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The interaction between prosody and meaning in second language speech production

Carrie N. Jackson¹ and Mary Grantham O'Brien²

¹Department of Germanic and Slavic Languages and Literatures, Pennsylvania State University

²Department of Germanic, Slavic, and East Asian Studies, University of Calgary

Abstract

Research has shown that English and German native speakers use prosodic cues during speech production to convey the intended meaning of an utterance. However, little is known about whether American L2 learners of German also use such cues during L2 production. The present study shows that intermediate-level L2 learners of German (English L1) use prosodic cues to disambiguate syntactically ambiguous German sentences during a contextualized sentence production task. These results highlight the interaction between prosody and meaning in L2 speech, suggesting ways in which prosodic training is important not only for L2 pronunciation, but also L2 listening and reading comprehension.

When foreign language instructors incorporate pronunciation training into the foreign language classroom, they often focus on particularly salient or troublesome second language (L2) sounds. In the case of German teachers in North America, for example, instructors may direct students' attention to how they pronounce sounds like <r>, <ch> or <ü>, in the hopes that more nativelike pronunciation of such sounds may reduce students' L2 accent (e.g., Ducate & Lomicka, 2009; O'Brien, 2004). However, researchers have shown that prosody may have a greater impact on the perceived strength of one's L2 accent than how one produces individual L2 sounds (e.g., Anderson-Hsieh, Johnson & Koehler, 1992; Derwing & Munro, 2005; Jilka, 2000; Munro & Derwing, 2006), leading to calls to emphasize prosodic training alongside exercises focusing on individual sounds, or segments, in the L2 (e.g., Chun, 1998, 2002; Derwing & Rossiter, 2003; Eskenazi, 1999a, 1999b; Moyer, 1999).

Beyond reducing L2 learners' foreign accent, there may be an additional reason to devote attention to pronunciation at the prosodic level: comprehensibility. Eskenazi (1999a) refers to intonation—a key component of prosody—as the “glue” that holds together messages (p. 64) and claims that “early prosody instruction, starting in the first year of language study, could be a boon to learning both syntax and phone articulation.” (1999b, p. 462). Simply put, if we want students to be understood, we need to focus on prosody (Derwing & Rossiter, 2003). In this vein, the present article outlines the types of prosodic cues speakers have at their disposal during speech production and reviews research showing the important role such prosodic information plays in real-time language comprehension for both native speakers and L2 learners. We then report the results of a study that examined how intermediate L2 learners of German use prosodic cues to disambiguate syntactically ambiguous sentences when reading sentences aloud during a contextualized sentence production task. Based on our findings, we conclude by offering suggestions for teaching and areas for future research.

Prosodic cues in L1 speech production

Broadly speaking, prosody refers to the suprasegmental features of speech and encompasses the stress, rhythm and intonation of an utterance. Among other things, speakers in a variety of languages, including English and German, can use prosodic information to convey the meaning of a syntactically ambiguous utterance. Some of the prosodic cues that speakers have at their disposal during speech production include 1) duration, for example the lengthening of words and syllables immediately prior to a prosodic boundary, 2) pauses, as a means to mark a boundary between two distinct prosodic phrases, and 3) changes in pitch, as a further means to highlight some sort of prosodic boundary (Chun, 2002).¹ However, which, if any, of these cues speakers will use to convey the intended meaning of an utterance often depends on the situation and how essential it is that speakers disambiguate their utterance in the first place. For instance, some studies have shown that speakers must be aware of the potential ambiguity to make use of prosodic cues, and others have shown that speakers are more likely to use prosodic cues to disambiguation in the presence of an interlocutor than when no interlocutor is present (e.g., Lingel, Pappert, & Pechmann, 2006; Schafer, Speer, Warren, & White, 2000; Snedeker & Trueswell, 2003; but see Kraljic & Brennan, 2005 for counterevidence).

Snedeker and Trueswell (2003) provide one example of how native English speakers would use prosodic cues to disambiguate a syntactically ambiguous sentence, like (1a), during a referential communication task.

