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The Role of Nuclear Stress in Intelligibility: The Case of Cantonese Speakers of English

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Abstract

The current study investigates the effects of nuclear stress on intelligibility for listeners who are Cantonese speakers of English. Three groups of participants listened to different versions of the same speech: group A listened to the lecture with accentuation on new information; group B listened to the lecture with accentuation on given information; group C listened to the lecture with no accentuation. Results found that group A recognized and identified significantly more new information than group B and group C, suggesting the importance of nuclear stress production and placement to the communication between Cantonese speakers of English.
Index Terms: nuclear stress, intelligibility, Cantonese speakers of English

1. Introduction

English is now a language for communication both among speakers from various countries and between speakers in one country; this spread in the use of English has resulted in English as an International Language (EIL) [1]. Yet, there exists language variation among speakers owing to various reasons; when the variety is restricted to pronunciation, it is known as accent, which can be a part of their identities. To strike a balance between being intelligible and allowing them to convey their identities, Jenkins [2] proposed the Lingua Franca Core (LFC), which promotes both intelligibility and regional appropriateness among EIL interlocutors. The only suprasegmental item of the main core features in LFC is the production and placement of nuclear stress, which refers to the greatest prominence on a word or syllable in a clause or utterance [3]. Nevertheless, little research has empirically examined the extent to which nuclear stress patterns affect intelligibility.

The present study aims to investigate to what extent different nuclear stress patterns affects intelligibility of interlocutors who are Cantonese speakers of English. The three nuclear stress patterns under investigation were accentuation on new rather than given information, accentuation on given rather than new information, and absence of accentuation, which are the main nuclear stress patterns of varieties of English found in World Englishes research [4, 5]. Studies on 'intelligibility' [6] commonly define it as the listener's ability to recognize words or utterances, and assess it by having the participants transcribe the actual words or utterances in standard orthography while listening to the excerpt. However, since it is practically unrealistic for the listeners to transcribe all words in a discourse played at natural speed, added to the fact that listeners tend to pay most of their attention on new information in comprehending the meaning of utterances in a discourse, the current study precisely defined 'intelligibility' as the listener's ability to recognize and identify new information. This construct was assessed by having participants identify and transcribe new information.

2. Design and methodology

2.1. Research design

The present study adopted a between-group design, in which three groups of participants listened to different versions of the same speech which are identical except for differences in nuclear stress placement: group A listened to the lecture with accentuation on new rather than given information; group B listened to the lecture with accentuation on given but not new information; group C listened to the lecture with deaccentuation on both new and given information.

Participants in each group listened to one of the versions and responded by identifying and transcribing new information.

The main independent variable under investigation was the nuclear stress placement. The dependent variable was the number of tokens of new information identified and transcribed.

2.2. Stimuli

2.2.1. Materials

The current study adapted three versions of the speech from Hahn [7,8] which in turn was adapted from a naturally occurring academic lecture on individualism and collectivism. The difference of these three versions is illustrated as follows:

A: You want <u>longer</u> breaks but I want <u>shorter</u> breaks.
B: You want longer <u>breaks</u> but I want shorter <u>breaks</u>.
C: You want longer breaks but I want shorter breaks.

Hahn [7,8] categorized all ideas of the speech into main ideas and supporting details by asking 10 experienced English teachers to analyze and eliminate half of the message units which were not essential to the overall meaning of the speech; the message units eliminated by at least half of the raters were considered supporting details whereas the retained message units were classified as main ideas.

In preparation of Version A of the speech, Hahn [7,8] recorded the reading aloud of the text by seven English speakers, after which two pronunciation experts listened to their recordings to verify the nuclear stress placement. As for Version B of the text, three pronunciation instructors listened to the recordings of 20 English speakers from Outer Circle or Expanding Circle countries to verify the nuclear stress placement. Based on the nuclear stress placement of these speakers, an idealized and prototypical placement of nuclear stress was obtained and assigned to each message unit.

2.2.2. *Talker*

The first author was the talker. His primary languages at home, at school, and with friends are Cantonese and English. He is a suitable talker as Cantonese is a language which does not usually use nuclear stress; hence he has an internalized idea of how speech is produced without nuclear stress.

