THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF PSYCHOLOGY

Second Language Listeners' Comprehension of Accented Speech in Quiet and Noisy Environments

GREGORY P. COSTANZO
SPRING 2024

A thesis
submitted in partial fulfillment
of the requirements
for baccalaureate degrees in Linguistics, Psychology, and Biology
with honors in Psychology

Reviewed and approved by the following:

Janet van Hell
Distinguished Professor of Psychology and Linguistics
Thesis Supervisor

Frank Hillary
Professor of Psychology
Honors Adviser

ABSTRACT

Research on accent comprehension in noise has previously supported the notion that language background is related to speech processing abilities in listeners' native language (L1). To our knowledge, accent comprehension in noise has not yet been studied in second language (L2) listeners. The present study examines how listeners with Dutch as their L1 and English as their L2 comprehend English sentences produced in Dutch-accented English, Southern-American English, Chinese-accented English, and unmarked American English in quiet and noisy conditions. Forty sentences were recorded in each accent condition, half of which were embedded in background noise. After participants heard each sentence, they were asked to type in the sentence. Forty participants were recruited for this study. The participants showed highly accurate transcription scores in the quiet condition for the Dutch, Southern, and American accent conditions with slightly lower mean scores in the Chinese accent. In the noisy condition, transcription scores for the American and Southern accents were high while the Dutch and Chinese accents were comparatively low with Dutch transcribed least accurately. The participants did not demonstrate an interlanguage speech intelligibility effect in noise, indicating a cognitive challenge in processing their native accent when masked. These findings are unexpected and require further analysis.

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ACKNOWLEDGEMENTS

This research is supported by an undergraduate fellowship awarded to Gregory Costanzo, in the NSF PIRE program NSF OISE-1545900, as well as grants NSF BCS-2041204 to Janet G. van Hell and Yushuang Liu and NSF BCS-2041264 to Janet G van Hell. This research was also supported by Holly Zaharchuk who helped program the study on LabVanced.

1. INTRODUCTION

Migration, both within and between countries, has created a world where everyday life involves interacting with people who speak with regional or nonnative accents. Communication between differently accented speakers can result in consequential misunderstandings with potentially impactful ramifications, such as when interacting with law enforcement or healthcare professionals. As such, it is becoming increasingly important to research the cognitive processes underlying accent comprehension for both native and nonnative speakers in order to better understand how listeners processes accented varieties of speech.

The challenge experienced by native speakers when listening to speech in accents different from a listener's native speech has been thoroughly researched and quantified through a breadth of methods (e.g. Bent & Holt, 2018; Goslin et al, 2012; Grey & Van Hell, 2017). For example, there is ERP (event related potential) data indicating that language processing at the neurological level can be affected by how listeners perceive nonnative accents. Grey and Van Hell (2017) conducted a study with both ERP and behavioral measures to understand the interaction between the comprehension and perception of, as well as attitudes towards, native and nonnative speech in U.S. L1 English listeners. The researchers were interested in understanding the extent to which language background and exposure, as well as sociolinguistic biases may interact with language processing on a neurocognitive level. The listeners in this study were all from Central Pennsylvania, U.S., had little exposure to nonnative accents, and were not studying any foreign languages. Participants completed language background and attitude surveys. They also listened to Chinese-accented and American-accented English

sentences that contained grammatical errors or semantic errors and their correct counterparts while their brain activity was recorded using EEG (electroencephalogram). ERPs data were used to measure participants' neurological responses to these errors in relation to the accent condition of each sentence. After the experiment, participants were also asked to identify the nationality of the nonnative-accented speaker. In response to grammatical and semantic errors in native-accented sentences, Nref and N400 effects were respectively observed. For errors in nonnative speech, participants who correctly identified the nonnative accent had a grammatical and semantic effect while those who did not identify the nonnative accent only showed an N400 semantic effect. This indicates that a listener's lack of exposure to an accent affects accented language processing on a neurological level.

There also appears to be an important distinction between processing native-, regional-, and nonnative-accented speech. Bent and Holt (2018) presented American-English speaking adults and children (aged 5-7) with English sentences spoken in American-, British-, and Japanese-accented English. For adults, these sentences were presented in three noise conditions (quiet, +4 dB SNR (signal to noise ratio), and 0 dB SNR) whereas for children the sentences were presented in only two noise conditions (quiet and +4 dB SNR). Participants were exposed to sentences in all three accent and background noise conditions and were asked to verbally repeat back the sentence they heard. When exposed to increasing levels of noise, comprehension accuracy of sentences spoken in different accents decreased (Bent & Holt, 2018). In the quiet condition, children were able to accurately understand the American and British accent conditions, but they struggled with Japanese-accented English. In the noisy condition, children were still able to accurately understand the American-accent condition, however, their comprehension of the British and Japanese-accented sentences dropped significantly. Despite

this drop in comprehension for both conditions, they were better able to understand the British-accented sentences than the Japanese-accented sentences. Adults were able to accurately comprehend all three accents in the quiet condition; however, the Japanese accent condition was the least accurately understood by a significant degree. In the +4 dB SNR condition, adults were still able to understand the American and British accents, although their accuracy dropped slightly relative to the quiet condition. Their understanding of the Japanese accent in noise, however, dropped significantly. In the +0dB SNR condition, their understanding of the American accent dropped, but not as strongly as their comprehension of the British accent, which was still better understood than the Japanese accent. This study suggests that children struggle to understand non-native accents and regional varieties as the background noise increases. This is also evident in adults, but not nearly as strongly as in children, and more noise is required in adults to affect language comprehension in a severe way. This is a good example of how masking can exacerbate the cognitive challenge of processing accents different than that of a given listener, including regional speech.

The differences between native-, regional-, and nonnative- accented speech processing have also been studied at the neurological level. Goslin et al. (2012) conducted an event-related potential (ERP) study to measure neurological responses to native, regional, and nonnative speech. This study sought to engage with two conflicting theories of accent perception, the Perceptual Distance Hypothesis and the Different Processes Hypothesis using ERP data. The Perceptual Distance Hypothesis posits that the degree of dissimilarity in phonology between nonnative accents and a listener's native speech explains the disparities in processing different accents. According to this hypothesis, regional accents and nonnative accents are processed along a single continuum of acoustic distance from a listener's native speech with most

nonnative accents being phonemically more distant than regional accents to a listener's L1. By contrast, the Different Processes hypothesis states that listeners process regional and nonnative accents through distinct cognitive mechanisms. This could be due to differences in processing the integration of segmental and suprasegmental features (such as syllable stress) from a nonnative-accented speaker's first language into L2 speech, posing a challenge for listeners. Furthermore, L1 speakers of unmarked varieties may more easily adapt to the unique features of regional varieties of the same L1 such that they are processed through a different mechanism as nonnative-accents. In their study, Goslin et al. (2012) recruited adult Southwest English-accented participants' responses to their native accent, a regional UK accent, and a nonnative accent. While all participants were exposed to Southwest English speech, the participants were split into two groups; one group was exposed to a regional South Wales English accent and a nonnative Polish accent, and the other group was exposed to a regional Yorkshire accent and a nonnative Italian accent. EEG recordings were taken as participants were exposed to sentences in these accent conditions while completing a go/no-go task in which participants had to indicate if a sentence's final word was an animal. The researchers focused on the participants' response to the final word of each sentence through measuring both Phonological Mapping Negativity (PMN) as an early stage of phonological processing and N400 signals as a marker of later semantic processing. In comparison to exposure to native-accented speech, a greater PMN in response to regional-accented speech and a reduced PMN in response to nonnative-accented speech was observed. There was also no significant difference in N400 signals between native- and regional-accented speech, while a significant N400 effect in response to nonnative-accent exposure was observed. The differences in ERP signals across accent conditions in this study indicate that

regional and nonnative accents appear to be processed differently in the brain, supporting the Different Processes Hypothesis.

The processing of regional accents and dialects in native listeners such varieties has also been studied. Zaharchuk et al. (2021) conducted an ERP study on both native speakers of Unmarked and Southern U.S English varieties focusing on error detection in relation to unique regional grammatical constructs. In this case, the study focused on measuring participants' attitudes, judgements, and neurological responses to the double modal structure (e.g. *might could*), a feature present in many Southern, but not Unmarked, U.S. English varieties. This study also had an important sociolinguistic component, specifically that double modals represent a grammatical difference between Southern and Unmarked U.S. English which drives a perception of Southern varieties as a non-standard and low-brow form of English by L1 Unmarked speakers. The participants in this study were divided into two groups based on their exposure to Southern varieties. This study involved a series of language background, attitude, and judgement surveys to assess each participants' personal history, views, and perception of the correctness of Southern double modals. Southern participants claimed more experience and familiarity with, as well as a greater perception of the acceptability of double modals than Unmarked participants. During the EEG component of the study, participants were exposed to a series of target sentences spoken by a Southern speaker with and without double modals along with interspersed comprehension questions. ERP data was collected and analyzed during participants' exposure to double modals. It was found that double modals elicited early anterior negativity and P600 effects in both Southern and Unmarked participants. This shows both error detection and sentence-level reanalysis, indicating incongruity with Southern participants' processing of double modals and their self-reported perceptions and judgements. This suggests that in native

dialect speech, familiarity with regional variants may not result in a processing advantage of regional features, and highlights that the processing of unmarked and regional speech in L1 regional speakers may be influenced by social prospections of these features.

It also appears that language processing engages different mechanisms in native and nonnative listeners (Baese-Berk et al., 2011; Bent & Bradlow, 2003; Grey et al., 2019). Baese-Berk et al. (2011) explored the theoretical basis and behavioral evidence for how bilinguals process sound in their first and second languages. It appears that nonnative listeners have to develop a sensitivity to phonetic categories which are different from their first language. In this way, it seems that L2 learners may generalize sounds differently than native speakers of the target language. There is also evidence to suggest that L2 learners experience phonetic boundary shifts which affect their perception and production of phonemes in their target language differently than native speakers of the same language. This is often influenced by the phonological features of the learner's L1 and language background in general.