- (1a) Tap the frog with the flower. (globally ambiguous)
- (1b) [Tap] [the frog with the flower]. (prosodic disambiguation; noun-attachment)
- (1c) [Tap the frog] [with the flower]. (prosodic disambiguation; verb-attachment)

Sentences, like (1a), are often referred to as globally ambiguous prepositional phrase (PP) attachment sentences because there are two possible syntactic structures for this sentence, each of which would lead to a different interpretation. Imagine a situation in which a speaker is presented with a sentence like (1a), alongside a set of objects including a frog, a flower, and a frog holding a flower, as was done in the study conducted by Snedeker and Trueswell. In one possible interpretation, the prepositional phrase provides additional information about the frog, indicating that one should tap the frog holding the flower rather than the frog not holding anything—a so-called modifier- or noun-attachment interpretation. In a second possible interpretation, the prepositional phrase provides additional information about the verb, indicating that one should tap the frog using the flower—a so-called instrument- or verb-attachment interpretation. Snedeker and Trueswell's experiment involved pairs of participants, a speaker and a listener, sitting on opposite sides of a screen. The speaker was given a sentence, like (1a), along with a demonstration of the intended action. Her goal was to produce the sentence aloud in a manner that would lead the listener to perform the correct action with objects placed in front of the listener. Acoustic analyses of the speakers' utterances revealed that they paused 40% of the time, and paused for longer periods, between the verb and the direct object (i.e., between *tap* and *the frog*) on noun-attachment sentences compared to verb-attachment sentences (see example 1b). Conversely, the speakers paused 68% of the time, and paused for longer periods, between the direct object and the prepositional phrase (i.e., between *the frog* and *with the flower*) on verb-attachment sentences compared to noun-attachment sentences (see example 1c). In noun-attachment sentences speakers also lengthened the duration of the verb prior to pausing,

¹Speakers make use of prosodic boundaries as a means of segmenting speech into meaningful units. The units that are demarcated by these boundaries are known as prosodic phrases. Refer to sentences (1b) and (1c), both of which contain a boundary that divides the sentence into two prosodic phrases, as indicated by the brackets.

whereas they lengthened the duration of the direct object prior to pausing in verb-attachment sentences. Finally, speakers placed a pitch accent—prominence on a particular unit—on the preposition *with* over 70% of the time in verb-attachment sentences, whereas they did so less than 15% of the time in noun-attachment sentences. Importantly, listeners in these experiments took advantage of the prosodic cues provided by the speakers, performing the correct action 70% of the time (Snedeker & Trueswell, 2003). More recent work by Lingel, Pappert and Pechmann (2006) shows that native German speakers also use duration and pauses, alongside other cues, when prompted to disambiguate German ambiguous PP-attachment sentences in a picture description task. Important for the purposes of the present study, the results from these studies demonstrate that both English and German native speakers use a variety of prosodic cues to differentiate between the two possible meanings (i.e., noun-attachment vs. verb-attachment) of syntactically ambiguous PP-attachment sentences during speech production.

Prosodic cues in L1 and L2 comprehension

Recent work by Fernandez points to a possible connection between the use of nativelike versus non-nativelike prosodic cues in L2 reading comprehension and L2 speech production. In a study investigating the use of prosodic cues by early Spanish-English bilinguals, Fernandez (2005) reported that bilingual participants used prosodic cues during the production of syntactically ambiguous Spanish and English sentences differently from monolingual speakers of each language, paralleling differences reported in the L1 and L2 sentence processing literature about how native and L2 speakers of Spanish and English parse similar sentences in real-time reading comprehension tasks (e.g., Dussias, 2003). These results raise the possibility of a more general correlation between L2 learners' prosodic phrasing patterns and L2 reading comprehension.

In a similar vein, two recent studies with late L2 learner populations have shown that even novice to intermediate classroom L2 learners may be sensitive to prosodic mismatches when listening to syntactically ambiguous L2 sentences (Dekydtspotter, Donaldson, Edmonds, Fultz, & Petrusch, 2008; Fultz, 2007). For example, Fultz (2007) found that American L2 learners of French with four to six semesters of French language instruction were less likely to judge that a syntactically ambiguous PP-attachment sentence in French sounded "good" when the prosodic contour of the sentence did not match the semantic content of the preceding context. While judgment accuracy improved among the more advanced students at the 5th and 6th semester level, even students with only four semesters of French performed above chance (Fultz, 2007, pp. 400–401).

