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Exploring the Effect of Socio-linguistic Competence in Native and Non-native English Speakers on Visual and Auditory Humor Comprehension

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Abstract

Despite the universal phenomenon of humor across societies and communities, humor comprehension in second language (L2) speakers is often overlooked. It is unclear whether L2 speakers rely primarily on sociocultural proficiency or linguistic proficiency when they process humor in a foreign language. We conducted two experiments examining the direct association of sociocultural proficiency and linguistic proficiency in humor comprehension behaviors in the visual and auditory modalities. Across both modalities, results revealed a significant association of social connectedness with humor detection and appreciation in non-native speakers. Furthermore, individual differences in language proficiency and social connectedness were shown to be more relevant for humor ratings in the visual modality. The finding suggests that L2 speakers' humor comprehension performance was related to sociocultural proficiency and integration with the L2 community.

Keywords: Humor Comprehension; Social Connectedness

Introduction

Humor is a ubiquitous phenomenon that fulfills various social, emotional, and communicative functions (Graham, Papa, & Brooks, 1992; Hay, 2000; Gervais & Wilson, 2005). Understanding humor often requires culture-specific background knowledge along with the need to appreciate deliberate ambiguities. All of these create pragmatic and linguistic challenges that even native (L1) speakers find difficult on occasion. Indeed, the ability to joke in a second language (L2) may prove useful as a yardstick for L2 speakers' fluency in their new language, and serve as a marker for successful integration into the new language community. Towards this goal, the present study compares the ability of native and non-native English speakers to understand simple verbal humor in puns and non-funny control stimuli.

Current research in L2 humor has tended to focus on production rather than perception (Bell, 2009). Despite a rich literature on L1 humor, research on the comprehension of humor among L2 speakers remains sparse. Through a series of observational studies on L2 humor skills, Bell suggested that L2 humor skills could be a marker of comprehensive language proficiency (Bell, 2005). However, evidence has also shown that the detection and comprehension of verbal humor poses a significant challenge for non-native speakers — even those with sophisticated linguistic competence (Nelms, 2001). In fact, it has been shown that L2 speakers need to reach a certain level of pragmatic and cultural competence in their L2 to be able to appropriately appreciate verbal humor

(Chen & Dewaele, 2019). This is likely because the ability to properly detect and resolve the incongruous elements in verbal humor requires a mastery of sociocultural norms that goes beyond essential linguistic proficiency.

Xu and colleagues addressed the relationship between linguistic proficiency, sociocultural familiarity, and L2 humor skills in a series of studies (Xu, Nakanishi, & Coulson, 2022). They recruited a group of L2 speakers to perform a humor detection task and to complete relevant questionnaires to examine whether accuracy on this task was correlated with sociocultural familiarity, linguistic proficiency, and/or foreign language anxiety. Another experiment addressed the relationship between these factors and a humor appreciation task in which participants rated how funny joke and non-funny control stimuli were. They found both humor detection and appreciation were positively correlated with social connectedness scores and negatively correlated with foreign language anxiety scores. However, the lack of objective measurement of linguistic proficiency makes it difficult to interpret the import of linguistic proficiency on L2 humor skills. In addition, humor detection and appreciation skills were assessed in separate experiments, which made it difficult to know whether poor appreciation performance reflected deficiencies in appreciation, or a failure to detect humor at all.

Here we address whether L2 humor comprehension can be a hallmark of pragmatic proficiency and social well-being in the L2 community. The first experiment replicated and extended prior work by Xu and colleagues as we asked participants to perform both the detection and appreciation tasks as well as obtaining an objective measure of their linguistic proficiency (Lemhöfer & Broersma, 2012). In the second experiment, we used spoken versions of the stimuli to explore whether the factors that influence humor comprehension in the visual modality operate similarly in the more naturalistic auditory modality. Previous research on auditory processing has shown that L2 speakers with lower linguistic proficiency rely primarily on bottom-up processes and encounter difficulty attending to contextual aspects of processing (Cook & Liddicoat, 2002). Thus, we hypothesized that L2 humor comprehension in the auditory modality may rely more on linguistic proficiency, compared to the visual modality.

