O'Brien, M. G. (2019). Investigating stress assignment. In J. Levis, C. Nagle, & E. Todey (Eds.), *Proceedings of the 10th Pronunciation in Second Language Learning and Teaching Conference*, ISSN 2380-9566, Ames, IA, September 2018 (pp. 70-81). Ames, IA: Iowa State University.

RESEARCH WORKSHOP

INVESTIGATING STRESS ASSIGNMENT

Mary Grantham O'Brien, University of Calgary

Correctly emphasizing syllables in words and words in sentences (i.e., producing stress) makes both words and sentences easier to understand. Determining whether L2 learners are able to accurately produce and perceive stress can be difficult, though. This may have to do, among other things, with a researcher's operationalization of stress, data collection procedures, and the ways in which the data are analyzed. This contribution takes researchers through a series of steps for both collection and analysis of L2 learner lexical and sentential stress data.

INTRODUCTION

Research has shown that correctly assigning lexical stress is an important aspect of being understood (e.g., Caspers, 2010; Trofimovich & Isaacs, 2012). If we consider the German example in (1), taken from Kleber and Niebuhr (2010), we can see that the meaning of some words changes depending on which syllable is stressed. When this is the case, we say that stress assignment is contrastive in a language.

(1) August
  a. ˈAugust
  b. Auˈgust

If the word is stressed on the first syllable [ˈ] in German, as in (1a), it is a name. If it is stressed on the second syllable, as in (1b), it is a month. Kleber and Niebuhr investigated the role of context in participants' perception of lexical stress assignment through a forced-choice identification task. Participants had to determine whether they heard (1a) or (1b) when it was presented in a context of another name or another month. When the cues to lexical stress were less robust, participants chose the name *ˈAugust* after they heard the name *Friedrich*. However, in the context of another month, *Juli,* 'July', participants chose the month *Auˈgust*. This study demonstrated the importance of context in the disambiguation of ambiguous lexical stress assignment cues. In the real world, however, the context is often less clear, and research has shown that listeners have difficulty processing speech with lexical stress assignment errors, even if the word being uttered is not a member of a stress minimal pair (i.e., two lexical items that differ only in stress assignment, as in (1), Bond & Small, 1983; van Heuven, 2008).

Lexical and sentential stress

When we speak of lexical stress, we mean the syllable in a word that is emphasized. A number of previous studies have demonstrated the importance of accurate lexical stress assignment in being understood. This is the case for both native (e.g., Field, 2005) and nonnative speakers (e.g., Trofimovich & Isaacs, 2012). Inaccurately assigning lexical stress may lead to slowed lexical access (e.g., van Heuven, 2008) and reduced understanding on the part of the listener (Caspers, 2010). L2

learners' ability to accurately perceive and produce lexical stress may depend on the pairing of the L1 and the L2. For example, native speakers of French, who do not have contrastive lexical stress assignment in their L1, have demonstrated difficulty perceiving (e.g., Dupoux, Sebastian-Galles, Navarrete, & Peperkamp, 2008) and producing (e.g., Yoon & Heschuk, 2011) variable lexical stress in languages like English.

Sentential stress differs from lexical stress in that it is assigned at the level of the clause. The way in which stress is assigned within a sentence depends on the scope of the focus, which can be broad (i.e., referring to an entire clause) or narrow (i.e., referring to an individual phrase or lexical item, e.g., Ladd, 1980). The focused element is the part of a clause that is emphasized and that can answer an implicit or explicit question (Krifka, 2008). When an utterance is produced out of the blue or in answer to a question like "What's happening?", this is considered to be a broad focus, or all-new, utterance. In Germanic languages like German and English, the final content word is emphasized in all-new utterances (Féry, 1993). When speakers produce utterances with narrow focus, they highlight information that is meant to stand out from the rest of the sentence. Narrow focus utterances are often produced in response to questions beginning with question words, as demonstrated in (2). As in (1), stress is indicated through the use of [ˈ] immediately preceding the onset of the stressed syllable.

(2) The children travel every day with the bus to school.
   a. When do the children travel with the bus to school?
      The children travel every ˈday with the bus to school.
   b. Who travels every day with the bus to school?
      The ˈchildren travel every day with the bus to school.
   c. How do the children get to school every day?
      The children travel every day with the ˈbus to school.
   d. Where do the children go every day on the bus?
      The children travel every day with the bus to ˈschool.

