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The Individual Effects of Suprasegmentals on Nonnative Speakers’ Comprehensibility

Deborah Smith Carlston and Mark W. Tanner

In an American grocery store, Juan, a forty-year-old native Spanish speaker, is looking for ice cream and milk. He approaches a clerk and asks: “Can you please help me find the ice cream and milk?” The clerk answers: “The ice is outside in the freezer, and the cream and milk are on aisle seven.” Juan, wanting only two items, does not understand why the clerk told him where three items were located. Nor does he understand why the clerk did not tell him where to find ice cream. He asks again: “I’m sorry, but I’m looking for ice cream and milk. I don’t want to know about ice or cream.” The clerk is very confused by this and thinks Juan is playing a joke on him. He says: “Why can’t you people learn to speak English?” and walks away.

The above situation, although fictitious, is nonetheless a representative illustration of a breakdown in communication due to a nonnative English speaker’s suprasegmental error and to a native speaker’s perception of this error. In Juan’s case, he used incorrect pitch patterns which caused the clerk to misunderstand him as well as to treat him quite rudely.

The impact suprasegmental errors have on comprehensibility, or understandability, has been studied in a variety of fields for several decades. As early as 1942, a study regarding the comprehensibility of deaf speech conducted by Hudgins and Numbers showed that 74% of the sentences they rated and judged as “intelligible” shared the common characteristic of good rhythmic, or stress and pitch, patterns. It is interesting to note that these sentences were characterized as intelligible despite articulatory errors (Cited in Gold, 1980, p. 405).

More recently, Le Dorze, Dionne, Ryalls, Julien, and Ouellet (1992) studied the effects that prosodic instruction had on the speech of a 74-year-old woman diagnosed with Parkinson’s disease. The results of their study were that, with appropriate instruction, the woman was indeed able to improve her manipulation of prosodic variables. Furthermore, she was perceived as more comprehensible after instruction than she had been before instruction.

Research in the area of suprasegmentals has further shown the impact that various prosodic elements have on comprehensibility (Maassen, 1986; Mehta and Cutler, 1988; Jović 1990; and Howell and Young, 1991). However, despite their proven impact on comprehensibility, none of these studies ever examined the comparative impact that individual prosodic elements have on comprehensibility.

In addition, the role suprasegmentals play in speech comprehension has also been researched in English as a Second Language (ESL) and language fields (Lanham, 1984; Van Els and De Bot, 1987; and Stevens, 1989). In Stevens’ study, he surveyed students of International Teaching Assistants (ITAs) and asked them what kinds of difficulties they encountered with understanding their ITAs. His research showed that most of the undergraduates involved in the study, when asked what problems they had in understanding their ITAs, generally did not “point to articulatory deficiencies.” Rather, they mentioned
suprasegmental factors (Stevens, 1989, p. 182).

On a similar plane, Anderson-Hsieh, Johnson, and Koehler (1992) analyzed the relationship between nonnative speakers’ SPEAK test scores of intelligibility and the speakers’ deviance in segmentals, prosody, and syllable structure. The highest correlation found in this study was between prosody and intelligibility. Thus, the “results indicate that the prosody appears to have a greater influence on the pronunciation rating than do either segmental or syllable structure error rates” (Anderson-Hsieh, Johnson, and Koehler, 1992, p. 545).

The importance suprasegmental factors have on pronunciation ratings and intelligibility was further confirmed in a 1995 study conducted by Munro. In this study, listeners were asked to identify foreign-accented speech for samples where segmental information had been significantly muffled using a low-pass filtering technique. The listeners did very well at identifying the samples, which led Munro to conjecture that speaking rates, intonation patterns, and timing had a more significant effect on the listeners’ judgments of accent than did segmental information. In the production of ESL materials, resources designed to teach pronunciation have recently included more instruction and tasks in the areas of stress, pausing, and intonation. While the manipulation of prosodic variables has shown to be influential on comprehensibility perception, very little empirical research has been conducted to determine which specific prosodic elements play the larger role in native English speakers’ perceptions of nonnative speakers’ comprehensibility. In fact, most of the research done to date regarding the influence various kinds of suprasegmentals have on comprehensibility has been conducted only in speech and hearing sciences, and this kind of research has not been extensive or recent. Consequently, the purpose of the present study is to identify which suprasegmental type (stress, pitch, or pausing) plays the larger role in influencing native English speakers’ perceptions of nonnative speakers’ comprehensibility.

