A Project entitled

Effects of acoustic parameter on students' perception of teachers' traits: a perceptual analysis

Submitted by

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Declaration

I, WENG Mingyu declare that is research report represents my own work under the supervision of Dr. YIP Chi Wing, Michael, and that it has not been submitted previously for examination to any tertiary institution for a degree, diploma or other qualifications.

Signed_____

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Abstract

Human speech has been proven to carry more information than people expected. It is suggested that listeners are able to extract the personal information including gender, age and even personality of the speaker who uttered the voice (Pisanski et al., 2014). Regarding the acoustic parameters which would significantly influence the perception of traits, former research argued that pitch, intonation and formant dispersion might affect the listener's judgement on speaker's personality (Hughes et al., 2009; Tyler, 2015; Klofstad et al., 2012). Such perception of personality might further influence the listeners following behaviour in various situation, yet it remains unclear that how the listeners' perception of the produced voice with different vocal parameters will influence the listener's judgement on speaker's personality in an education setting. Therefore, a psychological experiment was conducted to investigate the student's and adult's pattern of perception regarding the linkage between the acoustic parameters and the personality of artificial speaker given the context that the voice is uttered by a secondary school teacher. Results show that the students possibly tend to prefer the voice with higher fundamental frequency and higher formant dispersion, and significantly regard the voice with wider pitch range ($p = 0.016$) as produced by a better teacher. The adults and students show mere statistical difference regarding the perception of teacher's voice. Based on the preference for acoustic parameters, it is indicated that students tend to consider the teacher who sounds more trustworthy and less dominant as a better teacher.

Acknowledgement

The journey of this project is full of joy for me, and it finally comes to an end. It might be the only chance for me to write an acknowledgement in an academic publication, so I really would like to seize the chance.

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Introduction

Voice is a useful resource for perceiving the personal information of speakers. Previous studies have suggested that listeners can extract various information about a speaker's age, gender and even personal traits (Pisanski et al., 2014). The perception of personal traits has been found to affect listeners' subsequent behaviours in mate selection (Borkowska & Pawlowski, 2011; Apicella & Feinberg, 2008), political elections (Tigue et al., 2012) and job interviews (Schroeder & Epley, 2015). Although previous studies have suggested that vocal perception of traits can influence listeners' following decisions and behaviours in many situations, it remains unclear how the perception of personal traits would differ with the exposure to various voices if an educational context was given. In this study, the research question is when listeners are judging teachers' traits and determine whether they are good teachers based on their voices, whether there will be any different relationships between the acoustic parameters and the perceived traits of teachers. This investigation can cast new light on how personal information is vocally perceived by humans in both psychological and educational domains.

Literature review

Human voices have rich information about speakers which can be perceived by listeners. For example, the accents of speakers indicate where they come from, while the smoothness of voices may suggest whether the speakers are old or young. The voice provided information not only about the speakers' identity but also about the physical features such as health, body height and weight (Pisanski, 2016). Surprisingly, there are also a great number of acoustic and vocal cues in human voice containing abundant information about the personal traits of speakers which can be judged by listeners. For example, listeners were able to determine whether a speaker was trustworthy or not

from a completed sentence (Apicella & Feinberg, 2008), a single word (McAleer et al., 2014) or even an uttered vowel (Bruckert et al., 2010). Rather than being random, the relationship between the vocal cues and personal traits is consistent. According to McAleer and Belin (2019), the inter-listener consistency of predicting the attribution of the speakers was significantly high across various methods of statistical analysis. Though the correlation might not be in line with the speaker's self-reporting of personality, the consistency within the group of listeners with the same features remained remarkably high (Aronovitch, 1976).

Former research, therefore, focused on figuring out what traits can be perceived and judged by the listeners through acoustic cues. McCrae and Costa (1987) attempted to ask the participants to make judgements on the traits from 5 dimensions, including attractiveness, outgoingness, dominance, etc. Although the listeners were able to rate the targeted voice from various perspectives, it was argued that there were negligible redundant attributions that correlated to the dominating traits (McAleer et al., 2014). According to Oosterhof and Todorov (2008), the perceivable traits can be divided into dominance and trustworthiness, as being indicated by Principal Component Analysis. In former research, perceived traits were typically summarised into two dimensions. The first group of traits emphasized competence, dominance and power, which were further summarised as dominance (Sutherland et al., 2013; Scherer, 1972). While the other dimension was comprised of likeability, friendliness, kindness, and trustworthiness. etc., which were grouped as trustworthiness due to the similarity (Zuckerman et al., 1988; Rosenberg et al., 1968). It was suggested that a listener tended to make a quick and similar judgement on inter-connected traits, which formed the dimensions and groups of traits (McAleer et al., 2014). In other words, listeners tended to determine whether the speakers were a leader or generally a nice person from a brief

utterance produced (McAleer & Belin, 2019). To some extent, the overgeneralization of traits perceived was due to that the participants' judgements had been formed through the very beginning of short exposure to the stimulus already (Secord, 1958). Additionally, developed from the two-dimension model of perception of trait, it was found that the attractiveness of voice was established by combining trustworthiness and dominance according to the rating, indicating that these two main traits were predominant among others.

Regarding the vocal parameters that will influence the listener's perception of personal traits, several acoustic cues significantly correlated with the perceptual process. First, the relationship between formant dispersion and perceived dominance has been confirmed to exist in previous studies. To be specific, formant dispersion referred to a function of mean distance among formants in human voices, which indicated the distance from the mouth to the larynx and also indicated the vocal tract length (Fitch, 1997). In former studies, it was found that voices with smaller formant dispersion were perceived as being more dominant (Hughes et al., 2009). Such finding of perceived dominance was also supported by evidence for both male and female listeners (Puts et al., 2007). Since the vocal tract length is a comparatively rigid parameter based on the physiological difference in the vocal organs, it was argued that dominance was judged based on the more unmalleable features of humans (McAleer et al., 2014).

Apart from the influence of formant dispersion, it was also found that pitch and intonation have a significant role in the perception of personal traits. In previous studies, pitch referred to the perceived fundamental frequency while intonation was considered as the pattern of the fundamental frequency. For the female listeners, it was found that the ascending intonation sounded less trustworthy among female speakers, while the

slightly higher pitch of male speakers would be perceived as more trustworthy (Tyler, 2015; Klofstad et al., 2012). It is indicated that the perception of trustworthiness is generally associated with the pitch and pattern of intonation. Further, in the educational settings, the teachers whose voices had a narrower range of pitch seemed to be more confident in a classroom context, which was suggested to improve the effectiveness of teaching (Schmidt et al., 1998). It is worth noticing that both pitch and pattern of intonation are comparatively manageable by the speakers. In other words, being trustworthy and likeable was suggested to be more variable compared to more rigid dominance. Such phenomenon was also found in facial perception, as dominance was suggested to be associated with the overall structure of the face while friendliness and trustworthiness were found to be affected by the eyes and mouth which were more variable (Oosterhof & Todorov, 2008).

In terms of practical applications, previous studies focused on the relationship between the perception of traits and the effects on listeners' subsequent decisions and behaviours. One of the examples is the relationship between the perceived traits of the politician and who the listeners vote for. In general, voices with low pitch were found to be more competent and more likely to be a leader (Tsantani et al., 2016). In fact, a low-pitch voice was selected as the preferred candidate by the listeners in the context of political voting (Klofstad et al., 2012). Moreover, such preference for a low-pitch voice was confirmed to exist among the judgements towards both male and female candidates, which might account for the lack of female politicians based on the consideration that the physiological difference in the vocal tract and produced fundamental frequency (Ko et al., 2015).

Another situation where the perception influences the listeners' behaviours occurs in

mate selection. When listeners are deciding whether a speaker is a good partner, they will take dominance, fertility, physical body size, etc., into consideration (Borkowska & Pawlowski, 2011; Xu et al., 2013). It was mentioned that generally, both male and female listeners tended to consider lower-pitch voices as more attractive (Jones et al., 2010). In other research, it was suggested that both males and females would prefer the averaged voices which were manipulated with a higher harmonic-to-noise ratio, indicating the speakers were healthier due to the enhanced smoothness in the voice (Bruckert et al., 2010). Furthermore, not only did the perceived attractiveness affect mate selection and dating behaviour, but the preference of interviewees during the job interview was also partly derived from vocal attractiveness.