Previous research has also provided insight into how linguistic experience with a given accent may impact the processing of nonnative-accented speech in L2 listeners. Using ERPs, Grey, Schubel, McQueen, and Van Hell (2019) recorded the brainwaves of L1-Dutch L2-English bilingual speakers while they listened to American-and Chinese-accented English sentences that contained semantic or grammatical errors, and their correct counterparts. While the L2 English listeners could comprehend sentences in both accent conditions and detect the errors in behavioral tasks with high accuracy, the ERPs detected noteworthy differences in how the participants processed the two accents. Specifically, the neurological data indicated that participants experienced difficulty processing grammatical errors in the Chinese-accented English sentences, more so than in the American-accented sentences. This neurological evidence

suggests that L2 listeners comprehend familiar accents (here: American-accented English) more easily than ones they are not familiar with (here: Chinese-accented English). That being said, the American-accented English sentences also elicited delayed N400s in semantic processing in the L2 listeners, and this delay does not occur when L1 listeners are exposed to American-accented English sentences (Grey & Van Hell, 2017). This study provides neural evidence supporting the theory that processing one's native language and processing a second language seem to engage different neurocognitive processes.

The present study researches L2 accent perception in noisy and quiet environments. It aims to better understand how language experience interacts with L2 listener's comprehension of native, regional, and nonnative accents. Research on nonnative-accented speech comprehension has mainly studied listeners who listened to native language (L1) speech (Grey et al., 2019). American English L1 listeners find American-accented English easiest to comprehend, followed by British-accented and then Japanese-accented English (Bent and Holt, 2018). How do listeners process accented speech in their second language (L2)? L2 English listeners find accented speech in their own accent equally intelligible as speech spoken with a native L1 accent, and more intelligible than English talkers of other nonnative accents (e.g., Bent & Bradlow, 2003). The present study aims to uncover whether or not this pattern changes when speech is presented in noise.

Given that the world is noisy and full of distractions, background noise was chosen as a means of masking audio stimuli. Van Engen et al. (2014) explained how background babble engages both energetic (EM) and information masking (IM), reducing the amount of audible information and distracting the speaker's focus respectively. They also argue that researching the influence of masking through audio and other means provides a better glimpse at how cognition

works in realistically noisy and distracting environments. It also has a precedent in accent perception research as in the aforementioned study by Bent and Holt (2018).

There are very few, if any, published studies which have investigated L2 listeners' comprehension of accented speech in noise. This study exposed L2 listeners to four different L2 (English) accent conditions in varying degrees of noise. The accents chosen for this study were: Unmarked American English, Southern American English, Dutch-accented English, and Chinese-accented English. The L1 Dutch L2 English listeners will hear two accent conditions theorized to be familiar to them (Standard American- and Dutch-accented English) and two accent conditions which are (at least) less familiar or unfamiliar to them (Southern American English, Chinese-accented English). This study aims to specifically answer the following question: How do bilinguals listening to speech in their second language (L2) process different varieties of native and nonnative-accented sentences, presented in quiet and in noisy conditions?

When presented in quiet conditions, Bent and Bradlow (2003) found that L2 English listeners understood American-accented English and non-native accented English from somebody with the same L1 as the listener as equally intelligible. This effect was called the "matched interlanguage speech intelligibility benefit" (Brent & Bradlow, 2003). Extending the matched interlanguage speech intelligibility effect to Dutch L2 English listeners presented with sentences in quiet, it is predicted that they will find Dutch-accented English and Standard American-accented English equally intelligible, the less familiar Southern American English-accented sentences less intelligible, and the unfamiliar Chinese-accented English sentences the least intelligible. The Southern U.S. accent was chosen for this study to represent the very likely possibility that L2 speakers may encounter regional varieties of a target language not formally taught as part of language curricula. This was understood as an opportunity to focus to

emphasize the importance of factoring in internal accent and dialect diversity into psycholinguistic research.

When presented in noise, it was predicted that intelligibility performance will decrease significantly relative to the quiet conditions, but that this effect will be depend on listeners' familiarity with a particular accent. Specifically, it was hypothesized that performance differences between noise and quiet conditions will be relatively small for the Standard American-accented English and the Dutch-accented English sentences, and larger for the less familiar Southern American English-accented sentences and largest for the unfamiliar Chinese-accented English sentences.

2. METHODS

2.1 Participants

Forty Dutch participants were recruited for this study via Facebook (n = 3) and through Prolific (n = 37). All participants reported that they were Dutch L1 speakers and fluent English L2 speakers. Data from two participants were excluded because their transcription task scores which over two SD below the average group score for each condition. The remaining thirty-eight participants (gender: male = 22, female = 14, nonbinary = 2) were between 18 and 55 years old and never resided in the United States for a period greater than two months. These demographics were ascertained by participant filters in Prolific's recruitment system and confirmed in the language history and demographic questionnaire completed before the start of the experiment. The participants' average score on an English vocabulary test, LexTale (Lemhöfer & Broersma, 2012), was 86.53% (SD = 7.39%), which is above the average 81.4% LexTale score for Dutch

L1-English L2 students enrolled at Radboud University Nijmegen in the Netherlands (Lemhöfer & Broersma, 2012). All provided informed consent before participating in the study and were compensated $10/hour.

2.2 Materials

160 auditory stimuli were prepared for this study in collaboration with another study in the Bilingual Development Laboratory at the Pennsylvania State University. These stimuli consisted of complete English sentences in 4 accent conditions (40 sentences per accent condition). Stimuli were recorded by four female speakers with the following accents: Unmarked (Maine) U.S. English accent (Maine); a Southeastern U.S. accent with a typical Southern drawl (Kentucky), Chinese-accented English (Taiwan), and Dutch-accented English (the Netherlands). The speakers were selected on the clarity of their speech and absence of vocal abnormalities or rasps. The stimuli were designed to have as few overlapping content words (nouns, verbs, and adjectives) as possible. The sentence stimuli were matched across the four conditions on number of words (Unmarked: 7.80 (St. Dev = ±1.40), Southern: 8.35 (St. Dev = ±1.25), Chinese-accented: 7.83 (St. Dev = ±1.15), Dutch-accented: 7.85 (St. Dev = ±1.19),) and number of syllables (Unmarked: 9.57 (St. Dev = ±2.23), Southern: 11.25 (St. Dev = ±2.19), Chinese-accented: 9.53 (St. Dev = ±2.10), Dutch-accented: 9.60 (St. Dev = ±1.91)). No significant difference existed between the number of words or syllables across the four condition (both *p*'s = .99). A +0 SNR 2 speaker English speech babble was applied at random to half of the stimuli in each accent condition. In total, there were 20 sentences with quiet and noisy backgrounds per accent.

Two questionnaires were included in the study. The first questionnaire was a pre-screening survey to screen the eligibility of participants; this survey verified that all participants were aged 18-55 years, were Dutch L1 and English L2 speakers and had never spent more than two months in the United States of America. This was in order to minimize their potential exposure to the Southern U.S. accent. The second questionnaire was an accent perception questionnaire, administered after the transcription task. This questionnaire prompted participants with one sentence in each accent condition with a quiet background and asked participants to indicate where they believed the speaker was from, what their first language was, whether or not they perceived the speaker as having an accent (yes or no), and to rate each speaker's accentedness using a Likert scale from 1 (least accented) to 5 (most accented). The LexTale English vocabulary task was administered to assess each participant's English proficiency (Lemhöfer & Broersma, 2012).

2.3 Procedure

This experiment was programmed through the digital experiment interface *LabVanced* (Sciscovery GmbH, Germany). This online interface allows for a convenient and accessible tool for creating computer-based studies. Prolific, an online service which uses artificial intelligence to match researchers and test subjects, was used to recruit and pay participants. After completing pre-screening on Prolific, the participants then answered pre-screening questions again in *LabVanced*. Both processes verified that participants were from the Netherlands, Dutch L1 and fluent English L2 speakers, between the ages of 18 and 55 years old, and that they have not been in the United States for more than two months. They then had to undergo a screening test to verify that they were wearing accurately functioning headphones for this experiment.

After the prescreening, the participants completed the transcription task. Two varieties of the transcription task were made, labeled A and B, with differing arrays of sentences in noise and in quiet. The transcription task exposed listeners to a sentence, either in quiet or in noise, and then prompted the participant with a text box and 30 seconds to write to the sentence they heard verbatim in English the best of their ability. Before starting the experiment, 8 sentences were created as practice sentences. Each practice sentence was in a different accent condition and noise was assigned at random to two of these sentences. Once participants finished practicing the transcription task, they proceeded to transcribe the critical experimental sentences. After they submitted their transcription in the text box and pressing the enter key, the next sentence was immediately presented. If a participant did not write a response, the next stimulus was automatically presented after 30 seconds. This was repeated until all critical sentences were transcribed.

The accent perception questionnaire was the next task. Participants were prompted with a recording of each accent condition with a quiet background and asked to list which country they believed the speaker was from, what they believed their native language to be, and assign a Likert scale value to the speaker's accentedness between 1(least accented) and 5 (most accented). After this task, each participant completed the LexTALE English test to measure each participant's English proficiency.

