000) and the book by Boucsein (1992), do not have sections or index items on language.

Electrodermal Recording of Bilingual Speakers with Late Acquisition of English

In our first study (Harris *et al.*, 2003), native speakers of Turkish ($n = 32$) currently residing in the United States, heard and read a

variety of word types in L1 Turkish and L2 English. Participants responded to items by rating them for pleasantness, while skin conductance activity was monitored via fingertip electrodes. Items included taboo words (curse words, body parts, and sexual terms), reprimands ('Don't do that!'), aversive words (cancer, kill, death), positive words (bride, joy, kind), and neutral words (column, table). The reprimands were of the type that parents use in admonishing children, such as 'Shame on you!' and 'Go to your room!' The aversive, positive, and neutral words were single words (generally nouns and adjectives) selected to have comparable print frequency and familiarity, using Toglia and Battig's (1978) norms. The taboo items and reprimands included phrases, and were selected to be emotionally evocative (see discussion of stimulus selection processes and differences between Turkish and English stimuli in Harris *et al.*, 2003).

A continuum of responsiveness was found. The strongest skin conductance responses were elicited by taboo words, followed by reprimands, negative words, positive words, and neutral words. Unexpectedly, among these L1 speakers of Turkish, responsiveness to L2 English taboo words was also very high, showing that taboo words in either language activate emotionally-arousing conceptual structures. The strongest difference between a first and second language was for childhood reprimands. The difference between a first and second language for the reprimands suggests that the childhood learning context, including fear or anxiety associated with parental reprimands, contributed to an enduring language-specific response.

Heightened responsiveness to reprimands in the first language but not in the second language is consistent with prior theory and empirical work. Bloom and Beckwith (1989) noted that language is acquired during the same years of life (early childhood) as the development of emotional regulation systems. It is known that bilingual speakers can categorize autobiographical memories as occurring in their first or their second language (Schrauf & Rubin, 1998; see also Schrauf & Durazo-Arvizu, this volume). This suggests that at least the conversational aspects of memories are stored in a specific language. Memories of being reprimanded, including the words in the reprimand itself, may thus be stored with their emotional contexts.

Skin conductance responses also varied depending on auditory versus visual presentation, but only for Turkish stimuli. That is, for Turkish, words presented auditorially elicited stronger responses than those presented as visual stimuli. There were no modality differences for English, with both visual and auditory stimuli eliciting the same strength of response as visual stimuli in Turkish. The difference in modality effects for English and Turkish could reflect distinct learning environments. As the first language, auditory Turkish words were learned before visual

words, whereas many English spoken words may have been learned at the same time as, or even after, their print counterparts.

This work demonstrates that electrodermal monitoring is a robust and reliable method for investigating differences in emotional reactivity to a first and second language. However, the study raises many questions. What are the mechanisms underlying the greater emotionality of the first language? How do age of acquisition and language proficiency influence autonomic reactivity? Would the pattern of results be different if the second language were acquired in childhood? Our second study addressed this last question.

Emotional Responsiveness when a Second Language is Acquired in Early Childhood

The most obvious question generated from the study of Turks who learned English as a foreign language is whether a first language is always more arousing than a second. Would the language that was acquired first continue to be more arousing, even if in adulthood it became the speaker's less proficient and less dominant language?

To investigate this question, bilinguals who were early learners of English and bilinguals who became proficient in English somewhat later in life were recruited (Harris, 2004). The early learners were typically children of immigrants. Children of immigrants to the United States frequently acquire their parents' language in the home, and acquire English when they enter school around age 5 years (Homel *et al.*, 1987; Köpke, 2003). They usually identify English as their strongest, most proficient language, because of immersion in U.S. culture and 12 (or more) years of education in English-speaking schools.

All 52 Spanish–English bilinguals enrolled in this study were Boston University students, and highly proficient in English. The students were divided into two groups based on age of acquisition. The early learners ($n = 31$) were born in the United States or immigrated by age 7 years. The late learners ($n = 21$) arrived in the United States at age 12 years or older. Note that they had generally been first exposed to English during middle childhood (age 8–12) while residing in a Latin American country. For those who arrived in the United States at 18 to attend college, age of acquisition was frequently in middle childhood while attending a bilingual school.

The early learners who had been born in the United States regarded themselves as native English speakers, and judged English to be their better, more proficient language. Three who arrived in the United States at age 6 or 7 years regarded themselves as balanced bilingual speakers, rating themselves as having native-speaker or near-native-speaker abilities in both languages. The late learners regarded Spanish as their

strongest language and rated themselves as having less than native-speaker abilities in English.