Hahn (2004) investigated the role that correct production of sentential stress plays in the understanding of L2 speech. Participants in the study evaluated three versions of a lecture given by a speaker of L2 English: one with correct sentential stress, one with incorrect sentential stress, and one with no sentential stress. Participants both recalled more information from, and they showed a tendency to more easily process, the lecture with correct sentential stress.

EXPERIMENTING WITH STRESS

As is the case with any type of experimental research, it is important to ensure that the data we gather from our participants will enable us to answer our research questions in a meaningful way. When we want to investigate stress assignment, we have a range of options to examine how L2 learners produce and perceive stress.

Designing production experiments

Recent studies have looked at the extent to which L2 learners can assign lexical stress in production. Although it might be possible to make use of pictures to elicit semi-spontaneous utterances containing various target items, most L2 stress assignment experiments utilize a reading task, as this ensures that all of the participants produce the same target items, many of which cannot be illustrated

via images. In the experiments, words are often read within a carrier phrase such as "I say the word _____ again" (e.g., Chen, 2013; Domahs, Plag, & Carroll 2014[i]; Tremblay, 2008). Carrier phrases are used to control for prosodic effects (e.g., rising intonation, contrastive stress).

To date studies looking at L2 learners' production of sentential stress have been somewhat limited. Researchers who have investigated it have used two main types of tasks: contextualized sentence reading (O'Brien & Jackson, 2013) and responses to questions about images (e.g., O'Brien & Féry, 2015; O'Brien & Gut, 2011). In both of these types of tasks participants are provided with a context (i.e., a sentence preceding the reading task in O'Brien & Jackson, 2013 or a question about an image in O'Brien & Gut, 2011) that requires them to highlight a particular word in the utterance being produced. The *Questionnaire on Information Structure* (Skopeteas et al., 2006) provides researchers with materials for a range of studies investigating the production of focus and examining information structure more generally. The materials include a series of images and guidelines for experimental tasks that researchers investigating a variety of languages can use to elicit various types of focus (e.g., given vs. new, all new, contrastive focus).

Designing perceptual experiments

A number of task options are available, and this section presents just three of them: ABX tasks, stress preference perception tasks, and gating tasks. These tasks differ in the extent to which they require participants to rely purely on their discrimination ability when completing the task.

Participants' ability to detect lexical stress has often been examined through the use of ABX tasks or variants thereof (e.g., Correia, Butler, Vigario, & Frota, 2015; Dupoux, Pallier, Sebastian, & Mehler, 1997; Tremblay, 2009). In this task, participants hear three stimuli, A, B, and X, as shown in (3).

(3) Sample ABX task
A: ˈinsert
B: inˈsert
X: inˈsert

The participants are to determine whether the target stimulus, X, is the same as A or B. In this case, the correct answer is B. Researchers have criticized ABX tasks for placing a relatively high processing load on participants, who are required to hold both A and B in short-term memory and compare them both to X, thus resulting in less accurate performance when token A is the same as token X (Tremblay, 2009). Others have indicated that participants in ABX studies do not need to compare both token A and token B to X. Instead, simply determining whether B and X are the same allows participants to complete the task (Beddor & Gottfried, 1995). Researchers have proposed that AXB tasks solve this problem, as this task requires listeners to compare both A and B to X (Strange & Shafer, 2008; Tremblay, 2009).

Other tasks used to determine the extent to which participants perceive lexical stress require learners to rely on a more general lexical stress assignment system (i.e., analogy with known words or stress assignment rules) or some level of lexical encoding. One option available to researchers who are interested in investigating the extent to which learners are able to make use of phonological (e.g., syllable weight) or morphological (i.e., affixes) cues to lexical stress assignment is the stress preference perception task (e.g., Guion, Clark, Harada, & Wayland, 2003; Tight, 2007). In this task

participants are presented with a written word as in (4). They then listen to productions thereof that differ in terms of their lexical stress assignment.

(4) outrageous *(presented as a written word)*
a. ˈoutrageous
b. outˈrageous
c. outraˈgeous

When carrying out the task participants are required to listen to each variant of the target item (here a, b, and c) and determine which is correct. Researchers are able to not only measure correctness scores, but they can also measure the number of times participants have listened to each token as evidence of participants' level of confidence with their choice.

Another option for researchers investigating learners' abilities to encode cues to lexical stress is the gating task. This task requires participants to listen to increasingly longer portions of a word (often within a sentence) and to determine which of a number of similar words is being produced (Field, 2008; Grosjean, 1983; Grosjean & Hirt, 1996). A German example is provided in (5).

(5) Er sagt Direkˈtoren. (*target sentence, not presented to participants*)
'He says directors.'