2.2.3. *Stimuli preparation*

The talker recorded the three versions of the speech in a research laboratory, using a Sanako SLH07 Professional Headset. The talker's utterances were digitally recorded using the audio recording software Praat [9] to save the sound files in .wav before they were archived.

While recording, he read aloud the stimuli at natural speed and attempted to maintain the speech rate throughout. After recording, the audio recording software Audacity was utilized to slice portions of stimuli together to make up the experimental stimuli, to ensure that the three versions of the stimuli were identical except for the nuclear stress placement, and to adjust the speech at an average rate [10].

After the stimuli were prepared, two other researchers were invited to listen to the recordings individually, and to verify that the intended nuclear stress placement in the three versions could be perceived. They were proficient Cantonese speakers of English, and possessed knowledge of English phonetics and phonology. There was a 98.6% agreement between them.

2.3. Participants

60 Cantonese speakers of English (12 male and 48 female; aged from 18 to 21) were randomly assigned to one of the three experimental groups. A post-experiment questionnaire revealed that they have Cantonese and English as their primary languages at home, at school, and with friends. All of them obtained at least a level 5 in the English Language subject of the internationally recognized Hong Kong Diploma of Secondary Education examination; therefore they were comparably proficient speakers. They also reported to have no hearing or speaking deficit. The three groups had no significant difference in gender [$\chi 2(2) = 2.500$, $p = .287$] and in prior familiarity with the topic of the speech [$\chi 2(2) = .436$, $p = .804$]. They participated in this experiment voluntarily.

2.4. Procedures

Participants were tested in a research laboratory at a local university. The participants were first introduced with the instructions and the format of the experiment, followed by answering some listening comprehension questions of the speech, rating its comprehensibility, as well as commenting on the speech and their reaction to it. Prior to testing intelligibility, in order to reach a consensus on how new information was defined, participants were provided with a short written text on which they had to identify and underline all the new information, after which the first author checked the answers with them. Then, they listened to the speech during which they identified its new information and wrote them down in standard orthography. Subsequent to the experiment, participants filled out a post-experiment language background questionnaire.

2.5. Data collection and analysis

To devise the key for data analysis, two teaching assistants at the Department of English, who are proficient Cantonese speakers of English, were invited to identify the new information of the text. Before that, to reach a consensus on how new information was defined, they were provided with the identical written text shown to participants before listening to the speech on which they identified and underlined all new information, after which the first author checked the answers with them. Next, they read the text of the speech, and identified and underlined its new information. If the words were chosen by these two teaching assistants and the first author, they were considered the key for data analysis.

In marking the scripts, for each transcribed word which is identical to the key, one point was awarded. All transcriptions were marked together twice by the first author. The time interval between the two markings was one month. The number of tokens of recognized and identified new information from main ideas, supporting details, and all ideas were then collected.

3. Results

3.1. Recognizing and identifying new information from all ideas

Table 1 shows a medium effect size in the scores between group A and group B, as well as between group A and group C, but a small effect size in the scores between group B and group C.

Table 1. *Descriptive statistics and effect sizes: Number of tokens of recognized and identified new information from all ideas for each group.*

Group	Number	Mean#	Standard Deviation	Effect size
A	20	20.95	3.252	.441 (A-B)
B	20	17.40	3.939	.012 (B-C)
C	20	17.30	4.508	.421 (A-C)

#. Possible maximum scores = 41

Figure 1 displays the boxplot of the interquartile range for each experimental group in recognizing and identifying new information from all ideas. The middle 50% of the scores shows the most stable results of the groups. It can be observed that the middle 50% of the scores of group A falls considerably higher than that of either group B or group C. Further, the middle 50% of the scores of group B is slightly higher than that of group C.

