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Lying and perception of lies by bilingual speakers

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Abstract

Multiple studies on bilingualism and emotions have demonstrated that a native language carries greater emotional valence than the second language. This distinction appears to have consequences for other types of behavior, including lying. As bilingual lying has not been explored extensively, the current study investigated the psychophysiological differences between German (native language) and English (second language) in the lying process as well as in the perception of lies. The skin conductance responses of 26 bilinguals were measured during reading aloud true and false statements and listening to recorded correct and wrong assertions. The analysis revealed a lie effect, that is, statistically significant differences between valid and fictitious sentences. In addition, the values in German were higher compared to those in English, in accordance with the *blunted emotional response account* (Caldwell-Harris & Aycicegi-Dinn, 2009). Finally, the skin conductance responses were lower in the listening condition in comparison to the reading aloud. The results, however, are treated with caution given the fact that skin conductance monitoring does not allow assigning heightened reactivity of the skin to one exclusive cause. The responses may have been equally induced by the content of the statements, which prompted positive or negative associations in the participants' minds or by the specific task requirements.

Keywords: bilingual emotionality; fake news; lying behavior; skin conductance

Globalization has made our world into a multilingual space, in which languages are no longer confined to certain territories. On a daily basis, we communicate with our families in our mother tongues, read news in our second language or even rely on a third language at work or to have exchanges with friends. The ability to use multiple languages is not only economically, culturally, or socially beneficial but also appears to bear consequences, for instance, for emotionality. That is, bilinguals reportedly associate greater emotional valence with their native language (L1) than their second language (L2). This may not be surprising given, for example, an early development of “a rudimentary emotional understanding” (Pavlenko, 2014, p. 267) or the process of affective socialization in the L1, with more emotional contexts of learning (Harris, Gleason, & Aycicegi, 2006). However, this emotional discrepancy appears to influence other types of behavior, for example,

inner speech (Larsen, Schrauf, Fromholt, & Rubin, 2002), use of endearments and swear words (Dewaele, 2008, 2010, 2017), personal relationships (Dewaele & Salomidou, 2017), or moral decision making (Costa et al., 2014).

In the current study, we ask whether a difference in emotional arousal between the L1 and L2 can also be observed when people deceive or when they listen to lies. Specifically, we address the following set of questions: is it possible that bilinguals are better liars in their L2 given the emotional detachment, or on the contrary, can they lie better in their L1 as it is a less cognitively demanding task and less anxiety provoking one? In addition, are bilinguals able to detect a lie or a fake piece of news in their L1 more easily in comparison to their L2, given speeded lexical access? Finally, are bilinguals better at recognizing fake news in their L2, because often we come across it in English? Caldwell-Harris and Aycicegi-Dinn (2009) previously addressed bilingual lying behavior and demonstrated support for the *double-stressor account*, that is, stress of lying reiterated by stress of producing lies in an L2. This well-acclaimed piece of research, however, has not been followed by many other investigations into the domain. Hence, we replicate the original study but with German–English speakers. Next, we extend the investigation to the perception of lies as this way of operationalizing lying allows addressing the issue of misinformation, which is a current global problem. However, before we turn to the description of the study at hand, a review of the relevant literature is provided.

Emotionality in L1 and L2

Emotionality in L1 and L2 has been investigated from a number of different approaches, including introspective, experimental, neurophysiological, as well as psychophysiological (for a review, please refer to Pavlenko, 2012). Because the studies following the psychophysiological approach are most relevant for the current investigation, we will restrict ourselves to review of those. This type of studies relies on physiological markers of autonomic arousal such as heart rate, activation of smile or frown muscles, or electrical conductivity of the skin (Pavlenko, 2012, p. 417). The important aspect of utilizing this approach relates to the fact that bodily reactions are initiated by the autonomic nervous system. Hence, people cannot intentionally control them, which gives researchers an unadulterated insight into people's responsiveness to certain stimuli. Particularly useful to psycholinguistic researchers is the skin. The largest organ of the human body not only serves diverse physiological functions but also reveals a lot about our inner processes. As skin is very reactive to alarming stimuli, these can induce an increase of the adrenaline level in the blood and cause sweating. This, in turn, intensifies electrical skin conductivity, also specified as electrodermal activity (Critchley, 2002). A so-called skin conductance response (SCR) is defined as "transient increase [in electrical conductivity] to a specific stimulus . . . [which] occur[s] within 1 to 1.5 seconds following presentation of the stimulus, and may last for 2 to 6 seconds" (Harris et al., 2006, p. 259). The extent of the SCR is determined by the kind of stimuli, which can be visual, auditory, gustatory, or olfactory, and by the amount of produced sweat in response to the stimuli (Dawson, Schell, & Filion, 2000). One type of human sweat gland, the so-called eccrine sweat gland, is found typically on the palms of the hand

and under the feet. Its primary purpose is thermoregulation of the body, but it is also sensitive to psychologically arousing stimuli in emotional or stressful contexts. The sympathetic nervous system, as part of the autonomic nervous system, independently activates sweat production in the eccrine glands (Critchley, 2002). As soon as the skin sweats, dermal conductivity is enhanced. This is measured by electrodes that pass a small electric current when being placed on the distal phalanges of the first and middle fingers. Researchers interpret high levels of skin conductance and heightened SCR as an indicator of the fact that a person is emotionally aroused.