The following three options are provided on the screen:
a. Er sagt Direktor.
'He says director'
b. Er sagt Direktoren.
'He says directors.'
c. Er sagt Direktorat.
'He says directorate.'

Gates presented to participants:
1. Er sagt Di
2. Er sagt Direk
3. Er sagt Direkˈtor

The longest gate ever presented to participants should only be as long as the shortest potential answer. Upon hearing each of the gates, participants are required to make a judgement about which sentence is being produced (a, b, or c) and to provide a confidence rating on a scale from 1-10 (where 1=very unsure and 10=very sure). In example (5) above, the first gate contains no information about lexical stress assignment. We would therefore expect both that listeners would simply guess which sentence (a, b, or c) has been spoken and that they would rate their confidence in their decision very low. By the time participants get to the second gate, which also does not contain any overt cues to lexical stress assignment for the target item, we would expect them to exclude the first item, *Diˈrektor*, which is stressed on the second syllable. We would expect higher confidence ratings, given that participants are able to exclude one of the items. At the third gate, when participants hear the stressed syllable, we would expect that those participants who know that *Direkˈtoren* is stressed on the third syllable would choose option b and provide a high confidence rating. The combination of a participants' choice along with the confidence rating provides insights into the time course of

participants' processing of acoustic cues to lexical stress assignment. Gating tasks are a good fit when dealing with languages that have similar words that differ on the basis of lexical stress assignment (e.g., suffixed words).

Researchers who are interested in making use of a gating task should begin by recording the complete target items. Once it has been determined that the tokens contain both robust acoustic cues to lexical stress assignment and that listeners are able to hear these differences (see the section on acoustic analyses below), the sound files that correspond to the various gates can be prepared. Figures 1 and 2 contain the spectrograms for the first two gates for the sentence *I say po*ˈ*litical* (which can be distinguished in stress assignment from similar words ˈ*politics* and *poli*ˈ*tician*).

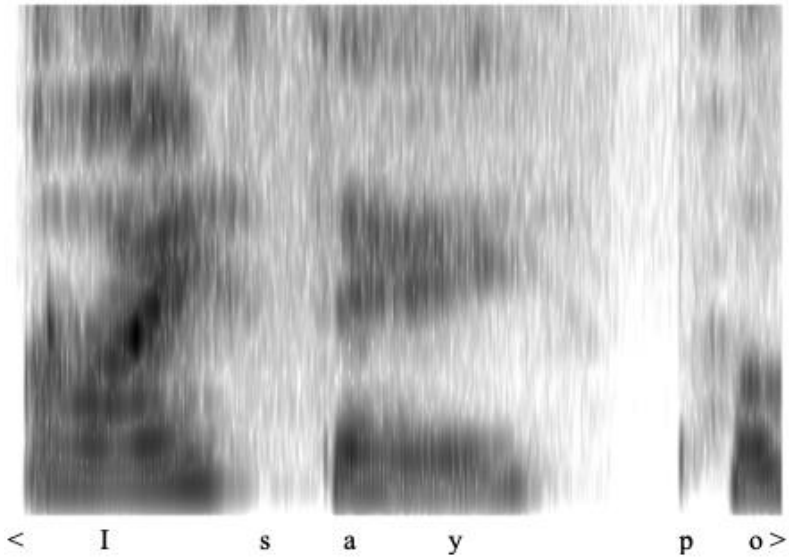

Figure 1. Spectrogram for gate 1 *I say po*.

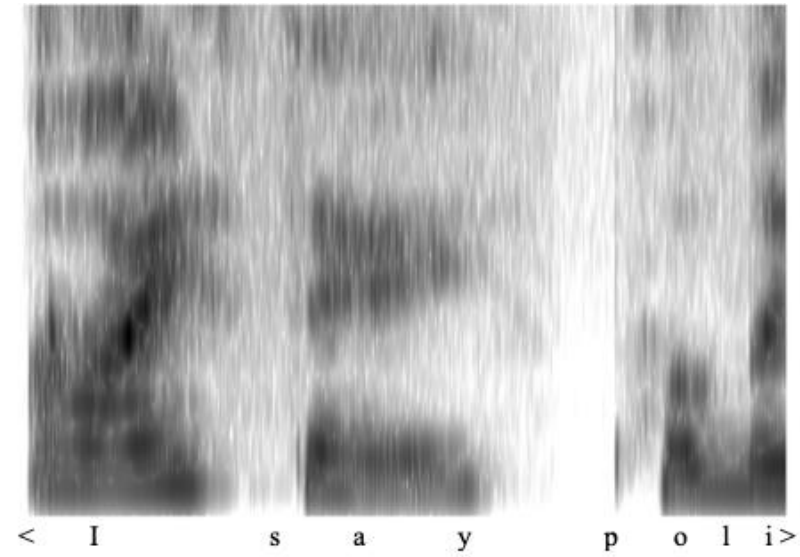

Figure 2. Spectrogram for gate 2 *I say po*ˈ*li*.