We did not ask participants to evaluate language dominance and proficiency separately. Language dominance refers to which language is generally most accessible in day-to-day life (Bahrick *et al.*, 1994; Marian & Kaushanskaya, 2004). It is the language that is most highly activated, and can be the default language for speaking and thinking. For immigrants with many years of immersion in their second language, the second language can come to be the most dominant language, even if it remains the less proficient language, as measured by tests of grammar and vocabulary. We asked participants to declare their stronger language and to rate their proficiency on a seven-point scale. In all cases, participants nominated their most proficient language to be their stronger language. We thus set aside the question of dominance, but note that for our late learners, Spanish was probably not just their most proficient language, but also their dominant language, as the length of residence in the United States was an average of only 2.4 years.

Stimulus materials resembled the study of Turkish–English bilinguals, with the addition of two categories of phrases: insults ('You suck!') and endearments ('I love you!'). Insults were included to expand the repertoire of negatively valenced expressions. Endearments were added to determine if skin conductance can be used to measure responsiveness to positively valenced language stimuli. A full description of the method employed appears in Harris (2004). The analysis in the current paper includes an additional 16 participants whose data were recently collected and added to the prior results.[1]

Skin conductance amplitudes were converted to z-scores, with outliers (defined as data points ± 2.5 standard deviations from the mean) truncated to the values of $+2.5$ or -2.5. For ease of graphing and interpretation, in the current paper, z-scores were transformed in the following way: 2.5 was added to each score and the result was multiplied by 100, yielding a data set ranging from 0 to 500, with a mean of 250.

Figures 10.1 and 10.2 present SCRs for the late and early learners, respectively. Error bars are the standard error of the mean for each condition. These indicate variability that could be due to sampling error. When words in the emotional categories were compared to neutral words, both early and late learners had stronger SCRs to emotional stimuli than to neutral words.

For the late learners (Figure 10.1), childhood reprimands presented in the L1 elicited stronger skin conductance responses than reprimands in the L2. None of the other categories elicited different SCRs for L1 compared with L2. Interestingly, the reprimands were also the category that showed the largest difference between L1 and L2 in our earlier study of Turkish–English bilinguals. These data are thus consistent

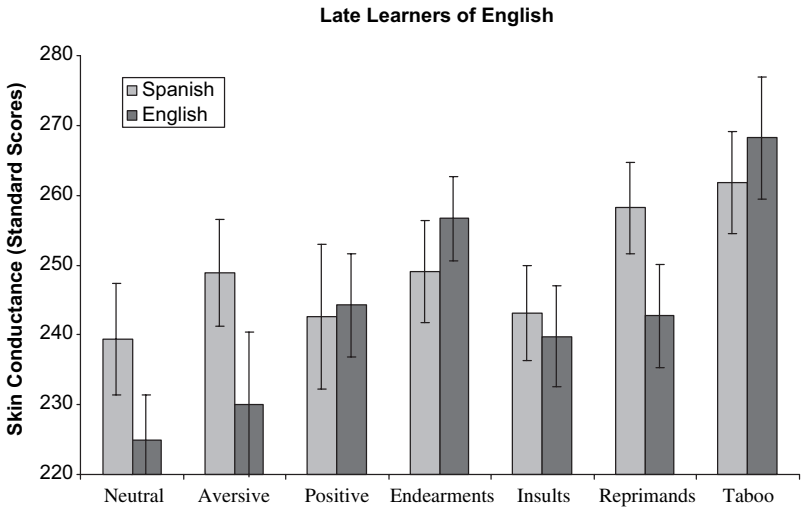

Figure 10.1 Skin conductance responses elicited by different stimulus categories for Spanish–English bilinguals who acquired English either via formal instruction in Latin America (after age 8 years) or when they arrived in North America (after age 12 years)

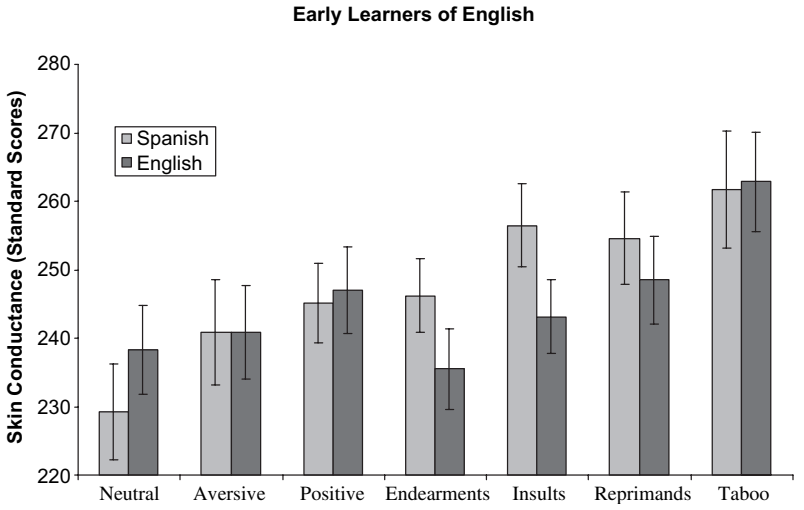

Figure 10.2 Skin conductance responses elicited by different stimulus categories for Spanish–English bilinguals who were born in the United States or immigrated by age 7 years

with findings from the Turkish study and with the hypothesis that a second language is less emotionally evocative than a first, at least for some kinds of words.

