Affective processing in bilingual speakers: Disembodied cognition?

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A recent study by Keysar, Hayakawa, and An (2012) suggests that "thinking in a foreign language" may reduce decision biases because a foreign language provides a greater emotional distance than a native tongue. The possibility of such "disembodied" cognition is of great interest for theories of affect and cognition and for many other areas of psychological theory and practice, from clinical and forensic psychology to marketing, but first this claim needs to be properly evaluated. The purpose of this review is to examine the findings of clinical, introspective, cognitive, psychophysiological, and neuroimaging studies of affective processing in bilingual speakers in order to identify converging patterns of results, to evaluate the claim about "disembodied cognition," and to outline directions for future inquiry. The findings to date reveal two interrelated processing effects. First-language (L1) advantage refers to increased automaticity of affective processing in the L1 and heightened electrodermal reactivity to L1 emotion-laden words. Second-language (L2) advantage refers to decreased automaticity of affective processing in the L2, which reduces interference effects and lowers electrodermal reactivity to negative emotional stimuli. The differences in L1 and L2 affective processing suggest that in some bilingual speakers, in particular late bilinguals and foreign language users, respective languages may be differentially embodied, with the later learned language processed semantically but not affectively. This difference accounts for the reduction of framing biases in L2 processing in the study by Keysar et al. (2012). The follow-up discussion identifies the limits of the findings to date in terms of participant populations, levels of processing, and types of stimuli, puts forth alternative explanations of the documented effects, and articulates predictions to be tested in future research.

Keywords: Bilingualism; Affective processing; Disembodied cognition; Language embodiment.

U ne étude récente de Keysar, Kayakawa et An (2012) suggère que « penser dans une langue étrangère » peut réduire les erreurs de décision parce qu'une langue étrangère procure une plus grande distance émotionnelle qu'une langue maternelle. La possibilité qu'une telle cognition « désincarnée » soit possible est d'un grand intérêt pour les théories de l'affect et de la cognition ainsi que pour plusieurs autres domaines de la théorie et de la pratique en psychologie, que ce soit en clinique, en psychologie judiciaire ou en marketing, mais il faut d'abord que cette hypothèse soit convenablement évaluée. Le but de cette analyse est d'examiner les données des études cliniques, introspectives, cognitives, psychophysiologiques et neuropsychiques portant sur les processus affectifs des personnes bilingues afin d'identifier un modèle de convergence dans les résultats observés, d'évaluer l'hypothèse d'une « cognition désincarnée » et de fournir des pistes pour des recherches futures. Les résultats à ce jour révèlent l'existence de deux processus affectifs reliées entre eux. La langue première (L1) augmente l'automaticité du traitement affectif du L1 et élève la réaction électrodermale aux mots chargés émotionnellement. La langue seconde (L2) atténue l'automaticité du traitement affectif du L2, ce qui réduit les interférences affectives et diminue la réaction électrodermale aux stimuli émotionnels négatifs. Les différences dans le traitement affectif entre L1 et L2 suggèrent que chez certaines personnes bilingues, particulièrement chez les bilingues récents et les usagers des langues étrangères, chaque langage respectif puisse être structuré de façon différentielle, les dernières langues apprises étant traitées sémantiquement et non affectivement. Cette différence permet de rendre compte de la réduction des erreurs d'organisation lors du L2 dans l'étude de Keysar et al. (2012). Ensuite, la discussion dégage les limites des résultats obtenus jusqu'à maintenant quant aux populations

étudiées, aux niveaux du traitement et aux types de stimuli. Enfin, elle propose une explication alternative des résultats observés et formule des prédictions qui pourront être testées dans une recherche ultérieure.

*U*n estudio reciente de Keysar, Hayakawa y An (2012) sugiere que 'pensar en una lengua extranjera' puede reducir sesgos en la decisión porque una lengua extranjera provee de una mayor distancia emocional que un idioma nativo. La posibilidad de tal cognición 'desencarnada' es de gran interés para las teorías del afecto y la cognición y para muchas otras áreas de la teoría y práctica psicológicas, desde la psicología clínica y forense hasta la mercadotecnia, pero primero se necesita evaluar esta afirmación apropiadamente. El propósito de esta revisión es examinar los hallazgos de estudios clínicos, introspectivos, cognitivos, psicofisiológicos y de neuroimagen acerca del procesamiento afectivo en hablantes bilingües a fin de identificar arreglos de resultados, arreglos que converjan entre sí, para evaluar la afirmación de 'la cognición desencarnada' y esbozar direcciones para la indagación futura. Los hallazgos a la fecha revelan dos efectos de procesamiento interrelacionados. La ventaja de la primera lengua (L1) se refiere a la automaticidad aumentada del procesamiento afectivo en la L1 y la elevada reactividad electrodérmica ante palabras de la L1 con contenido emocional. La ventaja de la segunda lengua (L2) se refiere a la automaticidad disminuida del procesamiento afectivo en la L2, la cual reduce los efectos de interferencia y aminora la reactividad electrodérmica ante estímulos emocionales negativos. Las diferencias en el procesamiento afectivo en la L1 y la L2 sugieren que en algunos hablantes bilingües, en particular bilingües tardíos y usuarios de una lengua extranjera, las lenguas respectivas pueden estar diferencialmente constituidas, es decir, la última lengua aprendida se procesa semánticamente pero no afectivamente. Esta diferencia explica la reducción de sesgos de encuadre en el procesamiento de la L2 en el estudio de Keysar et al. (2012). La discusión del seguimiento identifica los límites de los hallazgos a la fecha en términos de las poblaciones participantes, los niveles de procesamiento y los tipos de estímulos, manifiesta explicaciones alternativas de los efectos documentados y articula las predicciones que se ha de someter a prueba en investigaciones futuras.

A recent study by Keysar, Hayakawa, and An (2012) suggests that "thinking in a foreign language" may reduce decision biases because a foreign language provides a greater emotional and cognitive distance than a native tongue. The possibility of such "disembodied" cognition is of great interest for theories of the relationship between affect and cognition, embodied cognition, and for many areas of psychological research and practice, from clinical and forensic psychology to marketing. First, however, this claim needs to be properly evaluated in the light of what we know about affective processing in speakers of two or more languages. In the past decade, the study of bilingualism and emotions has emerged as a fruitful area of interdisciplinary inquiry. While interdisciplinarity is fertile for scholarly inquiry, it also has a major downside: When publications appear in a range of journals in different fields, it is much harder to keep track of new developments. The purpose of this paper is to offer a state-of-the-art review that integrates the findings to date and puts forth directions for future inquiry.

I will begin by discussing the difficulties inherent in defining the terms "bilingual speaker," "affective processing," and "emotional stimuli." Then I will examine the findings of studies of affective processing in bilingual speakers in five paradigms—clinical, introspective, cognitive, psychophysiological, and neuroimaging research. I will then return to the study by Keysar et al. (2012) and discuss whether our cognition is indeed less "embodied" when we process information in a later learned language.

WHAT DO WE MEAN BY "BILINGUAL SPEAKERS" AND "AFFECTIVE PROCESSING"?

Bilingual speakers

Who is a "bilingual speaker"? A layperson definition assumes that bilinguals are people who have similar levels of proficiency in two languages, typically learned from birth. In contrast, bilingualism researchers commonly adopt a use-based definition of *bilinguals* and *multilinguals* as speakers who use two or more languages in their everyday lives, be it simultaneously (e.g., in bilingual families) or sequentially (e.g., in the context of immigration or study abroad). The downside of such a broad definition is the need to distinguish between different populations in terms of order, age, and context of language acquisition, language dominance, and levels of language proficiency (for an in-depth discussion see De Groot, 2011; Grosjean, 2008).

Table 1 summarizes the definitions of the key terms used in the field. To describe the order of language acquisition, researchers usually adopt a chronological approach and refer to the first (L1), second (L2), third (L3) language and so on (on advantages and disadvantages of such classification, see Dewaele, 2010). The term *second language*

TABLE 1
Bilingualism: Terms and definitions

Bilinguals and multilinguals	Speakers who use two or more languages or dialects in everyday lives, regardless of their levels of proficiency in the respective languages
Order of language acquisition	
First language (L1)	A language or languages learned from birth, regardless of the speaker's current proficiency
Second language (L2) or additional language (LX)	A language learned after early childhood (ages 1–3 years) following the L1
Target language (TL)	L2 that speakers are learning or aim to learn
Age of acquisition	
Age of acquisition (AoA)	Age at which the L2 learning began
Simultaneous bilinguals	Speakers who acquired two or more languages from birth
Early or childhood bilinguals	Speakers who acquired the L2 in early or middle childhood, prior to age 12
Late or adult bilinguals	Speakers who acquired the L2 after the age of 12 or postpuberty
Age of arrival	
Age of arrival in the L2 environment (AoAr)	Age at which speakers arrived in the L2 context
Length of residence (LoR)	Length of residence in the L2 environment
Early arrivals	Speakers who arrived in the L2 context as children, prior to age 12
Late arrivals	Speakers who arrived in the L2 context after the age of 12 or postpuberty
Context of language acquisition	
Context of language acquisition (CoA)	Context in which the L2 was acquired
Foreign language (FL) or instructed context	Foreign language classroom
L2 or naturalistic context	Environment where the language is spoken
Mixed context	Classroom learning supplemented by learning the language in the environment where it is used as a native language by the majority of the speakers
Foreign language (FL) learners	L2 speakers who are learning the L2 in the classroom, outside of the environment where it is used as a native language by the majority of the speakers (e.g., Japanese studying English in Japan)
Second-language (L2) learners	L2 speakers who are learning the L2 in the environment where it is used as a native language by the majority of the speakers (e.g., Japanese studying English in the US)
Language proficiency	
Language proficiency	Overall level of language achievement
Language dominance	Overall level of language activation that creates the impression of fluency and ease of lexical retrieval and syntactic processing (may vary by domain)
Balanced bilinguals	Bilinguals who have relatively similar skills in their respective languages across different areas
Dominant bilinguals	Bilinguals who display greater ease in one of the languages (overall or in the domain in question)
Language attrition	Decreased level of language activation (due to disuse), manifested in dysfluency, lexicon reduction, and structural simplification
Modes of engagement with language	
FL or L2 learners	Speakers who are actively studying the L2
FL or L2 users	Speakers who are using the L2 in everyday life

or *L2* may refer to any language learned late in life, as does the term *additional language* or *LX*. The term *age of acquisition* (AoA) refers to the age at which the L2 learning began, regardless of its context. Based on the AoA, bilinguals can be subdivided into *simultaneous*, *childhood*, and *late* bilinguals. The age of acquisition should not be confused with the age of arrival (AoAr) in the target language (TL) context: The two may coincide or differ, with some speakers, for instance, starting the learning process in the classroom before they arrive in the TL context, and others relying on the L1 for a while in the TL context, before they start learning the L2. In the

case of such dissociation, the influence of the two variables is examined separately.

