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The perception of swear words by French learners of English: an experiment involving electrodermal activity

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1. Introduction

1.1. A speaker's L1 and L2 are processed differently

1 We do not process a second language the way we do our first. Our native language (L1) is acquired in an implicit manner, through automatic statistical computations done on the input (Hulstijn 2005). These mechanisms give way to what feels like intuitive knowledge about the language: we instinctively know whether a sentence is acceptable or not in our L1. On the contrary, knowledge in a foreign language we learn later in life (L2) does not, at least at first, feel intuitive. Explicit mechanisms are required to acquire another language, partly because they are in fact shortcuts that enable adult learners to gain mastery of an L2 in a much shorter time and with less exposure to the language (Andringa & Rebuschat 2015), and partly because the implicit mechanisms that were recruited in early childhood are not as efficient in adulthood (Paradis 2009).

2 In the L1, vocabulary is stored in declarative memory, which is associated with the storage and conscious retrieval of knowledge that can usually be verbalized. Syntax, however, is processed with the help of procedural memory, where habits and automatic skills are stored in a way that is inaccessible to consciousness. The initial learning of an L2 is mostly assisted by declarative memory: not only vocabulary but also grammatical rules, chunks and formulae are stored explicitly to try and form correct utterances in the L2. With experience and exposure to the L2, the mechanisms used to process the two languages tend to converge (Ullman 2001; Steinhauer et al. 2009). However,

whether native-like mechanisms can be used to process every aspect of the L2 once in its final stage of learning, remains an object of debate. For instance, it has been argued that, although vocabulary can mostly be learned to a native-like level in declarative memory, the exact semantic boundaries of each word cannot be acquired after a critical period ending around puberty or even earlier in childhood (Birdsong 2006). This may also include the emotional valence and tabooness of words in the L2.

3 Pavlenko (2005) theorized that there is a crucial difference between L1 and L2 in terms of embodiment. She suggests that affective socialization in early childhood is, in fact, the process of integration of phonological forms of words with information coming from visual, auditory, tactile and visceral modalities, autobiographical memories, and affect. In turn, some words become associated with positive memories, some with negative memories, and others, such as swear words, become associated with punishment and prohibition through the process of verbal conditioning. Languages evolve hand in hand with memory and emotional regulation, and thus acquire the appropriate affective and autobiographical dimensions. This is consistent with usage-based accounts of the nature of linguistic representations: they are stored as exemplars containing detailed information about linguistic experience, including redundant features, pragmatic, contextual, and social information (Bybee 2010).

4 This integration of language and affect in our first language is irrefutable, and could be considered banal if the second language were not so contrarily detached, or "disembodied". This detachment with regards to foreign languages may be explained by the commonly decontextualized nature of the language classroom, which does not specifically provide opportunities for integration of all sensory modalities and verbal conditioning. This decontextualization may result in the 'disembodied' processing of all emotionally charged words, as their emotional impact is not fully experienced by learners (Dewaele 2004a; 2004b; 2004c; 2008; 2010; Pavlenko 2004; 2005). Grosjean (2008) also suggests that a complementarity principle is present within a bilingual's mind, which implies that bilinguals' skills in different areas are language-dependent, due to the fact that their languages are acquired and used in different contexts, with different people, and for different purposes.

5 With regard to these theories, cognitive processing and affective processing should be studied separately, especially given the possibility that the L2 is processed only semantically and not affectively. Zajonc (1980) claims that the argument that cognition determines affect is wrong, and it is more pertinent to instead examine how affect determines cognition. Scherer (2009) defines affective processing as somatovisceral responses triggered by automatic appraisal of verbal stimuli, which might or might not be detected as subjective emotion at the level of higher cognition. This depends on their novelty, pleasantness, and the individual's personal goals and motivation. This view of affective processing as a subjective process driven by an individual's needs, and linguistic and cultural categories, gives more insight into understanding the variation in experienced language emotionality.