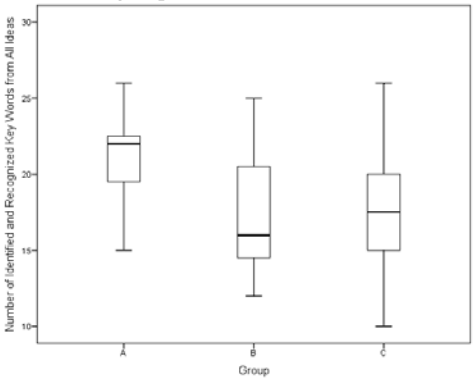

Figure 1: *Median and interquartile range of number of tokens of recognized and identified new information from all ideas for each group.*

A one-factor analysis of variance (ANOVA) was then conducted to determine whether any of the differences was statistically significant. A significance level 0.05, two-tailed, was set for this and subsequent inferential statistics. A significant difference in the number of new information from all ideas among the three groups [$F(2, 59) = 5.587$, $p = .006$] was observed. Post-hoc pair-wise comparisons using Tukey's Honestly Significant Difference (HSD) among the groups revealed that, regarding the number of new information from all ideas, group A was significantly higher than that of group B ($p = .016$) as well as that of group C ($p = .013$) but no statistical difference was observed between group B and group C ($p = .996$).

This result reveals that group A, which listened to the speech with accentuation on new information but not on given information, recognized and identified more new information from the speech than either group B or group C. This result implies that nuclear stress did affect a listener's ability to recognize and identify new information from all ideas; in particular, nuclear stress placement on new rather than given information led to a listener's higher ability to recognize and identify new information from all ideas.

3.2. Recognizing and identifying new information from main ideas

Table 2 shows a medium effect size in the scores between group A and group B, as well as between group A and group C, but a small effect size in the scores between group B and group C.

Table 2. *Descriptive statistics and effect sizes: Number of new information from main ideas recognized and identified for each group.*

Version	Number	Mean#	SD	Effect size
A	20	17.55	2.605	.346 (A-B)
B	20	15.40	3.202	.076 (B-C)
C	20	14.85	3.990	.372 (A-C)

#. Possible maximum scores = 26

Figure 2 shows the boxplot of the interquartile range for each experimental group in recognizing and identifying new information from main ideas. It can be observed that the middle 50% of the scores of group A falls considerably higher than that of group C. In addition, the middle 50% of the scores of group A is slightly higher than that of group B which in turn is slightly higher than that group C.

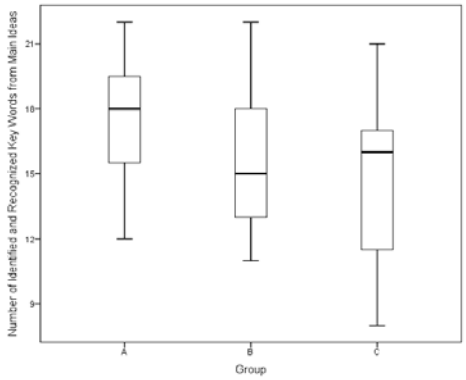

Figure 2: *Median and interquartile range of number of tokens of recognized and identified new information from main ideas for each group.*

An ANOVA was conducted to determine whether any of the differences were statistically significant. A significant difference in the number of new information from main ideas among the three groups was observed [$F(2, 59) = 3.706$, $p = .031$]. Post-hoc pair-wise comparisons using Tukey's Honestly Significant Difference (HSD) among the groups revealed that, regarding the number of new information from main ideas, group A was significantly higher than that of group C ($p = .033$) but no statistical difference was observed between group A and group B ($p = .109$), as well as between group B and group C ($p = .860$).

This result shows that group A, which listened to the speech with accentuation on new information rather than on given information, recognized and identified more new information from main ideas than group C. However, it seems that no significant difference was observed between group A and group B, as well as between group B and group C, in recognizing and identifying new information from main ideas. This result indicates that nuclear stress did affect a listener's ability to recognize and identify new information from main ideas. In particular, when comparing with no accentuation, nuclear stress placement on new rather than given information led to a listener's higher ability to recognize and identify new information from main ideas.

3.3. Recognizing and identifying new information from supporting details

Table 3 shows small effect sizes among all three groups. It appears to show that no remarkable difference exists among the three groups regarding the number of tokens of recognized and identified new information from supporting details. The negative effect size between group B and group C denotes that the mean score of group B is lower than that of group C.