When creating gates it is a good idea to save the original files separately in order to ensure that gated files can be recreated in the future if necessary. It is easiest to keep track of the gated files according to the name of the actual target word and the number of syllables that the target word contains (e.g., gate 1 as political1.wav).

Other perception tasks have been utilized in order to gain insights into how participants process lexical stress assignment in an L2. For example, lexical decision tasks and sequence recall tasks provide information about the extent to which L2 learners make use of lexical stress in the encoding of words. In studies investigating lexical stress, lexical decision tasks require participants to determine whether a given stimulus is a word (e.g., Dupoux, Peperkamp, & Sebastian-Galles, 2010). As such, words with incorrect stress assignments should not be categorized as words. In sequence recall tasks, participants are required to recall a series of minimal pairs that they have heard that differ only in lexical stress assignment (Correia et al., 2015; Peperkamp, Vendelin, & Dupoux, 2010). Participants in Correeia et al. (2015) were required, after hearing a series like [ˈnumi]-[nuˈmi]-[nuˈmi]-[ˈnumi]-[nuˈmi], to remember the order in which they heard the words and reproduce the order. The authors note that the task places a heavy processing load on participants.

Choosing tokens

When deciding on which tokens to use in lexical stress assignment studies, researchers should consider a number of important factors. These include a word's frequency, participants' familiarity with the word in question, and the cognate and real word status thereof. While a word's frequency as determined by referring to a spoken or written corpus may play a role in L2 learners' perception or production of lexical stress, familiarity may be a more important factor for L2 learners. For example, the most frequent words that classroom language learners are exposed to often differ from those that are most frequent in a corpus. One possibility for determining participants' familiarity with tokens is to have them rate familiarity at the end of an experiment. A rating scale might range from 1 ("I have never seen this word. I do not know its meaning or how to use it.") to 5 ("I know the word, its meaning, and how to use it."), as in Maczuga, O'Brien, and Knaus (2017).

Research has demonstrated that cognates have a special status in the L2, and participants' ability to correctly assign stress to cognates may differ from their assignment to non-cognates (e.g., Lord, 2001; Maczuga et al., 2017). Thus, if researchers decide to make use of cognates in their studies, they should control for and test the effects of a word's cognate status, for example, by determining if participants perform differently on cognate words as opposed to non-cognate words. One final factor to consider is whether to make use of nonsense words. Whereas tasks using real word tokens may tap into participants' lexical encoding abilities, those using nonsense words are frequently used to control for a word's frequency and participants' familiarity with it (e.g., Domahs, 2014; Jarmulowicz, Taran, & Hay, 2008; Tight, 2007).

ANALYZING STRESS

Researchers need to analyze stress assignment in stimuli used in perceptual studies and in the tokens produced in production studies. When preparing stimuli for perceptual studies and when analyzing stress assignment accuracy in production studies, researchers should ensure that tokens contain robust cues to lexical stress assignment. There are two options for analyzing stress assignment accuracy: acoustic analyses and listener judgments.

Acoustic analyses

When performing acoustic analyses, it is important for researchers to determine which acoustic cues are relevant for stress assignment in the given target language. Many languages rely on cues that include duration (i.e., stressed syllables usually take longer to pronounce), intensity (i.e., stressed syllables tend to be louder), and/or pitch (i.e., there is often a change in fundamental frequency in stressed syllables). Acoustic analyses can be carried out in software including *Audacity* (Audacity Team, 2018) or *Praat* (Boersma & Weenink, 2018). Figures 3 and 4 are waveforms, spectrograms, and TextGrids from *Praat* of the German word *Dominos* 'dominos' produced by the same speaker with stress produced on the first and second syllables, respectively. Syllable duration is marked on the syllables tier (S1, S2, S3), and vowel duration is marked on the vowels tier (V1, V2, V3). The yellow line represents intensity, and the blue line represents pitch. Formants are represented via the red dots.