**Literature Review**

One of the few studies available which compares the influence that separate elements of prosody have on comprehension was conducted approximately two decades ago by Parkhurst and Levitt (1978). In their study, 600 speech sample passages from 40 deaf children (each child reading 15 sentences) were acquired from previous research conducted by Smith (1972). Once the speech samples were obtained, they were analyzed by a trained speech pathologist who was provided with phonetic transcriptions of the passages. The pathologist analyzed the samples and rated them in four areas: adventitious sounds, excessive duration, pitch breaks, and pauses.

After the four areas were analyzed, the scores obtained in these areas were compared to intelligibility scores which were previously obtained from Smith’s (1972) study. Intelligibility scores were obtained by having a number of listeners (not given in the Parkhurst and Levitt study) who were unfamiliar with deaf speech listen to the speech samples and write down what they understood. The percentage of words correctly understood was used as the intelligibility measure.

Intelligibility scores and suprasegmental errors were analyzed using a multiple linear regression. Results indicate that prosodic errors definitely had an impact on intelligibility. More specifically, adventitious sounds, although not commonly
thought of in the ESL field as suprasegmentals, were seen as the most influential in affecting intelligibility scores. However, stress and pitch were also shown to be significant factors in determining intelligibility. Finally, pausing was also shown to be a factor, though its relation to intelligibility wasn’t as marked as that of pitch and stress.

Although the results of Parkhurst and Levitt’s research are useful, a few limitations exist that must be noted. The first limitation is that only one person rated the samples for prosodic errors. The second problem is that samples were given intelligibility ratings based on the percentage of words correctly transcribed from the speakers’ speech samples. The third, and perhaps more serious problem, deals with the lack of control the researchers had on the roles that segmentals and syllable structure played in raters’ intelligibility judgments. Since this study did not intend to compare segmentals to suprasegmentals, the influence segmentals and syllable structure had on comprehensibility ratings was ignored. Therefore, it is quite possible that some of the results of this study were distorted due to the varying levels of segmental and syllabic competence among the 40 deaf speakers.

Following Parkhurst and Levitt’s research, Metz, Samar, Schiavetti, and Sitler (1990) tried to compensate for segmentals’ influence on understandability in their research concerning the impact eight selected segmentals and six selected suprasegmentals had on intelligibility of hearing-impaired students. The types of suprasegmentals that were investigated were the following: pitch changes in both declarative and interrogative sentences; stress comparisons for the change of pitch in vowels, vowel length, and “vowel intensity between stressed and unstressed syllables in a contrastive stress paradigm” (Metz, Samar, Schiavetti, and Sitler, 1990, p. 33); and sentence length.

To test the impact these variables had on intelligibility, eight hearing-impaired students who had been classified as having varying levels of intelligibility were chosen to participate in the study. Various speech samples were collected from the participants in order to assess segmental and suprasegmental difficulties. Pitch changes in declarative and interrogative sentences were assessed by having participants read five pairs of sentences. Each pair consisted of one sentence which ended with a period and the identical sentence ending with a question mark. Vowel duration, vowel pitch changes, and vowel intensity differences in stressed and unstressed words were examined by having each participant read sentences which placed contrastive stress on monosyllabic words. “For example, in the sequence: ‘Was it a small bat? No, it was not a small bat. It was a big bat,’ the word big in the third sentence would receive more stress than it would in the sequence: ‘Was it a big ball? No, it was not a big ball. It was a big bat’” (Metz, Samar, Schiavetti, and Sitler, 1990, p. 478). Finally, sentence duration was studied by having participants read fifteen simple sentences (four to six words) three times. All suprasegmental and segmental aspects were examined acoustically, and intelligibility was measured by non-impaired hearing listeners who heard participants’ recordings of monosyllabic words. Scores were based on the percentage of words correctly identified. Once intelligibility scores were obtained, they were correlated to specific suprasegmental and segmental deviance, as acoustically analyzed. Results indicated that contrastive stress was the most influential (of the six suprasegmental types studied) in comprehensibility ratings.
Although Metz, Samar, Schiavetti, and Sitler’s (1990) study tried to focus on the meaning that suprasegmental manipulations carry, a few weaknesses are still present in their research. One of the main weaknesses deals with the fact that intelligibility ratings were obtained by listening to and transcribing isolated, rather than contextualized, words. In natural speech, true comprehensibility involves hearing contextualized speech and paying attention to the words being spoken as well as to the main message that is being delivered. Hence, comprehensibility should be assessed by listening to words within a larger context and reporting on what has been understood (main ideas and individual words included). Calculating understandability solely by using percentages of isolated words which have been correctly transcribed undoubtedly skews “true” comprehensibility ratings.