The term *context of acquisition* (CoA) refers to the context in which the language was learned, with a three-way distinction made between foreign language (FL) or instructed contexts, L2 or naturalistic contexts, and mixed contexts. The term *language proficiency* refers to the overall level of achievement in a particular language and to achievement in discrete skills, such as speaking or writing; it is commonly assessed through standardized proficiency tests and self-reports. Due to the *complementarity principle*, i.e., the fact that their languages are usually acquired and used

in different contexts, with different people, and for different purposes (Grosjean, 2008), bilinguals rarely exhibit equal skills in all language areas. The term *balanced bilinguals* commonly refers to those who have relatively similar skills in their respective languages and the term *dominant bilinguals* to those who display greater ease in one of the languages. The dominant language may also be more proficient but, as we will see, this is not always the case; dominance and proficiency may also vary across areas of language use. For instance, a late Russian–German bilingual living in Germany may display an overall dominance in L1 Russian along with an L2 German dominance in his or her professional field, while a childhood Spanish–English bilingual in the US may be dominant in the L2 English as the language of schooling and that of the environment. Dominance, in other words, reflects perception of greater ease of use and lexical access, which comes from daily usage and higher levels of activation of the language. The shift in use and dominance to L2, accompanied by declining use and inhibition of the L1, may result in *L1 attrition*, manifested in dysfluency, lexicon reduction, structural simplification, and even L2 accent in L1 (Schmid, 2011).

Another convention in the field is for the terms *bilinguals* and *bilingualism* to encompass multilinguals. I will adopt this usage in discussing the studies that focus on two languages of the speakers (who may in fact speak more) and use the term *multilinguals* when discussing findings of studies that examine three or more languages. The majority of the studies to date involve only two languages, and the term *multilinguals* will serve as a reminder that a greater variety is waiting to be explored. The variation in language combinations, language learning histories, and contexts of use makes bilinguals a challenging research population, because this population requires control of several additional variables and because the findings of studies with discrete populations cannot be generalized to all bilinguals and multilinguals. As a result, they are often avoided by researchers and when they are used as participants, this use may display one of three basic errors.

In some studies, bilinguals are treated as "native speakers" of their L1 on par with monolinguals— this is a problem because even a modest degree of L2 knowledge may affect one's competence and performance in the L1, an effect known as L2 influence on L1 (Cook, 2003; Jarvis & Pavlenko, 2008; Schmid, 2011). A second problem is displayed in studies that treat bilinguals and multilinguals with different language learning histories

as a single homogeneous population—as we will see later, lumping together different populations may create so much noise in the data that they would be impossible to disambiguate. The third and the most common problem is overgeneralization of the findings with one or two populations of bilingual speakers to all bilinguals and multilinguals. The variation in bilinguals' linguistic trajectories is undoubtedly a challenge for research and theory building. Yet in what follows, I hope to show that it also offers a unique opportunity for the study of the relationship between affect and cognition, because the manipulation of variables linked to acquisition of additional languages allows us to study dimensions of affective processing that are less salient in people who speak only one language.

Affective vs cognitive processing

You walk into a crowded party and immediately know that the object of your dreams and desires is there: Your heart starts beating faster, you have the proverbial butterflies in your stomach, you may start sweating and become tongue-tied. We are all familiar with these symptoms and in everyday interaction have no problem recognizing affective processing as detection of stimuli that trigger increased levels of arousal, be it the face of a person we are in love with or a mouse in our clothes closet. An academic definition of affective processing, however, remains elusive because most researchers have been unable to separate cognitive and affective processing, either in theory or in practice (e.g., Eder, Hommel, & De Houwer, 2007).

Theory-wise, emotion research still lacks consensus on the relationship between affect and cognition. Basic emotion theories see primary affective processing as discrete innate responses that precede cognitive judgments and are independent of language (Ekman & Cordaro, 2011; Izard, 2011; Panksepp & Watt, 2011). Appraisal theories see affective processing as subjective evaluation of stimuli with respect to their relevance for the individual's goals, values, and needs that triggers changes in endocrine, autonomic, and somatic nervous systems, only some of which enter consciousness and become labeled (Scherer, 2009). Constructionist theories deny the existence of "non-affective" thought (Duncan & Barrett, 2007) and see affect as cognition, a transformation of the organism's neurophysiological and somatovisceral state (*core affect*) into experiences understood in terms of language-specific emotion words

(Barrett, 2009). And if the theoretical conundrum were not enough, from a practical point of view, the differentiation is further complicated by the reliance on methods developed for cognitive research which may not be best suited for determining whether there is something distinct about affect or whether affective processing is a subtype of cognition (Cacioppo & Berntson, 2007).

For the purposes of this discussion, I will define *affective processing* as somatovisceral responses triggered by automatic appraisal of verbal stimuli, which may or may not register as subjective feelings at the level of higher cognition. This definition is grounded in appraisal theory (Scherer, 2009) and the choice is not accidental. The differentiation between some aspects of cognitive and affective processes—shared by appraisal and basic emotion theories—allows us to compare processing in bilinguals' two languages. In turn, the view of affective processing as a subjective process driven by individuals' needs, goals, and linguistic and cultural categories—shared by appraisal and psychological constructionist theories, albeit at different levels of categorization—allows us to understand variation in experienced language emotionality. The terms *affect*, *emotions*, and *feelings* will be used as synonymous throughout the paper and I will not assign undue significance to the fact that English provides us with three terms in this area.

Emotional stimuli

Before we proceed to this discussion we need to consider what counts as an emotional stimulus. Since you and I may not be in love with the same person nor share the same basic fears—I, for one, dislike mice but am indifferent to spiders—we may vary in the patterns and strength of our responses to stimuli in our environment. Not all potentially emotion-inducing stimuli automatically trigger affective processing; rather, the emotional meaning of the stimulus emerges in a situated process, where its perceived emotional content and relevance are shaped by a complex interplay of informational, contextual, and individual factors (Brosch, Purtois, & Sander, 2010; Eder et al., 2007). Stimuli may also lose emotionality—the person whose very appearance triggered an array of feelings in us just a year ago may today elicit nothing but indifference.

The focus of this review is on one particular class of stimuli, that is *verbal stimuli*, such as words, phrases, or autobiographical memories transformed into narratives. Consistent with the definition of affective processing adopted here, emotional or *emotion-laden* verbal stimuli will be viewed as stimuli that elicit heightened arousal, seen in somatovisceral responses, such as increased heart rate or skin conductance, and *perceptual prioritization*, seen in cognitive responses, such as preferential selection from a perceptual temporal stream, heightened recall and, in some cases, interference with the processing of other stimuli (Brosch et al., 2010).

In the processing of verbal stimuli, emotional responses may be triggered by: (a) referential *content* (denotation); (b) *intentionality*, i.e., speaker's intended meaning (connotation); and (c) *form*, i.e., structural properties (e.g., accent, double negation). The third category also includes languages, dialects, and language varieties, as they too may function as emotion triggers. Linguists are interested in all three aspects of processing but have focused on production in the first two areas and on perception in the third. In contrast, psychologists who carried out most of the perception research to date have narrowed down the locus of inquiry to content and focused on single words. This work is grounded in the assumption that even if the reaction to the word "cancer" in the lab is significantly less pronounced than in the office of an oncologist, some words still trigger negative associations and anxiety. Studies to date show that emotion-laden words, and in particular taboo and aversive words, elicit higher levels of autonomic arousal, are remembered better, and are extracted more rapidly under suboptimal conditions than neutral words (e.g., Bowers & Pleydell-Pearce, 2011; Manning & Melchiori, 1974; Talmi & Moscovitch, 2004; for a review, see Brosch et al., 2010).The question asked in research with bilingual speakers is whether bilinguals process verbal stimuli similarly in their respective languages and, if not, what factors might affect differential performance?

AFFECTIVE PROCESSING IN BILINGUAL SPEAKERS

Clinical approaches

Clinical approaches to the study of affective processing focus on *affective reactivity* or the pattern of arousal and language disturbances displayed in discussion of negatively valenced topics (e.g., Burbridge, Larsen, & Barch, 2005). The differential reactivity of bilinguals' languages was noticed more than 100 years ago by Freud and his disciples, who found that some of their

bilingual and multilingual patients favored the L2 or LX for the use of "obscene" words and discussion of anxiety-producing topics, such as sex (Ferenczi, 1916; Freud, 1893). This phenomenon was further explored by post-Second World War psychoanalysts who found that the switch to the L1 triggered repressed feelings and memories, allowing them to uncover the reasons for the patients' deep-seated anxieties (Buxbaum, 1949; Greenson, 1950; Krapf, 1955)

Clinical studies provided further evidence that bilinguals and multilinguals may display differential affective reactivity when using taboo words or discussing the same subject in different languages (Amati-Mehler, Argentieri, & Canestri, 1993; Aragno & Schlachet, 1996; Javier, 1995; Movahedi, 1996; Rozensky & Gomez, 1983). Their L2 descriptions may sound detached and unemotional, while in the L1 they may display higher levels of anxiety and affective reactivity, seen in increased variation in pitch or even crying. A switch to the L1 may also trigger previously repressed memories and elicit the feeling of "reexperiencing" events. In an experimental study, Schwanberg (2010) asked 19 late Spanish–English bilinguals with posttraumatic stress disorder to rate frequency and intensity of the symptoms in their respective languages, and to recount a traumatic memory and rate the intensity of the recall. The analysis demonstrated that, regardless of language order, the frequency and intensity of the symptoms and emotional intensity of the recalls were rated significantly higher in L1 Spanish.

