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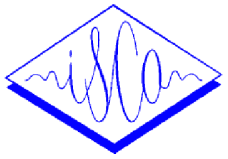

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Salient Prosodic Features on Judgments of Second Language Accent

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Abstract

The study specified relative weights of individual prosodic features for listeners' judgments on second language (L2) accent. It reported partial findings of Kang's (in press) research. Using the PRAAT computer program, 5 minutes of continuous in-class lectures from 8 international teaching assistants (ITAs) were acoustically analyzed for measures of speech rate, pauses, stress, and pitch range. ITAs' first languages included Chinese, Arabic, Japanese, and Korean. Fifty eight US undergraduate students evaluated the ITAs' accented speech. The results revealed that accent ratings were best predicted by pitch range and word stress measures.

1. Introduction

A common claim of L2 pronunciation researchers is that giving priority to the prosodic aspects of English not only improves learners' comprehensibility but is also less frustrating for students because greater change can be effected (Celce-Murcia, Brinton, & Goodwin, 1996). More recently, an increasing number of studies have addressed the importance of non-native speakers' (NNSs) prosody in instructional speech (Hahn, 2004) and in listeners' judgments (Isaacs, 2008; Kang, Rubin, & Pickering, in press). In addition, research has attempted to identify the prosodic factors that contribute to listeners' perceptions (Munro & Derwing, 2001; Trofimovich & Baker, 2006).

Knowing the degree to which the various prosodic features actually affect listeners' ratings of L2 speech would substantially strengthen the foundation for current pronunciation pedagogy. However, the conjoint impact of a wide array of prosodic features on listeners' judgments has not been widely investigated. Moreover, prior studies offer little empirical evidence to ascertain how prosody affects the judgments of non-native speaker (NNS) speech. Consequently, the current study sought to specify the relative weights of individual prosodic factors to listeners' accent judgments on NNS speech (particularly that of ITAs). Accentedness in this study refers to as the extent to which an L2 learner's speech is perceived to differ from native speaker norms (Munro & Derwing, 1995). Prosody closely examined here included fluency-based characteristics such as speaking rates and pausing, as well as stress and pitch. The study was guided by the following research question: What is the relative salience of acoustically measured prosodic features on accentedness judgments of NNS speech?

2. Method

2.1 Acoustic Analysis

All measures were assessed using a combination of auditory and instrumental analysis. Acoustic keys were measured through spectrograms, pitch contours, and intensity degree shown in the PRAAT (Boersma & Weenink, 2007) window (see Figure 1). Measurements were taken of the range of baseline native speaker realizations of the significant features. Selected quantifiable acoustic measures were speaking rate, pausing, prominent stress, and pitch range. Speaking rate measures included syllable per second, articulation rate, mean length of run, and phonation time ratio. Pause measures included number of silent pauses, mean length of silent pauses, number of filled pauses, and mean length of filled pauses. Stress measures included number of stressed words per minute and proportion of prominent words. Pitch range was set from 75 Hz to 300 Hz in PRAAT for the optimized intonation of male speakers. Overall pitch range was calculated from points of F_0 maximum and minimum in the 5-minute utterances. Approximately 10 per cent of the speech samples were analyzed twice by the second analyst to establish the reliability of acoustic analyses.

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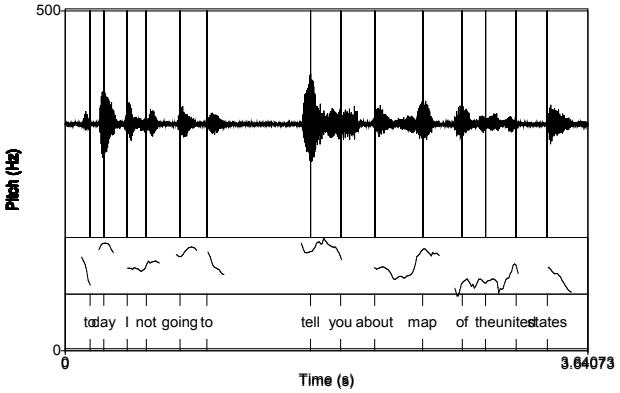