To our knowledge, no studies have yet looked at whether late L2 learners are similarly sensitive to how prosody can help disambiguate syntactically ambiguous sentences during L2 production. However, several studies have shown that L2 learners are less able to make use of prosodic cues to meaning during both comprehension and production when prosodic information marks the information structural, or discourse pragmatic, status of an element in an utterance. Put another way, elements within an utterance can be given (i.e., recoverable from the preceding discourse) or new (i.e., either not recoverable from the preceding discourse or contrary to a stated alternative). For example, in a study involving two groups of Vietnamese learners of English differing in levels of proficiency, Nguyễn, Ingram and Pensalfini (2008) reported that the less-proficient L2 learners could not identify how prosodic information marked the information structure of an utterance as well as native English speakers. The less proficient Vietnamese L2 learners of English also had greater difficulty producing pitch contrasts to distinguish the information structural status in similar sentences during a speech production task (Nguyễn et al., 2008). Parallel results have been reported in analyses of corpus data from intermediate to advanced L2 learners of English

with a variety of L1s, including German, Spanish, Japanese and Thai (Gut, 2009; Ramirez Verdugo, 2002; Wennerstrom, 1994). Specifically, L2 learners of English, regardless of L1 background, may use prosody to emphasize given information during speech production, whereas native English speakers are more likely to exhibit the opposite pattern, placing emphasis on new information in an utterance.

The number of studies that have investigated the relationship between prosody, L2 speech production and L2 comprehension more generally is still limited. However, as demonstrated by results from the studies summarized here, we feel this is an area that warrants additional research. Because of the close connection between prosody and meaning, through such research we can gain insight into how L2 learners use prosodic cues to aid L2 comprehension and communication. Ultimately, research of this nature has implications for the role of prosodic training in the foreign language classroom. The present study represents a first step towards expanding this body of research by exploring which, if any, prosodic cues intermediate L2 learners of German use to facilitate comprehension. To this end, we investigated learners' use of prosodic cues when reading syntactically ambiguous German sentences aloud during a contextualized sentence production task. Two research questions guided the current study:

1. Do intermediate L2 learners of German make use of prosodic cues to disambiguate syntactically ambiguous German sentences during a contextualized sentence production task?
2. If intermediate L2 learners of German do produce prosodic cues, which cues do they use?

Method

Participants

Twelve undergraduate-level L2 learners of German (English L1) were recruited from upper-division courses focusing on German composition, German culture and literature, or the history of the German language, at a large university in the northeastern United States. Ten participants reported that they began learning German in junior high or high school. Two participants did not begin learning German until they started college. Including both high school and college-level instruction, participants had been studying German between 3 and 10 years ($M = 7.5$). Seven of the 12 participants had participated in study abroad programs in Germany, ranging in length from one to six months. To provide an independent measure of participants' German proficiency, they also completed a 30-point multiple choice German proficiency task offered by the Goethe Institut (2004) that tested their knowledge of German grammar and vocabulary. All participants scored between 11 and 19 points on this test ($M = 15.3$), placing them in the B1–B2 range, or intermediate level, on the Common European Framework scale.

Materials and Procedure

The primary task was a contextualized sentence production task in which participants read target sentences aloud. Their responses were recorded. We chose to rely on a more constrained task, rather than a more open-ended production task, because we wanted to ensure that all participants produced the target structure and made use of identical lexical items. In one half of the target sentences, the sentence-final prepositional phrase (PP) modified the direct object, as in (2b), and in the other half the sentence-final PP modified the verb, as in (3b).²

²The complete set of experimental stimuli is available at: <http://arts.ucalgary.ca/lrc/GermanTools/Supplementalmaterial.pdf>

- (2a) Der Geschäftsführer einer großen Firma hatte zwei Sekretärinnen: eine mit zwei Kindern, die sehr fleißig arbeitete und eine ohne Kinder, die jeden Tag um 16.00 Uhr nach Hause ging.