Harris, Aycicegi, and Gleason (2003) investigated autonomic reactivity to emotional expressions in L1 and L2. They recruited 32 Turkish–English bilinguals, who acquired English at the age of 12 or later, for the experiment, which included visual or auditory presentation of Turkish and English neutral, positive as well as negative words, taboo expressions, and childhood reprimands. The participants assessed each word for pleasantness while their SCR were recorded. The results confirmed that response patterns differed for L1 and L2; with the responses to reprimands being most pronounced. In addition, taboo words provoked the highest SCR of all types of stimuli. In L1-Turkish, they provoked higher psychophysiological reactions than in L2-English, but this effect was only significant for the aural modality. The outcomes of this study substantiate the finding that L2 emotional words “although semantically equivalent, are physiologically not as arousing as the L1 terms” (Harris et al., 2003, p. 575).

Furthermore, Harris (2004) investigated whether the previously reported finding can account for early bilinguals, whose L2 evolved to become the more proficient language. For that purpose, she recruited both early (mean age of L2 acquisition was 3.7 years) and successive (L2 acquired in middle school) Spanish–English bilinguals. All the participants were confronted with a variety of emotional expressions (taboo words, reprimands, endearments, and insults but also non-emotionally laden words) visually or aurally. SCR were monitored throughout the participants’ ratings of each stimulus. The author found, in accordance with Harris et al. (2003), that taboo words elicited the largest SC amplitudes. Furthermore, early learners of English showed similar SCR to reprimands in both languages, while late bilinguals demonstrated greater reactivity to reprimands in Spanish rather than English. The almost equal reaction pattern of the early bilinguals to stimuli in either language is in line with age of acquisition effects and the fact that emotion-laden terms activate the autonomic nervous system equally when the two languages are learned simultaneously. The researcher concluded that bilinguals’ affective reactions depend on the age of L2 acquisition as well as language proficiency and that a higher level of L1 emotionality is likely to fade when the non-native language becomes the more proficient and dominant one.

The first experiment of Caldwell-Harris and Aycicegi-Dinn (2009) extends the previous line of research, however, from a slightly different angle. The researchers examined 70 Turkish–English bilinguals, who resided in Turkey, to address the importance of context. Many bilingual studies have involved recruiting immigrants in their L2 country, which may influence the SC amplitudes. That is, novelty or nostalgia effects when hearing one’s L1 in a laboratory may add to the perceived emotional weight of the stimuli. In the 2009 study, the participants listened to endearments, insults, reprimands, and neutral words. Overall, the results revealed

weaker emotional reactions in L2. The largest difference between Turkish and English occurred for childhood reprimands, which is consistent with Harris et al.'s (2003) findings. Moreover, the L1-more-emotional account was consolidated insofar as it also applies to bilinguals who live in a country where that language is predominantly spoken.

Bilingual lying behavior

“Successfully lying to another person usually involves the manipulation of language and the careful construction of a story that will appear truthful” (Newman, Pennebaker, Berry, & Richards, 2003, p. 671). Furthermore, it plays an important role in our everyday social interactions (Hancock, Thom-Santelli, & Ritchie, 2004), but it is a cognitively demanding task (Vrij, Fisher, Mann, & Leal, 2006). That is, liars have to concentrate on many aspects at once, for example, constructing a logical and coherent story, while not showing their internal stress from inhibiting the truth. Studies that have examined behavior of liars point out differences in non verbal performance between deceptive and honest speakers. Mehrabian (1971), for example, reported that during lying, movements are reduced, the distance to the interlocutor is increased, while talking is slower and contains more speech errors. These differences, however, are not necessarily the same across all cultures (e.g., Al-Simadi, 2000; Bond, Omar, Mahmoud, & Bonser, 1990). Hence, a question arises of whether language in which lies are told plays a role in terms of the force of internal arousal. Because bilinguals have two languages at their disposal and often they have a dominant language, it would seem reasonable to assume that they will be better liars or will be better at perceiving lies in one of their languages. It is possible that bilinguals can lie better in their L2 as the reduced level of emotionality in that language depicts the task as less face threatening or less deceitful. Nevertheless, it is also likely that as lying itself is a burdensome task, doing it in a non-native language will impose an additional mental strain. Both of these possibilities were investigated by Caldwell-Harris and Aycicegi-Dinn (2009), who coined the terms *blunted emotional response account* and the *double stressor account*. To test these accounts, the researchers requested Turkish–English participants to read aloud true and false statements in both of their languages while a skin conductor recorded their electrodermal reactions. In addition, the participants had to evaluate the emotional weight of each lie. The results demonstrated higher SCR for lies than true statements. In addition, the SCR were higher in English than in Turkish across both statement types. However, the self-evaluations of statements contradicted this outcome, as the participants indicated that Turkish lies felt more powerful than the English ones. While the second part of the results is in line with the common finding of an L1 emotional advantage, and by extension the blunted emotional response account, the SCR support the double stressor account. The researchers explain that two factors are considered to impact physiological reactivity in the process of lying in L2: bilinguals are first aroused about controlling their lying, and second, they need to manage the L2 speech production, which is not as automatic as L1 even in dominant bilinguals and, thus, increases the cognitive load.