In addition, Metz, Samar, Schiavetti, and Sitler’s (1990) study does not account for the influence that participants’ individual segmental and syllabic structural proficiency may have had on intelligibility ratings. In other words, the segmental errors of this study were acoustically analyzed and correlated to intelligibility ratings, but segmental and suprasegmental errors were not compared. For instance, perhaps someone scored very low on segmental production but did extremely well on suprasegmental production. Because intelligibility ratings were obtained from listening solely to isolated words and not to connected, conversational speech, it is likely that this individual received a low intelligibility score. In other words, this individual’s suprasegmental proficiency will have only a small effect on his/her intelligibility score because suprasegmental effects on comprehension are more marked in clauses, sentences, and passages.

Furthermore, because this individual’s proficiency in suprasegmentals will only slightly affect his/her intelligibility score and his/her segmental proficiency will greatly influence the intelligibility score, one can be quite assured that this intelligibility score will be low. This low score, when correlated to suprasegmental production, would perhaps erroneously show that suprasegmentals were not very important for intelligibility, but that segmentals were extremely important.

A final limitation of previous research concerning which types of suprasegmentals most impact comprehensibility is that the limited amount of studies available do not look at the same variables. For example, Parkhurst and Levitt’s (1978) study includes adventitious sounds, duration, intensity, and pausing, while Metz, Samar, Schiavetti, and Sitler’s (1990) research includes sentence length and different kinds of pitch and stress.

Method
In order to determine which types of suprasegmental errors are most influential in native English speakers’ perceptions of nonnative English speakers’ comprehensibility, speech samples were obtained from a native female Spanish speaker and were manipulated to create passages which each employed pitch, stress, and pausing errors (see Appendices A, B, and C). These types of errors were chosen because it was believed they would be the easiest to manipulate and that they represented a good sampling of the existent types of suprasegmentals. In addition, a passage with no stress, pitch, or pausing errors was also obtained from the same speaker to serve as a baseline for analysis. These four passages were then systematically ordered using a Latin Square design and were then played to 148 native
English-speaking subjects who rated the individual passages for comprehensibility. Additionally, a demographic survey was created to obtain 1) general information about subjects, 2) second-language learning experience, 3) linguistic learning experience, and 4) frequency of contact with Spanish. A detailed description of participants, research apparatus, and procedures follows.

Participants/Raters. The participants in this study were 148 adult university students from eight fall semester 1998 English 115 classes offered at Brigham Young University (BYU) in Provo, Utah. For the semester in which this study was conducted, 1,927 students were currently enrolled in English 115 courses. All eight participant English classes were comprised of intact groups for which students registered independently before or shortly after the beginning of fall semester 1998.

Apparatus. In order to compare the comprehensibility effects of one type of suprasegmental to another type, a passage was created in which each separate variable (stress, pitch, and pausing) was manipulated. In addition, the researchers were concerned about creating passages that did not detract listeners to the point of their assigning comprehensibility ratings based on content or segmental errors rather than suprasegmental errors. To eliminate this concern, and to allow for suprasegmental manipulation, one passage of 155 words was created which would syntactically allow for the manipulation of all three prosodic elements being researched in this study.