“The manager of a big company had two secretaries: one with two children, who worked very diligently and one without children who went home every day at 4pm.”

- (2b) *Der Geschäftsführer dankte der Sekretärin mit zwei Kindern.* (noun-attachment)

“The manager thanked the secretary with two children.”

- (3a) Der Geschäftsführer einer großen Firma hatte eine Sekretärin, die in den letzten Monaten viele Überstunden gearbeitet hat. Er wollte sich bei ihr bedanken.

“The manager of a big company had a secretary who worked a lot of overtime over the past several months. He wanted to thank her.”

- (3b) *Der Geschäftsführer dankte der Sekretärin mit einem Blumenstrauß.* (verb-attachment)

“The manager thanked the secretary with a bouquet of flowers.”

The target sentences contained a temporary syntactic ambiguity in that, until reading the final noun in the prepositional phrase, participants would not know whether the prepositional phrase modified the verb or the direct object. In this regard, the sentences in the present study differed from the PP-attachment sentences used in several previous production studies in that the structural ambiguity was only temporary, and was ultimately resolved via the semantic content of the prepositional phrase itself. This contrasts with globally ambiguous PP-attachment sentences, like those used by Snedeker and Trueswell (2003) or Lingel et al. (2006), in which the syntactic structure of the target sentence remained ambiguous because the prepositional phrase was equally plausible in both verb-attachment and noun-attachment conditions. The decision was made to rely on temporarily ambiguous sentences, rather than globally ambiguous sentences, due to the more constrained nature of the production task. That is, by including semantic information in the target sentence that could aid syntactic disambiguation, we hoped to guide participants in their interpretation and production of the target sentence.

Prior to seeing each target sentence, participants were presented with a short German situation, like (2a) or (3a). Participants read this situation on a computer screen and simultaneously listened to a recording of the situation read aloud by a native German speaker. These situations were designed to contextualize the target sentence and were intended to aid in the comprehension of the target sentences, as well as provide the participants with the background knowledge they needed to interpret each target utterance as either a noun-attachment or a verb-attachment sentence. For example, in (2) above, the situation introduces two different secretaries and the PP of the target sentence identifies which of the two secretaries the manager thanked. After reading and listening to the situation, participants clicked the mouse to see the target sentence, which they then read aloud.

There were a total of 14 target sentence-context pairs. Each item was manipulated similarly to examples (2) and (3) above. These target items were then distributed across two lists, so that each participant completed seven verb-attachment sentences and seven noun-attachment sentences, but no more than one version of each target item. This step was taken to reduce the possibility that participants would discover the primary experimental manipulation of attachment type as a result of seeing the same target item in both its verb- and noun-attachment conditions. These items were presented along with 34 filler items as an

additional means to disguise the primary experimental manipulation. Each participant also received one practice item prior to the actual experiment to familiarize herself or himself with the nature of the task.

Results

Data analysis

The participants' utterances were analyzed using Praat 5.1.21 (Boersma & Weenink, 2010), a program designed to perform phonetic analyses of speech. Based on previous studies looking at the production of PP-attachment sentences in both English and German (Kraljic & Brennan, 2005; Lingel et al., 2006; Snedeker & Trueswell, 2003; Snedeker & Yuan, 2008), we examined the following measures to gauge whether the participants used prosodic information to disambiguate the target sentences: duration of the verb (V) and the direct object (DO), the percentage and length of pauses between the verb and the direct object (V-DO) and between the direct object and the prepositional phrase (DO-PP), and the presence of a pitch accent (i.e., the most prominent accent in the phrase) on the preposition *mit* "with".³ Consistent with these previous studies, if the participants used prosodic information to convey the intended meaning of the target sentences, one would predict one or more of the following:

- Noun-attachment sentences: Longer durations on the verb and more frequent and longer pauses between the verb and direct object in noun-attachment sentences than verb-attachment sentences. Therefore, in the example sentence we would expect a break as indicated by the dash: *Der Geschäftsführer dankte / der Sekretärin mit zwei Kindern*. This break would indicate that the constituent *der Sekretärin mit zwei Kindern* "the secretary with two children" belongs together as a phrase.
- Verb-attachment sentences: Longer durations on the direct object and more and longer pauses between the direct object and the prepositional phrase, as well as a greater percentage of pitch accents on *mit* "with", in verb-attachment sentences than noun-attachment sentences. In the example sentence, we would expect a break as indicated by the dash below, and *mit* would be produced with greater emphasis: *Der Geschäftsführer dankte der Sekretärin / mit einem Blumenstrauß*. This break, along with the emphasis produced on *mit*, would indicate that the bouquet was used by the manager as a sign of thanks to his secretary.

Acoustic analyses

The duration of the verb and the direct object, the presence or absence of pauses, the duration of any pauses, and the presence or absence of a pitch accent were initially calculated separately for each sentence produced by each participant. The duration of the verb and direct object were marked by hand in the speech spectrogram by a trained phonetician and were checked for accuracy by a second coder. The waveform and the recording itself offered additional information about the onset and offset of the words in question. Following standard procedures in L1 and L2 production research, the values from these measures were then averaged across the seven verb-attachment and seven noun-attachment sentences for each participant, resulting in separate mean durational values and percentage of pauses and pitch accents for each attachment type for each participant. Finally, the resulting mean values and percentages from each participant were averaged to calculate

³Similar to Fernandez (2010), we included instances when participants did not pause at all between two constituents as 0 milliseconds (ms) when calculating the mean pause duration. Therefore, in essence, pause duration is another means to measure how often participants paused between two constituents, rather than a reflection of actual pause duration per se. Actual pause durations between the verb and the direct object ranged from 29 ms to 373 ms. Actual pause durations between the direct object and the prepositional phrase ranged from 130 ms to 626 ms.

the overall means presented in Table 1. Each of these measures was then analyzed using a paired *t*-test, to compare the means under the different circumstances, treating attachment type (noun-attachment vs. verb-attachment) as a within-participants variable.

Results of the *t*-tests revealed no significant difference between conditions in the duration of the verb or the direct object (verb: $t(11) = .53, p = .604$; direct object: $t(11) = .40, p = .700$). There was no significant difference between conditions in the percentage or duration of pauses between the verb and the direct object (pause percentage: $t(11) = .39, p = .706$; pause duration: $t(11) = .77, p = .455$). However, there was a significant difference in both the percentage of pauses and the length of pauses between the direct object and the prepositional phrase (pause percentage: $t(11) = 2.63, p = .023$; pause duration: $t(11) = 2.65, p = .023$). As seen in Table 1, participants were more likely to pause between the direct object and the prepositional phrase in verb-attachment sentences than noun-attachment sentences. There was also a significant difference in the percentage of pitch accents on *mit* "with" ($t(11) = 4.18, p = .002$). As seen in Table 1, participants were more likely to place an accent on *mit* in verb-attachment sentences than noun-attachment sentences.

Although all of the participants were recruited from upper-division undergraduate courses, L2 proficiency in such courses can vary widely, as demonstrated by participants' scores on the German proficiency test from the Goethe Institut (2004). To explore whether the overall results reported in Table 1 were driven by either the higher- or lower-scoring participants, correlational analyses were conducted comparing participants' raw score on the German proficiency test and the duration of pauses between the direct object and the prepositional phrase, the percentage of pauses between the direct object and the prepositional phrase, and the percentage of pitch accents on *mit*.⁴ These analyses revealed no significant correlation between proficiency scores and the extent to which participants made use of these three prosodic cues (all *ps* > .1). Further, a visual inspection of the data suggested that there were individual participants at both ends of the proficiency scale who were more likely, or less likely, to use each of these three prosodic cues to distinguish VP- from NP-attachment sentences. Naturally, these results must remain speculative in nature given the small number of participants. However, they suggest that all intermediate L2 learners can use prosodic cues to syntactic disambiguation, and the extent to which individual participants rely more (or less) on particular cues may vary independent of L2 proficiency.