Previous studies have partly indicated the relationship between acoustic cues and students' perception of teachers' traits. The examined acoustic cues were limited to several concrete parameters. For example, the teachers whose voices were equipped with a wider pitch range and loudness range were considered more pleasant by the students (Gampel & Ferreira, 2017). Moreover, it was suggested that higher pitch and slower speech rate sounded more motivating and could catch more attention (Rodrigues et al., 2018). It is believed that students' perception of teachers' traits will likely be affected by acoustic cues of the teachers' voices. Nevertheless, the relationship between acoustic cues and students' perception of teachers' traits requires more in-depth investigation regarding the vocal cues and type of traits.

Research gap & Question

As been mentioned above, previous studies attempted to figure out what judgements and behavioural decisions would listeners make after they listened to the targeted voices with some acoustic features manipulated. The studies on the perception of personal

traits through acoustic cues were observed to successfully predict the success in political elections (Klofstad et al., 2015), the results of job interviews (Schroeder & Epley, 2015) and other situations. The wide application of the relationship between acoustic cues and human behaviours in the authentic world implicates the significance of the study on the perception of traits. However, it was suggested that the listeners' perception would be influenced by who they were judging, such as politicians, interviewees or future partners (McAleer & Belin, 2019). So far, there has been no study attempting to cover how would the perception of traits change if the speaker is given the role as a teacher and the present study plans to extend the relationship between acoustic cues and perceived traits into the educational domain.

Apart from the judging context of perception, it is also noticeable that the age of the listeners should be taken into consideration as well. In general, previous studies investigating the field of trait perception mainly tend to choose adults as participants in the studies. Regarding the relationship between age and perception of traits, it was suggested that different ages, either young or older, would possibly influence the perceived first impression and personality (Ewing et al, 2015; Éthier-Majcher et al., 2013). For example, Saxton (2006, 2009) found that teenagers' perception of attractiveness would not be the same as adults' until they reached puberty. In fact, the survival-related perception of traits, including trustworthiness, was believed to develop at the early age of a human being (Oosterhof & Todorov, 2008). It is rational that the perception of traits of teenagers will change along with their cognitive development as they grow up. Apart from it, since most of the studies on vocal perception of traits focus on adults, it will be more precise to compare the performance of adults and secondary students regarding the perception. Hence, the research questions are:

1) When the listeners are judging teachers' traits and determine whether they are good teachers from the teachers' voices, will there be any relationships between those acoustic parameters and the perceived traits of a teacher? If so, what relationships are there?

2) Will there be differences in the vocal perception of traits between secondary school students and adults?

Methods

Participants

To compare the different patterns regarding the perception of traits from teachers' voices, two groups of participants were recruited in this study. For Group A, 16 secondary school students were recruited. The age of this group was located between 12 and 15 years (M = 14.375, SD = 0.719; 7 males and 9 females) since the research aimed to investigate the early adolescent's perception of traits of teacher's voice. For Group B, 16 undergraduate students were recruited. In comparison with the perception of teenagers, the participants' age was between 20 and 25 (M = 23.118, SD = 1.166; 7 males and 9 females).

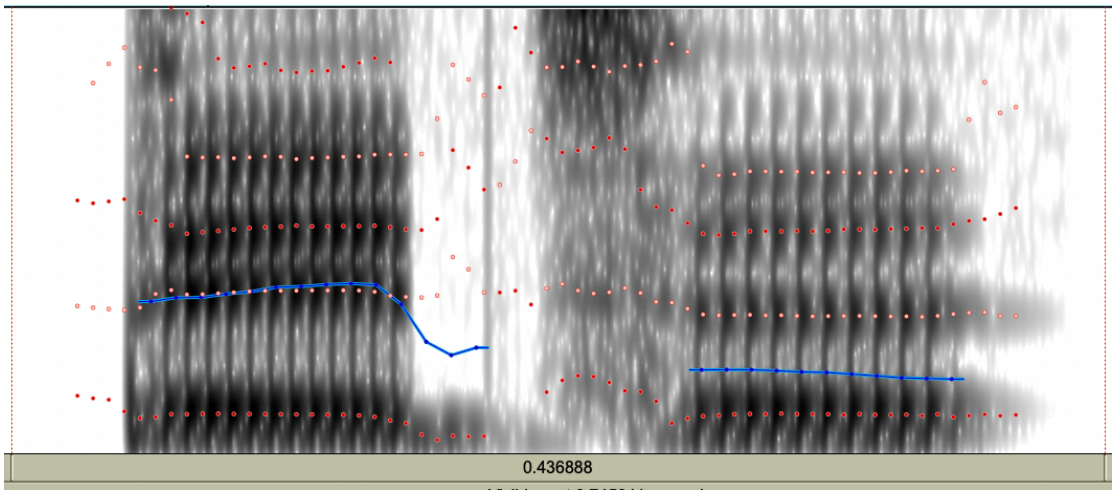
For both Group A and B, the participants were all native speakers of Mandarin Chinese and they completed Language History Questionnaires (Li et al., 2019) to reduce the unexpected influence of their language background and language proficiencies on the results. For the history of second language learning, the mean length of studying of English Language is 8.312 years (SD = 0.873) for Group A, while the mean length is 17.294 years (SD = 1.213) for Group B. None of the participants in either group reported any history of serious brain illness or damage, hearing loss, language difficulty or learning problems. The Education University of Hong Kong (EdUHK) ethics committee gave its approval to this project. Each participant was voluntary for approximately 15 minutes of study participation.

Materials

The original vocal stimulus was synthesized using VocalTractLab (Birkholz, 2020) to produce a male voice. Since the complexity of the intonation system of stimuli would

potentially influence the process of perception (Scherer, 1972), English was chosen for the stimuli due to the comparatively simplified phonological system to Chinese. The stimuli will be in the form of the same brief word with a duration of around 500ms. In this study, the word "bitter" is synthesized since a pilot experiment determined that the utterance sounds less machine-like compared to other synthesized consonants and vowels. That duration was chosen because of the proven consistency among listeners with the condition of 300ms exposure to the target, which was sufficient enough for people to make judgement through voice (McAleer, 2014).

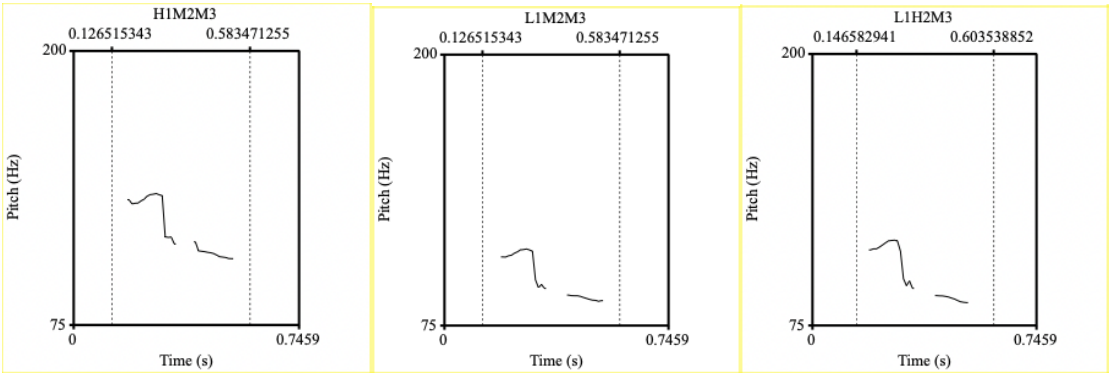
Figure 1. Spectrogram of synthesized "bitter"



Based on previous studies, three acoustic parameters were manipulated in this study: fundamental frequency, pitch range and formant dispersion. For both fundamental frequency and pitch range, the stimuli were resynthesized adopting the Manipulation function in Praat (Boersma & Weenick, 2001). Three levels of fundamental frequency (110Hz, 100Hz & 90Hz) and three levels of pitch range (50%, 100% & 150% wide) were manipulated based on a pilot experiment that determined the minimal difference which could be perceived by the participants. For formant dispersion, there were three levels of formant dispersion, with the formant shift ratio being manipulated to 95%,

100% and 105% respectively using the Convert function in Praat (Boersma & Weenick, 2001). In total, there were 27 conditions (3 conditions of fundamental frequency, pitch range and formant dispersion respectively) of voices for both male and female voices.