In order to manipulate the passages, nonnative prosodic errors had to be determined. To accomplish this, three female native English speakers and three female nonnative intermediate Spanish speakers were recorded reading the passage. Spanish speakers were chosen because they are the largest nonnative-speaking minority population in the state of Utah. All recordings were done with the SoundEdit 16 Version 2 software package. Once the recordings were complete, all six recordings were analyzed by the researchers for pitch patterns, pause lengths, and multi-syllabic stressing instances, as follows:

Pitch patterns were quantified by listening to all speech passages and indicating numerically the degree of the rise and fall of pitch occurring before punctuation marks. The levels of pitch ranged from 1 (for a pitch pattern that had reached its lowest point) to 5 (for a pitch pattern that had reached its highest point); pause lengths were calculated (using the SoundEdit 16 Version 2 software package) by measuring the amount of space between offset of voicing at the end of a word to the onset of voicing for the next word; and multi-syllabic stressing instances were determined by listening to the speech samples and indicating where the primary stress on each multi-syllabic word fell.

Once the nonnative English and native English speech samples were analyzed, “natural” nonnative Spanish-speaker errors were identified for the three prosodic areas. In this study, any nonnative speaker deviation from the established mean of the native English speakers’ pronunciation was considered an “error.”

After these natural errors were identified, a highly proficient female native Spanish speaker was recorded reading the passage. Next, her reading passage was analyzed using the methods described previously. Once the proficient Spanish speaker’s passage had been analyzed and suprasegmental errors were quantified, four pitch changes were made to ensure that the pitch patterns in the Spanish speaker’s passage were the same as those in the native
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English speakers' samples. In addition, the mean pause lengths after select words and all punctuation marks for the three native English speakers were inserted into the Spanish speaker's passage.

Finally, three changes in the Spanish speaker's stress patterns were also employed. All changes in pitch, pausing, and stress were made in order to produce a nonnative English speech passage which mirrored the native speaker passages and was void of suprasegmental errors (at least in the prosodic areas being studied). Once the passage without stress, pausing, or pitch errors was created, it was further manipulated in three main ways: 1) Pitch patterns were changed, 2) Stress patterns were altered, and 3) Pause lengths were elongated. Manipulation of the first passage involved inserting 15 pitch errors. These pitch errors were accomplished by having the advanced Spanish speaker record select sentences of the passage while using incorrect pitch patterns. The words in which these erroneous pitch patterns were applied were then pasted over words in the speech-passage version with no suprasegmental errors, thus creating a speech passage which had pitch errors but lacked pausing and stress errors. All pitch alterations were made in accordance with the pitch errors that had been previously identified in the three nonnative intermediate Spanish speakers' speech samples.

The technique used to create the second and third main manipulations of the text was exactly the same as was used in the pitch-manipulated version. The only difference was that 15 stress errors were inserted in the second version while all other prosodic elements were held constant, and 15 pausing errors were inserted in the third version while all other prosodic elements were held constant.

It is important to note that the advanced Spanish speaker was not asked to record a version of the passage where she employed erroneous pausing patterns. Rather, "incorrect" pause lengths were simply inserted by using the SoundEdit 16 Version 2 software package. These "incorrect" pause lengths were determined by comparing the mean length of the native speakers' pauses to deviations in nonnative speakers' pauses. After this analysis, 15 of the 17 highest incidences of nonnative-speaker pause-length deviations (mean length = .351 seconds, s.d. .195 seconds) were then pasted into the speech sample. Pausing errors at syntactical boundaries, although measured, were not used in this study because it was believed they would increase, rather than decrease, comprehension (see Blau, 1990).

Finally, segmental errors, although existent, were held constant across all four versions of the speech passage. This was easily accomplished since the only parts of the speech passage that were manipulated were the prosodic elements being studied. In addition, suprasegmental errors not being investigated in the present study (i.e., rhythm, syllable duration, etc.), were also held constant in the same way as were segmentals across all four versions of the speech passage.

All speech-passage manipulations carried out in this study were done so with the intent of creating speech samples which elicited comprehensibility ratings based solely on the suprasegmental variables being studied. In other words, great care was taken to ensure that all manipulations helped to better 1) separate out (as much as possible) or eliminate the effects that one type of suprasegmental has on the production of another and 2) to account for or eliminate the influence that segmentals have on
comprehensibility perceptions across all four speech passages.

