Journal of Neurolinguistics 42 (2017) 93–108

Contents lists available at ScienceDirect

Journal of Neurolinguistics

journal homepage: www.elsevier.com/locate/jneuroling

Foreign-accented speaker identity affects neural correlates of language comprehension

Sarah Grey [a, b, *], Janet G. van Hell [a]

[a] Department of Psychology and Center for Language Science, Pennsylvania State University, University Park, PA 16802 United States
[b] Department of Modern Languages and Literatures, Fordham University, Bronx, NY 10458 United States

ARTICLE INFO

Article history:
Received 10 December 2015
Received in revised form 30 November 2016
Accepted 3 December 2016
Available online 18 December 2016

Keywords:
Comprehension
Bilingualism
ERPs
Accent

ABSTRACT

This study tested semantic and grammatical processing of native- and foreign-accented speech. Monolinguals with little experience with foreign-accented speech listened to sentences spoken by foreign-accented and native-accented speakers while their brain activity was recorded using EEG/ERPs. We gathered behavioral measures of sentence comprehension, language attitudes, and accent perception. Behavioral results showed that listeners were highly accurate in comprehending both native- and foreign-accented sentences. ERP results showed that grammatical and semantic violations elicited different neural responses in native versus foreign accented speech. Native-accented speech elicited a frontal negativity (Nref) for grammatical violations and a robust N400 for semantic violations. However, in foreign-accented speech only semantic (not grammatical) violations elicited an ERP effect, a late negativity. Closer inspection of listeners who did and who did not correctly identify the foreign accent revealed that listeners who identified the foreign accent showed ERP responses for both grammatical and semantic errors: an N400-like effect to grammatical errors and a late negativity to semantic errors. In contrast, listeners who did not correctly identify the foreign accent showed no ERP responses to grammatical errors in the foreign-accented condition, but did show a late negativity to semantic errors. These findings provide novel insights into understanding the effects of listener experience and foreign-accented speaker identity on the neural correlates of language processing.

1. Introduction

With increased globalization, listeners and speakers from different language backgrounds are interacting with greater frequency, and the predominance of worldwide multilingualism (Marian & Shook, 2012) implies that such interactions often involve at least one non-native speaker of the language at hand. One of the most salient characteristics of a non-native speaker is a foreign accent (Gluszek & Dovidio, 2010). For a listener, foreign accents constitute a particularly challenging example of variability in the speech signal (Bent & Holt, 2013), often attributable to the speakers' non-native pronunciation of words as well as speech rhythm and intonation patterns which deviate from the listener's native language (cf. Reinisch & Weber, 2012). This variability induces intelligibility and comprehension difficulties (Munro & Derwing, 1995a, 1995b), but

* Corresponding author. Department of Modern Languages and Literatures, Fordham University, Bronx, NY 10458 United States.
E-mail addresses: sgrey4@fordham.edu (S. Grey), jgv3@psu.edu (J.G. van Hell).

http://dx.doi.org/10.1016/j.jneuroling.2016.12.001
0911-6044/

a respectable body of research demonstrates that listeners can quickly adapt to foreign-accented speech and that comprehension generally improves over time (for a review see Cristia et al., 2012).

Though behavioral research generally shows converging and comparable performance for foreign- and native-accented speech comprehension, recent neurocognitive studies using event-related potentials (ERPs) have produced divergent findings regarding the neural effects of foreign-accented language processing. An ERP study that tested native British English listeners' semantic processing during sentence comprehension compared ERP effects to words spoken in a foreign, regional, or native accent (all correct items; Goslin, Duffy, & Floccia, 2012). The authors found that the N400 effect (an index of lexical/semantic processing) was reduced to words spoken in a foreign accent compared to a regional or native accent, which were not different from each other. Goslin et al. (2012) concluded that the unreliable phonetic variation inherent to foreign-accented speech (as opposed to reliable variation in native-accented speech) leads to reduced lexical activation and increased reliance on top-down contextual cues during comprehension.