These results suggest that the participants did not explicitly use prosodic information to disambiguate the noun-attachment sentences from the verb-attachment sentences between the verb and the direct object.⁵ However, later in the sentence the participants did appear to use two cues to distinguish verb-attachment sentences from noun-attachment sentences: pauses between the direct object and the prepositional phrase, and pitch accents on the preposition *mit* "with", in line with previous L1 research in German and English.⁶ Although the percentage of time such pauses and pitch accents occurred was not as high as reported in previous English and German L1 research (Lingel et al., 2006; Snedeker & Trueswell, 2003;

⁴The correlational analyses were conducted on the pause duration, pause percentage, and pitch accent results for VP-attachment and NP-attachment sentences separately, as well as on participants' difference score for these three prosodic cues, as calculated by subtracting participants' results on NP-attachment sentences from their results on VP-attachment sentences for each of these three measures. Correlational analyses were also conducted in the same manner to compare the length of time students had spent abroad (range: 0–6 months) and their performance on the sentence production task. These analyses were also inconclusive.

⁵While previous studies in English and German (e.g., Lingel et al., 2006; Snedeker & Trueswell, 2003; Snedeker & Yuan, 2008) have found evidence that native speakers of English and German use prosodic information to place some sort of boundary between the verb and the direct object in noun-attachment sentences, the strength of these effects (e.g., the mean length of the pause) is generally much weaker than the effects seen between the direct object and the prepositional phrase in verb-attachment sentences.

⁶One possible explanation for the lack of significant effects of duration could be the variety of verbs and nouns used in the experimental stimuli, especially considering that participants did not read the same set of target items in each condition. Further, the number of syllables in the nouns and verbs in the experimental stimuli was not identical across all items. The resulting variability could have negated any potential durational differences across conditions.

Snedeker & Yuan, 2008), it is important to remember three things. First, even in L1 prosody research, participants do not use pauses and pitch accents 100% of the time. For example, Snedeker and Trueswell (2003) reported that their native English speakers inserted pauses only 68% of the time between the direct object and the prepositional phrase on verb-attachment sentences. Secondly, the participants in the present study were intermediate-level L2 learners of German. Therefore, their performance would likely be more variable than that of participants in L1 research. Finally, unlike previous studies (e.g., Lingel et al., 2006; Snedeker & Trueswell, 2003), in which prosodic cues were potentially the only means to disambiguate the syntactic ambiguity built into the target sentences, in the current study the semantic content of the prepositional phrase clearly pointed to the intended structure and interpretation of the target sentences. In this regard, the inclusion of prosodic cues to syntactic disambiguation was optional, and yet the participants still used these cues to differentiate verb-attachment from noun-attachment sentences. It is important to keep in mind that part of our purpose was to determine whether participants would opt to use prosodic cues in producing the elicited sentences. As such, the present results suggest that even intermediate L2 learners can use prosodic cues to convey the intended meaning of temporarily ambiguous sentences during L2 production.

Discussion

The results of the present study indicate that intermediate L2 learners of German can use prosodic cues to convey the intended interpretation of a sentence during L2 speech production. To our knowledge this is the first study that has examined L2 speech production in this manner with intermediate L2 learners. These results complement recent studies investigating L2 listening comprehension (Dekydtspotter et al., 2008; Fultz, 2007), in which even L2 learners of French in their fourth semester of language study demonstrated sensitivity to mismatches between prosodic information and syntactic structure when listening to and interpreting syntactically ambiguous French sentences. These recent L2 listening studies, when viewed together with the present L2 production study, suggest that although L2 learners may not always use prosodic cues correctly (e.g., Gut, 2009; Ramirez Verdugo, 2002; Wennerstrom, 1994), there are situations in which even novice and intermediate L2 learners understand the relationship between prosody and meaning, and can exploit this relationship when interpreting or producing L2 utterances.