2.4 Data Analysis

Participants' responses were scored on accuracy of the transcription of selected keywords for each sentence in the transcription task. A participant's score for a given sentence was determined as a series of points consisting of the proportion of keywords correctly transcribed

over the total number of selected keywords per sentence. The number of keywords was matched across all accent conditions (Unmarked: $M = 3.78$ ($SD = 0.80$), Southern: $M = 3.70$ ($SD = 0.72$), Chinese-accented: $M = 3.70$ ($SD = 0.60$), Dutch-accented: $M = 3.70$ ($SD = 0.76$)) with no significant difference across conditions ($p = .96$). Participants did not lose points for typos and minor spelling errors. Typos and minor spelling errors were defined as the erroneous use of a homophone, the subtraction or addition of a letter from a word that did not result in a word with a clearly different meaning, or the insertion or replacement of a letter whose keystroke borders the correct target letter. Participants who failed to transcribe a keyword within these parameters were not awarded that word's respective point. Participants' scores for each sentence were averaged across the accent and background noise conditions of the experiment, meaning they would have a different score for a given accent depending on their performance transcribing sentences in said accent with and without background noise. Each participant's score for the transcription task was determined from their transcription of 152 sentences (8 warm-up sentences were excluded). The scores from the 152 sentences were divided into 8 groups of 19 sentences for each accent condition in both noise conditions. A 2 (Noise condition: Noise, Quiet) x 4 (Accent: Dutch, Chinese, Southern, Unmarked) ANOVA was used to assess the performance in each accent and noise condition. Participants' responses to the perceived accentedness, country of origin, and L1 of each speaker were recorded as well with the accentedness rating was analyzed across accent conditions with a single-factor ANOVA.

3. RESULTS

3.1 Transcription Task Data Processing

The statistical analyses for this study were conducted through Microsoft Excel and SPSS. Excel was used to measure variance between stimuli characteristics (word count, syllable count, and syllable to word difference), to track and score participants' transcription task performances, and to create the figures for this experiment. SPSS was used for the ANOVA tests for task performance across participants for each accent and noise condition.

In the experimental interface used by participants, it was found that one stimulus sentence from the Unmarked American accent condition was erroneously replaced by the repetition of another sentence from the same accent condition. In this case, the sentence "She noticed the sofa was left in the dumpster" (items 66 in quiet and 135 in noise in transcription task A, items 59 in quiet and 142 in noise transcription task B) was heard twice while the original sentence "Harry was thirsty after marching through the desert" was omitted from both transcription tasks entirely due to this error. Since sentences in both transcription tasks were heard in a random order, each participant's first exposure with this sentence was recorded for the purposes of data analysis while their second exposure was removed from the analysis.

Outliers were identified as participants whose individual average scores for each accent by noise condition were lower than two standard deviations below the mean of the study average for each condition. Scores from 2 outlier participants were therefore removed from the transcription task analysis due to low scores. A similar process was applied to sentences which were found to be abnormally and consistently challenging for participants. Individual sentences which yielded an average score across participants of two standard deviations below the mean

for that accent condition were also excluded from the analysis of the transcription task. One Chinese-accented sentence in quiet and four Dutch-accented sentences in noise were removed from transcription task A. One Dutch-accented in noise and two Chinese-accented sentences in noise) from transcription task B were removed from the analysis.

3.2 Transcription Task Results

The 2 (Noise condition: Noise, Quiet) x 4 (Accent: Dutch, Chinese, Southern, Unmarked) ANOVA on the mean transcription scores yielded a significant interaction between Noise condition and Accent, $F(3,111) = 56.61$, $p < .001$, $\eta_p^2 = .605$. The main effect of Noise condition was significant, $F(3,111) = 103.58$, $p < .001$, $\eta_p^2 = .737$. The main effect of Accent was also significant, $F(1,37) = 124.41$, $p < .001$, $\eta_p^2 = .771$.

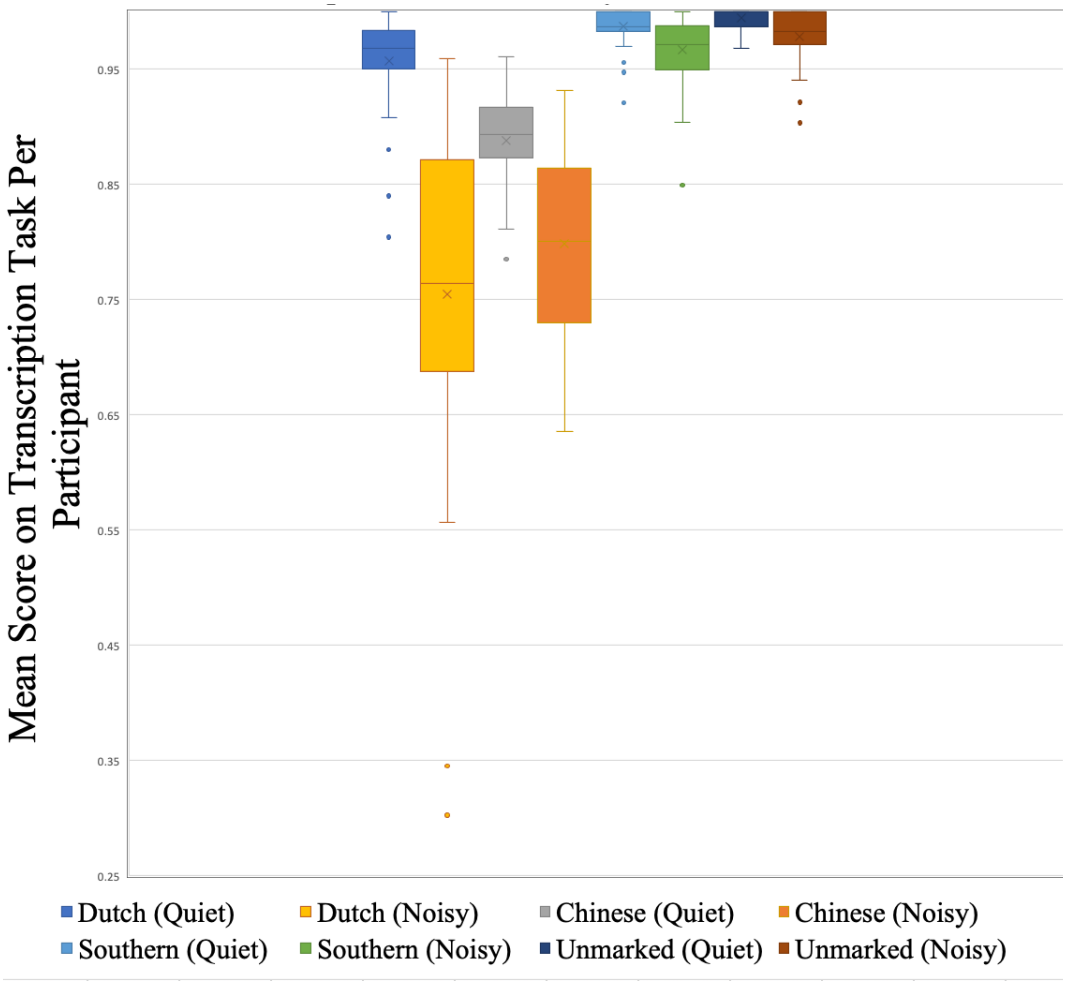
To identify the source of the significant two-way interaction, we conducted separate one-way ANOVAs on the mean transcription scores for the quiet and noisy conditions for the Dutch accent, the Chinese accent, the Southern accent, and the Unmarked accent. The main effect of noise on transcription scores for the Dutch accent was significant, $F(1,37) = 100.56$, $p < .001$, $\eta_p^2 = .731$; transcription accuracy dropped with 21.16% in the noise condition. For the Chinese accent, the effect was $F(1,37) = 48.73$, $p < .001$, $\eta_p^2 = .568$; transcription accuracy dropped with 9.4% in the noise condition. For the Unmarked accent, the effect was $F(1,37) = 16.23$, $p < .001$, $\eta_p^2 = .305$; transcription accuracy dropped with 1.87% in the noise condition. Finally, for the Southern accent, the effect was $F(1,37) = 14.05$, $p < .001$, $\eta_p^2 = .275$; transcription accuracy dropped with 2.34% in the noise condition. While the mean transcription accuracy was lower in the noise than in the quiet condition for each of the four accents, the effect of noise was particularly detrimental for the Dutch and Chinese accent conditions and less so for the Southern

and Unmarked accents. This differential effect is clearly visible in Figure 1 and confirmed by the effect sizes in these four one-way ANOVAs.

Table 1: Descriptive Statistics for the Transcription Task across Participants. Mean Scores are reported as a Proportion of 1.00.

Accent Condition	Noise Condition	Mean	Std. Deviation
Dutch			
	Quiet	.957	.043
	Noisy	.755	.147
Chinese			
	Quiet	.888	.039
	Noisy	.798	.084
Southern			
	Quiet	.987	.017
	Noisy	.967	.031
Unmarked			
	Quiet	.995	.008
	Noisy	.979	.024

Figure 1. Mean, Median, Upper Quartile, and Lower Quartile Ranges for each Accent Condition. Outliers for each Condition are Represented as Individual Dots.



An additional analysis was conducted to test for a correlation between participants' transcription scores across all accent and noise conditions and their performance on the LexTale English task. The Pearson correlation coefficients were: 0.14 in quiet and 0.11 in noise for the Dutch accent, 0.07 in quiet and 0.10 in noise for the Chinese accent, -0.10 in quiet and -0.11 in noise for the Unmarked accent, -0.25 in quiet and -0.08 in noise for the Southern accent. This indicates that there is little relation between English proficiency and transcription accuracy across accent and noisy conditions.

Table 2. Pearson Correlation Coefficients for the Relationship between each Participants' English Proficiency as LexTale Scores and Mean Transcription Scores across accent and noise conditions.