However, overall, as shown in Figure 10.1, differences in emotional reactivity evoked by L1 and L2 were relatively small. These differences were weaker than those obtained in the Turkish study. There are several reasons why weaker effects of L1 versus L2 would be found for the Spanish–English bilingual speakers compared to the study that used Turkish–English bilinguals. The late learners in these two studies differed in three factors that are plausibly related to electrodermal arousal: age of first exposure to L2, age of arrival in an English-speaking country, and self-rated proficiency in L2 as an adult. The Spanish–English late learners began learning English in middle-childhood (between ages 8 and 12 years) while attending bilingual schools in Latin America. They arrived in the United States between 12 and 18 years, and had high self-rated proficiency in English (very good to near-native). In contrast, the Turks began classroom English instruction later (at age 12 years or older), arrived in the United States at a mean age of 24 years and rated their English proficiency as only good to very good.[2] Any of these differences could explain why the Spanish late learners had only modest differences in electrodermal responsiveness between their two languages.

Turning to the early learners of English, what is striking in Figure 10.2 is that responses are even more similar between the two languages than those for the late learners. Indeed, none of the categories elicited different SCRs in the two languages. We thus conclude that autonomic reactivity was highly similar for these bilingual speakers' two languages. As noted above, the early learners rated themselves as either balanced bilinguals, or as having superior English skills. We suggest that there are two cases in which bilinguals' emotional reactivity is similar across languages: (a) when proficiency is similar, and (b) when the less-proficient language is the first learned language. Age of acquisition and proficiency may trade off against each other; early acquisition compensates for lower proficiency.

The studies just described showed that physiological responses of emotional arousal were weaker for emotional stimuli in a second language (specifically, childhood reprimands), but only when the second language was acquired after age 7 years. This suggests that when two languages are acquired before age 7, as in our Spanish early learners of English, the two languages may elicit highly similar patterns of emotional arousal. Furthermore, the strongest difference between a first and a second language occurred for the Turks, who acquired their L2 after age 12, and to only 'good' rather than 'very good' proficiency. On this basis, one might predict a general decline in the emotional force of language as age of acquisition increases and proficiency decreases, similar to the self-report findings of Dewaele (2004). Whether proficiency

or age of acquisition is more important for emotional responsiveness remains to be studied.

Ratings of Emotional Intensity as a Check on Language Differences

Note, however, that if items in one language were intrinsically more emotional than the corresponding items in the other language, this could influence skin conductance amplitudes and compromise our ability to attribute electrodermal differences to a language's status as a first versus a second language. We thus review here two types of ratings obtained on the stimuli used in the Spanish–English bilingual study.

Participants' task during electrodermal recording was to rate words for pleasantness on a 1–7 scale. Words in Spanish and English were rated very similarly, for both the early and late learners of English. However, participants were likely consulting their semantic knowledge of words' meaning when they did this rating. Indeed, the ratings for the positive, negative, and neutral words were very close to the pleasantness ratings obtained by Toglia and Battig (1978). This occurred both for the English items (the same ones rated by Toglia & Battig, 1978), and for their Spanish translations, supporting the validity of the translations. The reprimands and taboo items also received similar pleasantness ratings (see discussion in Harris, 2004).

Spanish and English items may have differed in their perceived emotional intensity, even though they were judged to be similar in pleasantness. For example, the Spanish reprimands included items such as '*Sabes que me lo vas a pagar*' (literally, 'You know, you're going to pay for this'). Perhaps this was more emotional than its corresponding English items (in this case, 'Now you're in trouble').

To examine whether the items were similar in emotional intensity, we obtained ratings from American college students ($n = 44$) and Spanish speakers residing in Columbia ($n = 12$). The English speakers were students, age 18–22 years, who responded to a paper-and-pencil questionnaire. The following instructions were used: For each word or phrase, imagine a situation in which this item was used, and rate the emotional intensity of that situation on a 1-to-7 scale, with 7 indicating highly emotional, and 1 indicating non-emotional. Give a medium score of 3 or 4 for an item of moderate emotionality.

The Columbian participants were recruited by word of mouth and e-mail by a research assistant who traveled to Bogota while this study was being conducted. Because university students in Columbia frequently have good English ability, we did not try to obtain exclusively monolingual Spanish speakers. The participants ranged in age from 24 to

41 years and rated themselves as having either good or very good English skills. However, they had not lived in an English-speaking country and considered Spanish their primary language.

Columbian and American respondents rated the items similarly, as shown in Figure 10.3. *t*-Tests conducted on the English and Spanish ratings for each category revealed no significant differences. Across all items, emotional intensity ratings for the Spanish and English items correlated at $r = 0.73$, a strong correlation. The rating study thus indicates that the Spanish and English items were similar in their emotional intensity. This similarity allows us to be more confident that similarities and differences in electrodermal responsiveness between Spanish and English items presented to the bilingual participants reflect differences in the languages' status as a first or a second language.