Materials and Methods

Stimuli

A set of 46 pairs of validated joke/non-joke stimuli and experimental procedure were adapted from the previous experiment (Xu et al., 2022). Kindly provided by the authors, the jokes are one-liner puns whose 'punch-line' involved the last word or phrase of the sentence; the non-joke version was created by replacing the final word or words such that the entire sentence was more serious or neutral. For example, the joke sentence: "Never fight with a dinosaur. You will get jurass-kicked," has a non-funny counterpart "Never fight with a dinosaur. You will get kicked." For each pair of sentences, one version was randomly assigned to one of two lists so that each subject saw only a single version of each stimulus. Individual participants thus saw 23 jokes and 23 non-joke control sentences, but across participants both versions were presented a similar number of times over the course of the study.

In an auditory experiment, audio versions of each stimulus pair were prepared by a native American-born English speaker. The actor was asked to read each sentence as if it were spoken in a natural conversation in a real-life situation. To avoid environmental noise, the recording was done in a soundproof environment. After the recording was complete, each audio file was edited to ensure 500 milliseconds of silence preceded the onset of speech, and another 500 milliseconds of silence followed its offset.

Lextale Questionnaire

The lexical test for advanced learners of English (Lextale) questionnaire was developed to assess vocabulary knowledge in speakers with an advanced level of English as a second language (Lemhöfer & Broersma, 2012). The questionnaire performance was shown to be significantly correlated with the TOEIC (the Test of English International Communication) results and previous experimental word recognition data (Lemhöfer & Broersma, 2012; Lemhöfer et al., 2008; Lemhöfer & Dijkstra, 2004). In total, it has 60 trials. In each trial, participants are asked to identify whether or not the presented word is an existing word in English. The final Lextale score is computed by taking the average of the sum of word and non-word accuracy with the range of 0 - 100. A higher score indicates more competent vocabulary knowledge.

Foreign Language Anxiety Scale

The foreign language anxiety scale was developed to quantify the feeling of anxiety specifically associated with L2 materials (Horwitz, Horwitz, & Cope, 1986) and has been used in multiple studies (Öztürk & Gurbuz, 2014; Park & French, 2013). There are 19 items in the scale. For example, the third items is "I start to panic when I have to speak English without preparation in advance. " Subjects are then asked to rate how well each item describes them using 5-point Likert scale (e.g., 1: strongly disagree, 5: strongly agree). The anxiety score is obtained by summing up the responses to each item, leading

to a range between 19 and 95. A higher score indicates that the respondent experiences greater levels of language anxiety.

Social Connectedness Scale

The social connectedness scale was developed to assess people's subjective sense of being supported by and connected to a particular society (Lee, Draper, & Lee, 2001). The social connectedness scale has 21 items in total. We modified some of the original items so that each asked about social connectedness specifically to the English-speaking community. The subjects were asked to rate each item using a 5-level Likert scale. The social connectedness score was obtained by summing up the responses to each item, leading to a range between 21 and 105. A higher score thus indicates that the individual feels a stronger social connection to the L2 community.

Experimental Procedure

The experiment was conducted on a cloud-based survey platform via Qualtrics online survey software. The survey began with a consent form approved by the Human Research Protections Program of the University of California San Diego. After granting informed consent, participants advanced to humor detection and appreciation tasks. Next, all subjects were asked to complete the Lextale questionnaire followed by the social connectedness questionnaire. Non-native English speakers were then asked to complete the foreign language anxiety questionnaire and to rate their subjective assessment of their linguistic proficiency in English. At the end of the study, all subjects provided their age and gender. Non-native English speakers also indicated their native language.

In the humor detection and appreciation task, the stimuli were presented visually (experiment 1) and auditorily (experiment 2) to each participant. After the presentation of each of the 46 experimental sentences (either joke or non-joke), subjects were asked to 1) classify whether the stimulus was a joke or a non-joke, and 2) rate its funniness using a 5-point Likert scale ranging from 1: not funny at all, to 5: extremely funny. In order to prevent subjects from adopting a strategy in which they clicked the same response on every trial, we interspersed "catch" trials that explicitly asked participants to respond with a particular response. For example, participants were instructed to "Please select joke" on the humor detection task, or "Please select 3" on the humor appreciation task.