Both the present study and other recent L2 perceptual work point to interesting avenues for future research. First, one limitation of the present study is that there was no explicit test to measure whether participants understood the target sentences. Facilitating comprehension of the target sentences was one motivation for presenting participants with a situational context prior to each target sentence. However, without some independent measure of whether participants in fact comprehended the situational contexts and the target sentences, there is no way to confirm that this occurred. Future studies should include such a measure, to help determine whether participants who demonstrate better comprehension of target sentences use prosodic cues differently from those who have greater difficulty comprehending L2 sentences in the first place.

Second, in light of L1 research in both German and English showing that listeners use prosodic information to aid in the comprehension of syntactically ambiguous utterances (e.g., Kjelgaard & Speer, 1999; Kraljic & Brennan, 2005; Lingel et al., 2006; Snedeker & Yuan, 2008), one might also ask native speakers to rate the comprehensibility of temporarily or globally ambiguous utterances from L2 learners. Specifically, it would be useful to know just how important it would be for L2 learners to use prosodic cues to convey their intended meaning to native speakers, or, for that matter, to other L2 learners.

Finally, if the presence of specific prosodic cues is a factor in how L2 learners segment the speech stream during the earliest stages of L2 acquisition (see Carroll, 2006 for discussion of this possibility), such research has implications not only for L2 speech perception and production, but also for models of L2 acquisition more broadly. There is evidence to suggest that people impose a prosodic structure on sentences, even during silent reading (e.g., Bader, 1996; Dekydtspotter et al., 2008; Fodor, 2002). Thus, investigating the interaction between prosody and syntax among L2 learners, and whether L2 learners necessarily impose native-like prosodic structures on utterances would be relevant not just for L2 listening comprehension and L2 production, but also for L2 reading.

Pedagogical implications

The intermediate L2 learners of German in the present study made use of prosodic cues to meaning, even though few of them had received targeted pronunciation training in their German courses prior to the study. At the same time, they did not do so as consistently as has been reported in previous research with English and German native speakers. Given that the sentences used in the current study included semantic cues to meaning in the prepositional phrases, the variability in the L2 learners' production may have stemmed from the fact that prosody was not essential to disambiguate the meaning of the sentences. Alternatively, it is possible that the L2 learners in the present study were not explicitly aware of how prosodic information can facilitate the comprehension of syntactically ambiguous sentences in German. This raises the possibility that with more explicit pronunciation training, intermediate-level L2 learners of German could learn to use phrasing techniques in German more consistently to distinguish meaning not only in PP-attachment sentences, but also other types of syntactically ambiguous sentences.

What follows is a sample training module for German language instruction based on syntactically ambiguous sentences, similar to the PP-attachment sentences from the present study and previous L1 and L2 research investigating the relationship between prosody and syntactic disambiguation in comprehension and production. Unlike the sentences used in the present study, however, the sentences used in this module are globally ambiguous. That is, the sentences provided have two possible interpretations, and the use of prosodic cues is central to expressing meaning. The idea is that by training students with sentences in which prosodic phrasing is necessary for disambiguation on a variety of sentence types, L2 learners can learn the importance of prosodic phrasing more generally— a tool that could aid communication during L2 speech production, and perhaps even carry over to how L2 learners process input during L2 reading comprehension (Dekydtspotter et al., 2008; Fernandez, 2010). A complete set of instructions, as well as the relevant materials to implement such a training unit, are available online (<http://arts.ucalgary.ca/lrc/GermanTools/pronunciationtraining.htm>).

This training module focuses primarily on the important role of the pause as a cue to phrasing through a combination of listening and production tasks. The individual activities follow the steps set forth in Chun (2002, p. 202):

1. sensitization (listening exercises)
2. explanation
3. imitation (controlled speaking exercises)
4. practice activities (rehearsed speaking activities)
5. communicative activities (extemporaneous speaking activities)

The tasks outlined below also rely on visualization techniques that provide learners with graphic representations of native speaking models and, in later stages, can guide learners in

their own productions, as previous research has shown such types of computer-assisted language training can be helpful to students (e.g., Anderson-Hsieh, 1996; De Bot, 1983; Seferoğlu, 2005).