In a subsequent study, Caldwell-Harris, Sanchez, and Nayak (2014) illustrated that the above described finding can be modified by the type of bilingual acquisition (i.e., simultaneous or sequential). In their study, Spanish–English bilinguals who grew up with two languages did not display a difference on the SCR in the mock deception task, whereas reduced emotional responses were registered in the L2 among the sequential participants. A difference between L1 and the foreign language when producing deceptive languages was also reported by Duñabeitia and Costa (2015). The researchers measured the size of the pupil dilation, speech latencies, and utterance durations on veridical and false statements. Pupil dilation was observed to be greater in a foreign language. In addition, the utterance durations were longer in L2, supporting the double stressor account. In addition, the researchers notice that the double amount of cognitive cost, associated with deception and speaking a foreign language, occurs at different levels of processing (i.e., preverbal and verbal). While the production of false statements operates mostly at the preverbal stage, the language production bares most of the cost at the stage of verbalization, when lexical access and phonological retrieval are at work.

Lying behavior, however, is not only limited to making untruthful statements, for by reversing the coin, we can also look at the ability to perceive lies in two languages. This aspect is especially relevant in the light of increasing amount of broadcasted *fake news*, which we often come across in English. According to Allcott and Gentzkow (2017), fake news is defined as news that is deliberately false and aimed at deceiving people into believing what is stated. Recently, the presence of fake news has intensified due to easy access to social media, which favors quick distribution of information. Hence, the role that language plays in this context should be explored further. This is one of the major aims of the current investigation, details of which are presented in the forthcoming sections.

Present Study

The current study serves as an extension of the comparatively limited research on bilingual lying behavior by partly replicating Experiment 2 by Caldwell-Harris and Aycicegi-Dinn (2009), with important modifications. While Caldwell-Harris and Aycicegi-Dinn investigated Turkish–English bilinguals' physiological reactions to deceptive statements, the current sample consisted of highly proficient German–English bilinguals. Furthermore, we employed another task to explore the auditory perception of lies in German and English. This was done in order to address the question as to whether bilinguals react differently when someone else lies to them in their native or non-native language. To the best of our knowledge, this is the first study to consider the autonomic reactions elicited by listening to true and false statements in L1 and L2.

The specific experimental predications that we tested were

- H1:** SCR will differ between true and false statements. More specifically, lies are assumed to elicit larger SCR than truthful statements, as this process is considered emotionally more arousing and stressful than telling the truth.

- H2:** The SCR in L1 German will differ from those given in L2 English, both in a reading aloud and a listening task. That is, if the responses in German are higher than those in English, this will point to the blunted emotional response account. However, if the pattern is reversed, this will be indicative of the double stressor account.
- H3:** The comparison of SCR from production and perception of lies will result in a difference. It is expected that SCR are going to be higher when producing lies than when perceiving them, as language production is a more cognitively demanding task than language comprehension. In addition, lying is an active process of fabricating truth, whereas perceiving lies is simply noticing deception, if at all recognized.

Method

Participants

Twenty-six German speakers of L2 English (3 males) took part in the study. All of them were between the ages of 20 and 25 ($M = 22.3$, $SD = 1.46$) and were enrolled at a German university, where many programs of study are taught in English. The mean age of English acquisition was 9.37 years ($SD = 1.74$), and it was acquired in at least two different contexts: school, university, and/or a stay in an English-speaking country. The self-assessed mean German proficiency was equal to 6.94 ($SD = 0.13$), while the English proficiency was 6.09 ($SD = 0.73$; on a scale from 1 = *not at all proficient* to 7 = *very proficient*). This is concomitant with the stated frequencies of English use: two-thirds of the participants used it on a daily basis, the rest, at least several times a week. More than half of the subjects indicated having been abroad in an English-speaking country and having English-speaking partners in the past. Therefore, the majority of the sample was familiar with the English language in other than classroom settings. Finally, the majority of the participants indicated having also a third language (French, Spanish, or Latin).