Data Analysis

Humor Detection The accuracy on the joke detection task was computed by taking the number of joke and non-joke stimuli the subject answered correctly and dividing by the total number of stimuli (i.e., 46). The independent t-test was applied to compare performance between the two groups. Given the repeated measurements within each group, logistic mixed effect regression models were applied to capture the fixed effects of Lextale score, social connectedness score, and stimulus condition (joke vs. non-joke) on predicting single trial accuracy. The random effect structure included one random

intercept term for each subject, another for each stimulus, and one for each stimulus list. The model specification was as follows: Detection Accuracy ∼ Stimulus Condition + Lextale Score * Stimulus Condition + Social Connectedness Score * Stimulus Condition + (1|List) + (1|Stimulus) + (1|Subject).

Humor Appreciation   A linear mixed effect regression model was applied to predict funniness ratings on each trial using fixed effects of Lextale score, social connectedness score, and stimulus condition (joke vs. non-joke). As in the logistic regression model, random effect structure included random intercepts for subject, stimulus, and stimulus list. The model specification was: Rating ∼ Stimulus Condition + Lextale Score * Stimulus Condition + Social Connectedness Score * Stimulus Condition + (1|List) + (1|Stimulus) + (1|Subject).

Because Lextale scores and foreign language anxiety scores were (negatively) correlated and only the former was available for native speakers, foreign language anxiety was not included in any of our regression models. Lextale scores and social connectedness scores were each z-scored across both groups for the purpose of standardization. The non-joke stimulus condition was set as the reference level for all regression models. Note that the detection accuracy was represented as 0 or 1, indicating correct or incorrect classification, respectively, for each stimulus. All models were created using the "lme4" package in R (Bates, Mächler, Bolker, & Walker, 2015). Separate models were created for native and non-native speaker groups, but the use of scores standardized across the two groups affords easy comparison of coefficients and confidence intervals within each experiment.

Experiment 1: Visual Humor Comprehension

The purpose of this experiment was to examine the relationship of visual humor comprehension with language proficiency and social connectedness in both native and non-native speakers. The stimulus set and experimental procedure were adapted from a prior study on this topic (Xu et al., 2022). Each sentence was presented independently in each trial.

Participants   We recruited 128 American-born native English speakers (91 females, mean age: 20.32 ± 2.02), and 101 non-native English speakers (71 females, mean age: 20.84 ± 1.68) to participate in this experiment in exchange for extra credit in their cognitive science, linguistics, or psychology course (Table 1). An additional 26 people were enrolled in the study but were excluded because they failed the attention checks described above. All subjects were undergraduate students, were at least 18 years old, and provided informed consent to participate in the experiment.

Results and Discussion   Descriptive statistics for the experiment are shown in Table 1. As shown by an independent t-test, the native English speakers achieved a higher detection accuracy than the non-native English speakers (Native: 76.53 ± 7.64 % vs. Non-native: 70.30 ± 10.02 %, $p < 0.001$). Whereas native speakers obtained a higher average

Lextale score than non-native speakers, no significant difference was found between groups (Native: 89.86 ± 10.10 vs. Non-native: 80.69 ± 11.44, n.s.); nor did the two groups differ significantly in their social connectedness scores (Native: 69.91 ± 12.48 vs. Non-native: 67.32 ± 11.33, n.s.).

Figure 1 shows that both native (top left) and non-native speakers (bottom left) displayed a significant effect of the joke version of the stimulus on detection accuracy (Native: Odd Ratio (OR) = 3.23, Confidence Interval (CI) = [2.67, 3.89], $p < 0.001$; Non-native: OR = 1.94, CI = [1.53, 2.46], $p < 0.001$), indicating that both native and non-native speakers were more likely to accurately detect the joke version of the stimulus over the non-joke version. In addition, a significant interaction of the joke version of stimulus and social connectedness score was found for non-native speaker subjects (OR = 1.31, CI = [1.12, 1.53], $p = 0.001$), suggesting that non-native speakers with higher social connectedness scores were more likely to correctly detect the joke versions of stimuli.

Figure 1 shows that the mixed-effects regression model for native speakers (right top) revealed a significant effect of the joke version of stimulus on the funniness ratings (estimate = 1.65, CI = [1.57, 1.71], $p < 0.001$), indicating that native speakers rated the joke version of stimuli as being funnier than their non-joke counterparts. The analysis also revealed significant effects of Lextale score (estimate = -0.14, CI = [-0.26, -0.01], $p = 0.028$) and the interaction between Lextale score and joke version of stimuli (estimate = 0.12, CI = [0.04, 0.19], $p = 0.004$), as native speakers with higher Lextale scores rated the non-jokes as less funny and the jokes as more funny than native speakers with lower Lextale scores. Lastly, the analysis revealed a significant interaction between the joke version of stimuli and social connectedness score (estimate = 0.08, CI = [0.02, 0.14], $p = 0.007$), indicating that native speakers with higher social connectedness scores tended to rate joke version of stimulus as more humorous.