Table 3. *Descriptive statistics and effect sizes: Number of tokens of recognized and identified new information from supporting details for each group.*

Group	Number	Mean#	SD	Effect size
A	20	3.50	2.544	.345 (A-B)
B	20	2.00	1.338	-.111 (B-C)
C	20	2.35	1.755	.254 (A-C)

#. Possible maximum scores = 15

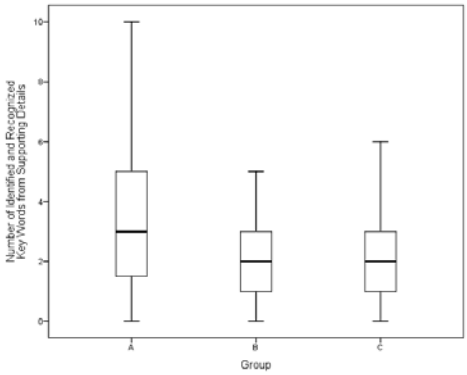

Figure 3: *Median and interquartile range of number of tokens of identified and recognized new information from supporting details for each group.*

Figure 3 above shows the boxplot of the interquartile range for each experimental group in recognizing and identifying new information from supporting details. It can be observed that in general the middle 50% of the scores of all groups are at comparable positions, representing the comparable number of tokens of new information from supporting details identified and recognized for all three groups.

An ANOVA was conducted to determine whether any of the differences were statistically significant. The results show a statistically significant difference in the number of tokens of new information from supporting details among the three groups [$F(2, 59) = 3.257$; $p = .046$], meaning that the differences found among the means on this variable were likely owing to the nuclear stress placement. Post-hoc pair-wise comparisons using Tukey's HSD revealed that, while no significant difference in the number of tokens of new information from supporting details identified and recognized was observed between group B and group C, as well as between group A and group C, a significant difference exists between group A and group B ($p = .046$). This result suggests that nuclear stress on given information might have lowered the listener's ability to recognize and identify words in supporting details.

4. Discussion

The present study shows that the participants could recognize and identify more new information in the speech with accentuation on new information but deaccentuation on given information than those with other stress patterns. This result implies that nuclear stress does affect a listener's ability to recognize and identify new information; in particular, nuclear stress placement on new information rather than given information leads to a listener's higher ability to recognize and identify new information. The results can be attributed to three factors: familiarity with accents, information processing, and listener attitudes.

The first factor is about the participants' familiarity with accents. Since the participants in the current study were more frequently exposed to accents of Inner Circle varieties due to their educational background and frequent exposure to English media of Inner Circle varieties, which is also in line with previous research findings [11], they were more familiar with the Inner Circle varieties of English which use accentuation on new information but deaccentuation on given information. Hence, participants could be considered to be more familiar with nuclear stress patterns of Version A. Such familiarity might explain the higher ability to recognize and identify new information for participants in group A [12].

Information processing of participants might also explain the results. Perhaps due to their familiarity with varieties of English from Inner Circle countries, it is likely that they expected nuclear stress to be applied on new information. The listeners might have used this knowledge to interpret the unaccented words as given information when hearing words with deaccentuation. Hence, in group B and C, as the speaker introduced new information with deaccentuation, the listener might have interpreted them as given information, which might have hindered their ability to recognize and identify new information. This explanation was evident among participants in group B and group C who commented that the stress placements failed, were wrong, or should be improved. It appears that they might have spent extra cognitive effort to notice the unexpected nuclear stress placements; to reinterpret the information status by using lexical, syntactic, and semantic clues; and to re-/identify the new information [7].

The present result could also be attributed to listener attitudes. From the open-ended responses, it was observed that the participants in groups B and C displayed more negative attitudes towards the speech, which are in the nuclear stress placement of varieties of English that deviate from Inner Circle varieties. Such negative attitudes, which in turn could have been owing to their familiarity with accents and information processing, also evident in previous attitudinal studies [13] might have undermined their ability to recognize words [14].

5. Conclusion

The current study reveals that nuclear stress production and placement is important for intelligibility in the communication between Cantonese speakers of English. The results have shed light on the extent to which phonological features affect intelligibility for the present target group and appear to have verified the importance of nuclear stress production and placement on intelligibility of Cantonese speakers of English, supporting part of Jenkins' Lingua Franca Core [2]. Future research, so as to fully verify the importance of nuclear stress placement in the LFC, should use speakers and listeners with different language backgrounds, English language proficiency, and roles, as well as speech with different genres, topics, and lengths.

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