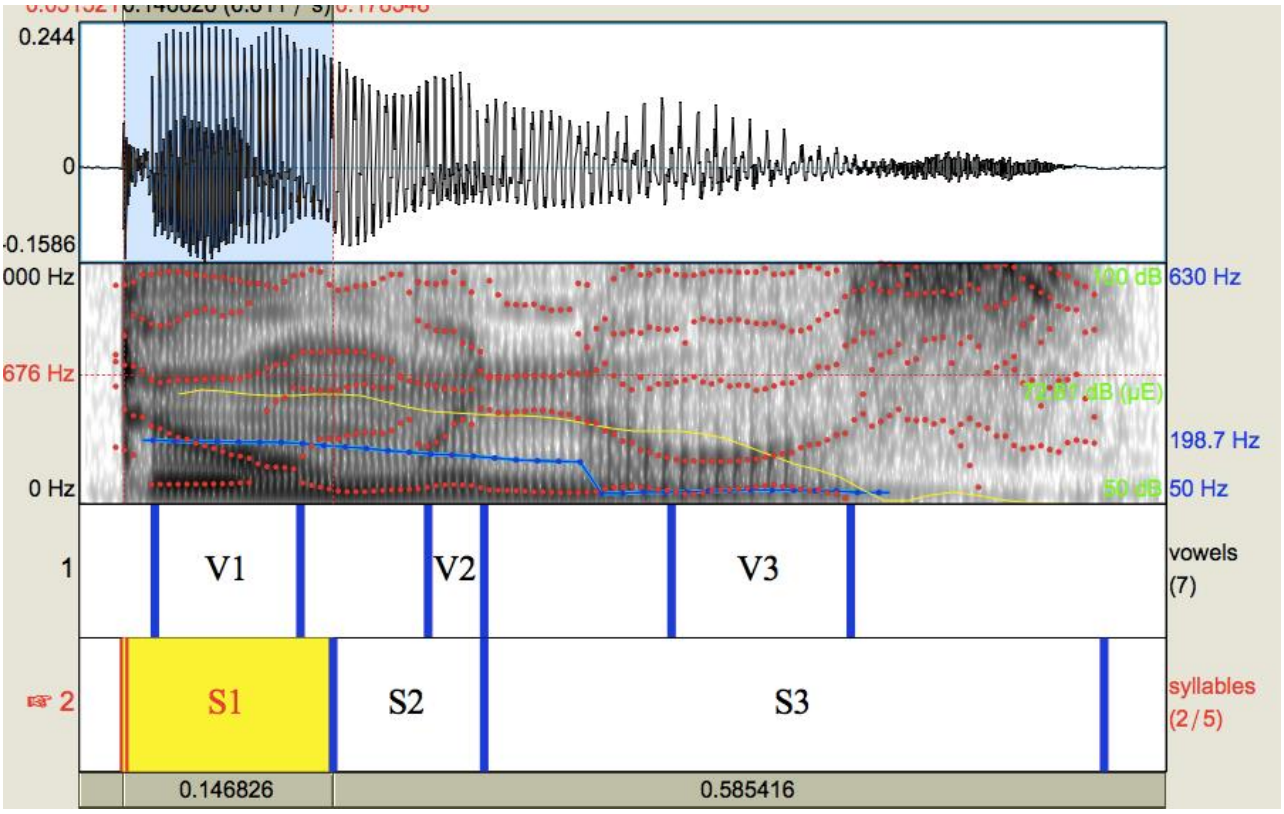

Figure 3. German ˈ*Dominos*.