Materials

Production of lies

In preparation of the deception task involving telling lies, the 16 true and false statements used by Caldwell-Harris and Aycicegi-Dinn (2009) were translated from English into German. Each category, for example “favorite food,” was assigned one statement, for example, *My favorite food is . . .* that included a gap in which the participants would later insert a true or an untrue answer. After an examination of the statements’ suitability, one category was changed. The category “fear of death” was replaced by “physical appearance” as the original item was considered too personal and the respective statement as too leading. Apart from this, the statement concerning the “belief in God” category was translated in such a way that the participants were more open in their answers to ensure that they had no difficulties filling in the gaps: *I believe in/that . . .* The final set of statements can be found in Appendix A. When the statements had been finalized, they were split into a German

and an English block with 8 statements each. Similarly to Caldwell-Harris and Aycicegi-Dinn (2009), 4 easy categories that lack a substantial moral or religious component (e.g., “favorite travel destination”) and 4 difficult categories that included a strongly personal and moral dimension (e.g., “world problems”) appeared in each language. Afterward, the statements were randomly designated as true or false and put in a randomized order to avoid carryover effects. The prepared statements were printed on two sheets of paper, each covering one language. The worksheets displayed four columns: Column 1 listed the respective category, whereas Columns 2 and 3 repeated the statement with a gap for the truth column and the lie column. Column 4 contained the truth-value per statement, but it was kept hidden by a fold in the paper until the beginning of the reading aloud task. This setup closely resembled that of Caldwell-Harris and Aycicegi-Dinn (2009).

Perception of lies

To prepare the stimuli for the deception task that involved perception of lies, various statements from the fields of politics, public figures, food, and geography were assembled in German and English. The sentences only differed in one aspect, namely, the truth-value, and were kept simple. An example sentence is: *Chile is located on the west coast of South America* (true) versus *Chile is located on the east coast of South America* (false). In total, 20 different statements were created, one half in German and the other half in English (Appendix B). To pretest the statements, we recruited three participants who received a printed version of the statements and had to indicate the truth-value and the level of difficulty in assigning this value of each assertion. Based on the ratings, the 4 most challenging statements per language block were detected and excluded.

Next, the sentences that were part of the final selection were recorded, one at a time, with the open source audio editor, Audacity (<https://www.audacityteam.org/>). The sentences were read out by the same speaker in both languages with normal intonation and pitch as in everyday conversations.

Questionnaire

In addition to the two experimental tasks, the participants had to fill in two questionnaires created with the SoSci Survey (<https://www.sosicisurvey.de/>). The first survey was directly related to the listening task, containing the recorded statements, and requested the participants to evaluate the truthfulness of each of them. The second questionnaire, which was partly based on Li, Sepanski, and Zhao (2006), consisted of 19 questions that covered numerous biographical (e.g., gender, age, and level of education) and linguistic (e.g., spoken languages, learning context of English, and self-rated proficiency) variables. In addition, in this part we asked participants about their lying behavior and perception of fake news (Appendix C).

Procedure

All participants were tested individually. After a short introduction, they were given the two sheets of paper and told to complete the sentences with a maximum

of five words each, according to the headers of the columns: “true statement” or “false statement.” The rationale behind letting the participants fill in the gaps in advance of the actual recording was to reduce any possible nervousness connected with providing answers offhand and in a foreign language (Caldwell-Harris & Aycicegi-Dinn, 2009). Next, the participants were connected to the skin conductor, a ProComp2 Encoder, which monitored their SCR. Two electrodes were attached to the distal phalanges of the index and middle finger of the nondominant hand. Electrodermal activity was recorded in microsiemens (μS) and could be followed in real-time by using the BioGraph Infiniti software. Next, the participants unfolded the last column of the paper sheet and read out the statements, one at a time, while their SCR was monitored. First, they read the German sentences, and after a short break they read the English ones. The experiment continued with the listening task. We briefed the participants that they would hear statements, first in German and next in English, which were correct or false. They had to focus on the content of each statement. This was intended to make them concentrate on the content of the recording, as there was no explicit task that the participants had to attend to.

Results

Quantitative analysis

The data were analyzed using a repeated-measures analysis of variance, with information about the relative peak SCR representing the dependent variable. Truth-value (true vs. false statements), language (German vs. English), and modality (reading aloud vs. listening) were the independent variables in the current study.