The mixed-effect regression model for non-native speakers (right bottom, Figure 1) revealed similar significant effects on funniness ratings from non-native speakers: joke version of stimulus (estimate = 1.82, CI = [1.73, 1.91], $p < 0.001$), Lextale scores (estimate = -0.18, CI = [-0.31, -0.05], $p = 0.006$), the interaction between joke version of stimulus and Lextale scores (estimate = 0.11, CI = [0.04, 0.19], $p = 0.004$), and the interaction between the joke version of stimulus and social connectedness scores (estimate = 0.22, CI = [0.15, 0.30], $p < 0.001$). When taken together, these effects indicate that non-native speakers with higher Lextale scores and higher social connectedness scores tended to find the jokes more humorous than non-native speakers who scored less well on the Lextale and the social connectedness questionnaire.

Overall, these analyses indicate a similar pattern of results in the native and non-native speaker groups suggestive of qualitatively similar performance on both tasks. Importantly, however, there were quantitative differences in the coefficients on significant effects in each group. For example,

Table 1: Demographic and experimental variables of the native and non-native English speakers.

	Experiment 1: Visual		Experiment 2: Auditory	
	Native	Non-native	Native	Non-native
Sample size, No.	128	101	97	90
Age, mean (SD), years	20.32 (2.02)	20.84 (1.68)	20.12 (1.91)	20.53 (1.95)
Female, No. (%)	91 (71.09)	71 (70.30)	70 (72.16)	68 (75.56)
Lextale score, mean (SD), %	89.86 (10.10)	80.69 (11.44)	91.75 (7.18)	79.35 (10.57)
Social connectedness score, mean (SD)	73.41 (13.10)	70.69 (11.90)	73.61 (12.39)	71.67 (13.18)
Foreign language anxiety score, mean (SD)	-	42.38 (16.82)	-	42.60 (16.46)
Humor detection accuracy, mean (SD), %	76.53 (7.64)	70.30 (10.02)	77.62 (9.23)	67.80 (8.03)
Funness rating, mean (SD)				
Jokes	2.79 (1.24)	2.79 (1.25)	2.41 (1.23)	2.71 (1.31)
Non-jokes	1.20 (0.52)	1.17 (0.51)	1.30 (0.73)	1.31 (0.68)

SD: standard deviation

the OR for detection accuracy on the joke version of stimuli was almost twice as high in native speakers as that in non-native speakers. This reflects that native speakers were more likely to accurately detect the joke version of stimulus. In addition, the coefficient on the interaction term between joke version of the stimulus and social connectedness score is three times higher in the model of non-native speakers' humor appreciation than in native speakers' model, suggesting that social connectedness scores are more related to humor ratings in non-native than native speakers.

Experiment 2: Auditory Humor Comprehension

This experiment aimed to examine the relationship between auditory humor comprehension performance and individual differences in language proficiency and social connectedness among native and non-native speakers of English. The procedure and materials were similar to experiment 1 except that the stimuli were presented in the auditory modality.

Participants Following the exclusion of several participants who failed to answer correctly on "catch" trials, there were 97 native English speakers and 90 non-native speakers recruited in this experiment (70 females, mean age: 20.12 ± 1.91; 68 females, mean age: 20.53 ± 1.95). Each subject was compensated with academic course credits. All subjects were at least 18 years old and provided informed consent to participate in the experiment.

Procedure Adapted from experiment 1, the layout of tasks in Experiment 2 was similar to the previous study. Note that the audio file was played as soon as subjects entered the new page for each stimulus. Audio files were only played once and subjects were not allowed to replay them.

Results and Discussion The detection accuracy was computed in the same way as Experiment 1. As shown by an independent t-test, native English speakers achieved a higher detection accuracy than the non-native English speakers (Native: 77.62 ± 9.23 % vs. Non-native: 67.80 ± 8.03 %, $p < 0.001$). Native English speakers also achieved a significantly

higher Lextale score than non-native speakers (Native: 91.75 ± 7.18 % vs. Non-native: 79.35 ± 10.57 %, $p < 0.001$). No significant difference in social connectedness scores was found between groups (Native: 73.61 ± 12.39 vs. Non-native: 71.67 ± 13.18, n.s.).