These findings suggested that the same internal verbal stimuli, such as negatively valenced memories or taboo words and swearwords, may be processed differently depending on the language of retrieval. This effect is commonly explained through direct links between autobiographical memories and languages of encoding. Evidence of such links comes from studies with late Russian–English (Marian & Neisser, 2000), Spanish–English (Schrauf & Rubin, 2000, 2004), Polish–Danish (Larsen, Schrauf, Fromholt, & Rubin, 2002), and Japanese–English (Matsumoto & Stanny, 2006) bilinguals which show that autobiographical memories are more likely to be activated by the language in which the original events took place (*language specificity effect*). A few studies also suggest that memories elicited in the language in which they were encoded are more detailed and higher in emotional intensity (*language congruity effect*) (Javier, Barroso, & Muñoz, 1993; Marian & Kaushanskaya, 2004).

Clinical case studies provide ground-breaking insights into bilinguals' affective reactivity, yet they also have inherent limitations which preclude easy generalization. To begin with, their findings are limited to a particular type of processing, namely retrieval, and a particular type of stimuli, autobiographical memories and taboo words and swearwords. They are also limited to one type of participants—patients in therapy. Moreover, because most studies approached bilingualism as a "generic" condition, they did not provide sufficient information about the patients' language learning trajectories, dominance, and proficiency to allow for meaningful crosscase comparisons and analysis. The studies that do provide this information generally involve late bilinguals with German or Spanish as L1 and English as L2. As a result, clinical studies provided us with evidence of differential affective processing of negative memories and anxiety-related topics and—jointly with studies of bilingual autobiographical memory—indicated its potential mechanism but did not clarify factors that influence such differences.

Introspective approaches

While clinical studies rely on therapists' observations, introspective approaches examine speakers' own perceptions of emotionality of their respective languages, language choice for emotional expression, language attitudes, and language anxiety.

Perceived emotionality and language choice in bilingual and multilingual speakers

To date, the largest questionnaire-based study of bilingualism and emotions has been conducted by Dewaele and Pavlenko (Dewaele, 2004a, 2004b, 2004c, 2006, 2008, 2010; Pavlenko, 2004, 2005). The Bilingualism and Emotions Questionnaire (BEQ) was administered in English, online, where it was freely accessible between 2001 and 2003. The BEQ was divided into three sections: (1) 13 sociobiographical questions, including questions about language learning history, proficiency, and dominance, (2) 13 closed-ended Likert type questions about language choice for expression of various emotions and perceptions of emotionality of individual languages and word types, (3) eight open-ended questions regarding the relationship between participants' languages and emotions (for full text see Dewaele, 2010; Pavlenko, 2005).

The BEQ collected data from a large sample of bilinguals and multilinguals around the

world: 1039 respondents in the first stage (Dewaele, 2004a, 2004b, 2004c; Pavlenko, 2004, 2005) and 1579 in the final database (Dewaele, 2010). This population was characterized by a wide range of ages (16–73 years) and languages (75 different L1s) and included bilinguals (20%), trilinguals (24%), and speakers of four (24%) and five or more languages (32%). More than a half (54%) of the participants declared themselves to be L1-dominant, and the rest reported dominance in two or more languages (36%) or in a language or languages other than L1 (10%). Of the respondents, 71% were female. Education-wise, the sample included people with doctoral degrees (27%), master's degrees (29%), bachelor's degrees (34%), and high school diploma or less (10%). A large majority of participants (79%) reported working in language-related professions, including students, teachers, researchers, and translators. The web-based and English-language medium of the questionnaire, the self-selected nature of the sample, and the over-representation of highly educated polyglot females undoubtedly limit the generalizability of the findings (for discussions, see Dewaele, 2010; Pavlenko, 2005). At the same time, the large number of diverse participants confers considerable statistical power, useful for discerning broad patterns of response. These patterns were then examined in studies with smaller populations, which combined the original or modified versions of the BEQ with interviews (e.g., Caldwell-Harris, Tong, Lung, & Poo, 2011; Dewaele, 2010).

Statistical analyses reveal four main factors that mediate perception of language emotionality and language choice for emotional expression: order of acquisition, language dominance, AoA and CoA (Dewaele, 2004a, 2004b, 2004c, 2006, 2008, 2010). The order of acquisition privileges the L1—it is rated as significantly more emotional, with emotionality of other languages gradually decreasing. The L1 is also significantly more likely to be used for expression of positive and negative affect. Nearly half of the BEQ respondents judged the sentence "I love you" to have greater emotional weight in the L1. They also rated L1 taboo words and swearwords as significantly more emotional and used the L1 more frequently to express anger and to swear. Partners in bilingual couples admitted reverting to languages in which their spouses had limited proficiency or none at all, and explained this switch by the satisfaction of using the language that felt "natural" (Dewaele, 2010; Pavlenko, 2005). Internal satisfaction was also cited as a factor in the choice of L1 for positive affect, in particular with children, with affective connotations of the L1 linked to speakers' own childhood experiences (Pavlenko, 2004, 2005).

The second factor affecting perceived language emotionality and use is language dominance: the BEQ responses show that the L1 is more frequently used for emotional expression by L1-dominant respondents but less frequently by those dominant in L1 and LX as well as by those dominant in LX. The third factor is the CoA: words and languages learned in naturalistic and mixed contexts are judged as more emotional and are more likely to be used than those learned in instructed contexts. An additional factor affecting the L2 is the AoA: early learners are more likely to perceive the L2 and its words as emotional and to express anger in the L2. Additional predictors included general frequency of language use, the size of the interlocutor network, and self-rated proficiency.

Several of these findings have been replicated in other studies. The order of acquisition effect was found by Puntoni, De Langhe, and Van Osselaer (2009), who asked Dutch–French–English trilinguals to rate emotional intensity of advertising slogans presented in French and Dutch (e.g., "Build something together with your child. You will never outgrow our toys"). The results revealed that L1 slogans were rated as more emotional, regardless of whether the L1 was French or Dutch.

The CoA and AoA effects were also replicated in studies that adopted a modified version of the BEQ. Caldwell-Harris et al. (2011) found that late Mandarin–English bilinguals judged the L1 Mandarin to be more emotional, while early bilinguals judged the two languages as equally emotional. Caldwell-Harris, Staroselsky, Smashnaya, and Vasilyeva (2012) found order of acquisition and AoAr effects: perceived emotionality of L1 Russian was highest in Russian–English bilinguals who arrived in the US after the age of 10 (late arrivals), lower (but not significantly) in bilinguals who arrived prior to age 10 (early arrivals), and significantly lower in English–Russian bilinguals who learned Russian as FL or L2 (Table 2). AoAr effects were particularly visible in the area of positive affect: While later arrivals perceived both positive and negative affect to be stronger in L1 Russian, early arrivals perceived negative affect to be stronger in L1 Russian and positive affect in L2 English. Perceptions of strong negative affect correlated with language use in the family setting and perceptions of strong positive affect with language use with friends and peers, which was higher among earlier arrivals.

Importantly, the influence of the mediating factors on bilinguals' perceptions is by no means

TABLE 2
Introspective approaches

Study	Participants	Tasks	Results
Caldwell-Harris et al. (2012)	(1) 23 childhood Russian–English bilinguals in the US, early arrivals, AoAr < 10 years (2) 21 late Russian–English bilinguals in the US, late arrivals, AoAr > 10 years (3) 20 English–Russian bilinguals in the US who learned Russian as FL or L2	Self-reports	L1 advantage (higher perceived emotionality)
Puntoni et al. (2009)	64 trilinguals in Belgium, with French and Dutch as L1 or L2 and L3 English	Rating advertising slogans in L1 and L2	L1 advantage (higher perceived emotionality)

straightforward. Dewaele (2004c, 2010) identified two intriguing dissociations in the data. In the L1, perceived emotionality of taboo words and swearwords was rated higher than perceived emotionality of the language itself, whereas in subsequent languages the perception was reversed, with taboo words and swearwords rated lower than the languages themselves. This finding suggests that ratings of words and languages may tap into different sources of cognitive judgments: ratings of emotional weight of taboo words and swearwords may be grounded in embodied perception of language emotionality and ratings of language emotionality in language attitudes and ideologies.

The second dissociation involves dominance effects: the shift in language dominance and resulting L1 attrition appear to influence the frequency of L1 use for emotional expression but not perceived emotionality of the language or that of taboo words and swearwords. This finding suggests that language choice for emotional expression cannot be taken as a straightforward index of language emotionality: at times, bilinguals and multilinguals may favor a less emotional language that allows them to control their emotions and to avoid guilt associated with L1 taboo words and swearwords or anxiety associated with L1 expressions of love (Dewaele, 2004a; Pavlenko, 2005; see also Caldwell-Harris et al., 2011). Studies of translingual writers, i.e., writers who write in more than one language or in a language learned later in life, show that the decreased emotionality of the L2, known as the emancipatory detachment effect, is the key distinguishing characteristic of L2 writing (Kellman, 2000; Kinginger, 2004; Pavlenko, 2005).

Language attitudes and foreign language anxiety

The difference between the ratings of taboo words and swearwords and those of overall language emotionality underscores the need to consider languages as a type of stimuli whose emotionality may be determined not only by learning experiences and contexts but also by attitudes. These attitudes have been examined in two types of studies—studies of attitudes toward particular languages, dialects, varieties, and accents, and studies of perceived foreign language anxiety.

Studies of language attitudes commonly ask participants to listen to tape-recorded speakers who differ in terms of language, dialect, register, or accent, and to rate them on affective and nonaffective attributes (e.g., pleasantness, politeness, intelligence). These studies show that nonlinguists are as good as linguists at recognizing dialects in their L1 and at distinguishing between accented and nonaccented speech (e.g., Bresnahan, Ohashi, Nebashi, Liu, & Shearman, 2002). These differences are frequently vested with affective meanings, with participants commonly rating speakers of their own language or variety and those of prestigious or standard varieties significantly higher on affective attributes than accented speakers and speakers of socially marginalized varieties, such as African-American Vernacular English (e.g., Bresnahan et al., 2002; for review see Lippi-Green, 2012).

