“The prevalence of tongue-tension amongst Chinese adolescent students singing belt”

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1. Introduction (410 words)

While teaching belt, a voice quality inherent in musical theatre (Roll, 2016), to aspiring adolescent Musical Theatre students in China, it became clear that many of these students have trouble with mastering this specific vocal style. The sound quality of these students seems to lack brightness, a distinctive characteristic of belt (Bourne and Kenny, 2016). While looking for explanations, it became clear that many of these students suffer from tongue tension and the phenomenon of a retracted, curled up tongue while belting, whereas a high tongue position - a lifted dorsum, with the sides of the tongue at the level of the upper molars - is preferred (Steinhauer et al., 2017).

The amount of literature on this topic seems very limited, but possible explanations and solutions could make a great difference for these students. The research question for this study is therefore: why is tongue tension (or more specific: a curled up tongue) in belting so prevalent amongst Chinese adolescent Musical Theatre students, and what could be effective strategies to reduce tongue tension in these students?

The first part of the research question - why is tongue tension (or more specific: a curled up tongue) in belting so prevalent amongst Chinese adolescent Musical Theatre students - will be analysed through a literature review. To answer this question, the first step is to get a brief overview of the anatomy of the tongue, before looking at desired tongue positions in belt. As a possible explanation for the prevalence of tongue tension in belting in Chinese adolescent Musical Theatre students, some fundamental principles of Mandarin language acquirement will be examined in the literature review section.

The second part of this research project will focus on strategies to reduce tongue tension. The effectiveness of a series of exercises will be tested using a mixed-methods approach, looking at both the acoustic evidence as well as the students' perceived effectiveness. Spectrographs measuring the acoustic parameters of the voice (Nair, 2021) will be used to collect quantitative visual data, whereas observations of tongue positions and other physical factors will be used as qualitative data. Because the effectiveness of strategies is also dependent on how it is perceived by the students, semi-structured interviews will be held to take into account the student experience.

The outcomes of this research project can be helpful for vocal teachers, especially those working with aspiring Chinese Musical Theatre artists, to apply effective strategies to reduce tongue tension and to help those students to become stronger belters.

2. Literature Review (1142 words)

The tongue and its positioning plays an important, though often overlooked, part in voice production (Nair, 2021). As discussed in the introduction, it can be assumed that the lack of brightness in belting in Chinese voice students can be explained by tongue tension and the curled-up position of the tongue.

This section will give a brief anatomical introduction to the tongue. The next step is to look at desired tongue positions for belting. To answer the question of why tongue tension and a curled up tongue in belting is noticeably prevalent amongst Chinese adolescent Musical Theatre students, a connection will be made with tongue positions in Mandarin Chinese in the final paragraph.

2.1 The Tongue

The tongue (figure 1) consists of several layers of muscle fibres running in various directions. The complicated interplay between intrinsic muscles and extrinsic muscles makes it possible to form the sounds of speech (Dimon, 2018).

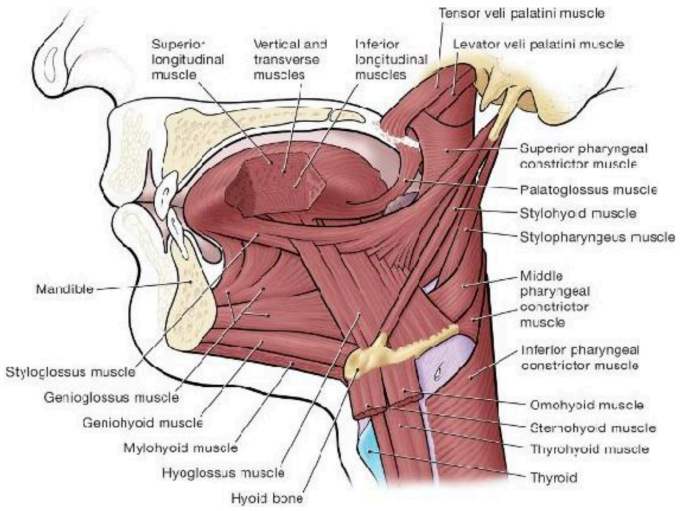


Figure 1: The muscularity of the tongue (Dimon, 2018)

The *intrinsic muscles* have no attachments to the bones and function as a muscular hydrostat (Sanders et al, 2013). This means that if a part of the tongue moves, it results in the reshaping of the whole tongue, because the volume of the tongue stays constant. These muscles play a crucial part in the formation of consonants (Nair, 2021).