Figure 2 shows that the humor detection accuracy in both native (top left) and non-native (bottom left) speakers were significantly greater for the joke version of the stimuli (Native: OR = 2.51, CI = [1.90, 3.32], $p < 0.001$; Non-native: OR = 2.09, CI = [1.59, 2.73], $p < 0.001$), indicating that both groups obtained higher detection accuracy on the joke version of the stimuli than the non-joke versions. In addition, a significant interaction between the joke version of of the stimuli and social connectedness scores was present for non-native speakers (OR = 1.16, CI = [1.01, 1.33], $p = 0.032$), indicating that non-native speakers with higher social connectedness scores were more likely to perform better on the jokes.

Figure 2 also shows results of the analyses of funniness ratings. For native speakers, the mixed-effect regression model revealed a significant effect of the joke version of the stimuli (estimate = 1.20, CI = [1.04, 1.36], $p < 0.001$), showing that – as expected – native speakers tended to rate the jokes as more humorous than the non-joke controls. Similarly, the analysis of non-native speakers ratings revealed a significant effect of the joke version of the stimulus (estimate = 1.34, CI = [1.20, 1.48], $p < 0.001$), with a similar effect size as the native speakers as the confidence intervals for the two groups overlap. These analyses suggest that funniness ratings for the two groups were quite similar as native and non-native speakers tended to rate the jokes as slightly more humorous than the non-joke stimuli.

General Discussion

The present study explored the relationship between humor comprehension, English language proficiency, and sociocultural familiarity in both auditory and visual modalities in native and non-native English speakers. While anticipating that both linguistic proficiency and sociocultural proficiency are significantly associated with L2 humor competence, we hy-
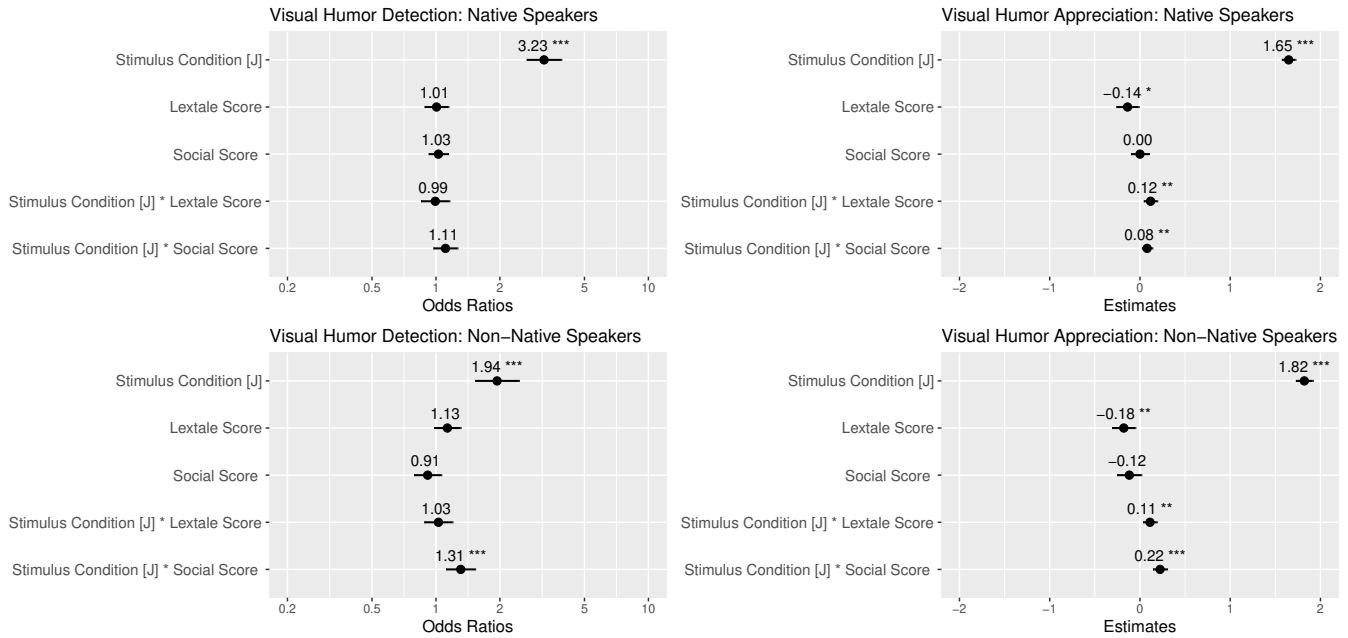
Figure 1: Mixed-effect regression results for humor detection (left) and humor appreciation (right) performance on visually presented materials. Plots on the left side show coefficients from the humor detection regression for native (top) and non-native (bottom) speakers. Plots on the right side show coefficients from the humor appreciation regression for native (top) and non-native (bottom) speakers. The regression coefficient for each term is printed above the data point and significance levels are depicted with asterisks ($*p < 0.05$, $**p < 0.01$, $***p < 0.001$).