The L1 is also not exempt from negative categorization—it may be viewed negatively by speakers who internalized the low social status of their mother tongue or those who associate it with negative personal experiences. A prominent example of such negative categorization of the L1 comes from Schmid's (2002) study of L1 attrition in German Jews who emigrated to English-speaking countries prior to the Second World War. The researcher analyzed 35 autobiographic interviews conducted by German historians for an oral history project in terms of amount of deviation from morphological and syntactic rules, such as case or gender errors, and in terms of overall proficiency (based on assessments of lexical richness, morphological and syntactic complexity, and

nativeness ratings). Then she examined the influence of three independent variables on the levels of deviation and degrees of proficiency: (1) age at the time of emigration (lower or higher than 17 years, with ages ranging between 8 and 30); (2) interim use of the language (based on self-reports), and (3) emigration period: (a) before September 1935, when the Nuremberg race laws were announced; (b) after the laws were announced but before October 1938; and (c) after the first deportations to Poland in October 1938 and the Kristallnacht on November 9, 1938. Schmid (2002) found that participants who displayed the highest degree of L1 attrition were not those who left Germany youngest, nor those who left it earliest, not even those who used German least. The only significant predictor of attrition was the time of emigration: it was highest among those who left Germany last, when the persecution of Jews turned into genocide. The emotional trauma had led these speakers to distance themselves from the language and the past it came to symbolize. The interviews also revealed individual variation in the categorization process: speakers who associated German with the Holocaust were reluctant to use it, while those who dissociated the language from the political events continued to treasure it as a language of their childhood (for discussion of similar findings see Pavlenko, 2005).

Negative attitudes may also be associated with languages learned later in life. A particularly prominent role is played by foreign language anxiety (FLA). In the analysis of BEQ responses, Dewaele (2010) found that the relationship between the order of acquisition and FLA displayed a monotonic increase from the L1 to L5, the opposite of perceived emotionality. This relationship was significantly affected by the AoA and CoA: early learners reported less FLA than later learners and classroom learners reported most FLA. FLA was additionally affected by the frequency of LX use, degree of socialization and the size of the social network, with people who used the LX least reporting highest levels of FLA.

Emotion identification

Studies of emotion identification examine a different type of emotion processing, with the focus on intentionality of vocal cues, which are often seen as the key indicator of emotional meanings. Even though the matches between vocal cues and meanings are never absolute, either within or across languages, in each speech community there are prosodic patterns that signal conventionalized affective meanings (e.g., Anolli,

Wang, Mantovani, & De Toni, 2008). Studies of emotion identification commonly ask participants to listen to tape-recordings made by professional actors or untrained native speakers of a particular language and ranging from one word to several sentences. The content of such utterances is most often neutral; sometimes it is rendered unintelligible (content-filtered) by means of a lowpass filter in order not to let it interfere with the identification task. The participants commonly include native speakers of the language in question and speakers of another language who may or may not be familiar with the language used in the task. They are asked to listen to each recording and to identify the emotion portrayed.

The findings to date reveal an "in-group" or L1 advantage for identifying emotions based exclusively on vocal cues: native speakers of Western (Dutch, English, German, Spanish, Swedish) and non-Western (Arabic, Cree, Hindi, Japanese, Shuar) languages are systematically more accurate (accuracy rates ranging between 58% and 94%) in identifying emotions in their own language, even when utterance content is neutral or unintelligible; non-native speakers and speakers unfamiliar with the language also identify emotions at levels above chance, but at a slower pace (Pell & Skorup, 2008) and with lower accuracy (accuracy rates ranging between 33% and 72%) (Bryant & Barrett, 2008; Graham, Hamblin, & Feldstein, 2001; Pell, Monetta, Paulmann, & Kotz, 2009; Scherer, Banse, & Walbott, 2001; Thompson & Balkwill, 2006; for reviews of earlier work see Elfenbein & Ambady, 2002; Juslin & Laukka, 2003; Pavlenko, 2005). A meta-analysis by Juslin and Laukka (2003) revealed a significant difference between the two populations. These findings suggest that identification of emotions in L2 involves both "universal" and language- and culture-specific cues learned in the process of L2 socialization and interaction. To date, however, these vocal cues have been largely examined in terms of categorization and it remains to be seen if they also trigger affective reactions.

Overall, introspective studies provide us with a more nuanced understanding of effects revealed in clinical studies. They show that perceived language emotionality may be moderated by language dominance and the order, age and context of language acquisition. They also suggest that affective processing of verbal stimuli may take place at two levels: automatic processing, reflected in ratings of perceived emotionality of taboo words and swearwords; and interpretive processing, reflected in emotion identification, language attitudes, and language anxiety. The difference

between the two could be illustrated with a thought experiment. If we were to measure levels of physiological arousal in response to L1 German in bilinguals similar to those in Schmid's (2002) study, we might find similarly high levels of arousal across participants, activated by links to autobiographical memory. This arousal, however, may be differently interpreted: some could interpret it as positive and link it to the language of childhood, while others may see it as negative and link it to wartime trauma and the Holocaust.

This thought experiment also highlights the limitations of introspective approaches. They do not provide us with direct access to affective processing; rather they offer participants' interpretations of their experiences. These self-reports may display both individual variation and cross-linguistic and crosscultural differences in rating scale use. This weakness may be partially addressed by adoption of the anchoring vignette methodology   (http://gking.harvard.edu/vign). Furthermore, the reliance on language as a medium privileges conscious, reportable feelings over affective experiences that are difficult to express. Consequently, self-reports are well suited for investigations of interpretive processing but may not be best suited for explorations of automatic affective processing (Eder et al., 2007).

Cognitive approaches

A processing that is automatic (or involuntary) and immediate is at the center of the inquiry in the cognitive paradigm which uses behavioral methods to determine whether emotional words are processed differently from neutral words. Word category membership is established in this paradigm through ratings of valence (positive, negative, neutral) and arousal (high, moderate, low). Given that ratings are a form of introspection, in what follows I will not discuss rating studies *per se* and will consider ratings only in the context of findings from other tasks. These tasks commonly focus on three perceptual prioritization effects: enhanced recall, greater interference, and facilitation through congruency or affective priming.

Memory effects: Recall and recognition

Studies with monolingual speakers show that emotional words, and in particular taboo words, are usually remembered better than neutral words (e.g., Jay, Caldwell-Harris, & King, 2008; Talmi & Moscovitch, 2004). How are they remembered by bilingual speakers?

Anooshian and Hertel (1994) asked English–Spanish and Spanish–English bilinguals to rate emotional (e.g., anger/*ira*, death/*muerte*) and neutral (e.g., table/*mesa*, street/*calle*) words for ease of pronunciation, implied activity, and emotional intensity, and then to perform a surprise recall task (see Table 3). They found that emotional words were recalled better but only in the L1, regardless of whether it was Spanish or English. They did not, however, control for the type of emotional words, mixing together emotion (e.g., anger) and emotion-laden (e.g., breast) words, as well as positive (e.g., party) and negative (e.g., death) words.

Ayçiçegi and Harris (2004) addressed these shortcomings by presenting participants with five categories of words: neutral (e.g., box), positive (e.g., bride), negative (e.g., cancer), taboo (e.g., shit), and childhood reprimands (e.g., shame on you!). These words were presented in auditory and visual modalities to late Turkish–English bilinguals who were asked to think about word meanings and to rate the words for unpleasantness. Then half of them performed a surprise free recall and half a recognition task. L2 English words, and in particular taboo words and reprimands, were recalled at higher rates in both surprise recall and recognition tasks. In L1 Turkish only taboo words were recalled better, while negative words were recalled more poorly than neutral words. These unexpected results were explained by the deeper processing required to judge the meaning and the degree of unpleasantness of emotion-laden words in L2.

In a follow-up study, Ayçiçegi-Dinn and Caldwell-Harris (2009) used the same stimuli but controlled for processing effects by including a shallow processing task (asking participants to count letters that contained a closed circle) and three deep processing tasks (rating of emotional intensity, translation, and word association). The results of the surprise recall task showed that L2 English reprimands produced superior recall across all conditions, a finding attributed to the novelty effect. The analysis that eliminated reprimands revealed processing task effects: in the emotional intensity rating condition, L1 taboo words were recalled best, in the translation condition L2 English taboo words were recalled best, and in the letter counting and word association conditions the effects were similar in the two languages. In a study by Ferré, García, Fraga, Sanchez-Casas, and Molero (2010), on the other hand, emotion-laden words were recalled similarly in the two languages of bilingual participants. These results led the authors to argue that age and

TABLE 3
Cognitive approaches

Study	Participants	Tasks	Results
Memory effects			
Anooshian & Hertel (1994)	18 late Spanish–English bilinguals, mean AoA = 16.3 years 18 late English–Spanish bilinguals, mean AoA = 18.4 years	(1) Word rating (2) Surprise recall	L1 advantage for emotional words (superior recall)
Ayçiçegi & Harris (2004)	42 late Turkish–English bilinguals in the US, AoA > 12 years, mean AoAr = 22 years (range 17–46 years), mean LoR = 2.1 (range 0.5–6 years)	(1) Word rating (2) Surprise recall or recognition	L2 advantage for emotional words (superior recall)
Ayçiçegi-Dinn & Caldwell-Harris (2009)	59 late Turkish–English FL users in Turkey, AoA = 12 years	(1) Shallow and deep word processing tasks (2) Surprise recall	L2 advantage for reprimands (superior recall)
Ferré et al. (2010)	74 Catalan–Spanish bilinguals 59 Spanish–Catalan bilinguals 35 childhood Spanish–English bilinguals, mean AoA = 8.3 years	(1) Word ratings (2) Free recall	No language advantage in recall tasks
Interference effects			
Colbeck & Bowers (2012)	19 native speakers of English 20 Chinese–English bilinguals in the UK	Rapid Search Visual Presentation task	L2 advantage (lower sensitivity to taboo words in the L2)
Eilola & Havelka (2011)	32 native speakers of English 31 childhood Greek–English bilinguals, mean AoA = 8.4 years, LoR = 2.5 years	Emotional Stroop task SCL measurement	Similar interference effects in L1 and L2; lower sensitivity to taboo words in the L2 (as measured by SCL)
Eilola et al. (2007)	34 childhood Finnish–English bilinguals, mean AoA = 9.2 years, range 7–13 years	Emotional Stroop task with neutral, positive, negative and taboo words	Similar interference in both languages
Sutton et al. (2007)	64 early Spanish–English bilinguals	Emotional Stroop task with neutral and negative words	Interference effects in both languages with greater interference in the dominant L2
Congruence effects			
Altarriba & Basnight-Brown (2011)	*Study 1* 57 native speakers of English 32 early Spanish–English bilinguals *Study 2* 52 native speakers of English 34 early Spanish–English bilinguals	Affective Simon Task	Similar congruency effects in both languages, with more robust effects in the dominant L2 English
Degner et al. (2012)	21 German–French bilinguals, mean AoA = 10.8 years 20 French–German bilinguals, mean AoA = 12.3 years	Affective priming	L1 advantage (speed of processing), L2 affective priming effects influenced by the frequency of L2 use
Segalowitz et al. (2008)	48 English–French bilinguals, dominant in L1 English	Implicit Affect Association Task	L2 advantage (greater interference effect in the L1)

context of acquisition and typological distance between languages do not reduce the emotional advantage in recall tasks.