Accent Condition	Noise Condition	Pearson Correlation Coefficient
Dutch	Quiet	0.14
	Noisy	0.11
Chinese	Quiet	0.07
	Noisy	0.10
Unmarked	Quiet	-0.10
	Noisy	-0.11
Southern	Quiet	-0.25
	Noisy	-0.08

3.3 Accent Perception Questionnaire Results

A one-way ANOVA was conducted to measure the difference between participants' scores for the accentedness questionnaire across accent conditions. A significant difference was found between both the perceived presence of an accent ($F(3,148) = 42.33$, $p < .001$) and degree of accentedness ($F(3,148) = 64.49$, $p < .001$) across accent conditions. The Chinese-accented speaker was perceived unanimously as having an accent (100%), followed by the Southern-accented speaker (97.4%) and the Dutch-accented speaker (81.6%). The unmarked American-accented speaker was perceived to have an accent by the fewest proportion of participants (28.9%) across accent conditions. The Southern-accented speaker was perceived to have the strongest level of accentedness of all speakers (4.158), followed by the Chinese-accented speaker

(3.816), and the Dutch-accented speaker (2.526). The Unmarked-American accented speaker was similarly perceived as the least-accented (1.605) across accent conditions. This data indicates that the L2 English participants may perceive regional L1 and foreign L2 English speakers as accented and the unmarked speaker as less or non-accented. Similarly, the perception of a strong accent, as seen in the Southern speaker, may not necessarily affect the speaker's intelligibility to this variety of accented speech.

Table 3. Descriptive Statistics of both the Presence of an Accent (yes or no) and the Level of Accentedness (least accented (0) to most accented (5)) for each accent condition. The Presence of an Accent (yes or no) is Reported out of a Proportion of 1.00. The Accentedness Likert Scale is Reported as a Mean Score Between 1 and 5.

Accentedness (Yes or No)		
Groups	Mean	Std. Deviation
Southern	0.974	0.162
Dutch	0.816	0.393
Chinese	1.000	0.000
Unmarked	0.289	0.460
Likert Scale Accentedness		
Groups	Mean	Std. Deviation
Southern	4.158	0.679
Dutch	2.526	1.084
Chinese	3.816	0.955

The vast majority of participants correctly identified the Unmarked American-accented (85%) and Southern-accented (95%) speakers as being L1 English speakers from the United States (100% for the Southern speaker and 97% for the unmarked speaker). The unmarked speaker was misidentified as an L1 English speaker from the United Kingdom (7%) and Australia (5%) and as a Dutch L1 speaker from the Netherlands (3%). The Southern speaker was similarly misidentified by 5% of participants as an English L1 speaker from Australia. The majority of participants accurately identified the Chinese-accented speaker as coming from China (China 62%, Taiwan 3%) and being an L1 speaker of a Chinese variety (56% Chinese, 8% Cantonese). The remaining participants (35%) failed to identify the country of origin and the L1 of the Chinese speaker. The most common misidentification of the Chinese speaker was as a Japanese L1 speaker from Japan (10%). The majority (67%) of participants failed to accurately identify the Dutch-accented speaker. The most common misidentification of the Dutch-accented speaker was as an English L1 speaker (41%) from the United Kingdom (25%), United States (8%), Australia (5%), and Canada (2%) as well as an L1 German speaker (10%) from Germany (7%) or Switzerland (3%). These results indicate that the English L2, Dutch L1 participants experienced some difficulty identifying non-native accents in their L2, especially for speakers who are also Dutch L1, English L2, and Dutch-accented.

Figure 2. Accented Speaker's Perceived Country of Origin According to Participants. Results were Reported as a Percentage Based on Participant Responses.

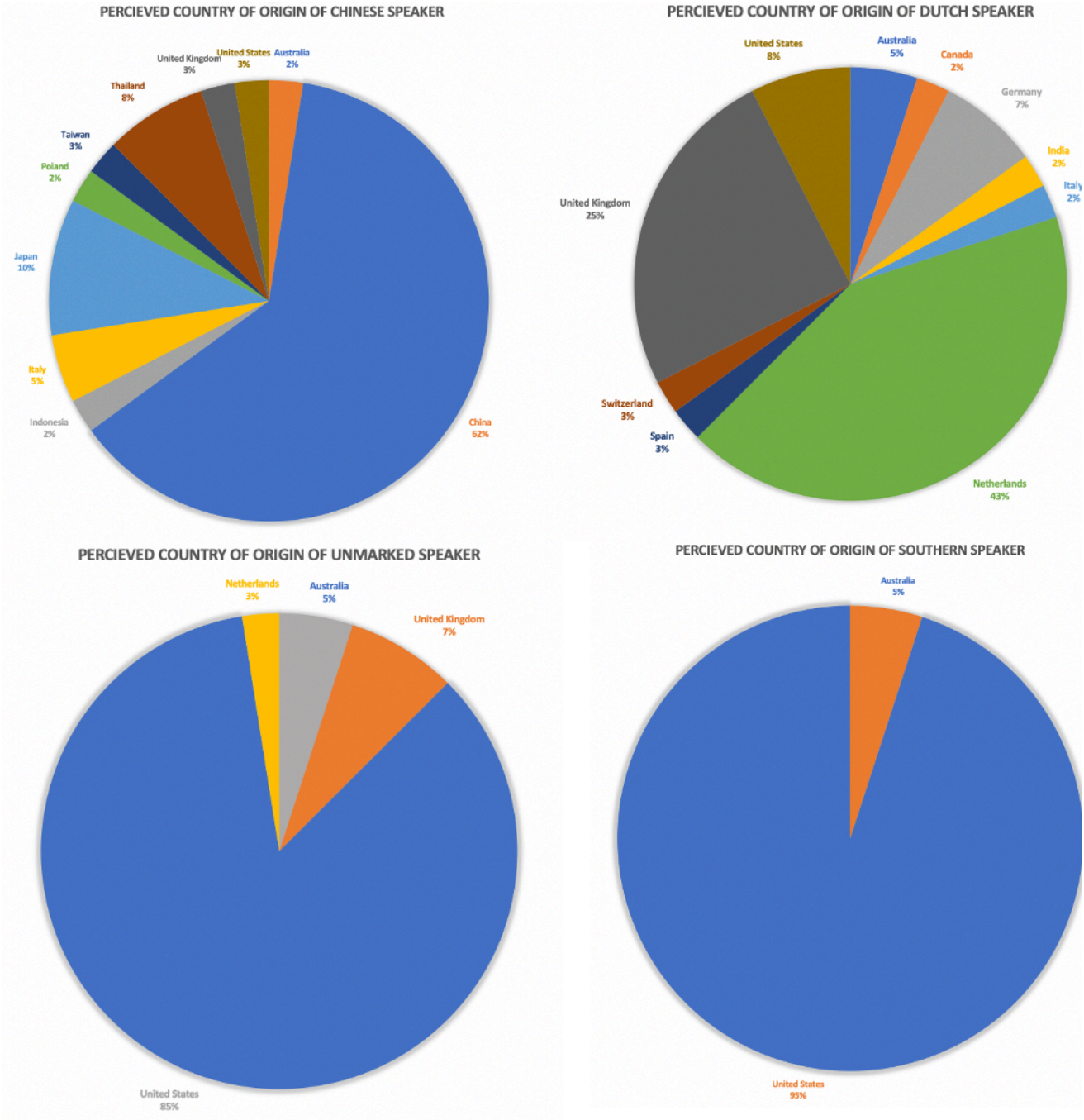
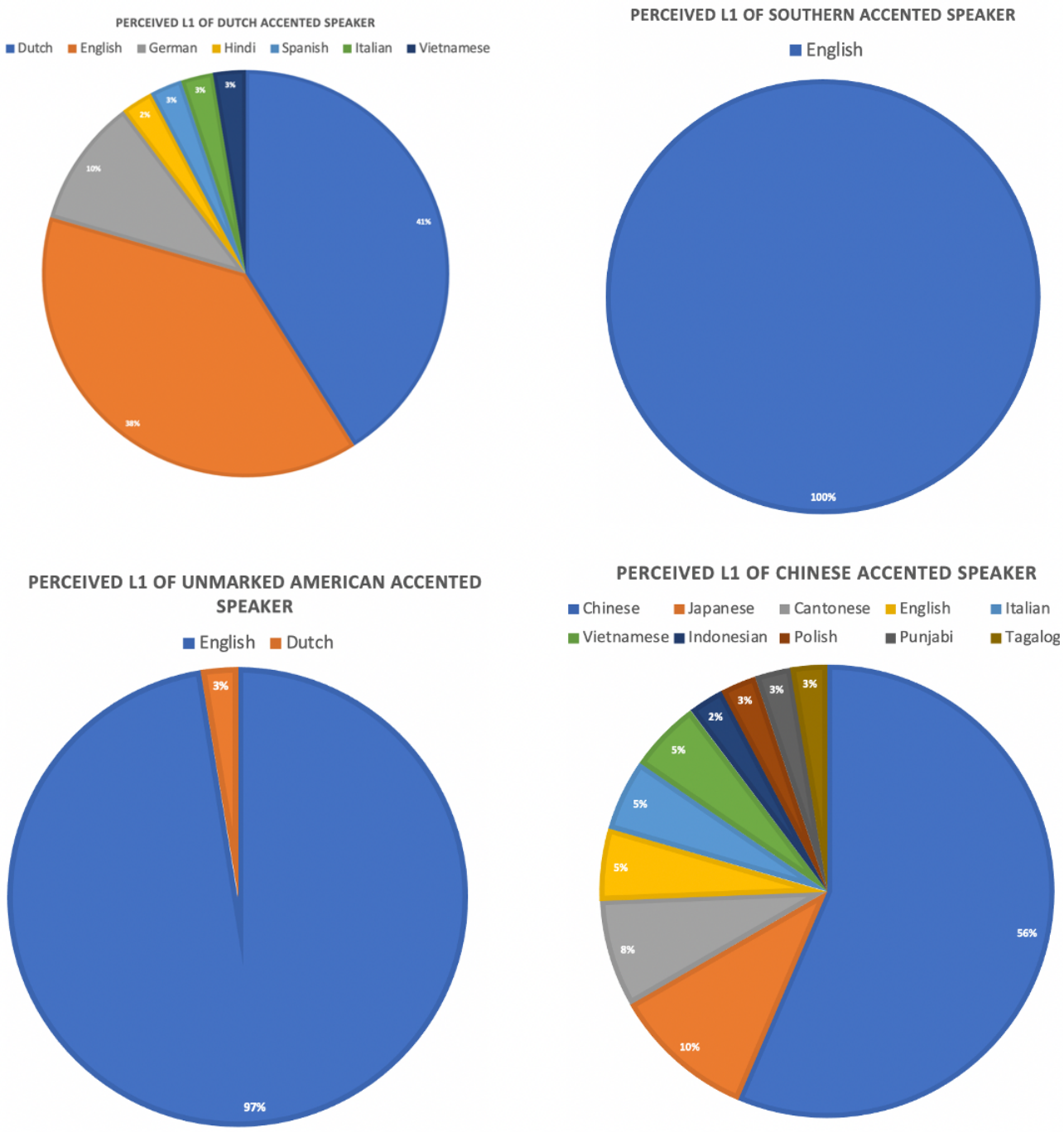


Figure 3. Accented Speaker's Perceived L1 According to Participants. Results were also Reported as a Percentage based on Participant Responses.