The analysis of variance revealed a statistically significant main effect of the truth-value, $F(1, 25) = 104.82, p < .001$. The mean relative SC peaks were smaller for true statements (.056 μS) than those for false assertions (.094 μS). In addition, a significant main effect of language was observed, $F(1, 25) = 164.04, p < .001$. Overall, German elicited higher SC responses (.100 μS) than those values obtained in the English language condition (.049 μS). Furthermore, a main effect of modality was detected, $F(1, 25) = 121.75, p < .001$, which means that the reading aloud task (.117 μS) differed significantly from the listening one (.032 μS). There was a significant interaction between language and truth-value, $F(1, 25) = 67.63, p < .001$, language and modality, $F(1, 25) = 138.49, p < .001$, and between truth-value and modality, $F(1, 25) = 118.32, p < .001$. The three-way interaction between language, truth-value, and modality was also significant, $F(1, 25) = 58.62, p < .001$. Table 1 summarizes the mean relative peak SCR from both tasks split across the language and truth-value conditions.

Given the significant two- and three-way interactions, the analysis of the main effects was followed by the analysis of the simple effects. The pairwise comparisons, with Bonferroni adjustment for multiple comparisons, revealed higher relative SCR when reading aloud false German statements compared to true ones, $t(25) = -10.70, p < .001$. This was also the case when true and false English sentences were compared, $t(25) = -5.61, p < .001$. No significant difference occurred between true and false

Table 1. Mean relative peak skin conductance responses across the different languages per task and truth-value

Language	Modality	Truth-value	Peak (μ S)	SEM
German	Reading aloud	True	.099 (.043)	.009
		False	.228 (.075)	.015
	Listening	True	.038 (.016)	.003
		False	.034 (.017)	.003
English	Reading aloud	True	.056 (.023)	.005
		False	.086 (.041)	.008
	Listening	True	.029 (.016)	.003
		False	.026 (.012)	.002

Note: Standard deviations are included in the brackets. SEM, standard error of the mean.

statements when the participants listened to the recording in German, $t(25) = 0.891$, $p = .382$. In addition, true English statements elicited the same SCR as false statements in the listening condition, $t(25) = 1.93$, $p = .065$. Next, four paired-samples t tests compared the differences in relative peaks across the German and English expressions, both while reading aloud and while listening to the lies. Each comparison resulted in a statistically significant outcome, with the German language eliciting higher SCR values, $t_{Gt-Et}(25) = 6.05$, $p < .001$, $t_{Gf-Ef}(25) = 12.96$, $p < .001$ (both results from a reading aloud condition), and $t_{Gt-Et}(25) = 2.632$, $p = .014$, $t_{Gf-Ef}(25) = 2.91$, $p = .007$ (listening condition). The most pronounced difference between the two languages was seen when the participants produced false statements. Finally, the pairwise comparisons across the two modalities demonstrated that in all four instances the reading aloud condition values were higher for our participants, $t_{Rt-Lt}(25) = 6.92$, $p < .001$, $t_{Rf-Lf}(25) = 13.04$, $p < .001$ (in German), and $t_{Rt-Lt}(25) = 5.54$, $p < .001$, $t_{Rf-Lf}(25) = 7.37$, $p < .001$ (in English). Figure 1 illustrates the two-way interactions between language and truth-values at one level of modality. Overall, it can be seen that listening to statements involved less autonomic reactivity than reading statements aloud (the scales were not adjusted for visibility purposes).

Finally, we compared the participants' offline answers given in the rating task, which served to evaluate the listening part of the experiment. The descriptive results are depicted in Figure 2. Here, "yes" (assuming the assertion to be true) was coded as 1, "no" as 3, and the indecisive option as 2. Consequently, for the true statements, the mean should ideally be at around 1 and for the false statements at around 3. One can assume that the closer the answers are to these two respective values, the more the participants felt certain about accepting or opposing the assertion. They were, overall, more confident about the true English statements ($M = 1.19$, $SD = 0.23$) than the true German ones ($M = 1.36$, $SD = 0.35$), as the mean of the former condition is closer to the expected value than that of the latter, $t(25) = 2.95$, $p = .007$. However, for the false sentences, the participants were more certain in rating the German input ($M = 2.70$, $SD = 0.21$) than the English ($M = 2.20$, $SD = 0.48$), $t(25) = 4.83$, $p < .001$.