Taken together, however, the contradictory results of the four above-mentioned studies warrant a more cautious interpretation. Spanish–English bilinguals in the study by Ferré et al. (2010) acquired their L2 English before puberty and performed as expected for early bilinguals, in contrast to late bilinguals in Anooshian and Hertel's (1994) study who did display the

L1 advantage. The populations in Ferré et al. (2010) also did not differ sufficiently in terms of the CoA— all were mixed context learners, including the Spanish–English bilingual group, where several participants were either English teachers or students who studied on the Spanish campus of an American university and were thus using English on a regular basis.

Studies by Ayçiçegi and Harris (2004) and Ayçiçegi-Dinn and Caldwell-Harris (2009), where the AoA and CoA were sufficiently different to

justify an expectation of effects, documented superior recall of L2 words. These findings suggest that recall may not be the most sensitive task, because the recall advantage cannot be unambiguously attributed to emotionality. Rather, recall of emotional words appears to be context-dependent (e.g., Schmidt, 2012) and, in studies with bilingual speakers, it seems further mediated by L2 proficiency. Some stimuli may be remembered due to their novelty and others due to additional cognitive efforts. The finding of task effects also raises the question of whether affective valence of emotion-laden words is always processed automatically.

Interference effects: Emotional Stroop tasks

The latter question is addressed in the study of interference and facilitation effects. To study these effects, researchers frequently adopt an emotional Stroop task, where participants are asked to identify the print color of emotion-laden (e.g., "kiss" in blue ink) and neutral (e.g., "truck" in red ink) words, with the expectation that emotional and in particular negative and taboo words will produce interference effects slowing down response times. A modified version of the emotional Stroop is a Rapid Search Visual Presentation (RSVP) task, where words are presented rapidly and sequentially in the same spatial location: the first word is either a neutral or a taboo word and the second a color word. The participants are asked to identify the color word and to ignore all other words in the stream. When participants search for two targets within 500 ms of each other, the accuracy in reporting the color word is reduced, due to the so-called attentional blink, which is magnified by taboo words. The mechanisms that produce these interference effects are still being debated—one possibility is that threatening stimuli slow down the disengagement of attention (e.g., Yiend, 2010).

Colbeck and Bowers (2012) used the RSVP task and found that, in the taboo word condition, L1 English speakers displayed significantly higher error rates (13.9%) than Chinese participants using L2 English (5.6%). After a reanalysis including only participants who could define all taboo words, the same overall pattern obtained (13.0% error rates for L1 English speakers and 6.7% for L2 English), leading the authors to argue that in this automatic processing condition the reduced emotionality of the L2 diminished interference, providing a processing advantage.

Emotional Stroop studies revealed similar levels of interference in both languages of Finnish–English bilinguals (Eilola, Havelka, & Sharma, 2007) and greater interference in the dominant L2 English of Spanish–English bilinguals (Sutton, Altarriba, Gianico, & Basnight-Brown, 2007). Eilola and Havelka (2011) combined emotional and taboo Stroop tasks with measurements of skin conductance level (SCL), taken to indicate overall levels of emotional arousal. They found that native speakers of English and childhood Greek–English bilinguals displayed similar levels of interference in English-language Stroop tasks, but differed in the SCL: L1 English speakers displayed elevated SCLs in response to negative and taboo words, while L2 speakers did not.

These findings showed that, given sufficient language exposure and proficiency, L2 acquisition prepuberty leads to automatic processing of emotion-laden words (Eilola & Havelka, 2011; Eilola et al., 2007; Sutton et al., 2007) and that a shift to L2 dominance may result in stronger effects in the L2 (Sutton et al., 2007). The results of Eilola and Havelka's (2011) study also raised a possibility that automatic processing of emotion-laden words may involve two subprocesses: automatic access of affective valence information (semantic processing) and automatic triggering of heightened levels of autonomic arousal (affective processing). If that is the case, late bilinguals with relatively high levels of L2 proficiency may pattern with L1 speakers in the first case and differ in the second.

Congruence effects: Affective priming

The processing of affective valence is examined in the priming paradigm, where lexical decision tasks (word/nonword) match primes and targets in valence, with the expectation that congruent conditions (e.g., negative–negative) would produce faster reaction times (priming). To examine affective priming, Segalowitz, Trofimovich, Gatbonton, and Sokolovskaya (2008) developed an Implicit Affect Association Task, where participants had to categorize noun phrases (e.g., a gentle child, the ugly boy) as "positive" or "negative." These lexical items were alternated with pictures of facial expressions, which they had to categorize as "sad" or "happy," and with pictures of objects they had to categorize as "whole" or "broken". In the congruent condition, the same reaction time panel was used for "positive," "happy," and "whole" objects; in the incongruent condition the same panel was used for "positive" expressions and "sad" faces (or

"broken" objects). To examine general efficiency of L2 lexical access the researchers used the Animacy Judgment Task, where participants categorized concrete nouns as living or nonliving items. Comparisons of L1 and L2 reaction times allowed researchers to create an index of L2 lexical access for each participant.

The participants were English–French bilinguals, who used both L1 English and the less fluent L2 French on a daily basis in the bilingual context of Montreal. Both language conditions demonstrated interference effects. However, the L2 interference effect for affectively valenced words was significantly smaller than the L1 effect, suggesting that the processing of affective valence in the weaker L2 is less automatic than in the L1. No correlation was found between overall skills in L2 lexical access and the processing of affective valence, leading the authors to argue that these skills may be separate from general word recognition and weaker in the L2.

An attempt to differentiate between affective valence as a type of semantic information and emotional effects was undertaken by Altarriba and Basnight-Brown (2011). The researchers used the Affective Simon task to compare the processing of emotion words (e.g., anger) and emotion-laden words (e.g., breast). The participants were presented with positive and negative words in white, blue, or green and instructed to rate the words in white on valence (pressing P for positive and Q for negative) and the words in blue and green on color (pressing P for blue and Q for green or vice versa). The analysis examined whether congruency effects reduced reaction times to, for instance, positively valenced words in blue. The responses of Spanish–English bilinguals displayed congruency effects in both languages, with more robust effects in the dominant L2 English. These results suggested that emotion-laden words more readily produce Affective Simon effects than emotion words.

An attempt to distinguish between semantic and affective priming was undertaken by Degner, Doycheva, and Wentura (2012). Both German–French and French–German bilinguals in their study responded faster in their L1. Similar semantic priming effects were observed in both groups and in both languages. Affective priming was observed in the L1 in both groups and in the L2 of French–German bilinguals. These effects were related to intensity of language use, which was much higher for French speakers living in Germany. Multiple regression analysis showed that only participants with frequent everyday usage of the L2—regardless of whether it was French or German—displayed affective priming

effects in the L2, while participants with low usage showed no effects.

Together, these findings suggest that automatic processing of affective valence may be a skill separate from general lexical processing and more automatic in the L1, as seen in greater affective priming (Degner et al., 2012 in German–French bilinguals; Segalowitz et al., 2008) and heightened recall (Anooshian & Hertel, 1994). The lower automaticity of the processing of affective valence in the L2 may reduce interference effects, thus resulting in the L2 advantage (Colbeck & Bowers, 2012; Segalowitz et al., 2008). The automaticity of processing of affective valence in the L2 may be increased by the shift in language dominance, which may override the L1 advantage (Altarriba & Basnight-Brown, 2011; Sutton et al., 2007), and by frequent L2 use in a naturalistic context (Degner et al., 2012; Eilola & Havelka, 2011; Ferré et al., 2010).

The findings of Eilola and Havelka (2011) show that in the context of the same task L2 speakers may pattern with L1 speakers in the processing of affective valence and diverge from them in levels of autonomic arousal. These task effects underscore the limitations of the cognitive paradigm, which often equates affective processing with processing of valence and does not allow us to determine whether valence actually triggers heightened arousal or is simply part of semantic meaning that serves as a basis of categorization in the absence of other salient features (e.g., Storbeck & Robinson, 2004). To see if we can get a more direct access to emotional experience, let us turn to psychophysiological approaches.

Psychophysiological approaches

Psychophysiological approaches (Table 4) rely on physiological markers of autonomic arousal, such as heart rate, activation of smile or frown muscles, or electrical conductivity of the skin. Our skin appears to be particularly sensitive to threatening and relevant stimuli—these stimuli increase the level of adrenaline in the blood and lead to sweating, which increases electrical conductivity of the skin (electrodermal reactivity), measured via fingertip electrodes. A transient increase that occurs 1 to 1.5 seconds after stimulus presentation is commonly referred to as a *skin conductance response* (SCR) (Harris, 2004). SCRs reflect responses to individual stimuli and differ from the overall skin conductance level (SCL) measured by Eilola and Havelka (2011). Studies with monolingual English speakers show that

TABLE 4
Psychophysiological approaches

Study	Participants	Tasks	Results
Caldwell-Harris & Ayçiçegi-Dinn (2009)	*Study 1* 70 Turkish–English bilinguals in Turkey, dominant in L1 Turkish, AoA > 12 years *Study 2* 45 Turkish–English bilinguals in Turkey, dominant in L1 Turkish, AoA = 13 years	*Study 1* Listening to emotional phrases in the two languages, with concurrent measurement of SCR *Study 2* Reading aloud true and false statements in both languages, with concurrent measurement of SCR	*Study 1* L1 advantage (higher SCRs elicited by L1 Turkish phrases) *Study 2* Higher SCRs elicited by L2 English
Caldwell-Harris et al. (2011)	64 Mandarin–English bilinguals, AoA 0–15 years, AoAr 0–24 years, LoR 0–23 years	(1) Rating of neutral phrases, endearments, insults, reprimands, and taboo phrases, with concurrent measurement of SCR (2) interviews	L1 advantage in self-reports (higher perceived emotionality), higher SCRs for L2 English endearments
Harris (2004)	15 early Spanish–English bilinguals, dominant in L2 English, mean AoA = 3.7, range 0–7 years 21 childhood Spanish–English bilinguals, dominant in L1 Spanish, mean AoA = 7.9 years, ages 1–16 years; AoAr 13–25 years; mean LoR = 2.4 years, range 0.5–20 years	Rating of childhood reprimands, and taboo words, endearments, insults, and neutral words, with concurrent measurement of SCR	AoA effects: L1 advantage in childhood bilinguals (higher SCRs elicited by childhood reprimands)
Harris et al. (2003)	32 late Turkish–English bilinguals in the US AoA > 12 years, mean AoAr = 34 years, range 16–31 years, mean LoR = 4, years, range 1–15 years	Rating of childhood reprimands and neutral, positive, negative, and taboo words, in visual and auditory modalities, with concurrent measurement of SCR	L1 advantage (higher SCRs elicited by L1 taboo words and child-hood reprimands)

threatening stimuli—including negatively valenced words, such as taboo and anxiety-related words—consistently elicit higher SCRs than euphemisms (e.g., f-word) and neutral words (e.g., Bowers & Pleydell-Pearce, 2011; Manning & Melchiori, 1974). Burbridge et al. (2005) also found that English speakers display higher heart rates and a higher frequence of nonspecific SCR in discussing negatively valenced topics (e.g., experiences of sadness, anger, pain, or disappointment).