6 The differential reactivity of bilinguals was noticed more than 100 years ago by Freud and his disciples, who found that some of their bilingual and multilingual patients favored their L2 or LX for the use of "obscene" words (Ferenczi 1916; Freud 1893). This phenomenon was further explored by post-Second World War psychoanalysts, and later, clinical studies provided evidence that bilinguals and multilinguals may display differential affective reactivity when using taboo words in different languages (Amati-

Mehler et al. 1993; Aragno & Schlachet 1996; Javier 1995; Movahedi 1996; Rozensky & Gomez 1983). On the one hand, clinical studies rely on therapists' observations, and on the other hand, introspective approaches examine speakers' own perceptions of emotionality of their respective language. Others turn to psychophysiological approaches that rely on physiological markers of autonomic arousal, such as heart rate, activation of facial muscles, or, more relevantly here, electrodermal activity.

1.2. Electrodermal activity (EDA)

7 Electrodermal activity is a property of human skin which is related to the sweat glands. It reflects the continuous variation in the electrical characteristics of the skin resulting from the sympathetic nervous system activity (Braithwaite et al. 2013). It is considered to be the only autonomic psychophysiological variable that is uncontaminated by parasympathetic activity. Moreover, it has been closely linked to autonomic emotional and cognitive processing, and is therefore widely used as a direct measure of emotional processing.

8 Electrodermal activity is viewed as a complex that enrobes two main components, tonic and phasic, which in turn result in different measurements. On the one hand, the tonic level reflects the slower acting components, as well as background characteristics of the signal. The common measure of this component is Skin Conductance Level (SCL), which is believed to reflect changes in autonomic arousal. On the other hand, the phasic component shows the faster changing elements of the signal, reflected through its most common measure of Skin Conductance Response (SCR). The term "response" for phasic phenomena implies a direct relationship to a stimulus that produces an electrodermal response (EDR), the intensity of which is determined by the intensity of the stimulus and its psychological significance (Boucsein 2012). Moreover, there is evidence that both tonic and phasic components are important and that they may rely on different neural mechanisms (Dawson et al. 2001; Nagai et al. 2004).

9 There is a long history of measuring emotional impact in terms of EDA, and its validity has been supported by brain imaging studies that have examined the correlation between EDA and limbic activity, in particular within the amygdala, the emotional center of the brain (Liberzon et al. 2000). Electrodermal activity is considered to be one of the most sensitive physiological measures of emotional and cognitive activation (Hugdahl 2001). It can be used to examine implicit emotional responses that may occur on an unconscious level or are beyond cognitive intent. This is why it has helped illuminate some wider areas of enquiry, especially in psychopathology, personality disorders, conditioning, neuropsychology, etc. It is a very important variable in psychological science. Furthermore, in recent research, it has been shown to index attentional processes, where salient stimuli and tasks evoke increased EDA responses. More recent research introduces its use in linguistics as well, as a way to measure differential responsiveness to words (Bowers & Pleydell-Pearce 2011; Caldwell-Harris & Ayçiçeği-Dinn 2009; Caldwell-Harris et al. 2011; Eilola & Havelka 2011; Harris 2004; Harris, Ayçiçeği & Gleason 2003).

1.3. Affective processing in L1 and L2

10 Studies on monolinguals show that threatening stimuli, such as insults or taboo words, consistently elicit greater skin conductance, as opposed to emotionally neutral words (Gray et al. 1982; Dinn & Harris 2000; Manning & Melchiori 1974; McGinnies 1949). In a more recent study, Bowers & Pleydell-Pearce (2011) explored the differential responses to taboo words and euphemisms in monolinguals, yielding the same results. Burbridge et al. (2005) even found that English speakers display higher heart rates and higher frequency of non-specific SCR in discussing negatively valenced topics.

11 However, through a series of studies by Caldwell-Harris and associates investigating electrodermal reactivity in bilinguals (Caldwell-Harris & Ayçiçeği-Dinn 2009; Caldwell-Harris et al. 2011; Harris 2004; Harris, Ayçiçeği & Gleason 2003), it was concluded that there is an auditory advantage in affective processing, because spoken language is acquired before visual language, at least in the L1, and therefore probably has more diverse emotional associations than written language. This view is supported by various studies with monolinguals. For example, Kissler et al. (2006) showed that although electrophysiological responses are reliably detected, they are not as large for visually presented emotionally laden words as they are for auditorily presented ones. Moreover, the auditory modality may activate autobiographical memories in speakers, provoking a stronger emotional response (Schrauf 2000).