Exercises in this training unit begin by highlighting to students the possibility for multiple interpretations of syntactically ambiguous sentences, like (4) – (6) below.

- (4a) [*Der Polizist sieht*] [*den Mann mit dem Fernglas.*] (PP-attachment)
“The policeman sees the man with the binoculars.”
- (4b) [*Der Polizist sieht den Mann*] [*mit dem Fernglas.*]
“The policeman sees the man with the binoculars.”
- (5a) [*Sabine*] [*oder Markus und Stefan*] *werden zur Party kommen.* (coordination)
“Sabine or Markus and Stefan will come to the party.”
- (5b) [*Sabine oder Markus*] [*und Stefan*] *werden zur Party kommen.*
“Sabine or Markus and Stefan will come to the party.”
- (6a) [*Sandra heiratet*] [*Martin nicht.*] (ellipsis)
“Sandra marries, Martin does not.”
- (6b) [*Sandra heiratet Martin nicht.*]
“Sandra is not marrying Martin.”

In Step 1, the sensitization phase, students listen to example sentences, and do not see them in print. The goal of the first activity is to have them identify the prosodic cues that they hear, with special attention drawn to pauses. They then guess the intended meaning of these sentences. These exercises involve both normal speech and speech samples that have been filtered to remove the segmental components, such that students hear only the intonational contour. In Step 2, the explanation phase, students are given a brief explanation of each type of sentence, with special emphasis on the meaning being conveyed through the use of the pause. During this phase students are also asked to determine the meaning of the sentences they hear. During Step 3, the imitation phase, students are presented with speech tokens and shown speech spectrograms, on which pauses are clearly marked. The discussion that follows focuses specifically on the meaning differences and how they are achieved via prosodic cues, especially pauses. In Step 4, the practice phase, students produce both types of prosodic contours for a given set of sentences. After they have listened to each sentence, they are asked to record their own versions of each sentence, paying close attention to the location of pauses.⁷ Students then work with partners on a set of intelligibility activities, in which partners must identify the intended meaning of the utterances they have produced. In Step 5, the communicative phase, follow-up communicative activities require students to come up with situations on their own in which it is necessary to use prosodic cues to make their meanings clear.

Conclusion

As outlined our review of previous literature, there is evidence that prosody plays an important role in L1 speech comprehension and production. Some L2 researchers have shown that prosodic training can be effective in making L2 learners' speech more intelligible (Derwing, Munro, & Wiebe, 1998). The results of the present study suggest that

⁷The attention of more advanced students could be drawn to the intonation contour as well.

a link between prosodic training and intelligibility can be traced, at least in part, to a direct connection between prosody and meaning during language production and comprehension. Along similar lines, Derwing and Munro (2005) have pointed to the fact that some aspects of pronunciation are more essential to meaning than others, that teachers should focus primarily on those aspects of pronunciation that affect meaning, and that this should be done as a regular part of classroom activities. A focus on meaning-based pronunciation training of the sort we propose does not exclude explicit training on individual L2 speech sounds. However, by emphasizing that the goal of pronunciation training is to increase intelligibility and improve the effectiveness of communication, one opens the door to including training beyond word-level pronunciation, to include the prosodic level (see also Jenkins, 2004; Munro & Derwing, 2006). If the results of the present study are any indication, even intermediate L2 learners have the potential to make use of prosodic cues to meaning. As a result, we believe that training similar to that which we have outlined may prove helpful in enhancing the effectiveness of communication in interactions between L2 learners and other speakers.

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Table 1

Mean duration of constituents and pauses, mean percentage of pauses and pitch accents (standard deviations in parentheses)

	Verb duration (in ms)	V-DO pause duration (in ms)	V-DO pause %	DO duration (in ms)	DO-PP pause duration (in ms)	DO-PP pause %	Pitch accent %
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
noun- attachment	458 (72)	32 (31)	30.0 (16.4)	673 (126)	17 (44)	6.0 (14.2)	8.3 (11.3)
verb- attachment	465 (45)	46 (48)	32.5 (20.0)	654 (116)	71 (103)	21.6 (21.5)	31.0 (21.0)