4. DISCUSSION

The findings of this study show highly accurate transcriptions of Unmarked American, Southern, and Dutch accents in quiet conditions. The transcription scores for the Unmarked and Southern accents were comparably high while the scores for the Dutch condition were lower than both North American accent conditions in quiet. The Chinese accent was transcribed least accurately in quiet compared to the other accent conditions. In noise, transcription scores for all accent conditions dropped. Scores for the Unmarked and Southern American accents experienced the smallest drop and, similar to the quiet condition, no difference was observed in transcription scores between these two accent conditions in noise. The Dutch and Chinese accents were transcribed least accurately in noise with the scores for the Dutch condition experiencing the largest drop. Surprisingly, the mean transcription scores for the Dutch accent and the Chinese accent in noise were at a similar level.

The vast majority of participants correctly identified the country of origin and L1 of both the Unmarked- and Southern-accented speakers as English-speaking Americans. A majority of participants also correctly identified the Chinese speaker as an L1 speaker of Chinese from China. Many participants perceived the Chinese speaker's L1 as another East/Southeast Asian languages as well, including Cantonese, Japanese, Tagalog, Indonesian, and Vietnamese. Surprisingly, less than half (43%) of participants accurately identified the Dutch speaker's L1 and country of origin. The most common misidentification (38% of participants) was as an L1 English speaker from the United Kingdom, the United States, Australia, or Canada. Another 10% of participants mistook the Dutch speaker as being an L1 German speaker from Germany or Switzerland.

It was hypothesized that there would be an advantage when processing L1-accented speech in listeners' L2 based on previous research (Bent & Bradlow, 2003; Grey et al., 2019). It was predicted that the Dutch L1 listeners would understand the Unmarked- and Dutch-accented conditions equally well due to a matched Interlanguage Speech Intelligibility (ISI) benefit in line with the findings of Bent and Bradlow (2003). Conversely, it was believed that processing the Southern- and Chinese-accented speech would pose a greater challenge to the listeners since it was anticipated that participants would perceive them as unfamiliar. Participants' responses to the Chinese accent condition followed expectations. It was the least accurately transcribed accent condition in quiet and was one of the least accurately transcribed accents in noise. This supports the main findings of Grey et al. (2019) which suggests that L1 Dutch L2 English listeners experience and increased level of difficulty when processing nonnative L2 speech from when uttered in an unfamiliar accent in quiet.

The results in the quiet condition suggest that L2 listeners process both Unmarked and regional varieties of native speech with greater ease than nonnative-accented speech, including speech in the accent of the listener's L1. This means this study's participants did not show a matched ISI benefit in quiet conditions between native and nonnative L1-accented speech. Nevertheless, Dutch-accented English, the theoretically more familiar English accent to the listeners, was transcribed more accurately than the unfamiliar Chinese-accented English. This indicates a matched ISI benefit between nonnative (but not native) accented speech in quiet conditions.

The results in the noisy condition were especially unexpected since the participants' transcription scores for the Dutch accent dropped to a similar level as the Chinese accent, which were both much lower than those of the Unmarked- and Southern-accents. These low

transcription scores for the Chinese and Dutch accent conditions in noise means that no mutual ISI benefit whatsoever was observed. This data refutes this study's original hypothesis that the ISI effect would cause Dutch L1 listeners to more easily comprehend L2 speech in their own accent in both noisy and quiet conditions.

There are several possible explanations for why a mutual ISI benefit was not observed in this study. The findings of Goslin et al. (2012) suggest that L1 listeners process nonnative and regional accents via different neural and cognitive mechanisms in congruence with the Different Processes Hypothesis. The findings of the present study demonstrate a significant difference in transcription accuracy in both noisy and quiet conditions between native and nonnative speech groups. This suggests that something similar to the Different Processes Hypothesis could be occurring in L2 processing as well. This notion is also supported by the findings of Grey et al. (2019) which also indicates that L2 English listeners process unmarked native, regional, and nonnative through different neural pathways. Similarly, L2 learners must adapt to the phonology of a given target language's native speech (Baese-Berk et al., 2011). It is possible that this L2 phonological adaptation causes learners to focus on both overt and subtle features of native speech similar across regional accents and not developing the same plasticity for nonnative speech during the language acquisition process. Focusing on adapting one's comprehension of a target language on native, but not nonnative speech could explain L2 listeners' difficulty with nonnative accent processing, especially when masked by noise.

Listeners' L1 also influences the development of phonological category perception in L2 learners. In this way, the linguistic, including phonological, distance between English and Dutch should be considered in this analysis as well. The distance between English, Dutch, and Dutch varieties like Frisian and Afrikaans is quite small, being some of the most closely related living

languages to English (Balsam, 2014). Furthermore, these languages all share common Germanic roots, origins in Northwestern Europe, and centuries of contact and mutual influence. It could be speculated that the short linguistic distance between these two languages caused the Dutch-accented speaker's accent to be subtle enough to fit within many listeners' Dutch influenced L2 category perception of native speech, thereby being perceived as a British or American accent. This could also potentially explain listeners' confusion when identifying the nonnative accent conditions in the accent perception questionnaire. Alternatively, masked Dutch-accented English speech may have caused confusion to participants by sounding similar to Dutch. The linguistic similarities between English and Dutch, combined with Dutch-accented English speech having similar phonological and suprasegmental features as Dutch might cause confusion for L1 Dutch listeners. Could it be possible that participants experienced a delay in language processing while their brains underwent a reanalysis to discern the language of this Dutch-accented speech when distracted by noise?

The present study relied on evaluating participants' transcriptions of speech and unfortunately does not provide any specific information which could explain the cognitive mechanisms at work in these situations. Additional ERP studies should be conducted to elucidate the neural pathways of L2 listeners' processing of regional, L1-accented nonnative and non-L1 accented nonnative accented speech in noise to better understand how these processes may differ in the brain. Specifically using an ERP approach to study the relationship between masking, linguistic distance, and accent perception between L1-Dutch L2-English listeners could shed light on these findings. It would be especially useful to have a neurological approach to uncovering how and why the Dutch accent condition's transcription scores were so low across participants in this study.

The background noise used for this experiment was a 2-talker English babble. As Van Engen et al. (2014) outlined, the type of masking occurring in background babble varies depending on the number of talkers. This experiment's babble had a comparatively high level of informational masking with some energetic masking, meaning some speech became incomprehensible due to audio interference (energetic masking; EM) and was became especially challenging for listeners to focus on only one voice (informational masking; IM). For some reason, the babble had a weaker effect in both the North American accent conditions and a stronger effect on the Dutch accent. Is it possible that participants' language background includes a relatively high level of exposure to masked native L2 speech while having little to no experience with masked Dutch-accented English?

The context in which participants gained exposure to various accents is also an important aspect of their language background. It is also well documented that people's ability to recall learned information and skills is enhanced when they are in the same context and setting where learning occurred and visa-versa (Balsam, 2014). Most real-world interactions experienced by Dutch L2 English speakers are probably with native-accented English speakers in Anglophone countries other than the U.S. or travelling outside of their home country. Similarly, these Dutch listeners may also have experience with other nonnative accented L2 English speakers in the Netherlands or elsewhere. It is important to question how much time these L1 Dutch speakers actually spend interacting with other L1 Dutch speakers in English. The main situation where Dutch speakers would speak to other Dutch speakers in English (rather than in Dutch) would be in the classroom to learn English or attending a university lecture intended for an international audience.

Migration may only be one facet of changing linguistic experiences globally. It is possible that listeners' media diet may heavily influence their experience with various regional accents from different parts of the world as well. Due to their large population and influence in the global technology and entertainment industries, North Americans dominate English-speaking film, television, music, and social media content. This means that global audiences are exposed to a wide range of accents from across North America, potentially on a daily basis. While the study controlled for participants' time spent staying geographically U.S., it did not control for participants' media preferences and therefore could not have truly controlled for exposure to the Southern or Unmarked accent because of media consumption.

Setting is also an important factor to consider when comparing media exposure and real-world accent exposure. The aforementioned forms of media all come with various visual and audio distractions, such as instrumentation and rhythm in music or background noise in film. It is possible that the participants in this study, being fluent L2 English speakers, hear both Unmarked and regional (including Southern U.S.) North American accents on a regular basis with background noise and other situational distractions, potentially for several hours per week while watching television, using social media, or listening to music. This could potentially explain the ease with which they were able to accurately transcribe both the Unmarked and Southern accents in noise. This also means that frequent exposure to English in a digital setting could have caused a performance enhancing effect when hearing native English speech throughout this study. The inability to account for participants' exposure to the Southern accent through media, specifically in a computerized setting, is a limitation of this study's methodology since it flouts the idea that the Southern accent would be perceived as unfamiliar to the participants.