12 Harris (2003) was the first to use electrodermal recording to study differential activity in the languages spoken by bilingual individuals. Working with late Turkish-English bilinguals, she found that the elicited SCRs were more remarkable in their L1 than in their L2. The largest difference between the two languages occurred with childhood reprimands, linking emotionality to social experiences and verbal conditioning. For both monolinguals and bilinguals, the strongest crosstask effects to date have been obtained with taboo words and, to a lesser degree, aversive words and childhood reprimands (e.g. Ayçiçeği-Dinn & Caldwell-Harris 2009; Eilola & Havelka 2011).

13 In this study, we investigated how bilinguals would react to taboo words in their first and second language. To that end, we recorded the electrodermal activity of French learners of English while they heard insults (e.g., “bitch”) and emotionally neutral words (e.g., “airplane”) in both languages. According to Pavlenko’s theory of embodiment (Pavlenko 2005), we expected that participants would show a gap in reactions between taboo and neutral words in their native language (French), but not in their L2 (English).

2. Experimental methods

2.1. Participants

14 Ten[1] female undergraduate English majors between 20 and 23 years of age (*M*: 20;10) took part in the experiment. Female participants were chosen due to the limited number of male students in our English department. They were all native speakers of French who had been raised as monolinguals and had upper-intermediate proficiency in English.

2.2. Material

15 Ten swear words were selected in English and in French separately. Words were not translated from one language to the other. Instead, five native speakers of each language were prompted to give as many swear words as they could, and the critical stimuli were selected from these lists according to the following criteria: they needed to be immediately recognizable as insulting, specifically aimed at women or applicable to them, and relatively short. Thirty neutral words were added in each language as fillers. The full list of stimuli can be consulted in the Appendix. These 80 words were recorded in a sound-attenuated booth by a simultaneous balanced bilingual, native speaker of both French and English, with an AT2020 USB microphone and Audacity (www.audacityteam.org, version 2.1.0) at a sampling rate of 44,100 Hz and a depth of 16 bits.

16 To make sure that any observed difference in electrodermal activity (EDA) was due to the type of word (neutral / swear word) or the language (L1 / L2) and not to a difference in intonation contour, the f0 contour was normalized with Praat (version 6.0.36, Boersma 2017) according to the following procedure. First, a mean f0 contour was extracted from all the stimuli whatever their category. Each stimulus was then modified to conform to this new mean f0 contour.

17 This altered version of the original audio was copied to the left channel of a stereo sound file. The right channel contained a trigger, i.e. a manually positioned quick rise and fall in the signal that was later used in the analysis as a timestamp to automatically locate the onset of each stimulus.

18 A presentation list was generated for each participant, in which the 80 words (40 in each language, 20 swear words in total) were fully randomized. The audio signal from the left channel of the stimuli was sent to both earphones while the trigger from the right channel of the audio file was recorded on a separate channel on our acquisition system.