Ideally, rating studies should be conducted before stimuli are chosen, and stimuli should be matched on a number of dimensions, including familiarity, frequency of use, and word length. Our laboratory has begun collecting normative data on emotional phrases in a number of languages. One such rating study revealed unexpected differences in emotional intensity. When we normed the stimuli used in the Turkish–English bilingual study described above (Harris *et al.*, 2003), students at Istanbul University rated the Turkish stimuli. Their emotional intensity ratings were higher than those of American monolingual speakers rating the English items, but only for some categories. The two groups

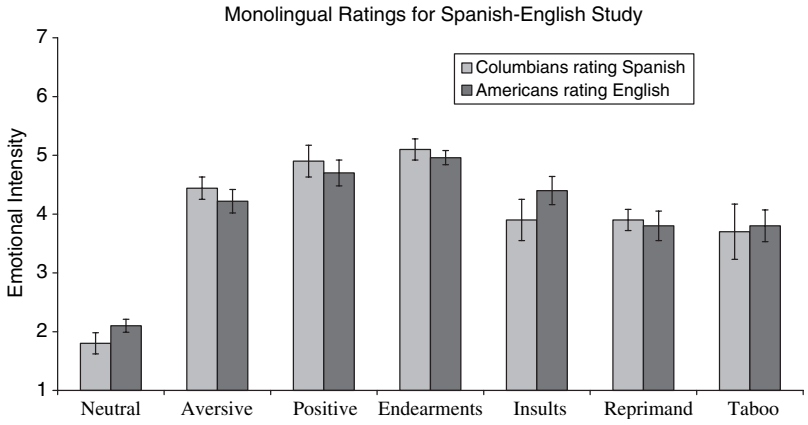

Figure 10.3 Emotional intensity ratings of the stimuli used in the Spanish–English bilingual study by monolingual English speakers in Boston and Spanish speakers in Bogota, Columbia (error bars represent one standard error of the mean)

evaluated the neutral and taboo items similarly, but Turks gave higher intensity ratings to both positive and aversive items, and to childhood reprimands, than did Americans. For example, on the seven-point scale, Turks gave mean ratings of 5.7, 5.4, and 5.3 to 'grave', 'war', and 'disease', respectively, while Americans rated these as 3.8, 3.6, and 4.2.

Could we attribute these differences to shortcomings in stimulus selection? That is, could it be that we selected emotionally pallid terms when selecting English terms, and emotionally colourful terms when selecting Turkish items? We do not feel this interpretation is tenable. We chose basic-level terms in both languages, not arcane or literary terms. Instead, differences in emotionality ratings could reflect differences in cultural connotations, differences in how participants approached the rating task, or cultural differences in the frequency of use of emotion-laden expressions (Fridlund, 1997; Goddard, 2002; Matsumoto, 2001). One could argue that words like 'war' and 'disease' might have more immediacy for members of Turkish culture, and that American college students are more removed from war than are members of some other cultures. This could be why Turkish college students rated emotion words as having greater intensity than did American students.

Cross-cultural researchers have long warned of the problems of stimulus equivalence when comparing ratings across cultures, and have suggested some remedies and guidelines (Poortinga, 1989). Bilingualism research faces the same pitfalls. We advocate obtaining ratings on multiple dimensions of the stimuli, and trying different response formats. For example, use of a five-point scale rather than the seven-point scale could prompt the Americans to use the high end of the emotionality intensity scale, meaning that Americans and Turks would end up rating words similarly (see Hui & Triandis, 1989, for discussion of how cultural differences can appear or disappear depending on response format). We return to the problem of stimulus equivalence in the conclusion of this paper, advocating the use of multiple testing settings, different cultures, and the balanced bilingual design.

In the next section we integrate the findings of our skin conductance studies with the literature on emotional arousal and bilingualism, and propose our own theoretical framework for explaining these results and generating predictions.

When is the First Language More Emotional?

Interviews, surveys, studies of autobiographical memory, and a few laboratory experiments have produced a consensus that bilingual speakers experience reduced emotionality when speaking their second language (Altarriba & Santiago-Rivera, 1994; Anooshian & Hertel, 1994; Bond & Lai, 1986; Dewaele, 2004; Dewaele & Pavlenko, 2002;

Gonzalez-Reigosa, 1976; Marian & Neisser, 2000; Pavlenko, 1998, 2002, 2004; Schrauf, 2000; Schrauf & Rubin, 1998). Dewaele (2004) asked bilingual and multilingual speakers to rate the emotionality of swear words in their various languages. Swear words in the native language were rated as the most forceful. Perceived forcefulness declined with age of acquisition and the languages' rank-order of acquisition. Naturalistic learning contexts also led to more perceived emotional force than formal instruction.