A series of studies by Caldwell-Harris and associates (Caldwell-Harris & Ayçiçegi-Dinn, 2009; Caldwell-Harris et al., 2011; Harris, 2004; Harris, Ayçiçegi & Gleason, 2003) investigated electrodermal reactivity in bilingual speakers. Harris et al. (2003) found that in late Turkish–English bilinguals SCRs elicited by L1 Turkish words were stronger than those elicited by L2 English, especially in the auditory modality.

The largest difference between the two languages occurred between childhood reprimands in both the auditory and visual modality. This finding links emotionality to socialization experiences and verbal conditioning where parental reprimands become associated with fear or anxiety. During the debriefing session several participants mentioned that they could hear, in their mind, Turkish family members addressing reprimands to them.

These findings were replicated by Caldwell-Harris and Ayçiçegi-Dinn (2009) with Turkish–English bilinguals in Turkey. The researchers used the stimuli from the previous study, with the exception of taboo words, which were eliminated in order to elicit larger and more equal SCRs in other conditions. SCRs elicited by the L1 stimuli were higher across all conditions, with the L1–L2 difference largest for childhood reprimands. This replication addressed concerns raised by the

previous study that the heightened SCRs to the L1 were caused by the novelty of hearing Turkish in an American university laboratory or by nostalgia for the mother tongue.

Harris (2004) examined the effects of the age of arrival on SCRs and found that early Spanish–English bilinguals displayed similar SCRs in the two languages, while in childhood bilinguals, L1 Spanish reprimands elicited heightened SCRs. The difference between the L1 and L2 was weaker than in Turkish–English bilinguals, which is understandable given the fact that Spanish–English bilinguals had started learning L2 English earlier, had spent more time in the US and were more proficient in English. The highest SCRs in both groups of Spanish–English bilinguals were elicited by taboo words in L2 English, which shows, once again, that the L1 advantage can be overridden by the shift in language dominance.

In the next study, Caldwell-Harris et al. (2011) embedded words in phrases that were subsequently categorized as neutral (e.g., I have shoes), endearments (e.g., I miss you), insults (e.g., Get lost), reprimands (e.g., Shame on you!), and taboo (e.g., He screwed your mother). They also asked the participants, Mandarin–English bilinguals, to think of a prior situation where such a phrase was used and to rate the emotional intensity of that situation. The results revealed that while L1 Mandarin reprimands were rated higher for emotionality, the SCRs elicited by reprimands were similar in the two languages. These findings may reflect greater than usual variation in the participant population, where some of the speakers learned English from birth and were English-dominant. Endearments were rated similarly in the two languages yet displayed a different pattern of SCRs: L2 English endearments elicited higher SCRs in balanced bilinguals and L1 Mandarin endearments higher SCRs in L2 English-dominant bilinguals. The researchers were cautious in interpreting these results, for they may represent a task effect, where a greater level of cognitive effort is required to remember situations in which words of the weaker language were used.

Another design variation was introduced by Caldwell-Harris and Ayçiçegi-Dinn (2009) who asked Turkish–English bilinguals to read true and false statements in Turkish and English. Both categories were further subdivided into morally deep statements (e.g., religious beliefs, feelings about family members) and those with little moral relevance (e.g., favorite beverage or travel destination). After completion of the task they were asked to rate how strongly they felt uttering the statement. Lies elicited larger SCRs in both languages, which is consistent with previous findings that lies elicit high levels of arousal. L2 English statements elicited higher SCRs across all conditions and were interpreted as increased anxiety elicited by performance in a less proficient language or FLA. Self-perceptions did not correlate with SCRs—the students rated their L1 Turkish lies as more emotionally felt; nevertheless L2 English statements elicited higher SCRs.

Studies of electrodermal reactivity provide compelling evidence of heightened arousal elicited by negatively valenced words, such as taboo words and swearwords, and phrases, such as childhood reprimands. The L1 auditory advantage in childhood and late bilinguals firmly grounds these effects in early childhood socialization (Caldwell-Harris & Ayçiçegi-Dinn, 2009; Harris, 2004; Harris et al., 2003). Harris (2004) has shown that the level of arousal can be moderated by the AoA and CoA, with early socialization in the L2 context leading to increased electrodermal response to L2 taboo words and swearwords. The discrepancies in the findings, such as the presence of the reprimand effect in late Turkish–English and childhood Spanish–English bilinguals and its absence in English monolinguals and early Spanish–English bilinguals, suggest that affective reactions may be mediated by crosscultural differences in socialization practices: reprimands may be less severe in the English-speaking context and taboo words more acceptable in the Spanish-speaking context (see also Caldwell-Harris et al., 2011).

The contradictory nature of some of the findings also highlights the limitations of the paradigm, recognized by Caldwell-Harris and associates (Caldwell-Harris & Ayçiçegi-Dinn, 2009; Caldwell-Harris et al., 2011), who state that measuring physiological responses is not a panacea for research on affective processing in bilingual speakers. Heightened levels of arousal could also be elicited by task- and L2-specific factors, such as greater cognitive effort required to process information in the L2 or anxiety over performance in the less proficient language. The lack of responses also needs to be interpreted carefully. As the setting and the task become familiar to participants, amplitudes decline and become flat. Consequently, lower SCRs may reflect lower emotionality of the stimuli or common habituation effects (Harris, 2004). An interesting challenge is also presented by the dissociation between SCRs and self-perceptions in the form of emotionality ratings. This discrepancy may indicate that the ratings are not sensitive to participants' actual experiences and are driven instead by cognitive judgments, or that the SCRs are not sensitive to

TABLE 5
Neuroimaging approaches

Study	Participants	Tasks	Results
Conrad et al. (2011)	40 late German–Spanish bilinguals 26 late Spanish–German bilinguals AoA > 12 years residing in Germany	Lexical decision task	L1 effects for positive and negative words, L2 effects for positive words and for negative words in L2 Spanish; delays in L2 visual processing
Opitz & Degner (2012)	16 German–French bilinguals 16 French–German bilinguals mean AoA = 12 years mean LoR = 14.9 months	Lexical decision task	Similar EPNs in the two languages, with a time lag in the L2
Wu & Thierry (2012)	15 native speakers of English 15 native speakers of Chinese 15 Chinese–English bilinguals AoA = 12 years, mean LoR = 20.5 months	Translation-priming task	Valence effects on processing: L2 English positive and neutral words activated L1 Chinese translation equivalents, while negative words did not

different types of affective reaction. These difficulties led Caldwell-Harris and Ayçiçegi-Dinn (2009) to ask whether neuroimaging methods could help distinguish between different sources of arousal and disambiguate different patterns of emotional response.

Neuroimaging approaches

To date, neuroimaging studies of affective processing in bilingual speakers (Table 5) have relied on event-related potentials (ERPs) and, more specifically, on early posterior negativity (EPN) effects at occipito-temporal electrode sites, interpreted as attention shift toward words with emotional relevance or spontaneous activation of the affective valence (e.g., Kissler, Herbert, Peyk, & Junghofer, 2007).

Conrad, Recio, and Jacobs (2011) examined three measures of bilinguals' performance on a visual lexical decision task: ERPs, reaction times, and error rates. The analysis of reaction times revealed that in the German-language condition, valence had no significant effect on response latencies in either L1 or L2. In the Spanish-language condition, valence had a significant effect in both L1 and L2, with responses fastest for positive words. Effect sizes decreased from L1 to L2 processing, suggesting weaker automatic processing of affective valence in the L2. Valence also affected error rates in the L2 (but not in the L1): in

L2 German, negative words were most likely to cause errors, whereas in L2 Spanish both positive and negative words generated more errors than neutral words. The ERP data in the L1 displayed effects for both positive and negative words, and in the L2 for positive words in both conditions and for negative words in L2 Spanish. In the German–Spanish group ERP effects were stronger for negative words and in the Spanish–German group for positive words, suggesting possible crosslinguistic differences in positivity–negativity biases or in the choice of stimuli.

Opitz and Degner (2012) found that both positive and negative words elicited amplified EPNs in the two languages of German–French and French–German bilinguals, but with a time lag in the L2. The participants also displayed a significantly higher rate of detection of pseudo-words in the L1.

Wu and Thierry (2012) used a translation-priming task, where, unbeknown to the participants, some English words concealed a sound repetition if translated into Chinese. These concealed repetitions facilitated priming for positive and neutral words, such as "holiday" or "theory." In contrast, words with negative valence, such as "violence," did not automatically activate their Chinese translations.

Together, the findings of ERP studies of bilingual processing provide supporting evidence for the claim that affective processing may be less automatic and immediate in the L2, due to delayed

lexical access. Wu and Thierry (2012) argue that the automaticity of this access may be further affected by affective valence. The possibility of differential processing of positively and negatively valenced stimuli needs to be examined in future research.

IS AFFECTIVE PROCESSING IN L2 PARAMOUNT TO DISEMBODIED COGNITION?

Now, what do these findings mean? To answer this question and to address the issue of disembodied cognition raised in the introduction to this review, let us try to discern converging patterns of results, without attributing undue significance to single studies. This is particularly important because studies with bilingual and multilingual participants often rely on limited numbers of participants, due to the need to control for a variety of variables. The small sample sizes combined with the fact that different studies often test different, and not directly comparable, populations preclude any strong inferences, leading me to interpret the findings with utmost caution and with an eye on issues that need to be examined in future research.