Figure 2. Pitch pattern of different conditions



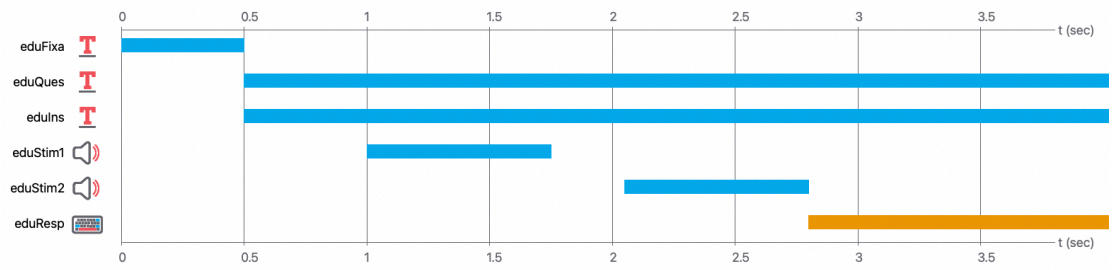
Note. From left to right: 1. high F_0, medium pitch range & medium formant dispersion; 2. low F_0, medium pitch range & medium formant dispersion; 3. low F_0, wider pitch range & medium formant dispersion.

Procedure

The experiment was conducted in a quiet room with a laptop (Model: MacBook Air 2020) and headphone (Model: Bose QC35). Two-alternative-forced-choice (2AFC) method was used in the experiment. The experiment was built using PsychoPy, an open-source package to design and make precise psychological experiments (Peirce et al., 2019). At the very beginning, the instructions of the experiment were displayed. A training session was provided including 5 trials for the participants to get familiar with the procedure of the experiment. After the training session, the student would be given 162 trials to judge. In each trial, participants would see a fixation for 500ms first, followed by the question about the expected trait to be evaluated for 500ms. After that, participants were required to listen to two voices (around 500ms each) with a 300ms

pause and choose the voice which matches the targeted trait better by pressing the 'F' and 'J' in the keyboard. The stimuli were played in random order regarding the combination of conditions. After the participants pressed the computer key to indicate their preference, another trial would begin. During the experiment, there were six vigilance trials to examine the participants' attention. All participants completed the vigilance trials with all answers correct.

Figure 3. Procedure of each trial



In each trial, only one acoustic parameter out of the three will be modified in order to control the variables (e.g., low F_0 - low pitch range - low formant dispersion vs. low F_0 - low pitch range - high formant dispersion). The participants were clearly given the context that the speaker to be judged is a secondary school teacher. In each question, there were 54 possible combinations of parameters as in Appendix 11.

Data Analysis

In this study, the data regarding students' perception of teachers' personalities were analysed. The collected data is analysed in two methods. First, based on the student's choice in each trial, the chosen voice will be regarded as "good teacher", while the left one will be labelled as "bad teacher". Logistic regression is conducted using SPSS to model the categorising (IBM Corp., 2020, Ver. 27). The three acoustic parameters of

each voice will be analysed as three independent variables, while the binary dependent variable is whether the voice is categorized as being "good" or "bad".

Second, the collected data will be analysed in the form of ratio. For each participant individually, the choice made in each pair will be quantified. For example, each time the former one is chosen in a certain pair (e.g., high-medium-medium & medium-medium-medium), the former voice will receive 1 score which will be transferred into a ratio (former score/total score) at the end. The score will be summed up and normalized for different level of analysis. For example, when investigating the preference for F_0, all the individual scores of voices with high F_0 in the pair where the F_0 is the modified parameter will be summed up and calculated into a ratio for further analysis. For the within-group analysis, the paired *t*-test is conducted to compare the ratio of higher or lower conditions. For the between-group analysis, the independent *t*-test is conducted to compare the ratio between the student and adult groups.

Results

The results of this study will be illustrated from three perspectives. First, students' preferred voice of the teacher will be described from the aspects of fundamental frequency, pitch range and formant dispersion separately in a general manner. Second, the preference will be further investigated when other acoustic conditions are fixed to a certain level. For example, the question that what kind of voice students will prefer when the teacher speaks at a lower pitch will be answered in this section. Lastly, the students' preference for the teacher's voice will be compared with the choices made by adult participants to further construct the pattern of the student's preference.

Preference for acoustic feature

Generally, it is found that the students show a clear preference for the acoustic features of perceived voice as illustrated in the left-hand section of Figure 4. For fundamental frequency (F_0), the students tend to choose the voices with higher F_0 ($M = 0.573$, $SD = 0.204$) more frequently compared to those with lower F_0 ($M = 0.427$, $SD = 0.204$). While for formant dispersion, participants prefer the voice with higher formant dispersion ($M = 0.587$, $SD = 0.186$) than lower one ($M = 0.413$, $SD = 0.186$). Specifically, the student participants show a significant preference for pitch range of the teacher's voice. The voice with wider pitch range ($M = 0.611$, $SD = 0.164$) are significantly preferred compared to voice with narrower pitch range ($M = 0.389$, $SD = 0.164$) when indicating which one would possibly be better teacher [$t(15) = 2.717$, $p = .016$, Cohen's d = 0.327]. Such finding is supported by modelling the pattern of categorizing teachers' voices using logistic regression as well. In the logistic regression model (Table 1), it is indicated that the narrower the voice sound, the less chance that the student will regard the speaker as a good teacher ($p = .011$, $OR = 0.734$, CI: [0.591; 0.935]).

Figure 4. Preference for the acoustic features of both groups

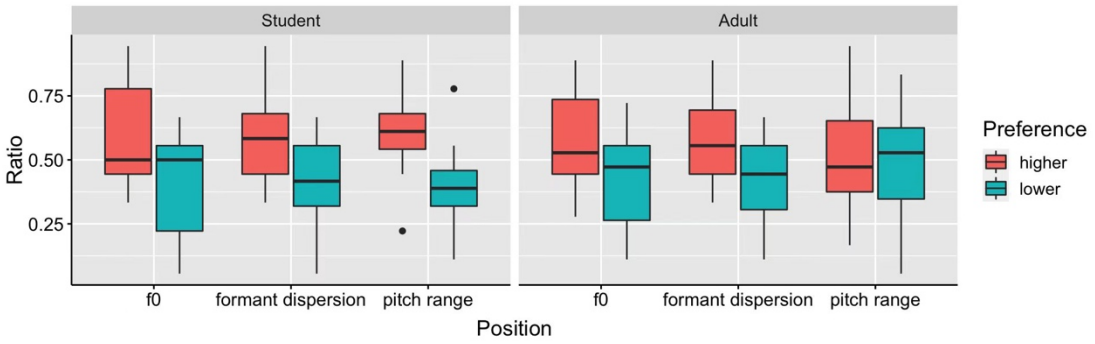


Table 1. Results of logistic regression of students

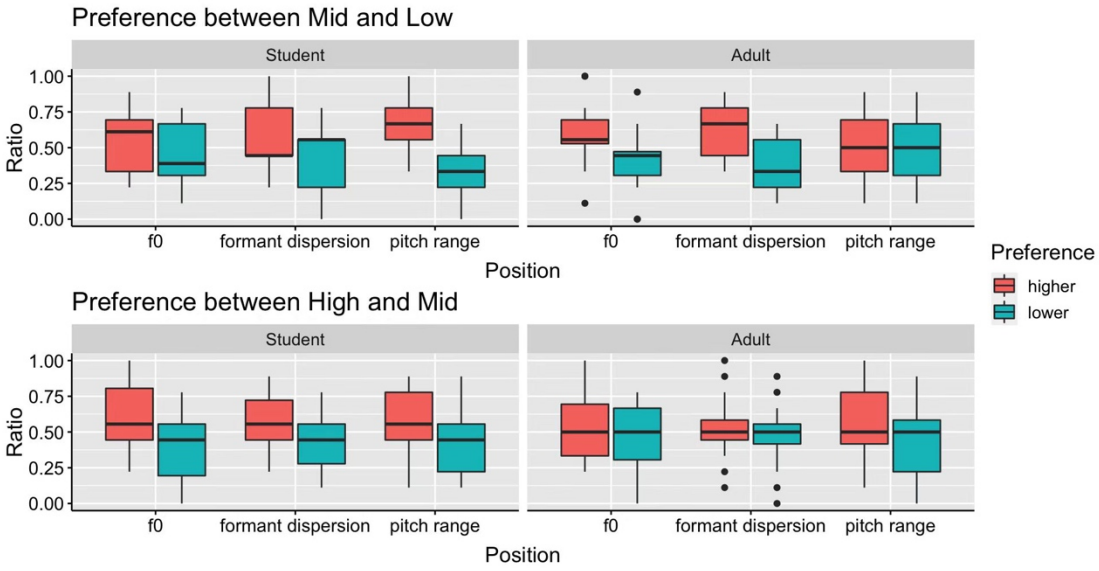
		95% *CI* for odds ratio		
	B	Lower	Odds Ratio	Upper
Intercept	0.037			
F_0-high	0.166	0.939	1.181	1.485
F_0-low	0.006	0.801	1.006	1.265
Pitch range-high	-0.053	0.755	0.949	1.192
Pitch range-low	-0.297*	0.591	0.743	0.935
Formant dispersion-high	0.124	0.900	1.132	1.422
Formant dispersion-low	-0.067	0.744	0.935	1.176