Differences in emotionality have been documented by analysing narratives and autobiographical memories. Immigrants' childhood memories were shown to be more emotionally charged when described in their native language (Koven, 2001; Schrauf & Rubin, 1998, 2000). Accurate recall of autobiographical memories depends on the language in which recall takes place. If language of recall matches the language in which the specific episode was originally encoded, recall is enhanced (Marian & Neisser, 2000; Schrauf & Rubin, 1998, 2000). Marian and Neisser (2000) demonstrated that Russian–English bilinguals produced higher levels of recall for specific life events if interviews were conducted in the language in which the experiences originally took place, an effect termed 'language-dependent memory'. In this view, language appears to be tied to memory traces and these traces carry 'language tags'.

So far, the research on emotion and bilingualism has been relatively atheoretical: scholars have needed to explore and document effects. The empirical findings are now substantial enough for us to consider two broad questions. What language learning factors promote the experience of emotional forcefulness, and what mechanism underlies emotionality effects in bilingualism?

Questions about 'mechanism' are facilitated by adopting a psycholinguistic perspective. For example, Johnson and Newport (1989) adopted a psycholinguistic perspective in their study of Korean and Chinese L1 learners of English as a second language. These researchers found that grammatical knowledge of English was strongly influenced by age of immigration to the United States, but minimally influenced by learning and biographical factors such as motivation and duration of time speaking the second language. To explain this pattern of results, Johnson and Newport (1989) posited a maturational mechanism, such as a set of genes for easily acquiring language that would be most strongly expressed in early childhood. A maturational mechanism, they argued, would not be influenced by language history variables or additional factors such as L1 and L2 similarity.

Birdsong and Molis (2001) also adopted a psycholinguistic perspective but came to different conclusions. In a sample of Spanish–English bilingual speakers, these authors found that motivation and frequency of L2 use did correlate with higher scores on L2 grammaticality judgement

tests. Bialystok and Miller (1999) noted that similarity between the L1 and L2 also influenced degree of L2 attainment. Birdsong and Molis (2001) thus argued that the contexts of learning and use are important in addition to a maturational mechanism (see also Hakuta *et al.*, 2003; Marinova-Todd *et al.*, 2000; Moyer, 1999).

Our approach in this paper will be similar, in that we will consider the influence of three categories of mechanisms – brain maturation, links to autobiographical memory, and context-depending learning – on bilingual emotionality. As with other speculations about brain maturation (e.g. Johnson & Newport, 1989), the specific brain mechanism that would cause the first language to be experienced as more emotional than subsequent languages remains to be determined. One could posit that words and phrases that are acquired early will have strong connections to the amygdala (LaBar & Phelps, 1998), because early language develops at the same time as emotional regulation systems (Bloom & Beckwith, 1989). Later learned language may have a more purely cortical representation, lacking connections to subcortical areas (Lieberman, 2000). A prediction of this view is that early age of acquisition will generally be a potent predictor of heightened emotional reactivity, allowing some exceptions in the case of some (unknown) level of L1 attrition.

A second approach is to posit that the memorial basis for emotion is autobiographical (Conway & Haque, 1999). There is evidence that autobiographical events are mentally represented along with words and phrases from the language in which they occurred (Marian & Neisser, 2000; Schrauf, 2000; Schrauf & Rubin, 1998, 2000; Schrauf & Durazo-Arvizu, this volume). Bilinguals may perceive a first language to be emotionally evocative because words and phrases in the first language are linked to emotionally relevant personal memories. An implication of the autobiographical approach is that second language learners will experience greater emotionality over time as words and phrases in their L2 lexicon are linked to emotional memories.

A similar approach has been proposed by Altarriba (2003), but the emotional context need not be an autobiographical memory. Simply, emotion words in the first language have typically been experienced in a larger diversity of contexts than have emotion words in a second language. The context in which emotion words appear creates multiple traces in memory for these words and strengthens their semantic representation. Words in a second language have been practised less and applied in fewer contexts. The result is that encountering L2 emotion words activates fewer associations than would the same word in the first language.

This notion of L2 words having fewer conceptual associations than L1 words is at the heart of the revised hierarchical model of Kroll and Stewart

(1994). This model is thus also a useful framework for understanding emotionality effects. Kroll and Stewart (1994) proposed that words in L1 are directly linked to conceptual representations (the conceptual store), but that L2 words are initially learned via translations to L1 words. Early in second language learning, L2 words thus have only weak links to the conceptual store. As proficiency in L2 increases, the links between L2 words and the conceptual store are strengthened. The conceptual store is the repository of meaning and thus includes the emotional and visceral connotations of words and phrases. Stronger connections to the conceptual store for L1 than for L2 means that stimuli in L1 will elicit a stronger emotional reaction. An implication is that as proficiency in L2 increases, the subjective impression of emotionality for L2 will increase.