pothesized that linguistic proficiency would play a more significant role in detecting humor in the auditory modality than the visual one. We also hypothesized that, compared to L1 speakers, sociocultural knowledge would play a greater role in predicting L2 speakers' humor detection and funniness ratings. While results did not support our hypothesis regarding linguistic proficiency and joke detection in the auditory modality, we found robust support for the importance of sociocultural knowledge in L2 humor appreciation.

Our results showed that while joke detection accuracy was better among the native speakers, native and non-native speakers' performance was remarkably similar. Regardless of presentation modality, both groups were better at detecting the jokes than the non-joke stimuli. Among non-native speakers, this effect was found to be positively associated with social connectedness scores, indicating better joke detection among non-native speakers with a greater connection to the English speaking community. Joke detection results of the present study thus replicate those reported by Xu and colleagues and bolster their claim that integration with the L2 community affords non-native speakers the opportunity to gain the sociocultural knowledge that is so critical for understanding jokes (Xu et al., 2022).

Interestingly, the present study provided no indication that linguistic proficiency is associated with non-native speakers' ability to detect jokes in either the visual or the auditory modality. This differs from work by Chen and De-

waele that showed a significant correlation between linguistic proficiency and humor comprehension. Our failure to observe a similar effect here may stem from the fact that there was a greater range of linguistic proficiency in Chen and Dewaele's study as they compared non-native speakers with Lextale scores ranging from 40% - 100%, whereas those in the present study were advanced L2 speakers, given that their average score on the Lextale was around 80%. Despite their high levels of English proficiency, though, our non-native speakers' joke detection was slightly lower than native speakers, consistent with the claim that L2 speakers with sophisticated linguistic competence still find humor detection to be challenging (Nelms, 2001). Further, our finding that social connectedness was associated with better joke detection in both written and spoken materials suggests that once L2 speakers' linguistic proficiency reaches a critical level, humor detection performance depends on exposure to the relevant sociocultural knowledge.