Differential affective processing and the limits of the L1/L2 metaphor

The first converging pattern of results identifies two complementary processing effects, the L1 advantage and the L2 advantage. The *L1 advantage effect* refers to increased automaticity of affective processing, seen in greater perceptual prioritization of L1 emotional stimuli (Conrad et al., 2011; Degner et al., 2012; Opitz & Degner, 2012; Segalowitz et al., 2008) and heightened electrodermal reactivity (Caldwell-Harris & Ayçiçegi-Dinn, 2009; Eilola & Havelka, 2011; Harris et al., 2003). This heightened reactivity is consistent with self-reports by bilingual and multilingual speakers (Caldwell-Harris et al., 2011, 2012; Dewaele, 2004a, 2004b, 2004c, 2010; Pavlenko, 2004, 2005), customers in advertising contexts (Puntoni et al., 2009), and patients in therapy (e.g., Schwanberg, 2010).

The parallel *L2 advantage effect* refers to decreased automaticity of affective processing, seen in reduction of interference effects (e.g., Colbeck & Bowers, 2012; Segalowitz et al., 2008), and lowered electrodermal reactivity (Caldwell-Harris & Ayçiçegi-Dinn, 2009; Eilola & Havelka, 2011; Harris et al., 2003). The decreased sensitivity to L2 emotional words, in particular taboo words

and swearwords, and overall detachment and distancing are consistent with self-reports by bilingual and multilingual speakers (Caldwell-Harris et al., 2011, 2012; Dewaele, 2004a, 2004b, 2004c, 2010; Pavlenko, 2004, 2005), writers (Kellman 2000; Kinginger, 2004; Pavlenko, 2005), and patients in therapy (e.g., Amati-Mehler et al., 1993; Rozensky & Gomez, 1983).

To explain these effects, I have put forth a theory of language embodiment (Pavlenko, 2005) which sees affective socialization in early childhood as the process of integration of phonological forms of words and phrases with information from visual, auditory, olfactory, tactile, kinesthetic, and visceral modalities, autobiographical memories, and affect. Some words become linked to positive memories (e.g., Charles Foster Kane's *Rosebud*), others to negative memories (e.g., spiders), and others, such as taboo words and swearwords, become associated with prohibition and punishment in the process of verbal conditioning. Developing jointly with autobiographical memory and emotion regulation systems, the languages thus acquire both affective and autobiographical dimensions. The evidence of such links comes from studies of bilingual autobiographical memory (e.g., Schrauf & Rubin, 2000, 2004), the auditory advantage in affective processing (e.g., Harris et al., 2003) and differential responses to taboo words and euphemisms (e.g., Bowers & Pleydell-Pearce, 2011).

The integration of language and affect in primary language acquisition is incontrovertible and would have also been banal if not for the L2 detachment effect, which requires explanation. This explanation, with regard to foreign languages, commonly involves the decontextualized nature of the language classroom, which does not provide many opportunities for integration of all sensory modalities and verbal conditioning (other than foreign language anxiety) and thus leads to development of "disembodied" words, used freely by speakers who do not experience their full impact (Dewaele, 2004a, 2004b, 2004c, 2008, 2010; Pavlenko, 2004, 2005).

The effects of such "disembodied cognition" on decision-making were explored by Keysar et al. (2012). Experiment 1 used a modified version of the Asian disease task, where the same choices are presented to participants in a gain frame (if you choose medicine A, X people will be saved) and in a loss frame (if you choose medicine A, X people will die). This task was performed by three groups of participants: (a) L1 English learners of FL Japanese in the US ($n = 121$, AoA = 17 years); (b) L1 Korean learners of FL English in Korea

($n = 144$, AoA $= 12$ years), and (c) L1 English learners of L2 French in France ($n = 103$, AoA $= 16$ years), randomly assigned to either L1 or L2 condition. In addition, a group of English learners of FL Spanish ($n = 84$, AoA $= 12$ years) performed the task in L2 Spanish. The analysis revealed framing effects (i.e., asymmetrical preferences in the gain-frame condition) in the L1 but not in the L2. In Experiment 2 the researchers tested loss aversion preferences and found that L1 Korean learners of FL English ($n = 146$, AoA $= 12$) took more bets in L2 English. Experiment 3 tested the preferences with actual cash given to L1 English learners of FL Spanish ($n = 54$, AoA $= 13$ years) and found higher willingness to take bets in L2 Spanish. These findings were interpreted as evidence of the L2 processing advantage, where decreased emotionality reduces framing biases and loss aversion.

In the context of the findings to date, this interpretation is certainly plausible. Decision-making is influenced by affective reactions to the target stimuli and in particular by anxiety, which increases risk aversion (Blanchette & Richards, 2010). Almost all of the participants in the study by Keysar et al. (2012) were late bilinguals and FL learners residing in the L1 context. Late FL learners with lower levels of L2 proficiency are the most likely to be resistant to anxiety effects of L2 words, such as "death." The only L2 group were Americans living in France and they did not differ in their performance from other groups either because of the late AoA or because of their low proficiency. The results, however, would have been much more convincing if combined with reaction times and SCRs, which allow one to differentiate between the influence of reduced emotionality and the greater deliberation required for processing in a weaker L2.

More importantly, the L1/L2 dichotomy adopted in the study by Keysar et al. (2012) and in my own discussion captures only prototypical cases of L1 and L2 acquisition, which may suffice in North America but do not do justice to the complexity of bilingualism and multilingualism around the world. The linear numbering practice (L1, L2, L3) works well with individuals who grew up with one language and acquired other languages consecutively, but fails to describe the languages of simultaneous bilinguals and multilinguals and the cases of intermittent and alternating acquisition where the L2 and L3 learned at school lose significance and the L4 becomes "the real L2" (Dewaele, 2010). The studies reviewed above show that, as a result of this complexity,

some bilingual populations display a less pronounced L1 advantage and others none at all.

The five influencing factors distinguished in these studies—the order of acquisition, the AoA, the CoA, frequency of language use, and language dominance—can be subdivided into two groups. The order of acquisition and AoA may be combined into *age effects*, seen in differences between early bilinguals who display similar rates of recall (Ferré et al., 2010), interference (Eilola & Havelka, 2011; Eilola et al., 2007; Sutton et al., 2007), and SCR responses (Harris, 2004) in the L1 and L2, and late bilinguals who display the L1 advantage in recall (Anooshian & Hertel, 1994), SCRs (Harris, 2004; Harris et al., 2003), and perceived emotionality of languages and emotional words (Caldwell-Harris et al., 2011, 2012; Dewaele, 2010). Unfortunately, in most studies early AoA coincides with the age of arrival in the L2 context, making it impossible to disambiguate AoA and CoA effects.

The CoA, frequency of use, and language dominance, on the other hand, are *context effects*, seen in differences between speakers who learned the L2 in the foreign language classroom and those who learned it in a mixed or naturalistic context (e.g., Dewaele, 2010; Harris, 2004; Harris et al., 2003). But what is it about context that drives these effects? We cannot answer this question without further disambiguation of these effects through manipulation of the LoR, frequency of use, and contexts and types of language use. The common assumption that the FL context is not "naturalistic" has done us a great disservice, for it oversimplifies patterns of language use and is particularly problematic in the case of English. Even outside of traditionally English-speaking countries, English lends itself to a variety of naturalistic uses—it may be used as a medium of instruction (e.g., in English-language universities), workplace interaction (e.g., in transnational corporations), entertainment (e.g., TV or internet), or family interaction (e.g., in bilingual families). Such usage, in turn, may lead to internalization of at least some aspects of L2 affective processing. Last but not least, the contributions of context and age may also vary depending on the level of affective processing.

Levels of affective processing and the limits of single words

The reliance on verbal stimuli is a disadvantage in the study of affective processing, because naturalistic interactions are much harder to simulate in a lab than naturalistic visual processing. As a

result, most research to date has focused on decontextualized single words that elicit weaker emotional responses than pictures. The implicit assumption in this research is that processing of isolated words out of context can tell us something meaningful about affective processing of language in general. This assumption has been questioned in research on affective processing. For example, Eder et al. (2007) argue that differential processing of emotion-laden and neutral words does not tell us anything about the processes driving the differences. The effects may stem from emotionality, novelty, a specific configuration of the stimuli or the processing goals implemented through the task setting. The studies above show that in bilingual processing the findings may be further affected by different levels of proficiency, with L2 emotional words prioritized due to novelty or the deeper cognitive processing required to access their affective valence (Ayçiçegi & Harris, 2004; Ayçiçegi-Dinn & Caldwell-Harris, 2009).

More importantly, the language we process on an everyday basis is not simply a string of more or less emotional words, registered one by one. The focus in everyday interaction is on detection of intentionality and relevance, precisely the aspects that are missing in the lab. The words "pompous asshole" might make us smile when heard in a lab recording and hurt when overheard in a conference hallway in reference to ourselves. The most robust crosstask effects to date, with monolinguals and bilinguals, have been obtained with taboo words and, to a lesser degree, aversive words and childhood reprimands (e.g., Ayçiçegi-Dinn & Caldwell-Harris, 2009; Eilola & Havelka, 2011). These words are often adopted as a stand-in for the languages they represent, yet I am not convinced that this is a legitimate generalization. The levels of arousal elicited by these words are linked to verbal conditioning and *residual emotionality*, i.e., previous uses and experiences with these words in emotional contexts. But once we have exhausted our pool of names for terminal illnesses, genitalia, and sexual acts we are still left with hundreds of thousands of words that may not produce any visible effects out of context.

So where do we go from here? In terms of ecological validity, the most logical direction is to study how words function in context, and that is indeed the direction taken in some of the recent research with monolingual (e.g., Burbridge et al., 2005; Schmidt, 2012) and bilingual (e.g., Caldwell-Harris & Ayçiçegi-Dinn, 2009; Keysar et al., 2012) speakers. In the study of bilingualism such focus makes particular sense because perception of individual words is not the area where bilinguals

themselves experience the key differences. The original impetus for research on bilingualism and emotions came from perceptions of language differences in speaking and memory retrieval (Buxbaum, 1949; Greenson, 1950; Krapf, 1955) and it is these processes that need to be examined in future research. This examination needs to distinguish, minimally, between four levels of processing.