2.3. Procedure

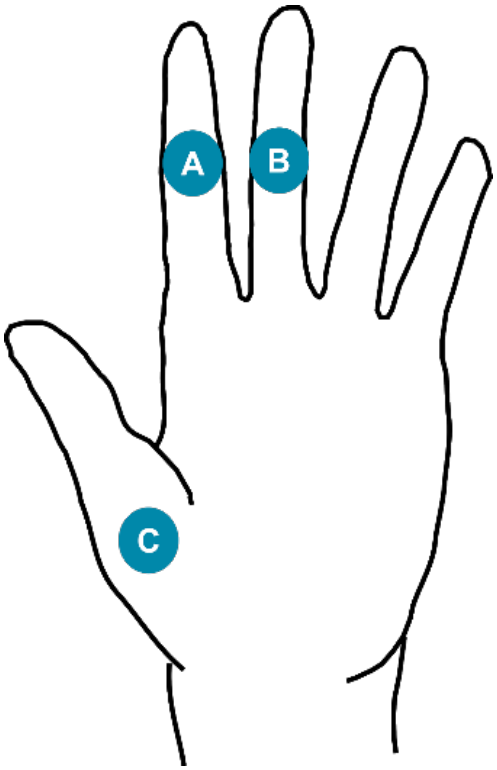
19 The electrodermal activity (and the trigger) was recorded with a BITalino (r)evolution Plugged Kit BT (Silva et al. 2014) and MATLAB R2017b. Electrodes for EDA data collection were placed at locations A, B et C (see Figure 1) on the participants' non-dominant hand. The signal was acquired with a 1-kHz sampling rate and a 10-bit depth.

20 Participants were seated at a table in a quiet room and asked to lay their non-dominant hand on the table and to avoid excessive movement during the experiment. The stimuli were played through Peltor circumaural noise-attenuating cups equipped with TDH-39 earphones. The volume was adjusted to a comfortable level prior to the experiment with a list of nonwords.

21 The experiment started with a 180 s wait during which participants were asked to relax, so that EDA would have time to stabilize. Participants then heard each word followed by a 10 s pause which was meant to let the participants' stress level return to its resting state. While the stimuli were presented, participants were asked to write down the word they had just heard. This task was added for two reasons. First, it kept participants focused on the experiment, and thus made sure they actually paid

attention to the stimuli. Second, it enabled us to check that the participants had understood each word correctly, notably the swear words in their non-native language.

Figure 1 Electrode placement for EDA recording



2.4. Analyses

22 The raw voltage EDA data for each participant was first converted to microsiemens (µS). A polynomial curve was fitted to and subtracted from the data to remove the drift that is typical of this type of signal. Then a zero-phase low-pass filter with a 5-Hz cutoff was applied. Timestamps were automatically extracted from the appropriate channel and used to split the EDA signal into epochs ranging from stimulus onset minus 100 ms to onset plus 9,000 ms. Each epoch was baseline-corrected with reference to the 100 ms of signal preceding stimulus onset, i.e. the mean value from this 100 ms chunk was subtracted from the remainder of the epoch.

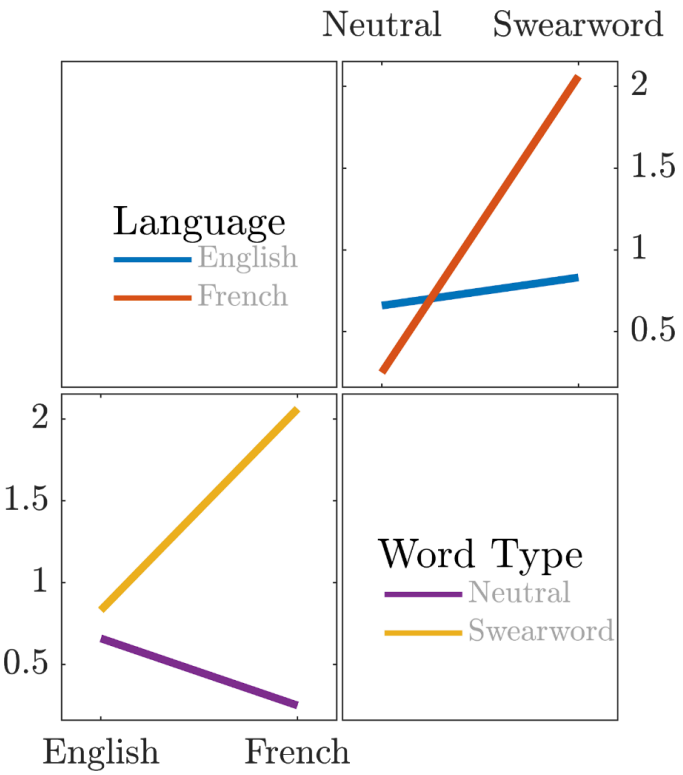
23 For each speaker, the mean epoch in each of the four conditions (French-Neutral, French-Swear word, English-Neutral, English-Swear word) was computed, yielding four curves per participant. Individual datasets were z-scored to compensate for the different range of EDA values across speakers.