Since the choice is normalized and analyzed in high and low only as in the pattern mentioned above, the findings may be limited to a certain extent and not comprehensive enough. To investigate and determine whether the perceived trait of a teacher is interpreted in a wrong manner, students' preferences of the acoustic feature are further analyzed separately between high-medium (High and Mid) pair and medium-low (Mid and Low) pair. As been indicated on the left-hand side of Figure 5, the students' preference for teachers' voices shows similar patterns between two different pairs. That

is, the voice with higher F_0, wider pitch range and a higher level of formant dispersion is comparatively preferred by the participants in both comparisons. In addition, students' preferences for acoustic features between high-medium pair and medium-low pair did not show any statistical differences. Rather, one interesting finding to notice is that the students' tendency to regard the voice with a wider pitch range as uttered by a good teacher is specifically significant when comparing medium and low stimuli [$t(15) = 3.983$, $p = .001$, Cohen's d = 0.349], while the comparison between the high and medium level of pitch range is not statistically significant.

To conclude the section shortly, the students tend to choose the voice with a higher fundamental frequency, wider pitch range and high level of formant dispersion when determining which voice is produced by a perceived good teacher. Specifically, such preference is consistent in both the comparison between medium-low pairs and high-medium pairs. Among the three mentioned acoustic features, the difference in pitch range is perceived more distinctly by the student participants, of which the higher pitch range is significantly perceived as a better teacher.

Figure 5. Preference for the acoustic features of both groups by High-Mid and Mid-Low



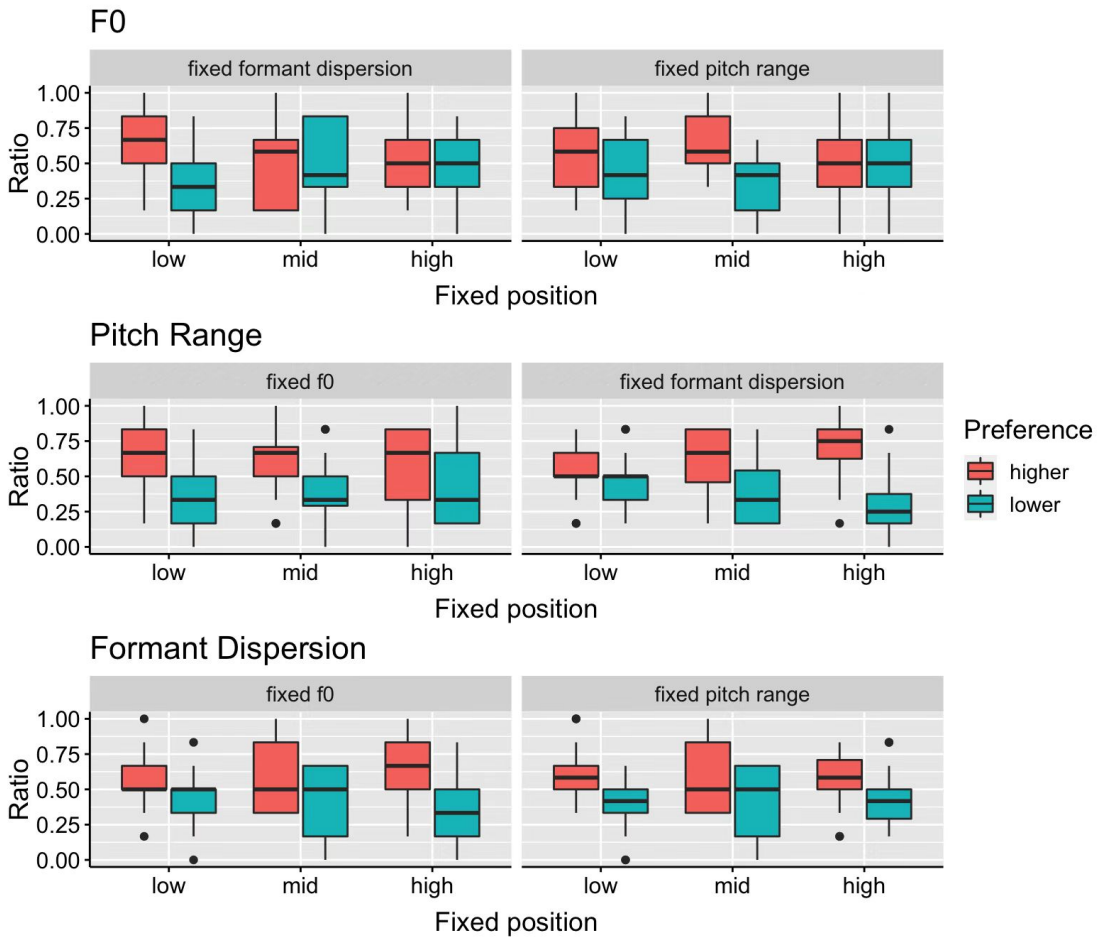
Preference by fixed condition

Apart from the general tendency of students' choice regarding the acoustic features of a good teacher, the question that what different choices the participants would make when a acoustic parameter is fixed to a certain level will be attempted to be answered in this part. In Figure 6, each of the boxplot charts refers to the participants' preference for either higher or lower acoustic feature (e.g. preference for F_0 in the first chart) when another parameter is fixed to a given condition (e.g. when the formant dispersion is fixed as in the left-hand side of the boxplot of the first row).

As indicated by Figure 6, the tendency of choice follows the rules which are found in above paragraph in general. The voice which shows higher F_0, wider pitch range and higher level of formant dispersion is still preferred when the other acoustic parameters are determined. In the first line of Figure 6, the preference of F_0 is investigated in various settings. For example, the students participants significantly tend to prefer the voice with higher F_0 ($M = 0.656$, $SD = 0.262$) compared to lower F_0 ($M = 0.344$, $SD = 0.262$) when formant dispersion is low [$t(15) = 2.390$, $p = .004$, Cohen's d = 0.459]. Another example is that when the pitch range is fixed to medium, students significantly

prefer the high F_0 voice ($M = 0.625$, $SD = 0.215$) rather than low F_0 voice ($M = 0.375$, $SD = 0.215$) when determining which voice is uttered by a better teacher [$t(15) = 2.324$, $p = .035$, Cohen's d = 0.430]. Indeed, such tendency may not be significant for every circumstance. For instance, the preference for higher F_0 ($M = 0.510$, $SD = 0.295$) seems to be very similar to lower F_0 ($M = 0.490$, $SD = 0.295$) when the pitch range is fixed to a high level. However, the general trend and conclusion stand still based on the collected data of students' perception. In addition to students' preference for F0, it is also found that the choice of pitch range is sensitive to the change of other vocal conditions as well. For example, participants would significantly prefer voice with wider pitch range ($M = 0.667$, $SD = 0.236$) than narrower one ($M = 0.333$, $SD = 0.236$) when the F_0 is fixed to a low level [$t(15) = 2.828$, $p = .013$, Cohen's d = 0.471]. Moreover, the wider pitch range voice ($M = 0.698$, $SD = 0.229$) is significantly preferred when the formant dispersion is at a high level as well [$t(15) = 3.450$, $p = .004$, Cohen's d = 0.459].

Figure 6. Preference for the acoustic features of the students by fixed positions and by variables



Comparison between student and adult

In the above passage, the pattern of students' perception and preference regarding a good teacher's voice is constructed. From the perspective of a student, a voice with a higher F_0, wider pitch range and higher level of formant dispersion is regarded as a good teacher's voice, of which the change of pitch range influences the perception with statistical significance. However, the question that whether such a pattern is consistent among adult listeners as well remains unsolved. In this section, the general pattern of adults' preferences will be illustrated first, followed by a comparison between the students' and adults' perception of a good teacher's voice.