The first two are interpretive processes, categorization and attribution, which function at the higher level of cognition. In the process of categorization, speakers use linguistic categories to interpret and convey their own feelings and to identify affective reactions of others, using content, prosody, and context to guide their interpretation. Studies show that even in the case of vocal cues, some of which are assumed to be universal, identification displays the in-group advantage and is affected by familiarity with the language in question (Elfenbein & Ambady, 2002; Juslin & Laukka, 2003; Pavlenko, 2005). Similar to other types of conceptual knowledge (e.g., Jarvis & Pavlenko, 2008), acquisition of language-appropriate emotion identification patterns is hypothesized to be influenced by context effects but not by age.

In the process of attribution, speakers attribute affective qualities to verbal stimuli, from individual words and speech acts to particular languages (and their speakers). These attributions may be affected by perceived language emotionality, in particular in the case of taboo words and swearwords, but they are largely cognitive judgments, shaped by the interplay of individual socialization experiences and language ideologies. This is not to say that some of these attributions are not felt— like any other entity, languages may become emotion-inducing stimuli and elicit heightened electrodermal reactivity, as seen in the case of foreign language anxiety (Caldwell-Harris & Ayçiçegi-Dinn, 2009). The ability to make attributions and to develop affective responses to languages should not be affected by age and context—throughout our life, we continue to evolve new likes and dislikes and may also develop new linguistic affections, enjoying the pleasant softness of one language and disliking the harsh sounds of another.

The differences between monolinguals and bilinguals become more apparent at the level of automatic processing, where we can also distinguish two processes, the processing of affective valence and somatovisceral responses. The L1 processing of affective valence usually displays increased automaticity (Conrad et al., 2011;

Degner et al., 2012; Opitz & Degner, 2012; Segalowitz et al., 2008), but speakers dominant in the L2 and those who learned the L2 early or use it frequently in the L2 context may approximate L1 patterns in affective priming (Degner et al., 2012; Eilola & Havelka, 2011; Eilola et al., 2007; Sutton et al., 2007) and ERPs (Conrad et al., 2011; Opitz & Degner, 2012). Approximation of somatovisceral responses, on the other hand, is not as easy. Eilola and Havelka (2011) found that the same L2 speakers may converge with L1 speakers in the processing of affective valence and diverge in patterns of electrodermal reactivity.

Undoubtedly, the distinction between top-down and bottom-up processes does not do justice to the complexity of affective processing. How should we characterize memory retrieval, the act that triggered the whole investigation of bilingualism and emotions? It can be conscious and yet some memories also come unbidden, triggered by a word, sight, or smell. The same argument could be made about other higher-level processes, such as interpretation, judgment, reasoning, or decision-making, all of which have automatic dimensions. Consequently, there are benefits to the study of integrated processes and to distinctions between them. The study of integrated processes could help us understand everyday language processing, while the study of differences between levels and types of processing could help us resolve the question raised by Eilola and Havelka's (2011) findings: why do L2 users approximate L1 speakers in automaticity of valence processing but not in automaticity of electrodermal reactivity response?

Language embodiment: Evolutionary adaptation or frequency effects?

I suggest two alternative explanations of the language embodiment lag, seen in decreased electrodermal responses. The first, focused on age, involves maturation. But why should somatovisceral reactivity to language be affected by maturation? My answer to this is purely speculative and linked to other linguistic abilities prominent in the L1 but not in the L2. Ever since Lenneberg (1967) put forth the idea of the critical period for language acquisition, scholars have been debating its existence in the L1 and L2. Recent empirical studies provide compelling evidence that achievement of native-like L2 competence and in particular native-like pronunciation decreases with the increase in the AoA and is close to impossible after the age of 12 (Abrahamsson, 2012; Abrahamsson & Hyltenstam, 2009; but see

Ioup, Boustagui, El Tigi, & Moselle, 1994). In the L1, on the other hand, we display great skills of native-like pronunciation and discrimination between various accents and dialects (e.g., Bresnahan et al., 2002; Lippi-Green, 2012). The "in-group" advantage also applies to emotion identification through vocal cues: as discussed above, it is slower and less accurate in a non-native language (Elfenbein & Ambady, 2002; Juslin & Laukka, 2003; Pell & Skorup, 2008; Pell et al., 2009).

These differences suggest that in the process of language evolution and divergence we have become equipped with the ability to acquire linguistic markers of in-group membership and to use linguistic cues to differentiate between in-group and out-group members, an adaptation that once upon a time would have had significant value. Furthermore, we do not simply differentiate. We also attribute affective meanings to particular linguistic cues, often favoring our own (e.g., Bresnahan et al., 2002). This too makes sense in terms of adaptive value: positive affect attached to "our" speech and negative affect attached to that of the outsiders could speed up the recognition of friend or foe. But as the ability to attribute affective meanings does not appear to decrease with age, why should language embodiment display maturational effects?

For most of their history humans lived in relatively small groups, with little boundary crossing. The great transnational migrations are a relatively recent phenomenon, even if we count ethnolinguistic changes wrought by Indo-European horse riders or the armies of Alexander the Great, Caesar, and Genghis Khan. Until the emergence of agriculture and the first cities, there was little adaptive value in maintaining past childhood the ability to learn another language in a native-like manner or to integrate this language with affect. To the contrary, the decreased ability to link the later learned language to emotions and to be perceived as an insider in another speech community could have served as an additional inducement for individuals to stay within the in-group. The maturational effects in language embodiment—but not in the ability to attribute affective meanings or to process affective valence—could thus represent an evolutionary adaptation that facilitated the maintenance of group boundaries or simply the lack of natural selection for a trait that did not, until relatively recently, provide a clear advantage.

The competing explanation, put forth by Caldwell-Harris et al. (2012) and Degner et al. (2012), privileges context effects and suggests that

the automaticity of affective processing is influenced by the frequency of language use. Importantly, the first study is based on self-reports and the second focuses on affective priming; consequently, they do not allow us to differentiate between priming effects and somatovisceral reactivity. The high frequency of L2 use undoubtedly influences the automaticity of L2 valence processing but it is up to future research to examine if, how, and when it influences somatovisceral reactivity. The key question here is what is the mechanism that drives context effects?

We can think of at least two possibilities. The first involves the mere-exposure effect or the frequency of use. Winkielman and Cacioppo (2001) found that increased frequency of exposure facilitates stimulus processing, which in turn elicits positive affective responses. In the context of language use, high frequency of L2 use increases language activation and also leads to facilitated retrieval and sometimes even a shift in language dominance. This effect of increased familiarity is undoubtedly possible and may be particularly evident in reduced FLA in subsequently learned languages (Dewaele, 2010), but it does not explain a full range of affective reactions, including ones linked to negative memories and experiences.

Another possibility involves the emotionality of the contexts of use, with emotionality being an intrinsic property of primary language acquisition and a variable property in secondary or subsequent language acquisition. In this view, consistent with the findings in the study of L1 processing of emotional stimuli (Brosch et al., 2010), emotionality of the interactions increases implicit relevance of particular verbal stimuli and enhances formation of long-term memory traces. Stronger traces, in turn, facilitate activation and lead to perceptual prioritization of these stimuli. Undoubtedly, it is also possible that there is no one cause-and-effect explanation and that processing advantages are shaped by the interplay of age and context effects. Insights into this interplay would enhance our understanding of the language faculty, but how could we test the different possibilities, given that people do not go through a second childhood in the L2?

The first population that allows us to examine the differential predictions of maturation, frequency, and context theories are L1 attriters; that is, late bilinguals—commonly immigrants or partners in bilingual couples—who live in the L2 context and have experienced a shift in language dominance to the L2 and L1 attrition. The combined effects of L1 attrition and dominance shift were shown to reduce the perception of

language emotionality (Dewaele, 2004c) but no studies to date have directly examined their effects on affective processing and language embodiment. If language embodiment is subject to maturation effects, these adults should still display heightened reactivity to the L1 and lower reactivity to the L2. If it is modulated by the frequency of use and language dominance, they should display equal or heightened reactivity to the L2 stimuli. And if it is modulated by the contexts of learning, we should see heightened arousal in those who are engaged in emotional relationships in the L2, in particular parenting, which is the closest we can come to reproducing the L1 childhood in another language.

Another important population involves international adoptees, children whose contact with the L1 was cut at an early age and who may display complete or near-complete L1 attrition. To examine the extent of such attrition, Pallier et al. (2003) recruited eight Korean adoptees in France (AoA 3–8 years) who reported that they had completely forgotten Korean. Both the adoptees and native speakers of French unfamiliar with Korean were asked to identify Korean sentences among recordings in Korean, Japanese, Polish, Swedish, and Wolof. The two groups performed similarly, failing to distinguish Korean sentences from Japanese. The functional magnetic resonance imaging (fMRI) measures did not detect any specific cortical activation in the adoptees in response to Korean stimuli relative to unfamiliar languages, while the areas activated by French stimuli were similar in the adoptees and native speakers of French. These findings suggested that in the case of global L1 attrition and replacement of the L1 with the L2, L1 verbal stimuli may no longer be perceptually prioritized. These findings, however, need to be replicated with a larger participant sample. For instance, Hyltenstam, Bylund, Abrahamsson, and Park (2009), who studied Korean and Latin American adoptees in Sweden, support the argument about the dominant language replacement but document some remnants of the L1. Furthermore, neither study examined affective processing. Direct examination of such processing in adoptees varying in the AoA could help us better understand the respective contributions of age and context.

CONCLUSIONS

In their introduction to the special issue of *Cognition and Emotion* on affective processing, Eder et al. (2007) argued that "the question of whether affective and cognitive processing are

distinctive can be reduced to the question of whether evidence can be found for effects that are driven exclusively by the affective properties of stimuli or participants and that cannot be reduced to the operation of more general cognitive processes" (p. 1145). The studies reviewed here identify a difference between "affective properties" of two populations: late bilinguals who process affective valence in the L2 semantically and early bilinguals who also display somatovisceral reactivity (Eilola & Havelka, 2011; Harris, 2004). This differential reactivity reveals a promising area for future research, namely language embodiment, which can be best examined in speakers of two or more languages. The findings to date also allow us to leave aside the question of which language is more emotional (the answer is: "It depends") and to replace it with more complex and nuanced questions involving age and context effects in automatic processing of affective valence and somatovisceral reactivity.

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