24 A two-way analysis of variance was conducted with Language and Word type as between-subject factors and the maximum EDA value per speaker and condition as a dependent variable.

3. Results

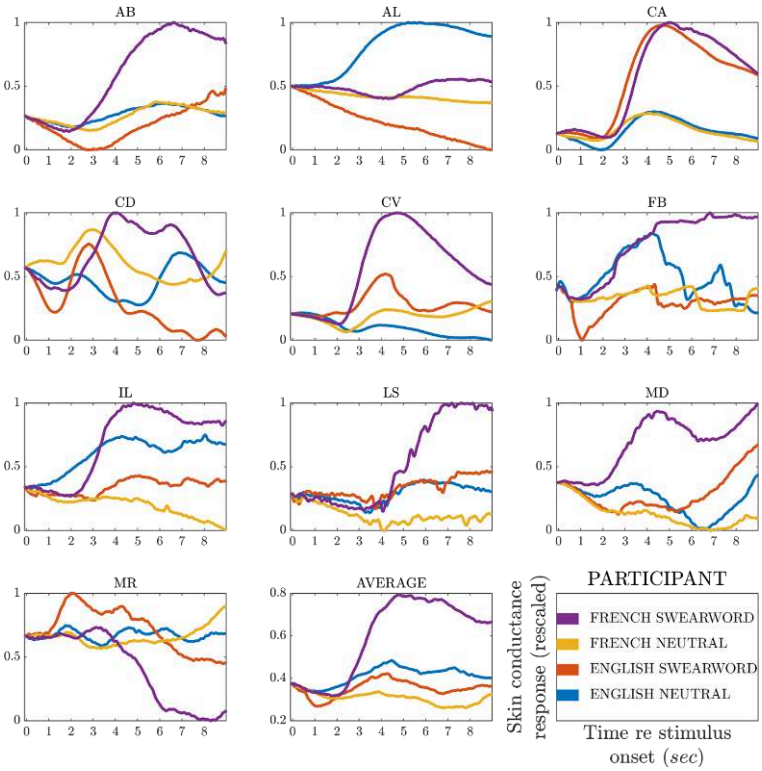
25 There was a significant main effect of Word type ($F(1,36)=16.07$, $p<.001$) and a Word type Language interaction ($F(1,36)=10.98$, $p<.01$). Post-hoc analyses of the interaction revealed that the effect of Word type (a larger reaction in response to swear words compared to neutral words) was limited to French ($M_{(French,Swear\ word\ -\ French,Neutral)}=1.81$, $p<.001$) (see Figure 2).

Figure 2 Interaction between word type and language



26 Figure 3 shows the individual profile of each participant. We can see that not all responses follow the general pattern. Some suggest better proficiency in and embodiment of the L2: CA exhibits an equally strong response to swear words in her L1 (French) and L2 (English). Other patterns are more unusual. For instance, MR displays a negative response to French swear words instead of the positive deflection observed in other participants. Even more surprising, AL's reaction to English neutral words is higher than for all other types of words.

Figure 3 Average pattern and individual responses to neutral and swear words in French and English



4. Discussion

27 In this experiment, we investigated how learners react emotionally to swear words in their native and second languages. We recorded the electrodermal activity of French learners of English while they heard neutral and swear words in their L1 and L2. We hypothesized that participants would have a stronger reaction to swear words than neutral words in their native language (French) but not in their second language (English). Our results support this hypothesis, although individual variability was high. Most participants' responses follow the general pattern, with the exception of some noisy data, which may be the result of individual skin properties or each participant's capacity to stay still during the experiment. One listener exhibits responses that suggest that her L2 is embodied almost to the same degree as her L1 (see Figure 3, participant CA), which may be to the result of better proficiency or of a higher frequency and variety of interactions in the L2. More metalinguistic data is needed for a more accurate interpretation of this pattern.