Figure 1. An example of the transcription shown for pitch ranges in PRAAT

2.2 Speech Performance Samples

The speech analysis utilized 8 ITAs' instructional presentations which described a concept from each presenter's major course of study (about 5 minute segments selected). All speech samples were male speakers to avoid confounding acoustic patterns caused by speaker gender. Three speakers spoke Mandarin as a first language (L1), 1 spoke Korean, 2 Japanese, 2 Arabic. Three recorded lectures of male TAs who were native speakers (NS) of North American English provided a baseline of standard NS performances for acoustic analysis.

2.3 Rater Participants

Listener participants were 58 undergraduate students from a large public university in the Southeastern U.S. They were native speakers of English, 14 male and 44 female aged from 19 to 23. Their weekly contact with NNSs were 6.04 hours on average (SD=11.21). The average number of linguistic classes taken in the past was 1.15 (SD=2.63). Participants varied in terms of their experience in foreign language studies from 0 to 15 years with the mean of 4.49 years (SD=2.42). All participants were remunerated for their time.

2.4 Rating Instruments

Accentedness rating scales. The accent standardness rating scale (e.g., speak with American accent: : : : : : : : speak with foreign accent) was composed of five 7 point-bipolar items. It was an extended version of Munro and Derwing (1995)'s single item scale. Its internal consistency was marginally acceptable: .78. The sum of these five items was utilized as a composite measure for subsequent analysis.

2.5 Procedures

At a face-to-face meeting, undergraduate rater particpants completed a brief rater background questionnaire (e.g., age, gender, etc.) and a consent form. After that, they were contacted by email with an online link to rate the eight-ITA speech samples. Speech samples were randomly presented for each participant as streaming audio files. Raters were asked to wear a headset in a quiet place while rating, even though the rating environment was not experimentally controlled.

2.6 Data Analysis

A stepwise multiple regression using SPSS (15.0) was performed to assess which prosodic variables predicted the most variance in the accent ratings of ITAs' oral performances. The dependent variable was accent rating outcomes and the predictors were the 11 prosodic variables.

3. Results

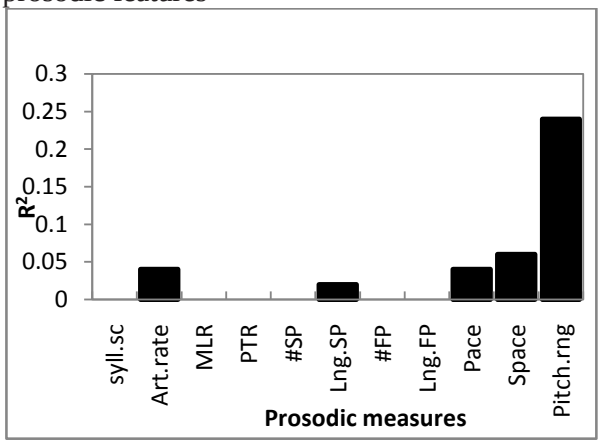
The study began to specify the relative weights of individual prosodic features to listeners' judgments of NNS speech on accentedness ratings. An initial analysis of zero-order correlations among 11prosodic variables revealed that articulation rate, phonation-time ratio, mean length of pauses, space, pace, and pitch range were highly correlated (r = .70 and above). Table 1 reveals the final model summary of stepwise multiple regression of prosodic variables on accentedness ratings. $p < .05$ was used as the criterion for significance for all tests. Five regression models generated in this analysis were statistically signficant (e.g., the final model, F (5, 488) = 33.21, p <.001).