Once the four versions of the speech passage were properly manipulated, they were each assigned a number: the passage without any of the suprasegmental errors being studied was assigned #1; the passage with stress errors was #2; the passage with pauses errors was given the #3; and the passage with pitch errors was #4. After numbers had been assigned to the passages, they were systematically randomized, using a Latin Square design, over four tapes. Tape 1 was ordered #1, #3, #4, #2; Tape 2 was ordered #4, #1, #2, #3; Tape 3 was ordered #3, #2, #1, #4; and Tape 4 was ordered #2, #4, #3, #1. This randomization was necessary in order to help diminish any potential bias of comprehensibility ratings due to passage order.

Procedure. All 148 raters completed a demographic survey which asked them to indicate their gender, age, language-learning background, and amount of exposure to Spanish speakers of English. Raters then heard each of the four passages and completed a rating sheet for each one in succession. Raters were instructed to rate each passage on a 100-point scale for level of comprehensibility and to not change any previous ratings once they heard other passages.

Results
A repeated-measures analysis of variance (ANOVA) showed a significant difference between the comprehensibility ratings for the four passages \( F = 5.91, p < .0006 \). Furthermore, the ANOVA revealed significant differences between the passage with no errors and the passage with stress errors \( (F = 15.72, p < .0001) \) and between the passage with no errors and the passage with pauses errors \( (F = 8.83, p < .0031) \). This analysis showed no significant differences between the passage with no errors and the passage with pitch errors \( (F = 2.62, p < .1061) \).

The independent variables in the study were the type of errors manipulated in the four passages: no prosodic errors, pitch errors, stress errors, and pauses errors. The dependent variables in the study were the comprehensibility scores. All comprehensibility scores were based on a 100-point Likert scale with 1 being "completely incomprehensible" and 100 being "completely comprehensible." An analysis of variance using the SAS statistical program was run to determine the differences between the comprehensibility scores for the passage with no errors and the passages with stress, pitch, and pauses errors. This analysis of variance was run on a mixed model with random effects which accounted for the repeated-measures nature of the data.

The mean values and standard deviations for all the prosodic variables investigated in this study are illustrated in Table 1, and results of the analysis of variance are presented in Table 2. For the passage with no errors, a mean comprehensibility score of 91.78 (out of 100) was obtained, showing that in general, most subjects perceived the speaker as quite comprehensible. Mean comprehensibility scores for the passages with stress errors, pauses errors, and pitch errors were also quite high (86.89, 87.87, and 89.83, respectively).
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Table 1
Mean Scores and Standard Deviations for the Passages with No errors, Stress Errors, Pausing Errors, and Pitch Errors

<table>
<thead>
<tr>
<th>Passage</th>
<th>Mean Comprehensibility Score¹</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>No errors</td>
<td>91.78</td>
<td>10.54</td>
</tr>
<tr>
<td>Stress errors</td>
<td>86.89</td>
<td>14.03</td>
</tr>
<tr>
<td>Pausing errors</td>
<td>87.87</td>
<td>13.69</td>
</tr>
<tr>
<td>Pitch errors</td>
<td>89.83</td>
<td>12.87</td>
</tr>
</tbody>
</table>

¹ Total Possible = 100

Although the mean comprehensibility scores for the five passage types were quite high and clustered within a five-point range, an analysis of variance indicated a significant difference between the comprehensibility ratings for the four passages ($F = 5.91$, $p < .0006$). Consequently, the data show that a definite difference existed in the native speakers’ perceptions of the nonnative speech samples used in this data. More specifically, the greatest significant difference in subjects’ assignment of comprehensibility ratings was found to be between the passage with no errors and the passage with stress errors ($F = 15.72$, $p < .0001$).

In addition to this finding, the current study also reveals that pausing plays a significant role in the influence of native-English-speakers’ perceptions of nonnative-English-speakers’ comprehensibility. In fact, strong significant differences were also found between the passage with no errors and the passage with pausing errors ($F = 8.83$, $p < .0031$). Differences between the passage with no errors and the passage with pitch errors were not found to be significant ($F = 2.62$, $p < .1061$).