In general, the adults' preference for a good teacher's voice shows both similarity and difference compared to students' choices. As illustrated in the right-hand side of Figure 4 and Figure 5, the adult participants tend to draw a pattern of perception similar to students, which shows a preference for voice with higher F_0, wider pitch range and high level of formant dispersion. Among the three acoustic parameters, the adult participants significantly tend to choose voice with higher formant dispersion (M = 0.639, SD = 0.188) than lower one (M = 0.371, SD = 0.188) when choosing between medium and low condition of formant dispersion [$t(15) = 2.953$, p = .010, Cohen's d = 0.376]. In logistic regression, the adult participants' sensitivity of formant dispersion is further supported. As in Table 2, it is reported that the lower level of formant dispersion is, the less likely that the adult participants will consider the voice as uttered by a good teacher (p = 0.033, OR = 0.780, CI: [0.621; 0.980]). In addition, adult participants tend to choose the voice with higher F_0 (M = 0.656, SD = 0.254) than lower F_0 (M = 0.344, SD = 0.254) when the formant dispersion is at a low level [$t(15) = 2.457$, p = .027, Cohen's d = 0.509]. Apart from it, the adults also prefer the voice with higher F_0 (M = 0.656, SD = 0.187) than lower F_0 (M = 0.344, SD = 0.187) when the pitch range is medium [$t(15)$ = 3.337, p = .004, Cohen's d = 0.376].

Table 2. Results of logistic regression of adults

		95% *CI* for odds ratio		
	B	Lower	Odds Ratio	Upper
Intercept	0.141			
F_0-high	0.003	0.799	1.003	1.261
F_0-low	-0.164	0.675	0.849	1.067
Pitch range-high	0.041	0.829	1.042	1.309
Pitch range-low	-0.028	0.774	0.974	1.223

Formant dispersion-high	-0.066	0.745	0.936	1.176
Formant dispersion-low	-0.248*	0.621	0.780	0.980

To compare the perception pattern of students and adults, it was found that the preference for vocal parameters is quite similar from one group to another. To investigate the statistical difference, an independent *t*-test was conducted on the perception performance between the two groups. As a result, it is surprising to find that students tend to choose the voice with wider pitch range ($M = 0.698$, $SD = 0.229$) while adults did not show such preference ($M = 0.490$, $SD = 0.254$) when the formant dispersion is fixed to a high level [$t(30) = 2.433$, $p = .021$, Cohen's d = 0.242]. The difference might be due to the feature mentioned in the former section that students show a significant preference for voice with a higher pitch range while adults are more sensitive to the change of formant dispersion, which leads to an insignificant preference for pitch range when the formant dispersion is already high. In one word, despite several certain situations in which the adults show unique features, adult and student participants largely share a very similar pattern of preference for the voice of a good teacher.

Discussion

This study aims at figuring out the relationship between the acoustic parameters of an uttered voice and the perceived trait of a good teacher. Based on previous findings, three acoustic features: fundamental frequency, pitch range and formant dispersion are chosen to investigate the relationship by a perception experiment. Since the question that whether there will be differences in vocal perception between students and adults remains unclear as well, two groups of participants (16 secondary school students and 16 adults) are recruited for further comparison and analysis.

For the findings of this study, it is found that under the educational context, the relationship between acoustic parameters and students' vocal perception of teacher's traits shows several new features. It is found that from the students' perspective, the voices which were comparatively higher in fundamental frequency, wider in pitch range and higher in the level of formant dispersion are more likely to be considered to be spoken by a good teacher. Among the three conditions, students' preference for voices with a wider pitch range shows statistical significance. The finding agrees with the former research suggesting that a wider pitch range is considered more pleasant by the students and a higher pitch sounds more motivating to students (Gampel & Ferreira, 2017; Rodrigues et al., 2018). For the study on formant dispersion, this study attempts to establish the relationship between a higher level of formant dispersion and the portrait of a good teacher, which furthered the understanding of students' vocal perception of a teacher's trait. Apart from the relationship within the student group, this study also examines the generality of the pattern of students' vocal perception of a good teacher by conducting the perception task on adult participants. The result shows that the adult group tend to present several unique features regarding the perception of a good teacher, including the negative influence of a low level of formant dispersion

which is significant. Except for the situation that students significantly tend to choose the voice with a wider pitch range than adults when the formant dispersion is fixed to a high level, the choices made by the students and adults indicate no statistical significance. Hence, it is rational to argue that regarding the vocal perception of a teacher's trait, age and cognitive development do not play an important part as expected in the research question.

To explain the relationship between the acoustic parameters and students' preference of voice, it is worth noticing that the perceived portrait of the teacher's voice is linked closely with the potentially indicated traits of certain acoustic parameters. For example, the wider pitch range was commonly reported to associate with the personality of being trustworthy and friendly (Gampel & Ferreira, 2017). Moreover, the higher fundamental frequency also indicated the trustworthiness of the speaker among male speakers (Tyler, 2015; Klofstad et al., 2012). Based on former studies regarding the linkage between acoustic cues and traits, it is rational to argue that from the students' perception, a teacher with a personality of being trustworthy and friendly is considered a better teacher than those with less trustworthiness. On the other hand, the acoustic parameter of formant dispersion, which reflected the length of the vocal tract, was reported to have a strong correlation with the traits related to dominance (Hughes et al., 2009). For example, the longer vocal tract results in lower formant dispersion, which is likely to be perceived as being dominated by the listeners. Hence, the students' preference in this study may suggest that a voice with less dominance, which is triggered by higher formant dispersion, is regarded as a better teacher according to the perception of student participants. Combining two aspects of the targeted acoustic parameters, the ideal personality of a good teacher could be possibly illustrated by the preferred condition of acoustic parameters: from the students' perspective, a teacher who is very trustworthy

while being not dominant at the same time is regarded as a good teacher from his or her voice. Previous research suggested that whether students considered the teacher as being competent positively related to the students' perception for the teacher's personality (Jones, 1989). In fact, the relationship between teacher's personality and the teaching effectiveness was proved to exist as well (Polk, 2006). Specifically, it was found that the caring and trustworthiness personality was significantly correlated with the perceived expertise of teachers as rated by the students (Teven & Herring, 2005). In other words, the personality related to trustworthiness, kindness and likeability tends to positively improve the teacher's perceived professionalism. Therefore, the current study supports the hypothesis that the teacher's personality would enhance the teaching and learning by evidence based the relation between the students' perception of specific vocal cues and the teacher's trait, which is a new perspective apart from the student's rating for the teacher and the teacher's self-report.

As for the future implication, this study will have potential influences on two aspects. First, the findings of this study will provide theoretical support for vocal training for future professional teacher development. In traditional teacher training, prospective teachers are trained regarding how to protect their vocal tract in the classroom (Rodrigues et al., 2013). Apart from it, experienced teachers are likely to pass the knowledge of how to catch students' attention based on authentic experiences. The findings of this study could possibly be applied in teacher training, suggesting that higher pitch and wider pitch range should be used based on students' perception patterns from the experiment. It was suggested that fundamental frequency and pitch range were very flexible and can be easily adjusted though formant dispersion is more fixed and closely related to the length of the vocal tract (Fitch, 1997). For teachers with certain

vocal tract lengths, this study also provides several suggestions for them to refer to when preparing for their voice.

The second implication of this study is that the findings will potentially enhance the quality of speech synthesis in robot-assist learning or other forms of online learning. In current online teaching platforms or robot-assist learning, it is seldom witnessed that the voice quality of the machine voice is adjusted to cater for the students' learning needs. In this study, it is found that the male voice with a wider pitch range, higher F_0 and high level of formant dispersion is perceived as being produced by a good teacher. In future speech synthesis tasks for educational purposes, it is suggested that the corresponding acoustic parameters of the synthesized voice should be manipulated to a comparatively higher level, which has been partially proven to have a positive impact on students' perception of the voice as an artificial teacher. In one words,

Limitation

Although this study attempts to establish a solid relationship between acoustic parameters and students' perception of teachers' voices, there are still limitations that restrict the generalization of the findings. First, the effect size of this study seems to be in a relatively small position. In most significant situations, the effect size of the findings ranges from 0.24 to 0.509, and most of the effect size falls around 0.45. According to Cohen (1988), differed from the statistical significance, effect size reflected what extent the phenomenon solidly existed among the group. In other words, the effect size will not change along with the enlargement of the sample size. In detail, it was argued by Cohen (1988) that the effect size smaller than 0.2 was regarded as small while the range from 0.2 to 0.5 was merely medium. Since this study focuses on the effect of acoustic parameters, further research on the performance of groups

categorized by different factors (e.g. sex, bilingual, academic performance, etc.) was out of focus. Therefore, the collected data might contain certain undiscovered patterns which may result in a small effect size regarding the current findings.