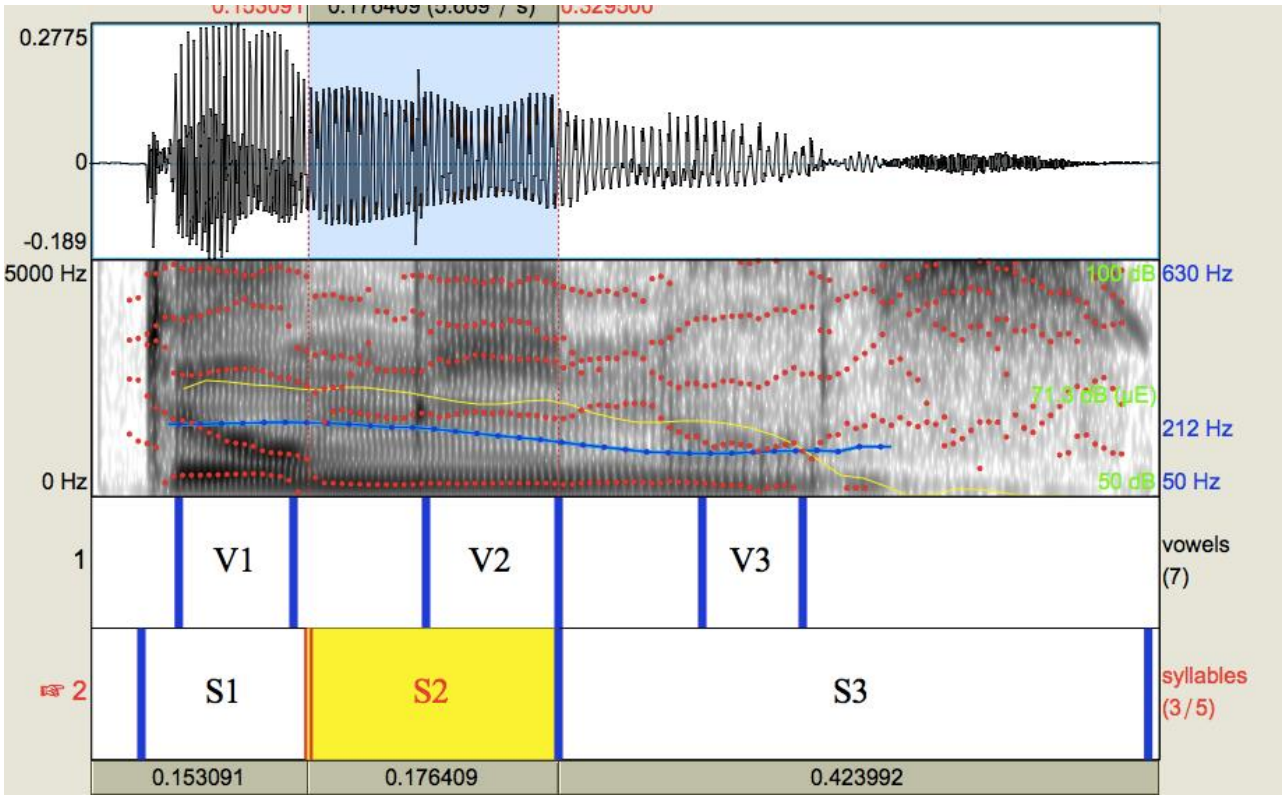

Figure 4. German *Do'minos*.

Speech segmentation is not a completely straightforward task. For example, when it comes to syllabification of words, it is important for researchers to have a plan for how to handle issues like measuring duration in vowels that have a relatively short steady state and where to divide word-medial consonant clusters. In addition, it is sometimes difficult to determine precisely where one segment ends and the next begins. It is therefore important for researchers to begin segmentation with a clear plan for how to handle issues such as these and for a second researcher to check segmentation. While it is possible to carry out acoustic measurements completely by hand[ii], it is highly recommended that researchers carry out acoustic analyses by creating TextGrids for each target item that they can then submit to batch analyses via a script in *Praat*. Although providing instructions for the creation of TextGrids and the use of scripts is beyond the scope of the current contribution, researchers who wish to make use of these are encouraged to visit the active, highly collaborative *Praat* users' group.[iii]

Listener judgments

Researchers who are interested in the extent to which stress assignment is perceived in the real world are encouraged to make use of listener judgments, which are considered the gold standard (Derwing & Munro, 2009). In fact, the researchers go so far as to state that "listeners' judgments are the only meaningful window into accentedness and comprehensibility… [W]hat listeners perceive is ultimately what matters most" (Derwing & Munro, 2009, p. 478).

Determining the presence or absence of stress on a given syllable is not always a clear-cut issue. For example, L2 learners may produce pauses between syllables, thereby making it difficult to determine which syllable is accented. Even if they do produce complete words, learners may produce equal stress on all of the syllables in a word and/or on multiple words in a sentence. When we carry out listener analyses of stress assignment, multiple listeners are often relied upon to determine which syllable is stressed. If the ultimate goal is to determine which syllable speakers have stressed, researchers often rely on the judgments of two listeners (e.g., Maczuga et al., 2017; Yu, 2008). The listeners usually carry out the judgments independently and discuss any disagreements. In the case of a disagreement, the researcher should keep track of such anomalies and have a plan for how to account for these tokens, even if it means removing them from the final analyses.

DISCUSSION

Stress assignment, like other aspects of prosody, is complex. As such, there are fewer studies investigating it than there are studies investigating the perception and production of segments. Nonetheless, given its importance for overall understanding, researchers are encouraged to investigate it in a range of L2s. Moreover, given that lexical stress varies across L1s, it is important to look at a range of L1-L2 pairings. Such studies will provide insights into notions like stress deafness and the role of awareness in stress assignment accuracy. Because the results of studies often depend on the methodology employed, researchers are encouraged to make use of a range of tasks—both perception and production—in order to gain a more nuanced understanding of L2 stress assignment.