Table 2
Comprehensibility Differences Between Passage with No errors and Passages with Stress, Pitch, and Pausing Errors

<table>
<thead>
<tr>
<th>Passage</th>
<th>$F$ Value</th>
<th>$&lt; p$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress errors</td>
<td>15.72</td>
<td>.0001</td>
</tr>
<tr>
<td>Pausing errors</td>
<td>8.83</td>
<td>.0031</td>
</tr>
<tr>
<td>Pitch errors</td>
<td>2.62</td>
<td>.1061</td>
</tr>
</tbody>
</table>

Discussion
These data seem to partially support the results from both Parkhurst and Levitt’s (1978) and Metz, Samar, Schiavetti, and Sitler’s (1990) studies indicating that out of the variables investigated in this research...
stress, pitch, and pausing) and under the most stringent levels of significance, stress appears to exert the strongest influence on native English speakers’ perceptions of nonnative-English-speakers’ comprehensibility. However, under regular levels of significance ($p < .05$), the data from this study implicate that pausing and stress both play equally significant roles in native English speakers’ perceptions of nonnative speakers’ comprehensibility. Because the results obtained in this study show that suprasegmental errors make a difference in native English speakers’ perceptions of nonnative comprehensibility, they help to strengthen the argument for suprasegmental instruction—especially for more proficient speakers (Gilbert, 1984; Wong, 1987b; Stevens, 1989; Morley, 1991; and Anderson-Hsieh, Johnson, & Koehler, 1992). On a similar plane, the results also seem to indicate that in pronunciation teaching, an added emphasis on learning to use correct stress patterns could be beneficial in raising native English speakers’ perceptions of nonnative comprehensibility levels. Likewise, the data also show that frequent pausing decreases comprehensibility. Hence, an added emphasis on learning to reduce the number of pauses in an utterance could also prove to be a beneficial undertaking in the pronunciation classroom.

In contrast, the results obtained in this study suggest that erroneous pitch patterns within an utterance or at the end of an utterance appear to have little influence on native English speakers’ perceptions of nonnative English speakers’ comprehensibility. Consequently, the data appear to indicate that pronunciation instruction involving pitch manipulation would not be as beneficial in elevating perceptions of nonnative comprehensibility as would other areas of suprasegmental instruction.

The researchers were a bit surprised that the data did not identify the passage with pitch errors as being significantly different from the passage with no errors. In reviewing the data, there are a few factors that could have influenced native speakers’ perception of pitch and its influence on perceived comprehensibility. First, when the researchers were analyzing native English speakers’ speech samples in order to determine appropriate pitch, stress, and pausing patterns, they noticed that each of the three native English speakers differed slightly in the types of pitch (either rising or falling) that they employed in certain instances. More specifically, not all the native speakers used rising-falling pitch for all statements or wh-questions. This was a problem for the current research because the three speech samples from the native speakers were to serve as a grounding for the pitch patterns that native English speakers regularly use. Consequently, because of the lack of agreement of pitch usage among the native speakers, the researchers had a difficult time creating the manipulated passage which employed 15 “naturalistic” pausing errors. More specifically, they were unsure as to where and what types of pitch errors should be inserted into the passage. As a result of this difficulty, the researchers inserted pitch errors into the passage which deviated from at least two of the native speakers’ speech samples but may have been in harmony with a third native speaker’s pitch patterns. Consequently, the resultant passage may have been comprised of pitch “errors” with which participants in the study may have been quite familiar, thus causing raters to not be adversely affected by hearing these errors in a nonnative speech sample. In addition, it could be possible that the
particular pitch "errors" that were inserted into the passage had little effect on comprehensibility perceptions; a second explanation as to why the passage with pitch errors was not significantly different than the passage with no errors could be due to the fact that all people have differing pitch levels in their speech. As a result, it might have been necessary for pitch changes/errors in the manipulated passage to be more dramatic so that the pitch changes would have been noticed as being erroneous rather than merely conforming to someone's individual pitch pattern; a third explanation could be that the number of pitch errors in the passage were not sufficient for native speakers to distinguish the passage as less comprehensible; fourth, it is possible that different types of pitch errors are more disruptive than the ones used in this study. If so, these are the types of errors that should have been imported into the pitch-errors passage so that a stronger influence on native English speakers' perceptions of nonnative English speakers' incomprehensibility could have been exerted; and/or a fifth explanation as to why the passage with pitch errors was not significantly different than the passage with no errors could plainly be that pitch errors are not big deterrents in native English speakers' perceptions of nonnative speech.