Our own approach is to articulate a context-of-learning theory. Learning contexts influence proficiency (Ervin-Tripp, 1981; Grosjean, 1982) and thus must play a role in emotionality, regardless of whether or not brain maturation is also operative. The common ingredient behind the autobiographical and lexical linkage approaches is that greater exposure to L2 increases the links to long-term emotional memory associations, following the logic of Kroll and colleagues discussed above (Kroll & Stewart, 1994; Kroll & Sunderman, 2003). The main way we add to Altarriba's approach is to propose a mechanism that could involve the language-learning factors known to influence bilingual emotionality. From Dewaele's (2004) Internet survey, we know that age of acquisition of a language, naturalistic learning context, and proficiency correlated with judgements of the emotional force of swear words. Our electrodermal studies have demonstrated that age of acquisition influenced emotional experience, but mainly for later learners, who happened also to be more proficient in their L1. When the L2 was the more proficient language, electrodermal responses did not differ for L1 and L2, suggesting that proficiency and age of acquisition may trade off against each other. These findings are compatible with the idea that age of acquisition is not itself a causal factor in bilingual emotionality. It may simply be highly associated with language learning factors, which are themselves causal (as we explain further below). The actual causal factor is the emotional context in which language is learned and used.

We propose that language comes to have a distinctive emotional feel by virtue of being learned, or habitually used, in a distinctive emotional context. We will refer to this as the 'emotional contexts of learning' theory. How or why does learning or using a language in emotional contexts provide it with a subjective feeling of emotional force? Simply because human experiences are generally learned and stored in a context-dependent manner. As psychologists have observed and theorized for a century, human learning is associative (Anderson & Bower, 1973; Thorndike, 1927). Scientists continue to employ the mechanism of

associative learning to explain context-dependent representations, as proposed by cognitive scientists working in the connectionist framework (Rumelhart & McClelland, 1986). Associative learning causes language forms to be mentally stored with their contexts of use. Distributed representations (also called 'superpositional' representations; Harris, 1994) assume that memories are composites of many individual experiences.

With context-dependent learning, distributional analysis sorts out, via exposure to many examples, which aspects of the overall meaning most frequently co-occur with specific words. This type of distributional learning has been illustrated for learning of grammatical categories and joint blending of semantics and grammatical knowledge (e.g. Rumelhart & McClelland, 1986; Elman *et al.*, 1996). Connectionist models illustrate pattern completion; activation of already learned patterns as well as learning can proceed even if the input is only partial. Connectionist networks have been used to illustrate learning of cognitive and perceptual prototypes and have been frequently used to model aspects of language learning and use. Indeed, they are recognized as one of the types of models that are particularly useful for understanding second language acquisition (Ellis, 2002).

Our 'emotional contexts of learning' theory is not merely stating the obvious. The view that language is stored with its contexts of occurrence is contrary to decades of linguistic theorizing. Most language learning theorists assume that non-linguistic correlates are stripped away during learning, allowing the abstraction of linguistic meaning and context-independent grammatical rules (Chomsky, 1965; Jackendoff, 1997; Pinker, 1984, 1994).

The emphasis on abstraction became the dominant view in 20th-century linguistics, and was exemplified by Chomsky's (1965) claims about the autonomy of syntax and by the enthusiasm for the concept of modularity in language in the following 40 years (Fodor, 1983; Frazier, 1999; Pinker, 1994). Some linguists have always questioned this view, and during the past few decades a particularly strong and coherent alternative has formed under the name of Cognitive Linguistics (Lakoff, 1987; Langacker, 1987; Talmy, 2000; Taylor, 2003). The emotional contexts of learning theory thus find a natural home under the umbrella of cognitive linguistics.

Evaluating the Emotional Contexts of Learning Theory

Our theory accounts for the basic observation that bilinguals usually report their first language to be their most emotional language. A first language is universally learned in a highly emotional context, the context of attachment to caregivers. In contrast, second languages vary in the emotionality of their context. They can be acquired in the emotional

context of attachment to caregivers and peers, or may be acquired in formal settings such as school or work, settings with fewer intense personal attachments (Schumann, 1997). Early age of acquisition thus functions as a proxy for a more emotional context of learning.

Our theory accommodates the finding that languages learned in naturalistic contexts are experienced as more emotional than those acquired in formal schooling contexts (Dewaele, 2004). Naturalistic learning contexts are more social than classroom contexts. They can also provide the social motivation that facilitates second language learning (Ervin-Tripp, 1981; Schumann, 1997). Explaining the association between proficiency and perceived emotionality is more difficult. Emotional contexts of learning may contribute to proficiency because emotional contexts are likely to be interpersonal and thus more motivating for learners. But the causal arrow may go in the other direction; having high proficiency in an L2 may facilitate one's access to emotional contexts, because it facilitates one's access to native speakers of that language and to interpersonal contexts. So, our view is that proficiency does not itself cause a language to be experienced as emotional, but high proficiency is frequently a marker of having had exposure to emotional contexts of learning.

Our framework is broad, but nevertheless makes predictions contrasting with those made by three simpler approaches.