Table 1.Final Model Summary of Stepwise Multiple Regression of Prosodic Variables on Accentedness Ratings

Prosodic variables	Beta (β)	*t*-value	Sig. *p*	Step	R^2 change
pitch range	-.47	-6.50	.00	1	.24
Space	.36	4.96	.00	2	.06
Pace	.28	4.59	.00	4	.05
Mean length silent pause	.11	2.44	.02	3	.04
Articulation rate	-.12	-2.31	.02	5	.03

Final model $\boldsymbol{R^2 = .42}$, F (5,488) = 33.21, p <.001, Adjusted R^2 =.38

Figure 2. Proportion of variance in accentedness ratings explained (R^2) by prosodic features



(syll.sc=syllable per second, art.rate=articulation rate, MLR=mean length of run, PTR=phonation time ratio, #SP=number of silent pauses, Lng.SP=length of silent pauses, #FP=number of filled pauses, Lng.FP=length of filled pauses, and pitch.rng=overall pitch range)

Overall pitch range showed a strong and negative effect on listeners' judgment of NNSs' accent (β= -.47). The wider the pitch range, the less accented the NSs perceive the speaker to be. Word stress measures (space and pace) were significantly associated with accentedness ratings and showed a positive relationship (β= .36, β= .28). It means that the more stressed words ITAs produced, the more accented their speech sounded to undergraduate students. Mean length of silent pauses also showed a positive association with accentedness judgments (β= .11). In other words, when listeners heard long pauses from ITAs' speech, they found it more accented. Finally, articulation rate showed a moderate and negative impact on judgments of ITAs' accent (β= -.12), which means that listeners evaluated ITAs' speech spoken more slowly as more accented. The remaining six predictor variables exerted no significant effects on this rating outcome.

Figure 2 illustrates distribution in proportion of variance explained by prosodic feature in accentedness ratings. Most of the variance in accent ratings is explained by pitch range and stress measures. Features of speaking rates and pauses marginally contribute to the prediction of accent ratings.

4. Discussion

The results revealed that approximately 42 % of the variance (R^2) in ITAs' accentedness ratings was attributable to selected prosodic features (e.g., overall pitch range, stress measures, and mean length of pauses). These results comport with Kang's (under review) study which included ITAs of different L1 backgrounds (e.g., Hindi). The pitch range variable alone explained 24% of variance in the rating outcome. US undergraduate students evaluated ITAs' English as more accented, when they listened to more compressed ITA speech with no pitch variation. A number of research findings support the claim that NNSs have a restricted pitch range (e.g., Binghadeer, 2008, for speakers of Arabic; Taniguchi, 2001, for speakers of Japanese; Wennerstrom, 1998 for speakers of Mandarin). Therefore, ITA participants in this study were expected to have such narrow pitch ranges.

Stress-related variables positively and significantly predicted listeners' accent judgments of ITA speech. In other words, the more stressed syllables in words ITAs produced, the more accented listeners found

the ITAs' lectures. Low-fluency speakers are inclined to give relatively equal pitch to each `word regardless of its role in the discourse structure (Hanh, 2004, for speakers of Korean, Wennerstrom, 1998), which leads to many sequential high-pitch words (i.e., stressed words in this study). One of the distinctive characteristics in ITAs speech analysis was that low proficiency ITAs placed stress on many functional words or articles such as 'be', 'the', 'that', and 'this is'.

Pausing was another feature that affected listener judgments of ITA accented speech. The mean length of silent pauses showed a positive association with ratings of accentedness. That is, ITAs who raters considered had a native-like accent tended to produce shorter pauses. Speech rate measures were not strongly associated with accent judgments except for articulation rate which was only moderately significant with $p = .02$. Listeners evaluated ITAs' speech more accented when articulation rate decreased.

5. Conclusions

The findings of the study provide additional evidence to support the importance of prosodic features on listeners' accent judgments. They also lead to important pedagogical implications for ITA trainers, program designers, and developers, suggesting that ITA programs should include instruction of prosody such as making distinctions between stressed and unstressed words, and varying intonation of their speech. On the other hand, the study can be further improved by analyzing other speech performance samples: (1) different levels of language proficiency, (2) experimentally controlled speech stimuli, (3) female speakers' performances; and (4) different L1 backgrounds. Moreover, prosodic analyses can be extended by including other variables such as tone choice or paratone.

Acknowledgments

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