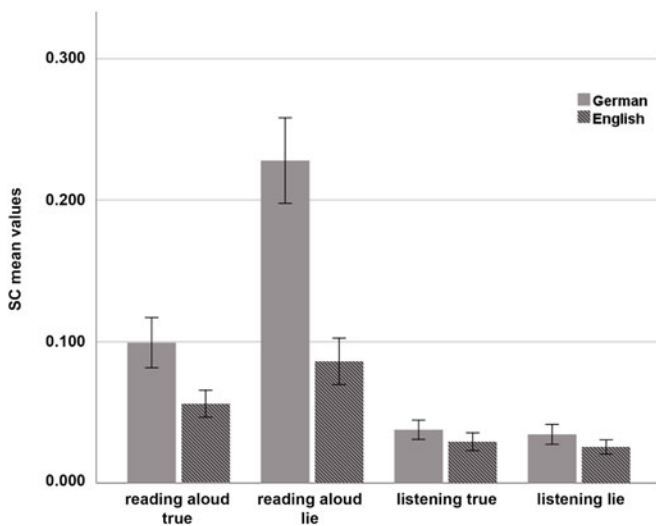


Figure 1. Relative peak skin conductance responses in microsiemens (μ S) for true and false statements in German and English across the reading aloud and listening modalities.

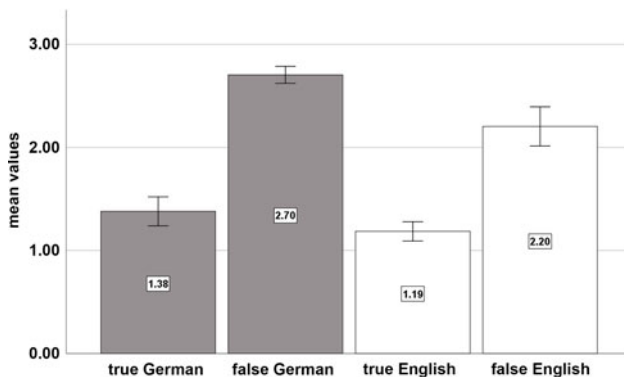


Figure 2. Mean values for the truthfulness of sentences given in the online rating task.

Qualitative analysis

In order to gain additional insights into the participants’ lying behavior, we inquired about language they found it easier to detect lies in. Almost half of the participants chose German (46%), while English was not selected at all; the rest (54%) said that the language did not matter in this regard. The reasons for choosing German were primarily related to the fact that it is the native and, thus, the more proficient language. Another interesting aspect is the language in which the participants preferred to lie: more than half (63%) favored German, especially for proficiency and automaticity reasons, concomitant to the answers given before. However, the remaining participants (37%) chose English for telling an untruth, because “it doesn’t feel as much as lying when doing it in a foreign language” and, as a matter of fact, it does

not cause blushing, as German would. English is perceived as the language of emotional detachment and, thus, some of the participants found it easier to fake or alter their pitch and tone. Some participants also mentioned the linguistic difference between German and English. That is, English has a distinct vocabulary, for example, more vague terms, and better expressions to talk around facts, which makes the language more suitable for lying in the eyes of some participants.

Discussion

For the present study, three hypotheses about lying and the perception of lies in two languages were investigated. First, it was hypothesized that SCR will be different for true and false statements, expecting that lies would elicit higher physiological responses than truthful statements. The second hypothesis regarded the difference in SCR between L1-German and L2-English. Here, we anticipated that either one of the directional hypotheses could be supported. Finally, higher SCR were expected in the reading aloud condition in comparison to the listening one, as the former being an active process, is considered more cognitively demanding.

The results demonstrated a lie effect (i.e., elevated SC values when the participants were telling lies in comparison to when they were making truthful statements). This pattern, however, was visible only in the reading aloud condition. Listening to recorded sentences that included lies did not result in a significant effect. Furthermore, a difference between the two languages was demonstrated. That is, German, the L1, elicited higher SCR than English across all conditions. This finding is in line with the vast research literature that relates to the bilingual emotionality discrepancy between L1 and L2. In addition, more participants pointed to German as the preferred language for lying as well as perception of lies. This preference was mostly related to a higher degree of proficiency in that language. Finally, the relative SC peak values in the reading aloud condition were higher than those when perceiving fake statements, which supports the argument that reading aloud as an active process exerts more strain that could lead to heightened SC values.

The fact that the lie effect was observed in the reading aloud condition is confirmatory of the increased difficulty of lying in comparison to telling the truth (Vrij et al., 2006). Lack of this effect in the listening condition, when measured with the SC encoder, is surprising, as hearing a false statement should, in principle, trigger a feeling of discomfort, suspicion, or maybe even annoyance, which in turn should lead to increased SCR. This was not the case in the current study. This result, however, is not necessarily related to difficulty of telling true statements apart from the fake ones. The difficulty of all statements was verified during the pilot stage of the study, and the participants were able to judge their truthfulness in the offline version of the task. Hence, the nature of the listening task might be at fault. That is, the participants listened to the sentences passively without any overt task. They were asked to focus on the content of what was being said and listen carefully to each statement; however, active processing of the semantic content and the truth-value of each sentence could not be guaranteed. Furthermore, the fabricated statements might have lacked personal relevance to the participants, that is, they focused more on an evaluation of factual knowledge, which might have reduced the lie/truth difference in the listening condition.