(1) The chronologically first-acquired language is always (or at least usually) more emotional, regardless of other aspects of participants' learning history.
(2) Age of acquisition determines emotionality, meaning a second language learned early will be more emotional than a second language learned late.
(3) The more proficient language is generally more emotional, meaning a second language will be more emotional than a first if it is learned to greater proficiency.

Before beginning this research, we were open to the prospect that hypothesis (1) might be the proper generalization. This could occur if early-acquired language becomes neurally connected to other regions of the brain that are undergoing rapid development, such as the emotional regulation centres of the brain. Findings in our study of Spanish–English bilinguals (Harris, 2004) were not consistent with hypothesis (1). Overall, emotionality was similar for Spanish–English bilinguals when both Spanish and English were acquired before age 7 years. These findings are not consistent with the proficiency hypothesis (3), because most of the early learners rated English as their more proficient language, yet their electrodermal responsiveness did not differ to stimuli in English and Spanish. Of course, strong conclusions cannot be drawn from failure to find statistically significant differences, and thus

future work is necessary to confirm or qualify these results. We are still interested in hypothesis (1), and indeed the truth may be that maturation has a causal role in addition to emotional contexts of learning. However, following Occam's razor, the simplest explanation should be preferred as long as data are consistent with it.

Because we think it unlikely that age and proficiency are themselves causal factors, our theory makes the prediction that it should be possible for a language to be perceived as highly emotional, even if it is acquired in adulthood and to lower than native-speaker levels of proficiency. However, the context of learning and use must be highly emotional, approximating the immersion in emotional interpersonal interactions that occurs in childhood. An example of where this might occur is when immigrants acquire a second language in the country while married to a native speaker and raising children, as described by Pavlenko (2004). Supporting anecdotes are easy to find. One of our colleagues, a native German speaker, resides in North America, where she teaches at a university and lives with her American husband and children. She reports that when on the telephone to her parents in Germany, speaking German feels like 'wearing mittens'. In our study of Turkish–English bilingual speakers, one participant showed stronger SCRs to English words than Turkish. As she was the only participant who displayed this pattern, we returned to the notes from our debriefing interview. We learned that the participant had immigrated to the United States in her 20s, married an American, had two children, and expressed no nostalgia for Turkey. In fact, she had expressed surprise when informed of our hypothesis and rejected the notion that her mother tongue would be the language that felt more emotional.

We are making the strong claim that, although age of acquisition is frequently correlated with measures of emotional force, the real causal factors are the language contexts that typically co-occur with early learning. Yet it is likely that in statistical studies that use multiple regression to consider multiple factors, age of acquisition may turn out to be strongest predictor of emotional force. We will illustrate how this is not necessarily evidence of causation by returning to the findings of Johnson and Newport (1989) and Birdsong and Molis (2001).

Birdsong and Molis (2001) found that learning factors were correlated with native-like grammaticality judgements in adulthood, but age of acquisition remained the strongest factor. Indeed, several learning factors dropped to non-significance when partial correlations were included in multiple regression. For this reason, Birdsong and Molis (2001) accepted Johnson and Newport's (1989) claims that biological maturation has causal force. This conclusion can be disputed. Maturational aspects of age may have no causal force, but the biological age of L2 exposure/acquisition is likely overwhelmingly and regularly

correlated with social, motivational, and learning factors. In contrast, social factors such as context of learning (peers/family versus school), amount of L2 use, and perceived importance of learning the L2 (Schumann, 1997) are subjected to considerable variation across L2 learners. As Grosjean (1982) has long noted, differing ages of acquisition imply differences in the learning context. Many L2 learners will learn in the classroom and have little contact with native speakers. Other late learners may acquire L2 outside the classroom but still lack the emotional connections contributed by speaking with friends and family. Consider that these helpful learning factors probably have only a small- to moderate-sized correlation of 0.15 to 0.45 with ultimate proficiency or grammatical attainment, as reported in Birdsong and Molis (2001). Across L2 learners, what remains consistent is the reliable correlation that biological age has with this large set of factors. Thus, in multiple regression, age of acquisition may emerge as the single strongest predictor.

Using this logic, age of acquisition may have the highest correlation with emotional responsiveness, yet not itself be a causal factor. Proficiency can also be understood as the type of variable that may correlate with emotionality but not cause it. Causal interpretations of proficiency and age of acquisition would be undermined if languages learned late in life were experienced as highly emotional even when learned to less than native-speaker proficiency. The causal force of early age of learning would be supported if languages learned early elicited strong emotional reactions even when learned to low proficiency.