It is likely that L1 Dutch speakers were mainly exposed to Dutch-accented English in controlled classroom settings during their education, in a (relatively) quiet setting. It is much less likely that L1 Dutch speakers hear Dutch-accented English on daily basis outside of these controlled settings, much less consuming media in Dutch-accented English. It is therefore possible that participants' previous exposure to Dutch-accented English speech in noisy conditions may be much smaller in scope than their exposure to a diverse range of North American English accents in noise through media exposure.

This effect of social and audio-visual media and the associated specific exposure situations it creates could possibly explain why transcription scores were so high for the Unmarked and Southern accent conditions. It is also possible that this increased exposure to native English speech in comparison to Dutch-accented speech could explain why there was an observed difference in the transcription scores for Dutch and North American accents in quiet. The effective lack of experience hearing Dutch-accented English outside of these controlled, in-person settings could also explain why transcription scores for Dutch-accented English sentences were relatively high in quiet but dropped so severely in noise. It is possible that previous research on language background holds true, but that researchers' assumptions about language and accent exposure are changing due to the widespread use of social and audio-visual media. Future accent research may benefit from an increased awareness of digital media's influence on participants' language background when working with L2 English speakers.

A potential limitation of this study is only approaching regional accentedness through a phonological lens. As Zaharchuk et al. (2021) explained, the Southern U.S. dialect is distinct in phonology, vocabulary, and grammatical features. The methodology of this study intentionally avoided using any grammatical or vocabulary features unique to the Southern U.S. dialect in

order to focus on participants' responses to the phonological differences across accents. In this way, the present study does not necessarily offer an applicable analysis of L2 listeners' comprehension of Southern speech since Southern U.S. English is distinct in more ways than the pronunciation of words. While this study suggests that L1 Dutch L2 English listeners comprehend Unmarked and Southern accented speech at a high level in noisy and quiet conditions when using standard American English vocabulary and grammar, it is possible that Dutch listeners would respond differently when exposed to a form of Southern speech which combines regional grammatical and vocabulary features with the Southern accent.

In conclusion, the unexpected nature of these findings calls for additional research on L2 listeners' comprehension of accented speech in quiet and noisy conditions. It is important to make sense of how L1-accented L2 speech can be mistaken in noise and to continue testing for the presence of mutual ISI benefits across languages and masking conditions. Researchers may also have to consider adapting future studies to changing definitions of language background and accent exposure due to the prevalence and accessibility of global, multilingual social and audio-visual media.

Appendix A: Experimental Stimuli

Transcription Task A

Practice Questions

Stimulus #	Accent	Noise	Practice Sentence
1	Unmarked	Quiet	Bill was sad when he did not pass the test
2	Southern	Quiet	She went on a two-week cruise
3	Dutch	Quiet	Some people have never had a square dance
4	Chinese	Quiet	Often, he has nightmares about that horrible jail
5	Unmarked	Noisy	Carl's family has raised cows for many years.
6	Southern	Noisy	The baseball game was canceled because of the storm
7	Dutch	Noisy	The exit was marked by a large arrow
8	Chinese	Noisy	None of his books made any money

Stimulus #	Accent	Noise	Sentence
1	Dutch	Quiet	New York is a **very busy place**
2	Dutch	Quiet	The **well-known singer opens** the new **shop**
3	Dutch	Quiet	The **hunter shot** and **killed** a **large bear**
4	Dutch	Quiet	She **cleaned** the **dirt** from her **dress**
5	Dutch	Quiet	His **view** was **blocked** by the **music box**
6	Dutch	Quiet	He **loosened** the **tie** around his **collar**
7	Dutch	Quiet	George must **keep** his **pet** on a **diet**
8	Dutch	Quiet	The **child** was **born** with a **rare gift**
9	Dutch	Quiet	The **ship disappeared** into the **thick mist**
10	Dutch	Quiet	The **charming young man gave** her a beautiful **flower**
11	Dutch	Quiet	Maggie **licked** the **bottom** of the **pan**
12	Dutch	Quiet	The **little girl** was **afraid** of the **snake**
13	Dutch	Quiet	He **put** his **feet** up on the **couch**
14	Dutch	Quiet	His **ring fell** into a **hole** in the **drain**
15	Dutch	Quiet	It is **dangerous** to let **children play** with a **rifle**
16	Dutch	Quiet	The **carpenter hurt** himself with a **knife**
17	Dutch	Quiet	Ken **built** his **new house** by a **quiet lake**
18	Dutch	Quiet	In the Netherlands almost **every student** has a **bike**
19	Dutch	Quiet	You **could count** on him on **being late** for **class**
20	Chinese	Quiet	Fred **sat** in his **chair** on the **back row**
21	Chinese	Quiet	A **large stone blocked** the **entrance** to the **cave**

22	Chinese	Quiet	The **truck** that Luke **drove crashed** into the **wall**
23	Chinese	Quiet	Her **sister** was **angry** and **threw** the **plate** against the **mirror**
24	Chinese	Quiet	The **kids fed** the **ducks** some **crumbs**
25	Chinese	Quiet	The **rich woman bought** an **expensive skirt**
26	Chinese	Quiet	While **skiing**, Michael **broke** his **ankle**
27	Chinese	Quiet	He **wrote** her a **love note**
28	Chinese	Quiet	Anna liked to **season** her **food** with **spice**
29	Chinese	Quiet	In the **morning** Jake **took** out the **trash**
30	Chinese	Quiet	They **rested** under a **tree** in the **shade**
31	Chinese	Quiet	**Even** their **friends** were **left** in the **rain**
32	Chinese	Quiet	He was **miles** off the **main track**
33	Chinese	Quiet	The **cigar burned** a **hole** in the **rug**
34	Chinese	Quiet	He **walked** in the **park** and **saw** a **beautiful bird**
35	Chinese	Quiet	The **overstrained** man **killed** the **woman** with a **bottle**
36	Chinese	Quiet	They were **startled** by the **sudden scream**
37	Chinese	Quiet	They **went** to the **rear** of the **long line**
38	Chinese	Quiet	They **liked** to **sleep** out **under** the **trees**
39	Southern	Quiet	They were **startled** by the **sudden explosion**
40	Southern	Quiet	He **frowned** and **sat** down at the **DESK**
41	Southern	Quiet	They went to the **end** of the **long train**
42	Southern	Quiet	The **doctor checked** his **damaged spine**
43	Southern	Quiet	The **teacher** told the **bully** to **stand** in the **hal**l
44	Southern	Quiet	The **cheerful child walked whistling** through the **snow**
45	Southern	Quiet	The **brown moose slept** in the **field**
46	Southern	Quiet	The **girlfriend** of my **brother likes** to **drink coffee**
47	Southern	Quiet	The **smiling woman gave** her **husband** a **rose**
48	Southern	Quiet	There wasn't any **toothpaste left** in the **house**
49	Southern	Quiet	In **three days,** he will **graduate**
50	Southern	Quiet	Most **adults** like to **work** in the **Fall**
51	Southern	Quiet	She **reached** up to **dust** the **lamp**
52	Southern	Quiet	The **rabbit hid** in the **tall bushes**
53	Southern	Quiet	The **little girl**s were **hiding** in the **bathroom**
54	Southern	Quiet	The **boss drew** a **graph** on the **whiteboard**
55	Southern	Quiet	My **father** was **hungry** and **took** the **last apple**
56	Southern	Quiet	They **enjoyed looking** through the **family photos**
57	Southern	Quiet	He **put** the **cigarette** out in the **sand**
58	Unmarked	Quiet	Frank’s **computer** got **hacked** by **criminals**
59	Unmarked	Quiet	Jane **got** into a **fight** with her **manager**

60	Unmarked	Quiet	Steve **always knew** he **wanted** to be a **chemist**
61	Unmarked	Quiet	The **school gave** all **students** a **free lunch**
62	Unmarked	Quiet	The **deer ran away** because it **saw** a **wolf**
63	Unmarked	Quiet	Roy **served** in the **navy** for **five years**
64	Unmarked	Quiet	The **flu gave** her a **sore throat**
65	Unmarked	Quiet	He had a **hangover** from **drinking** too much **wine**
66	Unmarked	Quiet	Harry was **thirsty** after **marching** through the **desert** ****
67	Unmarked	Quiet	She **stole** a **loaf** of **bread**
68	Unmarked	Quiet	**Fish** cannot **breathe** without their **gills**
69	Unmarked	Quiet	Josie **went fishing** with her **aunt** and **uncle**
70	Unmarked	Quiet	She **used** the **north star** to **find** her way **home**
71	Unmarked	Quiet	There is a **statue** of a **bull** on Wall **Street**
72	Unmarked	Quiet	Beth does not **like white pants**
73	Unmarked	Quiet	The **priest gave** out **clothes** to the **poor.**
74	Unmarked	Quiet	Jeff **tasted** the **strange blue liquid**
75	Unmarked	Quiet	Josh **saw** a **fox** on his **hike**
76	Unmarked	Quiet	He did not **want** to **wear** a **mask**
77	Dutch	Noisy	Max **hit** his **sister** on the **arm**
78	Dutch	Noisy	The **dog chased** our **cat** up the **hill**
79	Dutch	Noisy	The **earth** is **shaped** like an **egg**
80	Dutch	Noisy	Hank **reached** into his **pocket** to **get** the **keys**
81	Dutch	Noisy	Larry **chose** not to **join** the **team**
82	Dutch	Noisy	**Rushing** out he **forgot** to **take** his **coat**
83	Dutch	Noisy	She **tied up** her **hair** with a **yellow bow**
84	Dutch	Noisy	I **added** my **name** to the **roster**
85	Dutch	Noisy	Sophie **could never tell** a **joke**
86	Dutch	Noisy	Sara is **liked** by **all** her **peers**
87	Dutch	Noisy	It's **easy** to get **lost** without a **compass**
88	Dutch	Noisy	David's **shirt** was **made** of **silk**
89	Dutch	Noisy	The **apple pie** had a **delicious crust**
90	Dutch	Noisy	Rick **waited** and **read** a **paper**
91	Dutch	Noisy	As **soon** as they **got** in they **turned** on the **heat**
92	Dutch	Noisy	This **biologist** likes to **spend** his **holidays** on a **farm**
93	Dutch	Noisy	Jim **hit** his **horse** with a **stick**
94	Dutch	Noisy	**Yesterday** they **canoed** down the **lake**
95	Dutch	Noisy	The **child went** ever **higher** on the **swing**
96	Chinese	Noisy	He **scraped** the **cold food** from his **dish**
97	Chinese	Noisy	All the **guests** had a very **good meal**