The lie effect found in the reading aloud condition is in line with the outcomes demonstrated by Caldwell-Harris and Aycicegi-Dinn (2009). However, when the language effect from the previous and current studies is compared, a slightly different picture emerges. While data from Caldwell-Harris and Aycicegi-Dinn (2009) justified the double stressor account (i.e., higher SCR in L2), the present outcomes support the blunted emotional response account (i.e., higher SCR in L1). Caldwell-Harris and Aycicegi-Dinn (2009) explained their pattern of results with reference to double the amount of arousal associated with lying and the anxiety of using non-native language. The participants in the current study had a generally high level of English proficiency. Furthermore, more than half of them (67%) declared that they had spent a longer time in an English-speaking country (on average 12 months) and they were also taking university courses in English. Hence, producing several simple sentences in their L2 did not seem to cause increased levels of arousal or anxiety in this group of speakers, which in turn would lead to higher SC values. Nevertheless, despite this apparent equivalence between L1 and L2 in language proficiency, a difference in emotionality between L1 and L2 could still be detected. This confirms earlier findings obtained from self-reports by maximal proficiency bilingual speakers, who retained preference for expressing strong emotions in their L1 (Dewaele, 2011). In theoretical terms, both the Revised Hierarchical Model (Kroll & Stewart, 1994) and the Episodic Trace Model (Puntoni, de Langhe, & van Osselaer, 2009) can account for this discrepancy. The proponents of those frameworks claim that the L1 is more deeply entrenched in the bilingual mind through very early acquisition and a large amount of experience in this linguistic context, which results in stronger semantic representations. Hence, the strength of conceptual links (Revised Hierarchical Model) and the number of episodic traces (Episodic Trace Model) define how emotional a language is perceived, favoring the native language, while ultimately finding expression in heightened autonomic arousal. It is also possible, however, that a processing explanation can account for the current set of findings. That is, Opitz and Degner (2012) found evidence for delayed lexical access of emotional input due to slower processing in the non-native language. That is, the time that is needed for additional nonautomatic processing reduces the feeling of emotionality of the L2. Hearing statements in that tongue might have been equally arousing, but processing of the emotional valence was slower and, consequently, not as pronounced in terms of electrodermal activity.

Support for the blunted emotional response account can also be found in some of the answers to the open-ended questions. That is, many participants noticed, of their own accord, that both languages are not on the same level of emotionality. The native tongue was seen as the more comfortable and proficient language, which enabled these bilinguals to focus on other aspects than the linguistic ones, namely, the content of what was said or nonverbal behavior in face-to-face interactions. For these reasons, the participants preferred German for the detection of lies, which is reflected by the results of the rating task. Overall, the participants were more secure in judging false German statements as incorrect compared to false English ones. Nonetheless, even though most indicated that German is the preferred language for lying due to a proficiency and automaticity advantage, many others favored

English, because it reportedly offers more opportunities to hide behind certain expressions while not feeling the burden of lying that much. This might relate to high levels of proficiency in both languages, insofar as the participants regarded themselves sufficiently competent to be deceitful in their L2.

Finally, we foresaw the observed difference between the two modalities, reading aloud and listening, in advance. Reading aloud as an active process requires more cognitive resources in comparison to listening and hence, higher SCR values were expected in this condition. Nevertheless, it also has to be acknowledged that the SCR measure is sensitive to movement, including speaking. Therefore, the higher relative peaks reported in the reading aloud condition might be partially related to overt responses provided in that condition and lack of them in the listening one. Henceforth, we are currently evaluating the sensitivity of the SCR values when reading silently to oneself true and deceptive statements versus reading them aloud as well as when listening passively versus actively, whereby the evaluation of each sentence is provided directly after the sentence has been heard.

Limitations and relevance

Despite the fact that skin conductance monitoring might be a more reliable measurement of autonomic arousal than, for instance, self-reports, it does not allow researchers to draw straightforward conclusions from heightened electrodermal incitement. The reactions to stimuli cannot be unequivocally assigned to one individual trigger by means of physiological approaches, because these do not distinguish underlying brain mechanisms. The increased alertness/arousal might be related to task-specific requirements, the emotional weight of un/true statements, the general content or topic of what is spoken about, the level of proficiency of the speakers, the amount of individual emotional experience and memories, and/or either positive or negative preconceptions. Furthermore, the simulation of deception in a laboratory setup is rather limiting. That is, it is problematic to generalize any findings based on the fabricated lies and their corresponding physiological reactions as compared to lies in the real world. In the current context, the statements were prepared beforehand and read aloud. In addition, the participants knew that the experimenter commanded the truth-values in the experimental situation. In everyday social interactions, the interlocutor can only suspect whether someone is lying or not, given that the lie is usually not too obvious. Hence, in the future, physiological responses to lying in different languages should further be explored, both in expression and perception, to broaden the knowledge generated by the few studies we have so far. Researchers should focus on creating more sophisticated tasks that involve the invention of a story, which requires active reflection from the tested participant to produce a coherent narrative (e.g., Caldwell-Harris et al., 2014). The task could also be complicated by introducing a “lie detecting person,” who is personally known to the participant so as to increase moral intensity of lying.