**Conclusion**
The goal of this study was to determine which suprasegmental errors (of stress, pitch, or pausing) had the greatest impact on native English speakers' perceptions of nonnative speakers' comprehensibility. Overall, it was found that word-stress errors and excessive pausing errors had the greatest impact on perceptions of comprehensibility. In addition, that data from this study also indicate that the pitch errors investigated in this research were shown to have no significant impact on native English speakers perceptions of nonnative English speakers' level of comprehensibility. In light of this information, implications for pedagogy and instruction, limitations of the current research, and directions for future research are discussed below.

**Limitations.** One important limitation of the research design used in this study was the repeated listening of a passage with the same content. During the administration of the instrument, a very small number of subjects indicated that once they had heard the text two to three times, they felt the text was comprehensible despite the fact that each passage had specific prosodic elements that had been varied. Hence, although a Latin Square design was used to help eliminate passage-familiarity bias, the researcher still feels this limitation is one that would need to be addressed in future research.

Another limitation of the study deals with the generalizability of the findings. This limitation exists on two levels. On the first level, the results cannot be generalized to all nonnative speakers because the nonnative speaker used to create the instrument was a highly proficient, female, native Spanish speaker. In other words, it cannot be claimed that stress and pausing errors are significant factors in determining native English speakers' perceptions of comprehensibility for all nonnative speakers. Similarly, one cannot assert that pitch errors are not significant deterrents to comprehensibility for all language groups. Rather, such claims can only strictly be applied to highly proficient, female Spanish speakers. On the second level, the native-speaking subjects used in the current study were not characteristic of the general population in that 95.9% of them had second-language learning experience and
69.5% had Spanish or Portuguese language learning experience. Hence, the results obtained in this study cannot necessarily be generalized to a more linguistically naive population.

A third limitation of the research was that in creating the passage sample which employed 15 pausing errors, the researcher encountered some difficulty in inserting pauses where the highly proficient Spanish speaker used to make the recording did not originally place them. Pauses were therefore inserted electronically. With these pausing insertions, the resulting passage included a few examples where the voicing was not continuous, thus creating speech which had a slight mechanical sound.

A fourth limitation to this study involved asking native-speaking subjects to make comprehensibility judgments regarding a piece of text read by a nonnative English speaker. Because the text was read rather than being spontaneous speech, the speech was more carefully articulated, and the researchers believe that fewer overall errors were made than if the speaker had produced a piece of spontaneous speech.

**Directions for Future Research.** The influence of suprasegmentals on native speakers’ perceptions of comprehensibility needs further research. Following are a few ideas for future research concerning native English speakers’ perceptions of nonnative English speakers’ comprehensibility.

One possibility for future research involves creating four passages with different content but with similar phonological and syntactical characteristics. These passages would then have different types of suprasegmental errors inserted into each of them, after which the passages would then again be ordered using a Latin Square design. By so doing, passage familiarity should not interfere with the data collection. Furthermore, to help eliminate the “mechanical” sound of the speech sample with pausing errors, future research must have the speaker whom they are recording pause at locations where pausing insertions are desired and then electronically adjust the pause length. This should eliminate any of the unnatural voicing breaks which occurred in the original study.

A second recommendation for future research would be to use different language and proficiency groups to read the speech samples and then have more naive audiences listen to the samples and assign comprehensibility ratings. By using differing language and proficiency groups, it would be possible to strengthen the claims made in this study and/or to see if perceptions of comprehensibility are influenced differently as a result of suprasegmental errors according to language and proficiency groups.

A third idea would be to manipulate spontaneous nonnative speech rather than read speech. This type of research obviously presents more of a challenge in that passage control, constitution, and manipulation would be more difficult; however, since spontaneous speech is generally used in most communications, using spontaneous speech versus read speech would provide an even more accurate view of how suprasegmental errors influence native English speakers’ perceptions of nonnative English speakers in everyday encounters.

A final idea for future research would be to investigate exactly how many and what types of stress and pausing errors are needed in a passage for the speaker of the passage to be perceived as less comprehensible. By establishing what types of errors and how many errors cause a disruption in perceptions, ESL pronunciation teachers would be able to teach those items which most strongly affect
perceptions, thus helping more nonnative speakers of English, such as Juan, to be better understood by the people in their surrounding communities.