98	Chinese	Noisy	Her **new socks** were the **wrong color**
99	Chinese	Noisy	Emma **sang** while my **brother played** the **flute**
100	Chinese	Noisy	**Plants** will not **grow** in **dry weather**
101	Chinese	Noisy	Every **spring** they **held** the **annual ball**
102	Chinese	Noisy	In the **distance** they **heard** the **noise**
103	Chinese	Noisy	Sharon **dried** the **bowls** with a **rag**
104	Chinese	Noisy	He **shouted** at the **top** of his **voice**
105	Chinese	Noisy	Tim **threw** a **rock** and **broke** the **glass**
106	Chinese	Noisy	The **puppy chewed** on the **shoe**
107	Chinese	Noisy	The old **house** was **built entirely** of **brick**
108	Chinese	Noisy	The **thick mud stuck** to her **boots**
109	Chinese	Noisy	**Smoking** can **give** you a **bad cough**
110	Chinese	Noisy	Hannah **turned** on the **radio** and **listened** to the **news**
111	Chinese	Noisy	Bob **thought** she had such a **friendly face**
112	Chinese	Noisy	She **locked** the **valuables** in the **chest**
113	Chinese	Noisy	Captain Sheir **wanted** to **stay** with the **sinking raft**
114	Chinese	Noisy	the **birds** in the **yard ate** every last **seed**
115	Southern	Noisy	At **night** they **often took** a **short break**
116	Southern	Noisy	During **class** Jack **borrowed** some **pencils**
117	Southern	Noisy	Her **dad woke** up when she **dropped** the **pot**
118	Southern	Noisy	Robert **fell** down and **injured** his **elbow**
119	Southern	Noisy	The big **ruby looked** like a **cherry**
120	Southern	Noisy	He **bruised** his **thumb** when he went to **fix** his **shed**.
121	Southern	Noisy	The **children** went to **camp** for the **weekend**
122	Southern	Noisy	It was a nice **day** for a **walk** in the **woods**
123	Southern	Noisy	**Ample food** was **made** for the **picnic**
124	Southern	Noisy	The **boys** got **steak** for **dinner**
125	Southern	Noisy	The **sandwich** is **gross** without **beef**
126	Southern	Noisy	The **mayor felt** a **sharp pain** in his **hand**
127	Southern	Noisy	Rita **slowly walked** down the **stairs**
128	Southern	Noisy	They **left** the **dirty chopsticks** in the **kitchen**
129	Southern	Noisy	He **told** his **mom** that he **lost** his **job**
130	Southern	Noisy	He **burned** his **tongue** on the **hot potato**
131	Southern	Noisy	She **parks** her **car** in front of the **hospital**
132	Southern	Noisy	She **guessed** the **answer** to the **riddle**
133	Southern	Noisy	She **took** a **picture** with her **daughter**
134	Unmarked	Noisy	Sam was **great** at **playing golf**.
135	Unmarked	Noisy	She **noticed** that a **sofa** was **left** in the **dumpster** ****

136	Unmarked	Noisy	Kyle was **punished because** of his **behavior** at **church**
137	Unmarked	Noisy	The **park rangers rescued** the **lost tourist**
138	Unmarked	Noisy	Bob **thought** she had such a **friendly face**
139	Unmarked	Noisy	The **black wasp stung** his **knee**
140	Unmarked	Noisy	She **lived** in a **town near** Prague for **six months**.
141	Unmarked	Noisy	It is **illegal** to **own** a **tiger** in Boston
142	Unmarked	Noisy	The **tulips bloom** in **late May**
143	Unmarked	Noisy	John **sculpted** a **man** out of **clay**
144	Unmarked	Noisy	The **researcher** uses **sign language** to **talk** to **monkeys**
145	Unmarked	Noisy	Bart was **stranded** on a **tropical island**
146	Unmarked	Noisy	The **monk prayed** in his **temple**
147	Unmarked	Noisy	The **journalist** was **stopped** at the **border**
148	Unmarked	Noisy	The **police arrested** Nick **because** he **robbed** a **store**
149	Unmarked	Noisy	Will **brewed beer** in his **basement**
150	Unmarked	Noisy	Amy **gave birth** to a **healthy baby**
151	Unmarked	Noisy	She **beat** him at a **game** of **chess**
152	Unmarked	Noisy	Mark **still** has **flashbacks** to his **time** in the **army**

**** Stimulus 66: “Harry was thirsty after marching through the desert” was erroneously replaced by a repeat of stimulus 135 “She noticed a sofa was left in the dumpster” but in quiet instead of noise.

Transcription Task B

Practice Questions

Stimulus #	Accent	Noise	Practice Sentence
1	Unmarked	Quiet	Bill was sad when he did not pass the test
2	Southern	Quiet	She went on a two-week cruise
3	Dutch	Quiet	Some people have never had a square dance
4	Chinese	Quiet	Often, he has nightmares about that horrible jail
5	Unmarked	Noisy	Carl’s family has raised cows for many years.
6	Southern	Noisy	The baseball game was canceled because of the storm
7	Dutch	Noisy	The exit was marked by a large arrow
8	Chinese	Noisy	None of his books made any money

Stimulus #	Accent	Noise	Sentence
1	Dutch	Quiet	Max **hit** his **sister** on the **arm**
2	Dutch	Quiet	The **dog chased** our **cat** up the **hill**
3	Dutch	Quiet	The **earth** is **shaped** like an **egg**

4	Dutch	Quiet	Hank **reached** into his **pocket** to **get** the **keys**
5	Dutch	Quiet	Larry **chose** not to **join** the **team**
6	Dutch	Quiet	**Rushing** out he **forgot** to **take** his **coat**
7	Dutch	Quiet	She **tied up** her **hair** with a **yellow bow**
8	Dutch	Quiet	I **added** my **name** to the **roster**
9	Dutch	Quiet	Sophie **could never tell** a **joke**
10	Dutch	Quiet	Sara is **liked** by **all** her **peers**
11	Dutch	Quiet	It's **easy** to get **lost** without a **compass**
12	Dutch	Quiet	David's **shirt** was **made** of **silk**
13	Dutch	Quiet	The **apple pie** had a **delicious crust**
14	Dutch	Quiet	Rick **waited** and **read** a **paper**
15	Dutch	Quiet	As **soon** as they **got** in they **turned** on the **heat**
16	Dutch	Quiet	This **biologist** likes to **spend** his **holidays** on a **farm**
17	Dutch	Quiet	Jim **hit** his **horse** with a **stick**
18	Dutch	Quiet	**Yesterday** they **canoed** down the **lake**
19	Dutch	Quiet	The **child went** ever **higher** on the **swing**
20	Chinese	Quiet	He **scraped** the **cold food** from his **dish**
21	Chinese	Quiet	All the **guests** had a very **good meal**
22	Chinese	Quiet	Her **new socks** were the **wrong color**
23	Chinese	Quiet	Emma **sang** while my **brother played** the **flute**
24	Chinese	Quiet	**Plants** will not **grow** in **dry weather**
25	Chinese	Quiet	Every **spring** they **held** the **annual ball**
26	Chinese	Quiet	In the **distance** they **heard** the **noise**
27	Chinese	Quiet	Sharon **dried** the **bowls** with a **rag**
28	Chinese	Quiet	He **shouted** at the **top** of his **voice**
29	Chinese	Quiet	Tim **threw** a **rock** and **broke** the **glass**
30	Chinese	Quiet	The **puppy chewed** on the **shoe**
31	Chinese	Quiet	The old **house** was **built entirely** of **brick**
32	Chinese	Quiet	The **thick mud stuck** to her **boots**
33	Chinese	Quiet	**Smoking** can **give** you a **bad cough**
34	Chinese	Quiet	Hannah **turned** on the **radio** and **listened** to the **news**
35	Chinese	Quiet	Bob **thought** she had such a **friendly face**
36	Chinese	Quiet	She **locked** the **valuables** in the **chest**
37	Chinese	Quiet	Captain Sheir **wanted** to **stay** with the **sinking raft**
38	Chinese	Quiet	the **birds** in the **yard ate** every last **seed**
39	Southern	Quiet	At **night** they **often took** a **short break**
40	Southern	Quiet	During **class** Jack **borrowed** some **pencils**
41	Southern	Quiet	Her **dad woke** up when she **dropped** the **pot**