28 The profile of other participants is harder to explain. For one participant, the polarity of the expected response is reversed (negative instead of positive deflection), which may be due to idiosyncratic skin properties (see Figure 3, participant MR). For another, the only type of word that seems to trigger an autonomic response is English neutral words (see Figure 3, participant AL). This may be due to lower proficiency, or to higher anxiety associated with speaking the language: the participant may have been nervous about having misidentified insults as neutral words in English. Swearwords might also

have triggered responses going in opposite directions, i.e. an increase or decrease (as for participant MR) in skin conductance, which cancelled themselves out.

29 The individual differences in arousal do not necessarily imply differences in the understanding of the denotative meaning of the stimuli. Previous studies have shown that second-language learners seem to access the denotative meanings of emotionally charged words in their L2, but do not respond to their connotative meanings to the same extent as they do in their L1 (Eilola & Havelka 2011; Harris et al. 2003). Some further implications are that the emotional advantage is conditioned by the age of acquisition and proficiency, suggesting that the emotionality differences should be the strongest when L1 is the native language, and L2 a less proficient, foreign language (Caldwell-Harris 2014). This is mostly consistent with our findings when we factor in basic participant information: all participants reported being late bilinguals (they started acquiring in primary school) at an upper-intermediate level.

30 In addition to early age of acquisition and high proficiency, emotional responses are stronger when language is learned via immersion, as opposed to in a classroom setting (Dewaele 2010). This may be a crucial factor in our participants' responses, who all acquired their L2 through classroom learning, and had no immersion experience. Another important factor is high usage frequency (Degner et al. 2012). Words and phrases can come to have a distinctive emotional feel by virtue of being learned, or habitually used, in a specific emotional context. Indeed, it is one thing to know that a word is taboo in the L2, and quite another to witness a native speaker's reaction to hearing the word. Such a reaction is usually of intense discomfort, which can help condition the word for the L2 speaker. If activated in adequate social contexts, the taboo words can then come to have an effect on an L2 speaker, independently of their L1 (Degner et al. 2012). Our participants reported being most frequently exposed to their L2 in classroom contexts, which in turn might reduce their automatic affective processing of L2 as compared to L1. Nevertheless, it cannot be assumed that this is related to generally slower or less automatic semantic language processing (Segalowitz et al. 2008).

31 Furthermore, it should be taken into account that bilingual speakers' affective reactions may be influenced by factors other than semantic or pragmatic, such as the phonological form of the word (Bowers & Pleydell-Pearce 2011; Degner et al. 2012; Eilola & Havelka 2011; Harris et al. 2003; Segalowitz et al. 2008). Bowers and Pleydell-Pearce (2011) found that skin conductance responses in monolinguals were higher when reading actual swearwords (e.g., "fuck") than euphemisms having the same semantic content (e.g., "the F-word"), which shows that the actual form of the word has more emotional charge than its meaning. They dismiss the possibility that the semantic analyses of words have a role to play in emotionality. They cite Harris et al. (2003)'s study on bilinguals as corroborating evidence for this hypothesis: the participants' familiarity with taboo words, or even their translation equivalents, had no effect on the EDA reports. This is consistent with our findings, considering that our participants knew the semantic content of all the stimuli, and were aware of the taboo surrounding the swear words. Bilinguals, regardless of their level of proficiency, often report that they are aware of the meaning of the words, and the charge that they carry, but admit to still not being able to "feel" it (Pavlenko 2005). The reason for this may be that phonological forms in one's L1 store more information from other modalities, such as visual, auditory, tactile, kinesthetic, that in turn are not present in the phonological

forms of their L2. There may be a certain interference to take into account between L1 and L2, regarding words that could take similar phonological forms, i.e. cognates. Therefore, it is conceivable that an L2 speaker could have a strong emotional response to a word if it carries the same semantic content and takes a similar phonological form to a word in their L1, as if the encounter had activated and transferred all the information that was previously stored in the L1 phonological form only. However, further research is needed to confirm this hypothesis. The insults we used were frequent and familiar to each group of native speakers, but they were not cognates – or even semantic equivalents – between the two languages, as we chose to control for familiarity in priority. A potential step for further study would be to look at learners' response to neutral L2 words whose phonological form is similar to that of French taboo words.