- NS Pitch Patterns
* NNS Pitch Manipulations

Appendix A
Reading Passage - Pitch Manipulations

There are several necessary steps one should not overlook when searching

\[
\begin{align*}
&\text{\*2 3 3 4\text{\footnotesize$\backslash$}3} & &\text{\*3 3 4\text{\footnotesize$\backslash$}3} \\
&\text{\text{-3 3 4 5\text{\footnotesize$\backslash$}2}} & &\text{\text{-3 3 4 5\text{\footnotesize$\backslash$}2}}
\end{align*}
\]

for a suitable apartment in which to live. A systematic process is usually best.

\[
\begin{align*}
&\text{\*3 3 4\text{\footnotesize$\backslash$}3} & &\text{\*3 4\text{\footnotesize$\backslash$}3} \\
&\text{\text{-4\text{\footnotesize$\backslash$}3}} & &\text{\text{\text{-4 5\text{\footnotesize$\backslash$}2}}}
\end{align*}
\]

First, start by answering a few questions. In what style or type of neighborhood

\[
\begin{align*}
&\text{\*3 4 5\text{\footnotesize$\backslash$}1} & &\text{\*4\text{\footnotesize$\backslash$}3 4\text{\footnotesize$\backslash$}3} \\
&\text{\text{-3 4 5\text{\footnotesize$\backslash$}2}} & &\text{\text{-4\text{\footnotesize$\backslash$}4 3\text{\footnotesize$\backslash$}4}}
\end{align*}
\]

would you like to live? Would it generally be better to be close to work or school or to be close to family? Do the owners allow pets? How much money can you afford to spend on rent, utilities, transportation, and furnishings? Use good judgment, your rent should not be more than forty percent of your total income.

Next, review classified ads in the newspaper for the areas you’ve checked.

\[
\begin{align*}
&\text{\*4 3 2\text{\footnotesize$\backslash$}1} & &\text{\*4 4 4\text{\footnotesize$\backslash$}3} \\
&\text{\text{-3 3 3}} & &\text{\text{-3 4 5\text{\footnotesize$\backslash$}3}}
\end{align*}
\]

Examine the ads regularly, since new listings usually appear on different days.

\[
\begin{align*}
&\text{\*3 3 3 3\text{\footnotesize$\backslash$}4} & &\text{\*2 1\text{\footnotesize$\backslash$}2} \\
&\text{\text{-3 4\text{\footnotesize$\backslash$}3 2 2}} & &\text{\text{-4 4\text{\footnotesize$\backslash$}2}}
\end{align*}
\]

After you have clearly identified several potential choices, schedule appointments with the landlords and inspect each one of the units. Finally, determine for yourself which apartment best meets all the criteria you have established.
There are several necessary steps one should not overlook when searching for a suitable apartment in which to live. A systematic process is usually best.

First, start by answering a few questions. In what style or type of neighborhood would you like to live? Would it generally be better to be close to work or school or to be close to family? Do the owners allow pets? How much money can you afford to spend on rent, utilities, transportation, and furnishings? Use good judgment, your rent should not be more than forty percent of your total income.

Next, review classified ads in the newspaper for the areas you've checked. Examine the ads regularly, since new listings usually appear on different days. After you have clearly identified several potential choices, schedule appointments with the landlords and inspect each one of the units. Finally, determine for yourself which apartment best meets all the criteria you have established.
Appendix C
Reading Passage - Pausing Manipulations

There are several necessary steps one should not overlook when searching for a suitable apartment in which to live. A systematic process is usually best. First, start by answering a few questions. In what style or type of neighborhood would you like to live? Would it generally be better to be close to work or school or to be close to family? Do the owners allow pets? How much money can you afford to spend on rent, utilities, transportation, and furnishings? Use good judgment, your rent should not be more than forty percent of your total income. Next, review classified ads in the newspaper for the areas you’ve checked. Examine the ads regularly, since new listings usually appear on different days. After you have clearly identified several potential choices, schedule appointments with the landlords and inspect each one of the units. Finally, determine for yourself which apartment best meets all the criteria you have established.

Works Cited