Conclusion

Given the growing topicality of deception in everyday life, promoted by a digitalized social media generation, the current study was aimed at exploring the influence of a L1 versus a L2 on perceived emotionality of deceptive and true content in the overall context of lying and fake news. It has extended prior research in the field of bilingualism and emotions by investigating German–English participants' electrophysiological reactions to false and true statements in a reading aloud and a listening task. The experiment was partly based on Caldwell-Harris and Aycicegi-Dinn (2009), and a lie effect as well as a language effect were found. That is, false statements as well as the responses in German evoked more pronounced SCR than true ones and those answers given in English. The results can be attributed to the representational accounts: the Revised Hierarchical Model (Kroll & Stewart, 1994) and the Episodic Trace Model (Puntoni et al., 2009) as well as to a processing account of delayed lexical access in L2. However, when it comes to the interpretation of SCR results, it is essential to pay attention to the multiplicity of potential causes that might influence the outcomes apart from the intrinsic emotional value of a language. Factors such as psychological stress or anxiety due to lying in front of the experimenter, the production of words in a L2, the content of the task, which is presumably related to positive or negative memories and in general, and the unfamiliarity of the experimental situation were identified as possibly distracting and, thus, leading to higher skin conductance amplitudes. Nevertheless, psychophysiological measurement is still useful as a sensitive method to study emotional responses, particularly in comparison with introspective techniques such as questionnaires, because participants are unable to alter their autonomic reactions. However, the examination of lying in a laboratory setting cannot fully replicate an actual act of lying. Hence, the challenge of measuring of how effective is lying and perception of lies in both of bilinguals' languages in a spontaneous speech context is still an open question.

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Appendix A

Reading aloud task

Category	True statement	False statement	
Favorite entertainment	I enjoy watching ____.	I enjoy watching ____.	False
Reason for being late	When I am late, the main reason is ____.	When I am late, the main reason is ____.	False
Self-description	I am a ____ person.	I am a ____ person.	True
Favorite clothing	I like wearing ____.	I like wearing ____.	True
Favorite family relation	In my family, I love ____ the most.	In my family, I love ____ the most.	True
Childhood goals	I used to want to be a ____ when I grew up.	I used to want to be a ____ when I grew up.	False
Political leader	I admire ____ very much.	I admire ____ very much.	False
Mother's behavior	I would be angry if my mother ____.	I would be angry if my mother ____.	True

Appendix B

Listening task

1. Kokosnüsse sind Früchte. (true)
2. Königin Máxima ist mit König Carl Gustaf XVI von Schweden verheiratet. (false)
3. Angela Merkel ist eine große Befürworterin von Donald Trumps „America-First“-Politik. (false)
4. Das menschliche Ohr ist das Organ, das ebenfalls für das Gleichgewicht verantwortlich ist. (true)
5. Zurzeit wird in der Türkei besonders großer Wert auf die Pressefreiheit gelegt. (false)
6. Steve Jobs hat Apple gegründet. (true)
7. Der längste Fluss der Welt ist der Nil. (true)
8. Nordkorea gehört zu den engsten Verbündeten Europas. (false)
9. The German automobile industry currently experiences a crisis with regard to diesel vehicles. (true)
10. The United States of America became independent in 1778. (false)
11. Scarlett Johansson is an American actress. (true)
12. In 2016, a majority of people in the United Kingdom voted to leave the European Union. (true)
13. Vladimir Putin is keen on maintaining good diplomatic relations with the United States. (false)
14. Chile is located on the east coast of South America. (false)
15. The next Bundestag election will take place in October 2017. (false)
16. Greenland is the world's largest island. (true)

Appendix C

Questionnaire—Bilingualism and lying

1. Have you ever come across fake news?
 - a. Yes
 - b. No

If yes, please answer the following questions as precisely as possible.

2. Did you encounter the fake news in German or in English?
 - German
 - English
 - Other (please specify): _____
 - I cannot remember this.
3. Were you able to tell them apart from real news/the truth?
 - Yes
 - No

If yes, how could you tell them apart from real news/the truth?

4. Is it easier for you to discover lies in German or in English?
 - German
 - English
 - It doesn't matter.

If German, why?

If English, why?

5. Would you prefer to use German or English when lying?
 - German
 - English

Reasons: