



# The influence of L2 accent strength and different error types on personality trait ratings

Sarah Wesolek<sup>1,2</sup>, Piotr Gulowski<sup>1,3</sup>, Joanna Blaszcak<sup>3</sup>, Marzena Zygis<sup>1,2</sup>

<sup>1</sup>Leibniz-Centre General Linguistics, Germany <sup>2</sup>Humboldt-Universität zu Berlin, Germany  
<sup>3</sup>University of Wrocław, Poland

wesolek@leibniz-zas.de, piotr.gulowski@uwr.edu.pl, zygis@leibniz-zas.de

## Abstract

Accents can have a detrimental impact on interpersonal evaluations. However, the influence of specific language errors remains less understood. The present study tests how accent strength (constructed as a graded factor obtained through ratings) impacts evaluations of speakers' personality traits (warmth, competence) in the German-Polish context. Moreover, this study intertwines accentedness with two L2 typical error types: phonological (vowel substitutions) and grammatical (gender agreement errors). Results indicate that L2 accent strength had an unfavorable effect on speakers' competence but positively influenced warmth. The perceived competence was reduced by both error types (phonological, grammatical), while warmth was decreased solely by grammatical errors. The error effects diminished with increasing L2 accent. Finally, Polish participants were less sensitive towards errors and particularly resistant towards phonological substitutions when rating speakers' personality.

**Index Terms:** L2 accent, grammatical errors, phonological substitutions, personality trait, speaker perception, attitudes

## 1. Introduction

Non-native (L2) accents provide an important source of referential information about speakers. They can be salient indicators of (out-) group identity and, thus, situate the speakers in a geographical, ethnic, cultural, and social dimension [1, 2]. When perceived by L1 (native) listeners, accentual variation does not only hinder intelligibility [3], and introduce additional processing cost [4, 5], but also elicit negative biases against the speaker. It, for example, diminishes the perceived credibility of statements [6], hinders the estimation of the speaker's affective state [7], and triggers unfavorable evaluations of personality traits [2, 8]. Regarding the latter, a meta-analysis by [2] examined the effects of L2 accentedness on personality trait assessments across 20 studies including several languages. The overall findings revealed that while L2 accents led to widely reduced ratings of the speakers' competence and dynamism, they only modestly decreased the evaluations of solidarity. A possible explanation for the differences in how L2 accent affects competence compared to solidarity/warmth could be that competence is particularly influenced by linguistic performance. Increased accentedness, as well as uncanonical grammatical or phonological variants (errors) might impact the speaker's competence traits like their skillfulness, capability, and confidence, while traits falling into the dimension of warmth, such as a speaker's friendliness and sincerity, seem to be less affected. However, studies investigating how L2 accents influence personality trait assessments seldom delve into intricate patterns within the acoustic data, although L2 variation takes place on

distinct linguistic stages. Most often, L2 speech contains systematic phoneme substitutions from L1 phonology (e.g., Polish learners' production of long-tense German vowels as lax counterparts [9]) alongside with an increased occurrence of morpho-syntactic violations (e.g. gender mismatches [10]). The speaker's L2 background might be also detected based on subtle suprasegmental changes (e.g., deviation in stress timing and speech rate [11]), and unconventional lexical-semantic selections [12]. Thus, it seems beneficial to tease apart the extent to which different error types influence how speakers are perceived in their personality. Prior research identified differences in the effect of grammatical and phonological errors on L2 accent strength ratings [13, 14, 15]. Our previous study, for instance, has shown that both error types affected the perceived strength of L2 accentedness, with phonological errors exerting a greater influence in Polish compared to German language [15]. In contrast, when [13] introduced grammatical errors in their stimuli, L1 listeners assigned higher accentedness ratings to ungrammatical utterances when spoken by L1 but not by L2 speakers. Studies using event-related potentials (ERPs) have demonstrated that L2 accents significantly diminish neurophysiological reactions to grammatical errors and slips of the tongue [16, 17, 18]. Thus, the impact of how much weight those errors carry in interpersonal evaluations might also vary as a function of L2 accentuation, diminishing the errors' adverse impact when embedded in highly accented speech.

Speaker perception can be furthermore influenced by listeners' biases towards their national and cultural background [19]. The present study assesses interpersonal evaluations within the German-Polish context. Germany and Poland, as neighboring countries, share a long and complex history, which might contribute to attitudinal biases between their respective populations [20, 21, 22, 23]. In this context, the historical, cultural, and political backgrounds might result in varying effects of L2 accentuation on the assessment of personality traits across the two countries/accents investigated.

The current study tests the impact of accent strength and L2-typical error types (grammatical and phonological errors) on two personality trait dimensions, that is, the speaker's warmth and competence, adapted from the Stereotype Content Model [24]. It goes beyond previous research in the field of L2 speaker perception by (a) treating L2 accentedness as a continuous feature instead of assuming a binary distinction between 'native' and 'foreign' [25, 26], (b) testing specific linguistic errors (phonological and grammatical), and (c) applying the matched guise technique [27] across same structured German and Polish experiments (same bilingual speakers across both experiments), to minimize effects based on speakers' voice characteristics.

## 2. Experiments

We conducted two same-structured online perception studies. The experiments were part of the larger project entitled 'Grammatical tinnitus and its role in the perception of foreign language accent. A comparison of German and Polish (GRANTUS)' and matched in their experimental design. Participants of each experiment listened to sentences in their L1, produced by 4 male bilingual speakers, of which two had an L1 German/L2 Polish and two an L1 Polish/L2 German background. This way, speakers who produced L1 sentences for one experiment, also recorded L2 sentences for the other experiment. Sentences of the L2 accent condition were marked by subtle accentual variation across the whole utterance. On top of that, utterances were of three different sentence types: They either contained a phonological substitution, a grammatical error, or no explicit phonological or grammatical manipulations (control condition). L1 listeners were asked to listen to sentences and to evaluate the speakers' personality traits (warmth and competence) for each sentence occurrence. For each sentence, they additionally rated the utterance's L2 accent strength. In this study, the accent strength ratings (1-7), as well as the error types (phonological, grammatical, control), serve as predictors for the personality trait evaluations (warmth, competence). Please find our example audio stimuli, the database, as well as all statistical scripts under this link: [https://osf.io/ahyzc/?view\\_only=9f1152aa48a044208359cff83b44acd0](https://osf.io/ahyzc/?view_only=9f1152aa48a044208359cff83b44acd0)

### 2.1. Predictions

Based on previous research, we predicted that: (H1) Increased L2-accent strength will result in less favorable personality trait evaluations for competence, but not necessarily for warmth, see [2, 8]. (H2) Errors (grammatical and phonological) are more perceivable in less accented speech (more L1-like), see [16, 17], and will result in diminished competence ratings only for lower, but not for highly accented speech (more L2-like). (H3) Phonological errors will have a stronger impact on unfavorable competence ratings in Polish than in German, see [15].

### 2.2. Acoustic material

36 unique written experimental sentences were created for each language (German, Polish). Three versions of each sentence were derived (forming a sentence triple): control sentences (no phonological or grammatical error), sentences containing a phonological substitution, and sentences containing a grammatical error, resulting in 108 utterances. Sentences of both languages were of comparable length and followed the same syntactic structure. They consisted of general statements about various topics, mainly simple expressions about a person or object. The three versions of each triple differed only in the critical region, a prepositional phrase consisting of a preposition, possessive determiner and critical noun (two or three syllables long), see Examples 1 and 2. The violations included in the design were all typical for L2 learners of both languages. The phonologically anomalous condition contained a categorical vowel substitution in the stressed, penultimate syllable of the critical noun. Three native vowels were produced as L2-typical counterparts in an equal number of sentences. German learners of Polish tend to produce Polish lax vowels embedded in stressed syllables as tense vowels from their vowel inventory. Polish learners of L2 German, however, frequently replace long tense German vowels with lax vowels from their L1 vowel inventory [9]. Additionally,

the data contained substitutions between /y/ and /i/. /y/ does not belong to the Polish phoneme system and is therefore typically substituted by Polish /i/. /i/ is not part of the German vowel inventory and typically produced as /y/ by German L2 Polish learners. As a result, for German stimuli, the following substitutions were introduced: /e/→[ɛ], /o/→[ɔ], and /y/→[i]. Polish sentences contained the substitutions /ɛ/→[e], /ɔ/→[o], and /i/→[y]. The grammatical errors consisted of a gender mismatch between the possessive determiner and the noun in the critical sentence region. Learners of languages with lexical gender (e.g., German and Polish) typically have problems with correct determiner-noun congruence [10].

#### Example 1: Sentence triple (German Experiment)

<i>Lena</i>	<i>befragt</i>	<i>die</i>	<i>Lehrerin...</i>		
Lena	consults	the	teacher		
(i) control					
...zu	<i>ihrem</i>	<i>Fehler</i>	<i>in</i>	<i>der</i>	<i>Klausur.</i>
about	her <sub>[masc]</sub>	mistake <sub>[masc]</sub>	in	the	exam
(ii) phonological error					
...zu	<i>ihrem</i>	<i>F[ɛ]ler</i>	<i>in</i>	<i>der</i>	<i>Klausur.</i>
about	her <sub>[masc]</sub>	mistake <sub>[masc]</sub>	in	the	exam
(iii) grammatical error					
...zu	<i>ihrer</i>	<i>Fehler</i>	<i>in</i>	<i>der</i>	<i>Klausur.</i>
about	her <sub>[fem]</sub>	mistake <sub>[masc]</sub>	in	the	exam

#### Example 2: Sentence triple (Polish Experiment)

<i>Nina</i>	<i>robi</i>	<i>porządek...</i>			
Nina	makes	order			
(i) control					
...w	<i>swojej</i>	<i>kwateryze</i>	<i>przed</i>	<i>przyjazdem</i>	<i>gości.</i>
in	her <sub>[fem]</sub>	flat <sub>[fem]</sub>	before	arrival	guests
(ii) phonological error					
...w	<i>swojej</i>	<i>kwat[e:]rzyze</i>	<i>przed</i>	<i>przyjazdem</i>	<i>gości.</i>
in	her <sub>[fem]</sub>	flat <sub>[fem]</sub>	before	arrival	guests
(iii) grammatical error					
...w	<i>swojej</i>	<i>kwateryze</i>	<i>przed</i>	<i>przyjazdem</i>	<i>gości.</i>
in	her <sub>[masc]</sub>	flat <sub>[fem]</sub>	before	arrival	guests

Materials consisted of digitally recorded sentences. They were produced by four male speakers with a bilingual (unbalanced, advanced L2) language background, selected out of 6 speakers based on pretests (speakers' accent strength and perceived age). Each of the speakers recorded sentences for both languages, resulting in all speakers recording L1 and L2 accented sentences. Note that sentences recorded by L2 speakers contained a subtle accent throughout the sentence (based on suprasegmental variation), independently of the manipulation in the error conditions (control, phonological error, grammatical error). Speakers were instructed to produce phonological and grammatical errors on purpose. All recordings were examined by at least two phonetically trained linguists for no other categorical changes. If a recording contained any other categorical violation than the intended one, it was re-recorded. The different versions of experimental triples were distributed across three lists such that each participant listened to one version of a sentence triple only. To avoid a disproportional number of ratings (personality traits and accent strength) for single sentence occurrences, sentences were presented twice, once for the ratings of a speaker's warmth and once for competence. L2 accent strength was rated on each sentence occurrence. Thus, 36 sen-

tences appeared on each list. Due to the repetition, this resulted in 72 trials per participant. The material was fully randomized.

### 2.3. Rating material

The speakers' personality traits were rated on two dimensions, warmth and competence, adapted from the Stereotype Content Model (SCM) [24]. The SCM suggests that people form stereotypes and personal evaluations based on how competent and warm a person or group of people appears. Based on the model, competence relates to a person's capability, while warmth pertains to the intentions towards oneself or one's group [24]. The present study utilized ascending (left to right) 7-point semantic scales representing adjective pairs adapted and translated from [28], see Tables 1 and 2. Besides evaluating the speaker's personality, participants rated the question 'How strong is the foreign accent?' on a 7-point scale, reaching from 'no foreign accent' (German: 'kein Fremdsprachenakzent', Polish: 'brak akcentu') to 'strong foreign accent' (German: 'starker Fremdsprachenakzent', Polish: 'silny akcent'). None of the scale presentations included numbers.

Table 1: *Adjective pairs for warmth*

German	Polish	English transl.
unfreundlich - freundlich	nieprzyjazny - przyjazny	unfriendly - friendly
kalt - warm	zimny - ciepły	cold - warm
bösartig - gutmütig	źle usposobiony - dobrze usposobiony	bad natured - good natured
unaufrichtig - aufrichtig	nieszczery - szczerzy	insincere - sincere

Table 2: *Adjective pairs for competence*

German	Polish	English transl.
inkompetent - kompetent	niekompetentny - kompetentny	incompetent - competent
unsicher (selbst)sicher	niepewny siebie pewny siebie	unconfident confident
unfähig - fähig	niesprawny - sprawny	incapable - capable
unbeholfen - geschickt	nieuzdolniony - uzdolniony	unskilful - skilful

### 2.4. Procedure

Participants first took part in an ERP experiment, which utilized extended acoustic material and is not further discussed in this paper. Approximately one week later, they were sent a link for the perceptual experiment. The experiment was prepared with PsychoPy [29] and conducted on the Pavlovia platform (<https://pavlovia.org/>). The experimental session started with written instructions. Participants listened to automatically played sentences and rated the speakers' personality traits and accent strength on 7-point scales (four for the personality traits, one for accent strength) displayed on the screen. Once the participant selected a point on all scales, a green button appeared at the bottom of the screen. By clicking on it, the participant proceeded to the next trial.

### 2.5. Participants

63 participants took part in the study. The German participant group included 33 listeners (17 women, 16 men) aged between 21 and 35 years ( $M=26$ ,  $SD=3.8$ ). They were mostly students at Philipps-Universität Marburg. Eight participants were non-students. The Polish participant group consisted of 30 listeners (16 women, 14 men). They were students at University of Wrocław, aged between 21 and 31 years ( $M=23$ ,  $SD=2.4$ ). None of the participants reported knowledge of the vice-versa language nor a background in the field of linguistics.

### 2.6. Statistics

The statistical analysis was conducted with R [30]. A Linear Mixed-Effect Model (`lme4`, [31]) was fitted with the Personality Trait Rating (1-7) as the dependent variable. Note that for the Personality Trait Rating we averaged the results obtained through 4 semantic scales for warmth and competence respectively. Fixed factors were the Accent Strength (1-7), the Personality Dimension (warmth, competence), the Error Type (control, phonological error, grammatical error), and the Language (German, Polish). The model included random slopes for Participant and Sentence Triple, with random intercepts for Accent Strength, Personality Trait Dimension, Error Type, and their interaction. We also included a random slope for Speaker, with Accent Strength, Personality Trait Dimension, Error Type, Language, and their interaction as intercepts. Some random intercepts had to be removed due to convergence issues or high correlation. Ultimately, the model contained random slopes for Speaker, Participant and Sentence Triple and random intercepts for Dimension and Accent Strength for each of them. To evaluate the effects' and interactions' significance, a Type II Wald-Chi-Square test (`car`, [32]) was performed. Pairwise comparisons (`emmeans`, [33]) were calculated on significant interactions. In total, 4536 datapoints were submitted to the analysis.

## 3. Results

Firstly, we predicted that increased L2-accent strength ratings will result in less favorable personality trait evaluations for competence, but not necessarily for warmth (H1). The results revealed a significant (lower-level) interaction between Accent Strength and Dimension ( $W(4)=149.63$ ,  $p<.001$ ). As illustrated in Figure 1, increased accent strength reduced the perception of the speakers' competence, while it had a somewhat positive effect on the the speakers' warmth traits.

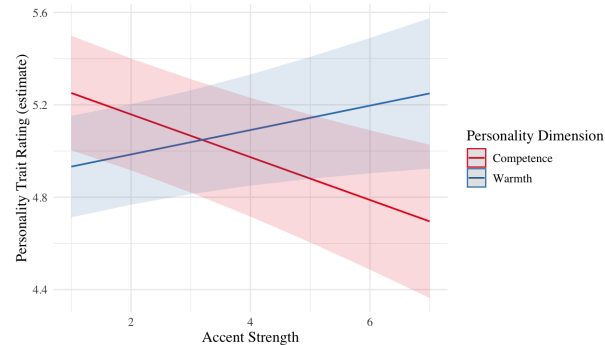


Figure 1: *Personality trait rating by Accent Strength and Personality Trait Dimension.*

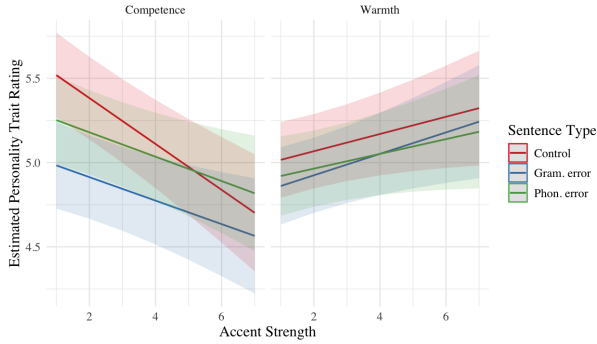


Figure 2: Personality trait rating by Accent Strength, Personality Trait Dimension, and Error Type.

Secondly, we hypothesized that errors (grammatical, phonological) will result in diminished competence ratings only for lower, but not for highly L2 accented speech (H2).

The data revealed a significant 3-way interaction between Accent Strength, Personality Trait Dimension, and Error Type ( $W(4)=8.15$ ,  $p<.05$ ). For competence, at an estimated Accent Strength Rating of 1 (no accent), pairwise comparisons indicated significantly lower ratings for the grammatical ( $z=-9.72$ ,  $p<.001$ ) and phonological condition ( $z=-4.46$ ,  $p<.001$ ), compared to control sentences (Figure 2). Within the competence dimension, for the highest estimated Accent Strength Ratings (7), we found no significant effect of errors (grammatical and phonological) compared to the control condition. This difference indicates a decline in the error effect with increasing accent strength. As illustrated in Figure 2, phonological violations seemed to have an overall smaller effect on the evaluation of a speaker’s competence than grammatical errors. Surprisingly, for the evaluations of warmth, the results confirmed a significant effect of grammatical, but not phonological errors in the lowest accented sentences (1) ( $z=-2.92$ ,  $p<.05$ ). For the highest estimated Accent Strength Ratings (7), we found no significant effects of errors within the warmth dimension, see Figure 2.

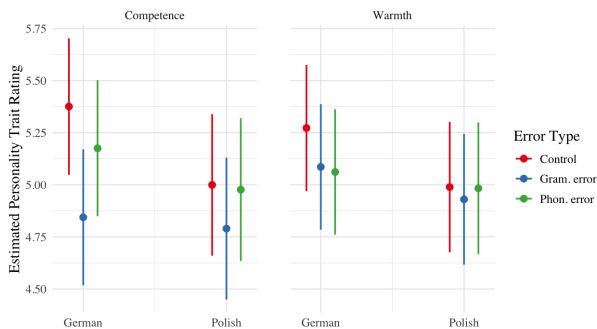


Figure 3: Personality trait rating by Personality Trait Dimension, Error Type, and Language.

Based on previous studies, we additionally hypothesized language-specific differences in the impact of grammatical versus phonological errors (H3). The analysis indicated a significant interaction between Personality Dimension, Error Type, and Language ( $W(4)=7$ ,  $p<.05$ ). As can be seen in Figure 3, for competence, errors seem to have a similar effect across the two languages investigated, with the differences between error

type (phonological, grammatical) and control condition being less pronounced in Polish. Against our prediction, the comparison revealed significant effects for both error types in German (grammatical error:  $z=-10.88$ ,  $p<.001$ ; phonological error:  $z=-4.19$ ,  $p<.001$ ), but only a significant effect of grammatical errors for Polish ( $z=-4.27$ ,  $p<.001$ ).

## 4. Discussion

The present study explored how accent strength and different error types (phonological and grammatical) influence the perception of a speaker’s personality. German and Polish participants listened to utterances and evaluated L1 and L2 speakers’ warmth and competence traits [24], as well as the sentence’s L2 accent strength (used as a predictor for the analysis). The utterances either contained an L2 typical vowel substitution, a grammatical mismatch between determiner and noun, or no such error.

Our study found both, the accent strength and specific linguistic errors to influence speaker perception: Firstly, L2 accents had an overall unfavorable effect on competence, but positively influenced the speakers’ warmth. Secondly, in line with the reduced attention towards L2 embedded errors indicated by previous research [16, 17, 18, 13], phonological and grammatical errors negatively affected the speaker’s competence at the lowest, but not at the highest ratings of L2-accentedness. Regarding warmth, only grammatical errors resulted in decreased trait ratings, and this effect vanished for highly accented speech. Thus, our results indicate a decline in the effect of errors with increasing L2 accent strength when evaluating speakers’ personality.

As expected, our data also revealed language-specific differences: In German, both error types decreased the perception of speakers’ competence and warmth. Contrary to our third hypothesis, in Polish, the negative impact of grammatical errors on competence was the only significant effect observed. Thus, the results suggest that Polish participants were less sensitive to errors, and particularly resistant towards phonological substitutions. However, in our previous research examining the perception of L2 accent strength [15], Polish participants showed greater sensitivity to phonological than to grammatical errors. We attribute this asymmetrical behavior to differences in evoking judgments related to accentedness and personality traits. Although biases against the vice-versa culture might have influenced the findings, we did not find any significant interaction between the personality dimension (warmth, competence) and the languages investigated (German, Polish).

## 5. Conclusions and future research

Both L2 accent strength and the occurrence of errors (grammatical and phonological) can influence the speaker’s personality is evaluated. In our study, accent strength negatively impacted competence but had a positive effect on warmth. Additionally, grammatical errors carried more weight than phonological errors when assessing competence. The present research was limited to explicit ratings. In a follow-up project we aim to compare those results to more unconscious measures, using the Implicit Association Test. Future studies could also investigate differences specific to language and L2 accents, as well as additional error types. Another key question concerns how listeners’ familiarity with L2 accents, along with their attitudes towards the vice-versa culture, influences assessments of personality traits.

## 6. Acknowledgements

This work has been financially supported by Deutsch-Polnische Wissenschaftsstiftung (project: ‘Grammatical tinnitus and its role in the perception of foreign language accent. A comparison of German and Polish’, grant number: 2020-07, PIs: Marzena Zygis, Joanna Błaszczak, Krzysztof Migdalski) and Leibniz Society. We would like to thank Ulrike Domahs for the opportunity to record the German data at Philipps-Universität Marburg and our speakers for their excellent work in producing speech errors.

## 7. References

- [1] D. Pietraszewski and A. Schwartz, “Evidence that accent is a dimension of social categorization, not a byproduct of perceptual salience, familiarity, or ease-of-processing,” *Evolution and Human Behavior*, vol. 35, no. 1, pp. 43–50, 2014.
- [2] J. N. Fierres, W. H. Gottdiener, H. Martin, T. C. Gilbert, and H. Giles, “A meta-analysis of the effects of speakers’ accents on interpersonal evaluations,” *European Journal of Social Psychology*, vol. 42, no. 1, pp. 120–133, 2012.
- [3] M. Munro and T. Derwing, “Processing time, accent, and comprehensibility in the perception of native and foreign-accented speech,” *Language and speech*, vol. 38, no. 3, pp. 289–306, 1995.
- [4] K. J. V. Engen and J. E. Peelle, “Listening effort and accented speech,” *Frontiers in Human Neuroscience*, vol. 8, pp. 1–4, 2014.
- [5] A.-C. B. Marko Dragojevic, Howard Giles and N. T. Tatum, “The fluency principle: Why foreign accent strength negatively biases language attitudes,” *Communication Monographs*, vol. 84, no. 3, pp. 385–405, 2017.
- [6] S. Lev-Ari and B. Keysar, “Why don’t we believe non-native speakers? the influence of accent on credibility,” *Journal of Experimental Social Psychology*, vol. 46, no. 6, pp. 1093–1096, 2010.
- [7] K. T. Holden and J. T. Hogan, “The emotive impact of foreign intonation: An experiment in switching english and russian intonation,” *Language and Speech*, vol. 36, no. 1, pp. 67–88, 1993.
- [8] D. Sumantry and B. L. Choma, “Accent-based stereotyping, prejudice, and their predictors,” *Personality and Individual Differences*, vol. 179, 2021.
- [9] K. Nimz and G. Khattab, “On the role of orthography in l2 vowel production: The case of polish learners of german,” *Second Language Research*, vol. 36, no. 4, pp. 623–652, 2020.
- [10] T. Grüter, C. Lew-Williams, and A. Fernald, “Grammatical gender in l2: A production or a real-time processing problem?” *Second Language Research*, vol. 28, no. 2, pp. 191–215, 2012.
- [11] P. Trofimovich and W. Backer, “Learning second language suprasegmentals: Effect of l2 experience on prosody and fluency characteristics of l2 speech,” *Studies in second language acquisition*, vol. 28, no. 1, pp. 1–30, 2006.
- [12] S. Lev-Ari, “Comprehending non-native speakers: theory and evidence for adjustment in manner of processing,” *Frontiers in Psychology*, vol. 5, 2015.
- [13] Y. Asano and A. Weber, “Listener sensitivity to foreign-accented speech with grammatical errors,” *Cortex*, vol. 116, pp. 308–320, 2016.
- [14] M. J. Munro and T. M. Derwing, “Foreign accent, comprehensibility, and intelligibility in the speech of second language learners,” *Language Learning*, vol. 45, no. 1, pp. 73–97, 1995.
- [15] S. Wesolek, P. Gulowski, J. Błaszczak, and M. Zygis, “What influences the foreign accent strength? Phonological and grammatical errors in the perception of accentedness,” in *Proc. INTER-SPEECH 2023*, Sep. 2023, pp. 3098–3102.
- [16] A. Hanulíková, P. M. van Alphen, M. M. van Goch, and A. Weber, “When one person’s mistake is another’s standard usage: the effect of foreign accent on syntactic processing,” *Journal of Cognitive Neuroscience*, vol. 24, no. 1, pp. 878–887, 2012.
- [17] S. Grey and J. G. van Hell, “Foreign-accented speaker identity affects neural correlates of language comprehension,” *Journal of Neurolinguistics*, vol. 42, pp. 93–108, 2017.
- [18] R. A. R. Jue Xu and W. Sommer, “Perceived language competence modulates criteria for speech error processing: evidence from event-related potentials,” *Language, Cognition and Neuroscience*, vol. 35, no. 6, pp. 752–765, 2020.
- [19] T. E. Lehnert, S. Krolak-Schwerdt, and T. Hörstermann, “Language and nationality attitudes as distinct factors that influence speaker evaluations: Explicit versus implicit attitudes in Luxembourg,” *Language & Communication*, vol. 61, pp. 58–70, 2018.
- [20] J. Błaszczak, M. Zygis, and B. Beinhoff, “What influences our attitudes? a survey study on attitudes of polish university students towards german people,” *Studia Linguistica*, vol. 39, pp. 27–55, 2020.
- [21] M. Zygis, J. Błaszczak, A. Cwiek, M. Saint-Petersen, and S. Wesolek, “Attitudes in the German-Polish context based on perceptual evidence,” in *Proceedings of the 20th International Congress of Phonetic Sciences (ICPhS)*, Prague, Czech Republic, Sep. 2023, pp. 3557–3561.
- [22] M. Omyla-Rudzka, *Attitude to other nationalities*, Centrum Badania Opinii Społecznej, 2012. [Online]. Available: [https://www.cbos.pl/SPISKOM.POL/2012/K\\_022\\_12.PDF](https://www.cbos.pl/SPISKOM.POL/2012/K_022_12.PDF)
- [23] Instytut Publicznych Spraw, *Common direction, Different perspectives. Polish and German views on their mutual relations, Europe and the world. Polish-German Barometer 2019. Key Conclusions*, 2019. [Online]. Available: <https://www.isp.org.pl/pl/publikacje/gemeinsame-richtung-verschiedene-perspektiven-deutsche-und-polsche-ansichten-zu-den-gegenseitigen-europaischen-und-globalen-beziehungen-1063-1065>
- [24] S. Fiske, A. Cuddy, P. Glick, and J. Xu, “A model of (often mixed) stereotype content: Competence and warmth respectively follow from perceived status and competition,” *Journal of Personality and Social Psychology*, vol. 82, pp. 878–902, 2002.
- [25] T. Piske, I. R. MacKay, and J. E. Flege, “Factors affecting degree of foreign accent in an l2: a review,” *Journal of Phonetics*, vol. 29, no. 2, pp. 191–215, 2001.
- [26] L. V. Kremin and K. Byers-Heinlein, “Why not both? Rethinking categorical and continuous approaches to bilingualism,” *International Journal of Bilingualism*, vol. 25, no. 6, pp. 1560–1575, 2021.
- [27] W. E. Lambert, R. C. Hodgson, R. C. Gardner, and S. Fillenbaum, “Evaluational reactions to spoken languages,” *The journal of abnormal and social psychology*, vol. 60, no. 1, pp. 44–51, 1960.
- [28] A. J. C. Cuddy, S. T. Fiske, V. S. Y. Kwan, P. Glick, S. Demoulin, J.-P. Leyens, M. H. Bond, J.-C. Croizet, N. Ellemers, E. Sleebos, T. T. Htun, H.-J. Kim, G. Maio, J. Perry, K. Petkova, V. Todorov, R. Rodríguez-Bailón, E. Morales, M. Moya, M. Palacios, V. Smith, R. Perez, J. Vala, and R. Ziegler, “Stereotype content model across cultures: Towards universal similarities and some differences,” *British Journal of Social Psychology*, vol. 48, no. 1, pp. 1–33, 2009.
- [29] J. Peirce, J. Gray, S. Simpson, M. MacAskill, R. Höchenberger, H. Sogo, E. Kastman, and J. Lindeløv, “Psychopy2: Experiments in behavior made easy,” *Behavior Research Methods*, vol. 51, 2019.
- [30] R. C. Team, *R: A Language and Environment for Statistical Computing*, R Foundation for Statistical Computing, Vienna, Austria, 2021. [Online]. Available: <https://www.R-project.org/>
- [31] D. Bates, M. Mächler, B. Bolker, and S. Walker, “Fitting linear mixed-effects models using lme4,” *Journal of Statistical Software*, vol. 67, no. 1, pp. 1–48, 2015.
- [32] J. Fox and S. Weisberg, *An R Companion to Applied Regression*, 3rd ed. Thousand Oaks CA: Sage, 2019. [Online]. Available: <https://socialsciences.mcmaster.ca/jfox/Books/Companion/>
- [33] R. V. Lenth, *emmeans: Estimated Marginal Means, aka Least-Squares Means*, 2024, r package version 1.10.1. [Online]. Available: <https://CRAN.R-project.org/package=emmeans>