Romero-Rivas, Martin, and Costa (2015) tested the effects of foreign-accented speech on semantic processing by examining semantic integration (N400 effects) and meaning reanalysis (P600 effects) in response to semantic anomalies (e.g., I drink my coffee with cream and *concrete before work each morning; *marks the anomaly). In their study, native Spanish listeners showed larger and more broadly-distributed N400s to semantic anomalies in foreign-compared to native-accented speech. This contrasts with Goslin et al. (2012) who tested all correct sentences as opposed to semantic anomalies and found reduced N400s. Additionally, Romero-Rivas et al. (2015) found that semantic anomalies elicited P600s in the native-accented but not foreign-accented condition. Romero-Rivas et al. interpreted the larger N400 as evidence that semantic anomalies were harder to process during foreign-accented speech comprehension, and suggest that this may be due to increased demands on lexical processing for the retrieval of the anomalous words. Regarding the absence of a P600 for foreign-accented semantic anomalies, the authors suggest that listeners avoid attempting to find an alternative meaning for the semantic violation when it is produced by a foreign-accented speaker, or that listeners do not have sufficient processing resources to carry out the reanalysis of meaning during foreign-accented speech comprehension.

In contrast to semantic anomaly processing, a related study by Romero-Rivas, Martin, and Costa (2016) tested the effects of foreign-accented speech on anticipatory lexical processing in correct semantics that varied by relatedness/expectancy. In the study, a group of native Spanish listeners heard foreign-accented sentences (Experiment 2) that contained a word corresponding to (1) the best lexical fit for the context (e.g., In the pirates' map there was an X showing the location of the treasure; English translation, underlined in the original), (2) a semantically related, low cloze probability item (e.g., In the pirates' map there was an X showing the location of the chest), or (3) a semantically unrelated, but plausible, low cloze probability item (e.g., In the pirates' map there was an X showing the location of the enemy; examples from Romero-Rivas et al., 2016). The authors compared these data to a separate group of native Spanish listeners who were presented with the same sentences but spoken by a native-accented Spanish speaker (Experiment 1) and found equivalent N400 responses to sentences like (1), suggesting that native listeners show similar anticipatory lexical processes for native- and foreign-accented speech. They also observed larger N400s to sentences like (3) versus (2) in Experiment 1 (native-accented speech) but no such N400 amplitude difference in Experiment 2 (foreign-accented speech). The authors interpret this as evidence that although listeners can use equivalent anticipatory processes for native- and foreign-accented speakers during semantic processing, when the semantic expectations are not met (i.e., are not the best fit) the anticipatory processes do not show the same benefit for foreign-accented as compared to native-accented speech.

Hanulikova, Van Alphen, Van Goch, and Weber (2012) tested both semantic anomaly and grammatical error processing. In their study, which tested native Dutch listeners, N400s to semantic anomalies were not different in magnitude, but were more broadly distributed for Turkish-Dutch foreign-accented speech compared to native Dutch-accented speech. For grammatical processing, the authors examined P600 effects as an index of syntactic repair for Dutch agreement errors compared to correct agreement in sentences produced by the foreign- and native-accented Dutch speakers. Their findings showed that native-accented grammar errors elicited a P600 at the beginning of the experiment whereas foreign-accented errors did not elicit any comparable ERP effects. Hanulikova et al. (2012) interpreted the equivalently-sized N400s as evidence that the effect "was not modulated by the accent of the speaker" (p. 884) and that the listeners did not experience shallow processing or comprehension difficulties; the authors did not discuss implications of the broader N400 distribution for foreign-accented speech comprehension. For grammatical processing, Hanulikova et al. (2012) concluded that the listeners' familiarity with the Turkish-Dutch foreign accent led them to modify their expectations about syntactic well-formedness for this foreign-accented speaker identity, since the error was common for those foreign-accented speakers. Indeed, when prompted to identify the foreign accent at the end of the experiment, over 80% of the listeners correctly identified the accent as Turkish.

In sum, all four studies used ERPs to test semantic processing of foreign-accented speech and each study found different patterns of results. Although Hanulikova et al. (2012) and Romero-Rivas et al. (2015) both found more broadly distributed N400s for semantic processing, Hanulikova et al. (2012) report comparably-sized N400 effects between foreign- and native-accented speech while Romero-Rivas et al. (2015) report larger N400s for foreign-than native-accented speech. Goslin et al. (2012) found smaller N400s for foreign compared to either native or regional accents, and the effects showed similar distributions. Finally, Romero-Rivas et al. (2016) found equivalent N400s for anticipatory semantic processing for expected lexical items in native- and foreign-accented speech, but their comparisons were made between-subjects. Moreover, both Goslin et al. (2012) and Romero-Rivas et al. (2016) tested all correct items, which differs from the semantic anomaly paradigm employed by the Hanulikova et al. (2012) and Romero-Rivas et al. (2015). Of the four studies, only Hanulikova et al. (2012)