The second limitation of this study is the manipulation of the stimulus. For the manipulation, the voice has been manipulated into 27 conditions (three acoustic features at three levels separately). Although these 27 conditions have already represented a large scale of stimulus, the manipulation still fails to provide cues for the exact voice quality and condition that can motivate the students most. Restricted by the number of conditions, the results of this study only suggest whether the higher or lower condition is preferred, instead of listing an exact pitch range that can most attract the students.

Therefore, future researchers are suggested to improve the situation in two aspects. To solve the problem of small effect size, future studies could attempt to figure out the influence of various personal factors by comparing the between-group results. Apart from the change of methodology, a more accurate statistical method and model should be adapted as well. In this study, the *t*-test and logistic regression were mainly applied in the analysis. It is expected that other statistic-categorical methods (e.g. k-means, decision tree, etc.) may show more properly fitting results instead, which is likely to solve the problem of small effect size and small likelihood. Additionally, the manipulation of stimulus should be more specific as well. In the future, that manipulation of stimulus is suggested to be made in a continuous manner or more levels of condition should be manipulated.

Conclusion

This study attempts to establish the relationship between the acoustic features and the perceived traits of a teacher and further investigate the difference between adult and secondary students regarding the pattern of perception. To achieve such goal, 16 secondary school students and 16 adults are recruited to conduct a psychological experiment which asks the participants to make judgements about trait and personality between two voices. As a result, the study finds that students significantly prefer the voice with wider pitch range when choosing which one sounds like a good teacher, and tend to choose voice with higher fundamental frequency and formant dispersion. Several significant results related to the situation where certain condition is fixed are found as well. For the adult group, it is found that the general preference for teacher's voice remains the same to a large extent, despite some special circumstance. The results indicate that the students tend to regard the voice which shows more trustworthiness and less dominance as being uttered by good teacher, which could potentially benefit the future teacher training and speech synthesis for educational purpose.

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Appendix

Appendix. 1 Design of experiment Question

Trait	Question	Acoustic parameter 3 conditions (high – medium - low)		
		Formant dispersion	Fundamental frequency	Pitch range
Is he/she a good teacher?	Which one of the teachers is better in teaching?			
	Which one of the teachers will you pay more attention?			
	Which one of the teachers can better motivate the student??			
	Which one of the teachers is more responsible?			
	Which one of the teachers will you listen to more carefully?			
Dominance	Which one of the speakers is more competent?			
	Which one of the speakers is more predominant?			
	Which one of the speakers is more aggressive?			
	Which one of the speakers is more submissive?			
	Which one of the speakers is more confident?			
Trustworthiness	Which one of the speakers is more kind-hearted?			
	Which one of the speakers is more likable?			
	Which one of the speakers is more trustworthy?			
	Which one of the speakers is more easy-going?			
	Which one of the speakers is more friendly?			

Appendix. 2 Language History Questionnaire (adapted from Li et al., 2019)

Please answer the following questions to the best of your knowledge.

PART A

1. Age (in years):

2. Sex (circle one): Male/Female

3. Education (degree obtained or school level attended):

4(a). Country of origin:

4(b). Country of Residence:

5. If 4(a) and 4(b) are the same, how long have you lived in a foreign country where your second language is spoken? If 4(a) and 4(b) are different, how long have you been in the country of your current residence?

6. What is your native language? (If you grew up with more than one language, please specify)

7. Do you speak a second language?

___YES my second language is_____.

___NO (If you answered NO, you need not to continue this form)

8. If you answered YES to question 6(b), please specify the age at which you started to learn your second language in the following situations (write age next to any situation that applies).

At home_____

In school _____

After arriving in the second language speaking country _____

9. How did you learn your second language up to this point? (check all that apply)

Mainly through formal classroom instruction _____

Mainly through interacting with people _____

A mixture of both _____

Other (specify)_____

10. List all foreign languages you know in order of most proficient to least proficient. Rate your ability on the following aspects in each language. Please rate according to the following scale (write down the number in the table):

very poor (1) poor (2) fair (3) functional (4) good (5) very good (6) native-like (7)

Language	Reading	Writing	Speaking	Listening

11. Provide the age at which you were first exposed to each foreign language in terms of speaking, reading, and writing and the number of years you have spent on learning each language.

Language	Age first exposed to the language			Number of years learning
	Reading	Writing	Speaking	

PART B

12. What language do you usually speak to your mother at home? (If not applicable for any reason, write N/A)

13. What language do you usually speak to your father at home? (If not applicable for any reason, write N/A)

14. What languages can your parents speak fluently? (If not applicable for any reason, write N/A)

Mother: _____ Father: _____

15. What language or languages do your parents usually speak to each other at home? (If not applicable for any reason, write N/A)

16. Write down the name of the language in which you received instruction in school, for each schooling level:

Primary/Elementary School _____ Secondary/Middle School _____

High School _____ College/University _____

17. When you are speaking, do you ever mix words or sentences from the two or more languages you know? (If no, skip to question 18).

18. In which language (among your best two languages) do you feel you usually do better? Write the name of the language under each condition.

	Reading	Writing	Speaking	Understanding
At home				
At school				

19. Among the languages you know, which language is the one that you would prefer to use in these situations?

At home _____ At work _____

At a party _____ In general _____

20. If you have taken a standardized test of proficiency for languages other than your native language (e.g., TOEFL or Test of English as a Foreign Language), please indicate the scores you received for each. Language Scores Name of the Test

_____ _____ _____ _____

_____ _____ _____ _____

_____

21. If there is anything else that you feel is interesting or important about your language background or language use, please comment below.

Appendix. 3 Consent form for student participants (English)

THE EDUCATION UNIVERSITY OF HONG KONG

Department of Psychology

CONSENT TO PARTICIPATE IN RESEARCH

Effects of acoustic parameter on students' perception of teachers' traits: a perceptual analysis

I hereby consent my child, _____, to participate in the captioned project supervised by Dr. Yip Chi Wing Michael and conducted by Mr. Weng Mingyu, who are staff and student of Department of Psychology in The Education University of Hong Kong.

I understand that information obtained from this research may be used in future research and may be published. However, my right to privacy will be retained, i.e., the personal details of my child will not be revealed.

The procedure as set out in the **attached** information sheet has been fully explained. I understand the benefits and risks involved. My child's participation in the project is voluntary.

I acknowledge that we have the right to question any part of the procedure and can withdraw at any time without negative consequences.

Signature: _____

Name of Participant: _____

Date: _____

Signature: _____

Name of Parent / Guardian*: _____

Date: _____

**Please delete as appropriate*

Appendix. 4 Information Sheet for student participants (English)

INFORMATION SHEET

Effects of acoustic parameter on students' perception of teachers' traits: a perceptual analysis

You are invited to participate with your child in a project supervised by Dr. Yip Chi Wing Michael and conducted by Mr. Weng Ming Yu, who are staff and student of Department of Psychology in The Education University of Hong Kong.

The introduction of the research

The perception of trait has been found to influence the listeners' following decision and behaviour in many situations. However, it remains unclear that how the pattern of trait perception would differ if an educational context was given. This study attempts to figure out that when the secondary school students are judging teachers' traits and determine whether they are good teacher from their voices, whether there be any different relationships between the acoustic parameters and the perceived traits of teacher compared to the former situations.

In general, previous studies investigating the field of trait perception mainly tend to choose adult as participants in the studies. Regarding the relationship between age and perception of trait, it was suggested that different age would possibly influence the perceived first impression and personality. For example, the teenagers' perception of attractiveness would not be the same as adults until they reached puberty. Hence, based on the question raised up above, the difference in the perception of traits between teenagers (secondary school students) and adults would also be addressed

The methodology of the research

30 secondary school students will be recruited, whose age will be located between 12~15 years since the research will investigate on the early adolescent's perception of traits of teacher's voice. Apart from them, 30 undergraduate students will also be recruited to be in comparison with the perception from participants aged 12~15. The participants will be recruited through both online post of recruitment and calling for participants in local secondary schools.

Before the experiment, participants will be asked to take a language history questionnaire including age, gender, language proficiency. During the experiment, the voice will be played through a headphone connected to the computer. The two-alternative forced choice (2AFC) method will be used in the experiment. At the very beginning, the instruction of the experiment will be displayed first. In each trial, participants will see a fixation for 300ms first, followed by the question about the expected trait to be evaluated for 500ms. After that, participants will hear two voices (around 500ms each) with a 100ms pause and choose the voice which matches the

targeted trait better. The reaction time will be recorded by the computer using PsychoPy. The stimuli will be played in random order regarding the gender and type of manipulation of parameters. After the participants press the computer key to indicate the preference, another trial will begin. There will be 150 trials in total for each participant. The participants will be clearly given the context that the speaker to be judged is a secondary school teacher. There will be three traits in total: dominance, trustworthiness, and personality as a teacher. The total duration of each single experiment is expected to be 15 to 20 minutes. The place of the research is expected to be either at the psychology lab of EdUHK or in an online form (Pavlovia).
There will be no compensation for the participants in any form.