For materials accurately categorized as either a joke or a non-funny statement, both groups rated the jokes as being slightly funnier than the statements. In fact, non-native speakers rated the jokes slightly higher than the native speakers did, and this was the case for both the visual and the auditory modality. In the visual modality, linguistic proficiency was clearly related to humor appreciation in both native and non-native speakers. Subjects with higher Lextale scores not only rated the jokes as slightly funnier than their less profi-
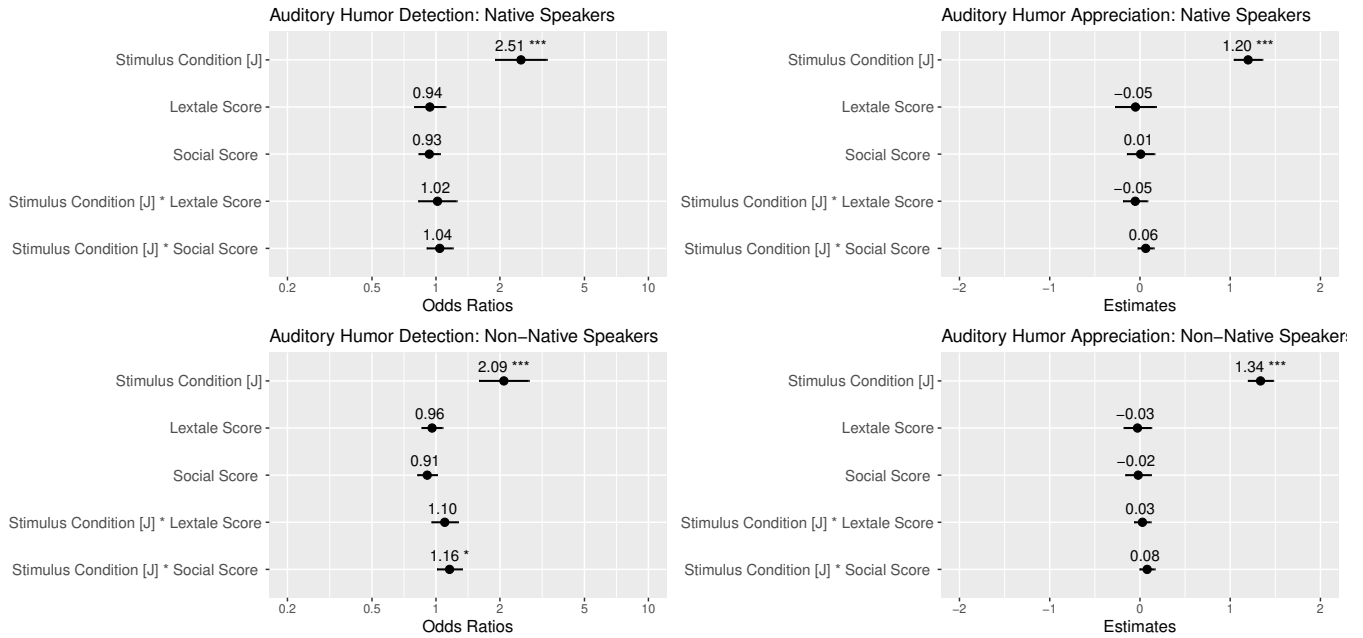
Figure 2: Mixed-effect regression results for humor detection (left) and humor appreciation (right) performance on auditory material. Plots on the left side show coefficients from the humor detection regression for native (top) and non-native (bottom) speakers. Plots on the right side show coefficients from the humor appreciation regression for native (top) and non-native (bottom) speakers. The regression coefficient for each term is printed above the data point and significance levels are indicated with asterisks ($*p < 0.05$, $**p < 0.01$, $***p < 0.001$).

cient peers, they also rated the non-jokes as being less funny. The latter finding is especially meaningful given that when participants are unsure about a given sentence on this task, they tended to classify it as a joke.

Social connectedness was also associated with higher ratings for the visually presented jokes in both groups. Whereas the effect size for Lextale scores was very similar in native and non-native English speakers, the effect of social connectedness was larger among the non-native speakers. The similar effect size for Lextale scores between native and non-native speakers suggested that they both need a certain level of linguistic proficiency to appreciate the ambiguities in the jokes. However, presumably due to their different cultural experiences, non-native speakers sometimes lacked the sociocultural knowledge needed to properly appreciate the jokes.

In the auditory modality, humor appreciation was unrelated to scores on either the Lextale or the social connectedness questionnaire. Thus when non-native speakers accurately detect a joke, their appreciation is similar to that of native speakers. Moreover, individual differences in linguistic proficiency and sociocultural familiarity are more relevant when subjects read jokes as opposed to listening to them. Given that individual difference factors predictive of joke detection were quite similar in the visual and auditory modalities, modality differences in funniness ratings suggest that the demands of joke comprehension on non-native speakers primarily involve joke detection. Indeed, this is in keeping with Chen and De-

waele's finding that the ease of understanding for humorous stimuli was positively correlated with the L2 funniness rating (Chen & Dewaele, 2019). Modality differences in joke processing in the present study thus present an intriguing area for further research.

The present study suffered from a number of limitations. First,the simple design of the humor detection task may not be entirely diagnostic of participants' comprehension of the materials. For future studies, one improvement might be the development of a set of questions that assess whether participants are privy to the sociocultural knowledge needed to properly understand the humorous content of the materials. Second, only a single questionnaire was used to measure linguistic proficiency which may have limited our ability to detect a relationship between humor detection and language skill. Future work should use multiple instruments in order to assess aspects of language knowledge beyond vocabulary, such as grammar and reading comprehension. Also, the high level of English proficiency among our non-native speakers limited our ability to observe how humor comprehension varies across the full range of non-native speakers. Nevertheless, the present study confirmed that L2 speakers' sociocultural proficiency was relevant for the detection of verbal humor in both modalities, and its appreciation in the visual modality.

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