5. Conclusion

32 In this study, we found that upper-intermediate, classroom-instructed L2 learners were less emotionally sensitive to insults in their L2 than in their L1, as evidenced by smaller skin conductance responses to the former than the latter. This confirms that a relatively high proficiency is not enough for real emotional processing of the L2, and that exposure might be necessary. Further research incorporating more varied learner profiles as well as words controlled for their phonological form will help determine whether more natural exposure or phonological form influences affective responses the most.

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APPENDIXES

Appendix - List of stimuli

1 – Swear words in French (10)

casse-couille

connasse

dinde

garage à bite

guenon

mal baisée

pétasse

poufiasse

salope

suceuse

2 – Swear words in English (10)

asshole

bitch

cunt

ho

motherfucker

piece of shit

pussy

shithead

slut

whore

3 – Neutral words in French (30)

abeille

abricot

album

allumette

ampoule

ananas

aquarium

armoire

arrosoir

artichaut

avion

cercle

cerveau

chaise

chemisier

classeur

horloge

labyrinthe

lunettes

mèche

microscope

placard

poche

porte

sablier

sel

tabouret

trombone

tronc

ville

4 – Neutral words in English (30)

airplane

border

box

branch

column

cycle

fence

foot

glue

habit

handle

job

label

marble

margin

name

noon

panel

phone

pottery

rice

rock

sheet

soap

spare

stamp

street

trace

track

uniform

NOTES

1.

The small number of participants is due to the fact that this was a pilot study. We plan to collect data from more participants in the future.

ABSTRACTS

Hearing swear words or taboo words causes us discomfort. Research suggests that emotional responses caused by such words are stronger when the words are spoken in the listener's first language (L1), rather than their second language (L2). We attempt to replicate these findings with a perceptual experiment. French learners of English were asked to listen to English and French swear words while their electrodermal activity (EDA) was monitored. Emotionally-neutral words were also included as baseline. EDA records small fluctuations in skin conductance caused by variations in the activity of sweat glands. Such variations are known to be correlated to the emotional state of the listener and reflect levels of stress or arousal in particular. We found a Word type Language interaction, which shows strong emotional reactions to swear words limited to the listener's first language. This supports the claims that the L1 and L2 may be embodied differently, with the L2 being processed only semantically but not affectively. The role of different factors on L2 emotionality is discussed.

Entendre des mots grossiers ou des mots tabous met souvent mal à l'aise. Cependant, il a été démontré que la réponse émotionnelle qui en découle est plus forte lorsque les mots sont dans la langue maternelle (L1) de l'auditeur plutôt que dans une deuxième langue (L2). Pour répliquer ces résultats, nous avons réalisé une expérience dans laquelle nous avons demandé à des apprenants francophones de l'anglais d'écouter des mots grossiers (des mots émotionnellement neutres ont été inclus comme contrôles) en anglais et en français alors que leur activité électrodermale (EDA) était enregistrée. L'EDA reflète les légères fluctuations de la conductance de la peau dues à des variations dans l'activité des glandes sudoripares. Ces variations sont corrélées à l'état émotionnel du participant et, en particulier, indiquent des états d'excitation et de stress. Les résultats ont montré une interaction entre le type de mot et la langue : les mots grossiers provoquaient une réaction émotionnelle plus forte que les mots neutres, mais seulement dans la langue maternelle des participants. Ces résultats sont en accord avec l'hypothèse que la L1 et la L2 pourraient être incarnées différemment, la L2 étant traitée seulement sur le plan sémantique et non affectif. Nous discutons également le rôle de différents facteurs dans la manière dont la L2 est traitée sur le plan émotionnel.

INDEX

Mots-clés: Acquisition langue seconde, émotions, cognition (dés)incarnée, activité électrodermale, mots tabous
Keywords: Second language acquisition, emotions, (dis)embodied cognition, electrodermal activity, taboo words

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