The potential risks of the research

There are no potential risks during the process of research. Participants were not involved under coercion. No personally identifiable information or sensitive information was collected and the participants' right to privacy was not impinged. No financial inducement was offered. The procedure did not include deception and no prolonged testing was involved. No discomfort or psychological stress was caused. No drug, placebo, blood & tissue sample, irradiation or DNA work was used or collected in the research.

Your child's participation in the project is voluntary. You and your child have every right to withdraw from the study at any time without negative consequences. All information related to your child will remain confidential and will be identifiable by codes known only to the researcher.

Describe how results will be potentially disseminated

The results of the study will be published in the form of the thesis of undergraduate. In the future, the results would have chances to be published as a journal article or presentation in academic conference. Upon signing, you will grant the permission of the future use of the data and the future publishment of the results of the research.

If you would like to obtain more information about this study, please contact me by email at or telephone number , or my supervisor Dr. Yip Chi Wing by email at

If you have any concerns about the conduct of this research study, please do not hesitate to contact the Human Research Ethics Committee by email at hrec@eduhk.hk or by mail to Research and Development Office, The Education University of Hong Kong.

Thank you for your interest in participating in this study.

Weng Mingyu

Appendix. 5 Consent Form for student participants (Chinese)

香港教育大學
心理學系

參與研究同意書

聲學參數對學生對教師特質感知的影響：一項感知分析

茲同意敝子弟_____參加由葉志榮博士負責監督，翁明宇先生負責執行的研究計劃。她／他們是香港教育大學的教員和學生。

本人理解此研究所獲得的資料可用於未來的研究和學術發表。然而本人有權保護敝子弟的隱私，其個人資料將不能洩漏。

研究員已將所附資料的有關步驟向本人作了充分的解釋。本人理解可能會出現的風險。本人是自願讓敝子弟參與這項研究。

本人理解本人及敝子弟皆有權在研究過程中提出問題,並在任何時候決定退出研究，更不會因此而對研究工作產生的影響負有任何責任。

簽署：_____
參加者姓名：_____
日期：_____

簽署：_____
父母／監護人*姓名：_____
日期：_____

**請刪去不適用者*

Appendix. 6 Information Sheet for student participants (Chinese)

有關資料

聲學參數對學生對教師特質感知的影響：一項感知分析

誠邀閣下及 貴子女參加葉志榮博士負責監督，翁明宇先生負責執行的研究計劃。她／他們是香港教育大學的教員和學生。

研究計劃簡介

研究發現，在許多情況下，對演講者美德特質的感知會影響聽者的決定和隨後的行為。然而，目前尚不清楚，在教育場景下，聽著對特質的感知模式將如何變化。本研究試圖找出中學生在判斷教師特質並從聲音判斷其是否為好教師時，聲學參數與感知教師特質之間是否存在與前人研究不同的關係。

一般來說，以往研究特質感知領域的研究主要傾向於選擇成年人作為研究的參與者。關於年齡與特質感知的關係，研究認為不同的年齡可能會影響感知的第一印象和個性。例如，青少年在進入青春期之前對吸引力的看法與成年人不同。因此，基於以上提出的問題，青少年（中學生）和成年人之間在特徵認知上的差異問題也將得到解決。

研究方法

本研究將招募 30 名 12～15 歲之間的中學生，以調查早期青少年對教師聲音特徵的感知。除此之外，本研究還將招募 30 名本科生，與 12~15 歲參與者的認知進行比較。參加者將通過網上招聘和徵集當地中學參加者招募。

實驗前，參與者將被要求完成語言史問卷，包括年齡、性別、語言能力。在實驗過程中，語音將通過連接到計算機的耳機播放。實驗中將使用二選一強制選擇（2AFC）方法。一開始，實驗說明會先顯示在屏幕上。在每次試驗中，參與者首先會看到 300 毫秒的注視（fixaiton），緊接著實需要評估的特徵的問題（500 毫秒）。之後，參與者將聽到兩個聲音（每個大約 500 毫秒），期間暫停 100 毫秒，然後參與者將選擇更符合目標特徵的聲音。計算機將使用 PsychoPy 記錄反應時間。刺激物將按關於性別和參數操作類型的隨機順序播放。參與者按下計算機鍵表明偏好後，將開始另一次試驗。每個參與者總共將有 150 次試驗。參與者將清楚地知道被評判的演講者是中學教師的背景。總共會有三個需要判斷的特徵：支配性，可信度和作為教師的個性。每個單項

實驗的總持續時間預計為 15 到 20 分鐘。研究地點預計將在香港教育大學的心理學實驗室或以在線形式（Pavlovia）進行。是次研究並不為閣下提供個人利益，但所搜集數據將對研究學習動機的問題提供寶貴的資料。

說明任何風險

研究過程中不存在潛在風險。 參與者沒有受到脅迫。 沒有收集任何個人身份信息或敏感信息，參與者的隱私權沒有受到影響。沒有提供經濟誘因。 該程序不包括欺騙，也不涉及長時間的測試。 沒有引起不適或心理壓力。 研究中沒有使用或收集藥物、安慰劑、血液和組織樣本、輻射或 DNA 工作。
閣下參與該項目是自願的。閣下及 貴子女有權隨時退出研究而不會產生負面影響。 與 貴子女有關的所有信息都將保密，並且通過只有研究人員知道的代碼進行識別。

描述將如何發佈研究結果

研究結果將以本科畢業論文的形式發表。將來，這些結果將有機會作為期刊文章或學術會議報告發表。簽署後，您將授予未來使用數據和未來發表研究結果的許可。

如閣下想獲得更多有關這項研究的資料，請以電郵 或電話 與本人或本人的導師葉志榮博士 聯絡。

如閣下對這項研究的操守有任何意見，可隨時與香港教育大學人類實驗對象操守委員會聯絡(電郵：hrec@eduhk.hk; 地址：香港教育大學研究與發展事務處)。

謝謝閣下有興趣參與這項研究。

翁明宇

Appendix. 7 Consent form for adult participants (English)

THE EDUCATION UNIVERSITY OF HONG KONG

Department of Psychology

CONSENT TO PARTICIPATE IN RESEARCH

Effects of acoustic parameter on students' perception of teachers' traits: a perceptual analysis

I, _____, hereby consent to participate in the captioned project supervised by Dr. Yip Chi Wing Michael and conducted by Mr. Weng Mingyu, who are staff and student of Department of Psychology in The Education University of Hong Kong.

I understand that information obtained from this research may be used in future research and may be published. However, my right to privacy will be retained, i.e., my personal details will not be revealed.

The procedure as set out in the **attached** information sheet has been fully explained. I understand the benefits and risks involved. My participation in the project is voluntary.

I acknowledge that I have the right to question any part of the procedure and can withdraw at any time without negative consequences.

Signature: _____

Name of Participant: _____

Date: _____

Appendix. 8 Information Sheet for adult participants (English)

INFORMATION SHEET

Effects of acoustic parameter on students' perception of teachers' traits: a perceptual analysis

You are invited to participate with your child in a project supervised by Dr. Yip Chi Wing Michael and conducted by Mr. Weng Mingyu, who are staff and student of Department of Psychology in The Education University of Hong Kong.

The introduction of the research

The perception of trait has been found to influence the listeners' following decision and behaviour in many situations. However, it remains unclear that how the pattern of trait perception would differ if an educational context was given. This study attempts to figure out that when the secondary school students are judging teachers' traits and determine whether they are good teacher from their voices, whether there be any different relationships between the acoustic parameters and the perceived traits of teacher compared to the former situations.

In general, previous studies investigating the field of trait perception mainly tend to choose adult as participants in the studies. Regarding the relationship between age and perception of trait, it was suggested that different age would possibly influence the perceived first impression and personality. For example, the teenagers' perception of attractiveness would not be the same as adults until they reached puberty. Hence, based on the question raised up above, the difference in the perception of traits between teenagers (secondary school students) and adults would also be addressed

The methodology of the research

30 secondary school students will be recruited, whose age will be located between 12~15 years since the research will investigate on the early adolescent's perception of traits of teacher's voice. Apart from them, 30 undergraduate students will also be recruited to be in comparison with the perception from participants aged 12~15. The participants will be recruited through both online post of recruitment and calling for participants in local secondary schools.