ACKNOWLEDGMENTS

I would like to acknowledge research assistants Ross Sundberg, Stéphanie Chicoine, Lisa Süßenbach, and Helene Bramwell for assistance with this work. This research was supported by the Social Sciences and Humanities Research Council of Canada.

ABOUT THE AUTHOR

Mary Grantham O'Brien is a professor of German at the University of Calgary. Her research centers on L2 perception and production. In recent studies she has investigated listener judgments of L2 speech as well as the extent to which L2 learners make use of target language-relevant acoustic cues in their productions. She has carried out a number of perceptual studies to determine the extent to which L2 listeners perceive prosodic cues. Her current research focuses on lexical stress assignment among L2 learners of German.

Contact information:
School of Languages, Linguistics, Literatures and Cultures
University of Calgary
C216 Craigie Hall
Calgary, AB T2N 1N4
Canada
mgobrien@ucalgary.ca

REFERENCES

Audacity Team. (2018). *Audacity.* [Computer program]. Version 2.3.0 retrieved 11 Nov 2018 from https://www.audacityteam.org/.

Beddor, P. S., & Gottfried, T. L. (1995). Methodological issues in cross-language speech perception research with adults. In W. Strange (Ed.), *Speech perception and linguistic experience: Issues in cross-language research* (pp. 207–232). Baltimore: York Press.

Boersma, P., & Weenink, D. (2018). *Praat: Doing phonetics by computer.* Available at www.praat.org (Last accessed November 11, 2018).

Bond, Z. S., & Small, L. H. (1983). Voicing, vowel, and stress mispronunciations in continuous speech. *Perception & Psychophysics, 34*(5), 470–474.

Caspers, J. (2010). The influence of erroneous stress position and segmental errors on intelligibility, comprehensibility and foreign accent in Dutch as a second language. *Linguistics in the Netherlands, 27,* 17–29.

Chen, H. C. (2013). Chinese learners' acquisition of English word stress and factors affecting stress assignment. *Linguistics and Education, 24,* 545–555.

Correia, S., Butler, J., Vigario, M., & Frota, S. (2015). A stress 'deafness' effect in European Portuguese. *Language and Speech, 58*(1), 48–67.

Derwing, T. M., & Munro, M. J. (2009). Putting accent in its place: Rethinking obstacles to communication. *Language Teaching, 42*(4), 476–490.

Domahs, U., Plag, I., & Carroll, R. (2014). Word stress assignment in German, English and Dutch: Quantity-sensitivity and extrametricality revisited. *The Journal of Comparative Germanic Linguistics, 17*(1), 59–96.

Dupoux, E., Pallier, C., Sebastian, N., & Mehler, J. (1997). A distressing 'deafness' in French? *Journal of Memory and Language, 36,* 406–421.

Dupoux, E., Sebastian–Galles, N., Navarrete, E., & Peperkamp, S. (2008). Persistent stress "deafness": The case of French learners of Spanish. *Cognition, 106*(2), 682–706.

Dupoux, E., Peperkamp, S., & Sebastian-Galles, N. (2010). Limits on bilingualism revisited: Stress 'deafness' in simultaneous French-Spanish bilinguals. *Cognition, 114*(2), 266–275.

Féry, C. 1993. *German intonational patterns.* Tübingen: Max Niemeyer Verlag.

Field, J. (2005). Intelligibility and the listener: The role of lexical stress. *TESOL Quarterly, 39*(3), 399–423.

Field, J. (2008). Revising segmentation hypotheses in first and second language listening. *System, 36,* 35–51.

Guion, S. G., Clark, J. J., Harada, T., & Wayland. R. P. (2003). Factors affecting stress placement for English nonwords include syllabic structure, lexical class, and stress patterns of phonologically similar words. *Language and Speech, 46*(4), 403–427.

Grosjean, F. (1983). How long is the sentence? Prediction and prosody in the on-line processing of language. *Linguistics, 21,* 501–529.

Grosjean, J., & Hirt, C. (1996). Using prosody to predict the end of sentences in English and French: Normal and brain damaged subjects. *Language and Cognitive Processes, 11,* 107–134.

Hahn, L. (2004). Primary stress and intelligibility: Research to motivate the teaching of suprasegmentals. *TESOL Quarterly, 38*(2), 201–223.