Conclusions and Directions for Future Research

Can psychophysiological methods be used to measure differences in emotions experienced by bilingual speakers? We measured skin conductance responses to emotional phrases and neutral words presented in speakers' first and second languages for bilingual speakers who spoke Turkish or Spanish as their first language. The strongest language effects were found in the Turkish study, where childhood reprimands elicited stronger skin conductance responses in L1 Turkish than in L2 English (Harris *et al.*, 2003). This study raised the question of whether emotionality effects would be stronger in a first language even if the first language was the weaker language. To answer this question, two groups of Spanish–English bilinguals were compared: the adult offspring of Latin American immigrants, for whom English was considered L2 but was the dominant language, and those who moved from Latin America to the United States in their teen years (Harris, 2004). Only the latter group had heightened emotionality to reprimands in Spanish, thus replicating the finding of the Turkish study. The early learners of English had similar patterns of electrodermal responding in their two languages.

This indicates that when two languages are learned in childhood, they elicit similar physiological reactions.

To explain why a first language was not more emotional than a second language which was acquired in childhood, we proposed a mechanism independent of age: the emotional contexts of learning hypothesis; where language is experienced as emotional when it is acquired and used in an emotional context. We noted the similarity between this view and that of others (Altarriba, 2003; Marian & Neisser, 2000; Schrauf, 2000; Schrauf & Rubin, 1998, 2000), and discussed novel aspects of our proposal.

If language acquired and used in emotional contexts comes to be experienced as emotional, then one prediction is that emotion words acquired in early childhood will elicit stronger SCRs than emotion words acquired in middle childhood. Our reasoning here is that childhood provides an emotional context of learning because emotional regulation systems are developing. Such a finding would contribute to the ongoing debate about whether the age at which words are acquired influences their mental representation (Ghyselinck *et al.*, 2004; Gilhooly & Logie, 1980).

We have not examined cases where a second language is acquired late, but comes to be the dominant language. This can happen when one immigrates and marries a native speaker of the L2, and raises children whose dominant language is the L2 (see cases discussed by Pavlenko, 2004). Our prediction is that in this case at least some emotional phrases presented in the L2 will elicit skin conductance amplitudes that are similar to those elicited by the first language.

Our data suggest that age of acquisition is an important correlate of emotional reactivity. What remains unknown is whether a maturational mechanism underlies this correlation, or if early acquisition simply correlates with emotional contexts of learning. If a maturational mechanism is at work, then language learned early should elicit greater physiological responses beyond what would be predicted via proficiency. This could occur if early acquired language is stored with early developing emotional regulation systems. Independently of questions about causal mechanisms, it would be useful to quantify how proficiency and age of acquisition quantitatively trade off against each other.

As noted earlier, our current research has the drawback that the set of stimuli (e.g. the reprimands) chosen for one language could have been inherently more arousing than analogous items selected for the other language. Thus, differences between a first and second language could be attributed to differences in items rather than status of the language as being acquired early or late. Even after matching items according to monolingual ratings of emotionality, such matching can be imperfect (e.g. individuals from different cultures may respond to rating scales

differently). One solution is to use a balanced bilingual design (as in, for example, Anooshian & Hertel, 1994). This is a design in which the same language functions as the first language for one group of speakers and the second language for a different group. We are currently pursuing this option by studying English–Turkish bilinguals residing in Istanbul. Their physiological responses will be compared to Turkish–English bilinguals residing in Boston. Thus, in both studies, speakers are immersed in the language of their L2. Participants in the two locations can also be matched for their language-learning history, that is, have comparable age of acquisition, proficiency, and length of residence.

The balanced bilingual design minimizes problems of stimulus equivalence, but does not eliminate cultural effects. Cultures are known to differ in the social acceptability of employing emotion-laden expressions (Fridlund, 1997; Goddard, 2002; Matsumoto, 2001). For example, Turks may have greater responsiveness to childhood reprimands than do North Americans, because an authoritarian parenting style is more common in Turkey than in North America (Kagitcibasi, 1992). This authoritarian style may engender more fear or anxiety in children who are being reprimanded than might occur in a more laissez-faire environment, and we propose that a representation of the heightened emotion is stored along with the phrases themselves. As noted earlier, SCRs are particularly sensitive to feelings of threat, and it is in just those anxiety-provoking childhood reprimands where we find the greatest responses in our Turkish participants.

Our response to this issue is not to give up on this research as inherently indeterminate, but to study multiple languages and cultures. Consistent patterns that hold across many languages can be attributed to universal psychological mechanisms, whereas inconsistent patterns will indicate cultural or language-specific findings. Cultural and language-specific findings can then be linked to anthropological and sociolinguistic research, whereas cross-culturally consistent patterns will inform theories about the nature of universal cognitive and physiological processes.

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Notes

1. The overall pattern of results has not changed with the addition of more participants. The additional data points allowed us to explore a slightly different graphing of the data. In Harris (2004), the positive, negative, and neutral single words were grouped into a common category, called single words. Having more participants reduces within-category variance, making it feasible to plot these categories separately.
2. Note that length of stay in the United States was slightly higher for the Turks, with a mean of 4 years, compared to a mean of 2.4 years for the Spanish–English late learners. One would expect greater length of immersion in one's second language to correlate with greater emotional reactivity. If the Turks had only 2.4 years of immersion, they might have shown even less emotional reactivity in English.

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