Before the experiment, participants will be asked to take a language history questionnaire including age, gender, language proficiency. During the experiment, the voice will be played through a headphone connected to the computer. The two-alternative forced choice (2AFC) method will be used in the experiment. At the very beginning, the instruction of the experiment will be displayed first. In each trial, participants will see a fixation for 300ms first, followed by the question about the expected trait to be evaluated for 500ms. After that, participants will hear two voices (around 500ms each) with a 100ms pause and choose the voice which matches the

targeted trait better. The reaction time will be recorded by the computer using PsychoPy. The stimuli will be played in random order regarding the gender and type of manipulation of parameters. After the participants press the computer key to indicate the preference, another trial will begin. There will be 150 trials in total for each participant. The participants will be clearly given the context that the speaker to be judged is a secondary school teacher. There will be three traits in total: dominance, trustworthiness, and personality as a teacher. The total duration of each single experiment is expected to be 15 to 20 minutes. The place of the research is expected to be either at the psychology lab of EdUHK or in an online form (Pavlovia).
There will be no compensation for the participants in any form.

The potential risks of the research

There are no potential risks during the process of research. Participants were not involved under coercion. No personally identifiable information or sensitive information was collected and the participants' right to privacy was not impinged. No financial inducement was offered. The procedure did not include deception and no prolonged testing was involved. No discomfort or psychological stress was caused. No drug, placebo, blood & tissue sample, irradiation or DNA work was used or collected in the research.

Your participation in the project is voluntary. You and your child have every right to withdraw from the study at any time without negative consequences. All information related to your child will remain confidential and will be identifiable by codes known only to the researcher.

Describe how results will be potentially disseminated

The results of the study will be published in the form of the thesis of undergraduate. In the future, the results would have chances to be published as a journal article or presentation in academic conference. Upon signing, you will grant the permission of the future use of the data and the future publishment of the results of the research.

If you would like to obtain more information about this study, please contact me by email at or telephone number or my supervisor Dr. Yip Chi Wing by email at

If you have any concerns about the conduct of this research study, please do not hesitate to contact the Human Research Ethics Committee by email at hrec@eduhk.hk or by mail to Research and Development Office, The Education University of Hong Kong.

Thank you for your interest in participating in this study.

Weng Mingyu

Appendix. 9 Consent form for adult participants (Chinese)

香港教育大學
心理學系

參與研究同意書

聲學參數對學生對教師特質感知的影響：一項感知分析

本人同意參加由葉志榮博士負責監督，翁明宇先生負責執行的研究計劃。她／他們是香港教育大學的教員和學生。

本人理解此研究所獲得的資料可用於未來的研究和學術發表。然而本人有權保護本人的隱私，本人的個人資料將不能洩漏。

研究員已將所附資料的有關步驟向本人作了充分的解釋。本人理解可能會出現的風險。本人是自願參與這項研究。

本人理解本人有權在研究過程中提出問題,並在任何時候決定退出研究，更不會因此而對研究工作產生的影響負有任何責任。

簽署: _____

參加者姓名： _____

日期： _____

**請刪去不適用者*

Appendix. 10 Information Sheet for adult participants (Chinese)

有關資料

聲學參數對學生對教師特質感知的影響：一項感知分析

誠邀閣下參加葉志榮博士負責監督，翁明宇先生負責執行的研究計劃。她／他們是香港教育大學的教員和學生。

研究計劃簡介

研究發現，在許多情況下，對演講者美德特質的感知會影響聽者的決定和隨後的行為。然而，目前尚不清楚，在教育場景下，聽著對特質的感知模式將如何變化。本研究試圖找出中學生在判斷教師特質並從聲音判斷其是否為好教師時，聲學參數與感知教師特質之間是否存在與前人研究不同的關係。

一般來說，以往研究特質感知領域的研究主要傾向於選擇成年人作為研究的參與者。關於年齡與特質感知的關係，研究認為不同的年齡可能會影響感知的第一印象和個性。例如，青少年在進入青春期之前對吸引力的看法與成年人不同。因此，基於以上提出的問題，青少年（中學生）和成年人之間在特徵認知上的差異問題也將得到解決。

研究方法

本研究將招募30名12～15歲之間的中學生，以調查早期青少年對教師聲音特徵的感知。除此之外，本研究還將招募30名本科生，與12~15歲參與者的認知進行比較。參加者將通過網上招聘和徵集當地中學參加者招募。

實驗前，參與者將被要求完成語言史問卷，包括年齡、性別、語言能力。在實驗過程中，語音將通過連接到計算機的耳機播放。實驗中將使用二選一強制選擇（2AFC）方法。一開始，實驗說明會先顯示在屏幕上。在每次試驗中，參與者首先會看到 300 毫秒的注視（fixaiton），緊接著實需要評估的特徵的問題（500 毫秒）。之後，參與者將聽到兩個聲音（每個大約 500 毫秒），期間暫停 100 毫秒，然後參與者將選擇更符合目標特徵的聲音。計算機將使用 PsychoPy 記錄反應時間。刺激物將按關於性別和參數操作類型的隨機順序播放。參與者按下計算機鍵表明偏好後，將開始另一次試驗。每個參與者總共將有 150 次試驗。參與者將清楚地知道被評判的演講者是中學教師的背景。總共會有三個需要判斷的特徵：支配性，可信度和作為教師的個性。每個單項

實驗的總持續時間預計為 15 到 20 分鐘。研究地點預計將在香港教育大學的心理學實驗室或以在線形式（Pavlovia）進行。是次研究並不為閣下提供個人利益，但所搜集數據將對研究學習動機的問題提供寶貴的資料。

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閣下參與該項目是自願的。 閣下有權隨時退出研究而不會產生負面影響。與閣下有關的所有信息都將保密，並且通過只有研究人員知道的代碼進行識別。

描述將如何發佈研究結果

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如閣下對這項研究的操守有任何意見，可隨時與香港教育大學人類實驗對象操守委員會聯絡(電郵：hrec@eduhk.hk; 地址：香港教育大學研究與發展事務處)。

謝謝閣下有興趣參與這項研究。

翁明宇

Appendix. 11 List of all possible pairing of stimulus

Number	Match	Number	Match
1	H1H2H3&M1H2H3	28	L1H2M3&L1M2M3
2	H1H2H3&H1M2H3	29	L1H2M3&L1H2L3
3	H1H2H3&H1H2M3	30	H1M2M3&M1M2M3
4	M1H2H3&L1H2H3	31	H1M2M3&H1L2M3
5	M1H2H3&M1M2H3	32	H1M2M3&H1M2L3
6	M1H2H3&M1H2M3	33	M1M2M3&L1M2M3
7	L1H2H3&L1M2H3	34	M1M2M3&M1L2M3
8	L1H2H3&L1H2M3	35	M1M2M3&M1M2L3
9	H1M2H3&M1M2H3	36	L1M2M3&L1L2M3
10	H1M2H3&H1L2H3	37	L1M2M3&L1M2L3
11	H1M2H3&H1M2M3	38	H1L2M3&M1L2M3
12	M1M2H3&L1M2H3	39	H1L2M3&H1L2L3
13	M1M2H3&M1L2H3	40	M1L2M3&L1L2M3
14	M1M2H3&M1M2M3	41	M1L2M3&M1L2L3
15	L1M2H3&L1L2H3	42	L1L2M3&L1L2L3
16	L1M2H3&L1M2M3	43	H1H2L3&M1H2L3
17	H1L2H3&M1L2H3	44	H1H2L3&H1M2L3
18	H1L2H3&H1L2M3	45	M1H2L3&L1H2L3
19	M1L2H3&L1L2H3	46	M1H2L3&M1M2L3
20	M1L2H3&M1L2M3	47	L1H2L3&L1M2L3
21	L1L2H3&L1L2M3	48	H1M2L3&M1M2L3
22	H1H2M3&M1H2M3	49	H1M2L3&H1L2L3
23	H1H2M3&H1M2M3	50	M1M2L3&L1M2L3
24	H1H2M3&H1H2L3	51	M1M2L3&M1L2L3
25	M1H2M3&L1H2M3	52	L1M2L3&L1L2L3
26	M1H2M3&M1M2M3	53	H1L2L3&M1L2L3
27	M1H2M3&M1H2L3	54	M1L2L3&L1L2L3

Note. H, M & L refers to whether the parameter is at high, medium of low conditions, whereas 1, 2 & 3 refers to fundamental frequency, pitch range and formant dispersion correspondingly. For example, M1 means medium level fundamental frequency