Jarmulowicz, L., Taran, V. L., & Hay, S. E. (2008). Lexical frequency and third-graders' stress accuracy in derived English word production. *Applied Psycholinguistics, 29*(2), 213–235.

Kleber, F., & Niebuhr, O. (2010). Semantic-context effects on lexical stress and syllable prominence. In *Speech Prosody 2010,* paper 829. Available at https://isca-speech.org/archive/sp2010/papers/sp10_829.pdf (Last accessed November 11, 2018).

Krifka, M. (2008). Basic notions of information structure. *Acta Linguistica Hungarica, 55,* 243–276.

Ladd, D. R. (1980). *The structure of intonational meaning: Evidence from English.* Bloomington: Indiana Press.

Lord, G. (2001). *The second language acquisition of Spanish stress: derivational, analogical or lexical?* (Unpublished doctoral dissertation). The Pennsylvania State University, State College, PA.

Maczuga, P., O'Brien, M. G., & Knaus, J. (2017). Producing lexical stress in second language German. *Die Unterrichtspraxis / Teaching German,50*(2), 120–135.

O'Brien, M. G., & Gut, U. (2011). Phonological and phonetic realisation of different types of focus in L2 speech. In M. Wrembel, M. Kul, & K. Dziubalska-Kolaczyk (Eds.), *Achievements and perspectives in SLA of speech: New Sounds 2010 Volume 1* (pp. 205–216). Frankfurt am Main: Peter Lang Verlag.

O'Brien, M. G., & Jackson, C. (2013, April). Realization of information structure in German speech. Paper presented at the Germanic Linguistics Annual Conference-19, University at Buffalo, Buffalo, NY.

O'Brien, M. G., & Féry, C. (2015). Dynamic localization in second language English and German. *Bilingualism: Language and Cognition, 18*(3), 400–418.

Peperkamp, S., Vendelin, I., & Dupoux, E. (2010). Perception of predictable stress: A cross-linguistic investigation. *Journal of Phonetics, 38*(3), 422–430.

Skopeteas, S., Fiedler, I., Hellmut, S., Schwarz, A., Stoel, R., Fanselow, G., Féry, C., Krifka, M. (2006). Questionnaire on Information Structure. Potsdam: Universitätsverlag Potsdam https://www.sfb632.uni-potsdam.de/quis.html (Last accessed November 11, 2018)

Strange, W., & Shafer, V. L. (2008). Speech perception in second language learners: The re-education of selective perception. In J. G. Hansen Edwards & M. L. Zampini (Eds.), *Phonology and second language acquisition* (pp. 153-191). Amsterdam: John Benjamins.

Tight, D. G. (2007). Lexical subregularities and the stress preferences of L2 Spanish learners. *Hispania, 90*(3), 565–578.

Tremblay, A. (2008). Is second language lexical access prosodically constrained? Processing of word stress by French Canadian second language learners of English. *Applied Psycholinguistics, 29,* 553–584.

Tremblay, A. (2009). Phonetic variability and the variable perception of L2 word stress by French Canadian listeners. *International Journal of Bilingualism, 13*(1), 35–62.

Trofimovich, P. & Isaacs, T. (2012). Disentangling accent from comprehensibility. *Bilingualism: Language and Cognition, 15*(4), 905–916.

van Heuven, V. J. (2008). Making sense of strange sounds: (Mutual) intelligibility of related language varieties. A review. *International Journal of Humanities and Arts Computing, 2,* 39–62.

Yoon, T.-J., & Heschuk, J. (2011). Acoustic analysis of a Canadian French speaker's production of English stress. *Language Research, 47*(1), 1–21.

Yu, Y-J. (2008). *A cross-language study in perception of lexical stress in English.* (Unpublished PhD dissertation). Wayne State University, Detroit, MI.

[i] The German carrier phrase in Domahs et al. (2014) was *Ich habe gehört, dass Peter _____ gesagt hat.* ('I heard that Peter said _____.')

[ii] An individual can open a sound file and take measurements (e.g., a vowel's formant values or duration, an utterance's peak F0) by highlighting a specific segment, word, or phrase and writing down the measurements. This is possible without creating and saving an accompanying TextGrid; however, this means that a researcher has no permanent record of precisely what was analyzed. TextGrids provide a researchers with a reliable and efficient means to re-analyze a given speech sample if necessary. *Praat*'s help menus and website provide instructions for analyzing speech samples.

[iii] The *Praat* users' group can be found at https://uk.groups.yahoo.com/neo/groups/praat-users/info.