42	Southern	Quiet	Robert **fell** down and **injured** his **elbow**
43	Southern	Quiet	The big **ruby looked** like a **cherry**
44	Southern	Quiet	He **bruised** his **thumb** when he went to **fix** his **shed**.
45	Southern	Quiet	The **children** went to **camp** for the **weekend**
46	Southern	Quiet	It was a nice **day** for a **walk** in the **woods**
47	Southern	Quiet	**Ample food** was **made** for the **picnic**
48	Southern	Quiet	The **boys** got **steak** for **dinner**
49	Southern	Quiet	The **sandwich** is **gross** without **beef**
50	Southern	Quiet	The **mayor felt** a **sharp pain** in his **hand**
51	Southern	Quiet	Rita **slowly walked** down the **stairs**
52	Southern	Quiet	They **left** the **dirty chopsticks** in the **kitchen**
53	Southern	Quiet	He **told** his **mom** that he **lost** his **job**
54	Southern	Quiet	He **burned** his **tongue** on the **hot potato**
55	Southern	Quiet	She **parks** her **car** in front of the **hospital**
56	Southern	Quiet	She **guessed** the **answer** to the **riddle**
57	Southern	Quiet	She **took** a **picture** with her **daughter**
58	Unmarked	Quiet	Sam was **great** at **playing golf**.
59	Unmarked	Quiet	She **noticed** that a **sofa** was **left** in the **dumpster** ****
60	Unmarked	Quiet	Kyle was **punished because** of his **behavior** at **church**
61	Unmarked	Quiet	The **park rangers rescued** the **lost tourist**
62	Unmarked	Quiet	Bob **thought** she had such a **friendly face**
63	Unmarked	Quiet	The **black wasp stung** his **knee**
64	Unmarked	Quiet	She **lived** in a **town near** Prague for **six months**.
65	Unmarked	Quiet	It is **illegal** to **own** a **tiger** in Boston
66	Unmarked	Quiet	The **tulips bloom** in **late May**
67	Unmarked	Quiet	John **sculpted** a **man** out of **clay**
68	Unmarked	Quiet	The **researcher** uses **sign language** to **talk** to **monkeys**
69	Unmarked	Quiet	Bart was **stranded** on a **tropical island**
70	Unmarked	Quiet	The **monk prayed** in his **temple**
71	Unmarked	Quiet	The **journalist** was **stopped** at the **border**
72	Unmarked	Quiet	The **police arrested** Nick **because** he **robbed** a **store**
73	Unmarked	Quiet	Will **brewed beer** in his **basement**
74	Unmarked	Quiet	Amy **gave birth** to a **healthy baby**
75	Unmarked	Quiet	She **beat** him at a **game** of **chess**
76	Unmarked	Quiet	Mark **still** has **flashbacks** to his **time** in the **army**
77	Dutch	Noisy	New York is a **very busy place**
78	Dutch	Noisy	The **well-known singer opens** the new **shop**
79	Dutch	Noisy	The **hunter shot** and **killed** a **large bear**

80	Dutch	Noisy	She **cleaned** the **dirt** from her **dress**
81	Dutch	Noisy	His **view** was **blocked** by the **music box**
82	Dutch	Noisy	He **loosened** the **tie** around his **collar**
83	Dutch	Noisy	George must **keep** his **pet** on a **diet**
84	Dutch	Noisy	The **child** was **born** with a **rare gift**
85	Dutch	Noisy	The **ship disappeared** into the **thick mist**
86	Dutch	Noisy	The **charming young man gave** her a beautiful **flower**
87	Dutch	Noisy	Maggie **licked** the **bottom** of the **pan**
88	Dutch	Noisy	The **little girl** was **afraid** of the **snake**
89	Dutch	Noisy	He **put** his **feet** up on the **couch**
90	Dutch	Noisy	His **ring fell** into a **hole** in the **drain**
91	Dutch	Noisy	It is **dangerous** to let **children play** with a **rifle**
92	Dutch	Noisy	The **carpenter hurt** himself with a **knife**
93	Dutch	Noisy	Ken **built** his **new house** by a **quiet lake**
94	Dutch	Noisy	In the Netherlands almost **every student** has a **bike**
95	Dutch	Noisy	You **could count** on him on **being late** for **class**
96	Chinese	Noisy	Fred **sat** in his **chair** on the **back row**
97	Chinese	Noisy	A **large stone blocked** the **entrance** to the **cave**
98	Chinese	Noisy	The **truck** that Luke **drove crashed** into the **wall**
99	Chinese	Noisy	Her **sister** was **angry** and **threw** the **plate** against the **mirror**
100	Chinese	Noisy	The **kids fed** the **ducks** some **crumbs**
101	Chinese	Noisy	The **rich woman bought** an **expensive skirt**
102	Chinese	Noisy	While **skiing**, Michael **broke** his **ankle**
103	Chinese	Noisy	He **wrote** her a **love note**
104	Chinese	Noisy	Anna liked to **season** her **food** with **spice**
105	Chinese	Noisy	In the **morning** Jake **took** out the **trash**
106	Chinese	Noisy	They **rested** under a **tree** in the **shade**
107	Chinese	Noisy	**Even** their **friends** were **left** in the **rain**
108	Chinese	Noisy	He was **miles** off the **main track**
109	Chinese	Noisy	The **cigar burned** a **hole** in the **rug**
110	Chinese	Noisy	He **walked** in the **park** and **saw** a **beautiful bird**
111	Chinese	Noisy	The **overstrained** man **killed** the **woman** with a **bottle**
112	Chinese	Noisy	They were **startled** by the **sudden scream**
113	Chinese	Noisy	They **went** to the **rear** of the **long line**
114	Chinese	Noisy	They **liked** to **sleep** out **under** the **trees**
115	Southern	Noisy	They were **startled** by the **sudden explosion**
116	Southern	Noisy	He **frowned** and **sat** down at the **DESK**
117	Southern	Noisy	They went to the **end** of the **long train**

118	Southern	Noisy	The **doctor checked** his **damaged spine**
119	Southern	Noisy	The **teacher** told the **bully** to **stand** in the **hal**l
120	Southern	Noisy	The **cheerful child walked whistling** through the **snow**
121	Southern	Noisy	The **brown moose slept** in the **field**
122	Southern	Noisy	The **girlfriend** of my **brother likes** to **drink coffee**
123	Southern	Noisy	The **smiling woman gave** her **husband** a **rose**
124	Southern	Noisy	There wasn't any **toothpaste left** in the **house**
125	Southern	Noisy	In **three days** he will **graduate**
126	Southern	Noisy	Most **adults** like to **work** in the **Fall**
127	Southern	Noisy	She **reached** up to **dust** the **lamp**
128	Southern	Noisy	The **rabbit hid** in the **tall bushes**
129	Southern	Noisy	The **little girl**s were **hiding** in the **bathroom**
130	Southern	Noisy	The **boss drew** a **graph** on the **whiteboard**
131	Southern	Noisy	My **father** was **hungry** and **took** the **last apple**
132	Southern	Noisy	They **enjoyed looking** through the **family photos**
133	Southern	Noisy	He **put** the **cigarette** out in the **sand**
134	Unmarked	Noisy	Frank's **computer** got **hacked** by **criminals**
135	Unmarked	Noisy	Jane **got** into a **fight** with her **manager**
136	Unmarked	Noisy	Steve **always knew** he **wanted** to be a **chemist**
137	Unmarked	Noisy	The **school gave** all **students** a **free lunch**
138	Unmarked	Noisy	The **deer ran away** because it **saw** a **wolf**
139	Unmarked	Noisy	Roy **served** in the **navy** for **five years**
140	Unmarked	Noisy	The **flu gave** her a **sore throat**
141	Unmarked	Noisy	He had a **hangover** from **drinking** too much **wine**
142	Unmarked	Noisy	Harry was **thirsty** after **marching** through the **desert** ****
143	Unmarked	Noisy	She **stole** a **loaf** of **bread**
144	Unmarked	Noisy	**Fish** cannot **breathe** without their **gills**
145	Unmarked	Noisy	Josie **went fishing** with her **aunt** and **uncle**
146	Unmarked	Noisy	She **used** the **north star** to **find** her way **home**
147	Unmarked	Noisy	There is a **statue** of a **bull** on Wall **Street**
148	Unmarked	Noisy	Beth does not **like white pants**
149	Unmarked	Noisy	The **priest gave** out **clothes** to the **poor.**
150	Unmarked	Noisy	Jeff **tasted** the **strange blue liquid**
151	Unmarked	Noisy	Josh **saw** a **fox** on his **hike**
152	Unmarked	Noisy	He did not **want** to **wear** a **mask**

**** Stimulus 142: "Harry was thirsty after marching through the desert" was erroneously replaced by a repeat of stimulus 59 "She noticed a sofa was left in the dumpster" but with background noise instead of quiet.

Appendix B: Questionnaires

1. Screening Questionnaire

Screening Questions

Question	Response
Is Dutch your native language?	Yes or No
Is English your second language?	Yes or No
Have you staed in the United States for more than two months?	Yes or No
What is your age?	Under 18, 18-25, 26-35, 36-45, 46-55, Over 55
Do you have normal hearing?	Yes or No
What best describes your gender identity?	Man, Woman, Non-Binary, Other

2. Accent Perception Questionnaire

Audio Stimuli:

Accent	Noise	Practice Sentence
Unmarked	Quiet	Bill was sad when he did not pass the test
Southern	Quiet	She went on a two-week cruise
Dutch	Quiet	Some people have never had a square dance
Chinese	Quiet	Often, he has nightmares about that horrible jail

Question	Response
Does this speaker have an accent?	Yes or No
How Strong is the speaker's accent?	very weak 1, 2, 3, 4, 5 very strong
What is the speaker's native language?	Drop down menu: Please choose … (Arabic, Bengali, Bhojpuri, Burmese, Cantonese, Chinese, Dutch, English, French, German, Gujarati, Hausa, Hindi, Igbo, Indonesian, Italian, Japanese, Javanese, Kannada, Korean, Maithili, Malayalam, Marathi, Odia, Persian, Polish, Portuguese, Punjabi, Romanian, Russian, Sindhi, Spanish, Sunda, Tagalog, Tamil, Telugu, Turkish, Ukrainian, Urdu, Uzbek, Vietnamese, Yoruba)
Where is the speaker from?	Drop down menu: Please choose … (Argentina, Australia, Austria, Belgium, Brazil, Canada, China, France, Germany, India, Indonesia, Iran, Italy, Ireland, Japan, Mexico, Netherlands, Nigeria, Poland, Russia, Saudi Arabia, South Korea, Spain, Sweden, Switzerland, Thailand, Taiwan, Turkey, United Kingdom, United States)

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