The *extrinsic muscles* have attachments to the mandible (genioglossus), the styloid process (styloglossus) and hyoid bone (hyoglossus) while the other end inserts within the tongue (Sanders et al, 2013). These extrinsic muscles are responsible for alterations of the tongue position through

vertical and horizontal movements, as well as tongue surface shapes, which help in the shaping of vowel sounds (Nair, 2021).

2.2 Tongue positioning in Belt.

Belting is typically described as a singing (voice) quality, produced by specialised manipulation of the larynx and vocal tract (Miles and Hollien, 1990). Although an unambiguous definition of belting is lacking, it will be defined here as *a bright quality, with a high intensity, requiring high subglottal pressure, a higher larynx and a longer closed phase of the glottis*.

The preferred tongue positioning in belting is a high tongue position (Klimek at al., 2005; Bourne & Kenny, 2016). Doscher (1990; in Miles & Hollien, 1990, p. 68) describes the vocal tract in relation to belting as “a high laryngeal position, a high tongue base and minimal pharyngeal space”. Purdy (2016) states that the brightness occurs in part because of vocal tract positioning, with a raised larynx, and an arched, elevated tongue position. These findings are also supported by LoVetri, Lesh and Woo (1999) where the bright vowels were predominantly made with a high posterior tongue, in combination with adjustments in the palate and oral pharynx.

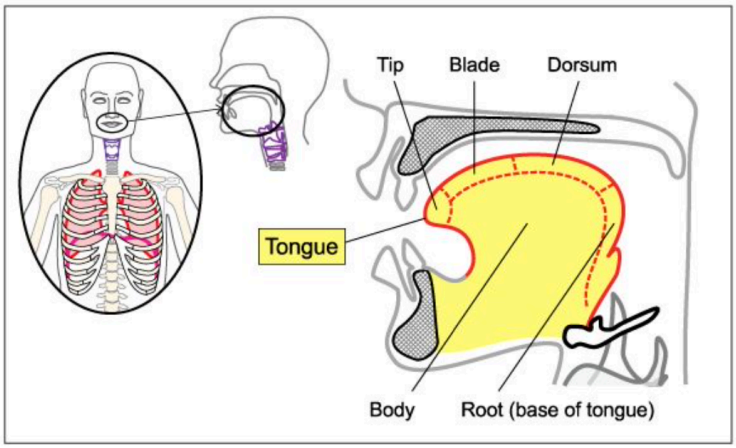


Figure 2: Lateral view of the tongue (Steinhauer et al., 2017)

The Estill Voice Model gives a clear description of the physiology of the high tongue (Steinhauer et al., 2017, p.200): with a high tongue position, the dorsum (Figure 2) of the tongue is raised by the palatoglossus and styloglossus (See Figure 1). When the dorsum is raised, the root of the tongue is lifted and the back surface of the tongue is stretched up and shifted forward, opening space in the throat. The sides of the tongue are at the level of the upper molars, while the tip of the tongue rests behind the bottom teeth, to move freely for consonant production.

2.3 Tongue Positioning in English versus Mandarin Chinese.

Many voice teachers have noticed issues with tongue tension in Mandarin Chinese speakers, either raising the back of the tongue or pressing down the back of the tongue to create more space

to curl up the tip in a post-alveolar position (Zhao, 2019). When talking to Chinese Musical Theatre colleagues - all with a degree in Musical Theatre from a Chinese university - 4 out of the 6 teachers respond that they have learned to press down the back of the tongue in belting, to create more space. This is a noticeable contrast with the voice science principles of the high tongue in belting, discussed in the previous paragraph.

These differences can be explained by native speaking tongue positions and the placement of vowels in Mandarin Chinese (Li, 2018). There are many differences in language acquirement in Mandarin Chinese compared to Western languages, that go beyond the scope of this study. A short overview of the for this research important differences are discussed here:

A. Chinese characters are not primarily phonetic, but pictorial. Pinyin is used to transcribe the Chinese characters into Latin alphabets, but only represents the sounds of Mandarin Chinese characters (Odinye, 2015). Chinese is a monosyllabic language, where each word is a syllable composed of an initial (consonant), belly (main vowel) and final (either a vowel or a consonant). Every syllable is further divided into one or more phonemes, but not more than four (Choi, 2018).

B. Mandarin Chinese has six single vowels: a [ɑ:], o [o:], e [ə:], i [i:], u [u:] and ü [y:], and there are no open versions of vowels in Mandarin Chinese (Zhao, 2019). In addition [w], [j], and [ɥ] are considered vowels rather than consonants in Mandarin (Li, 2018).

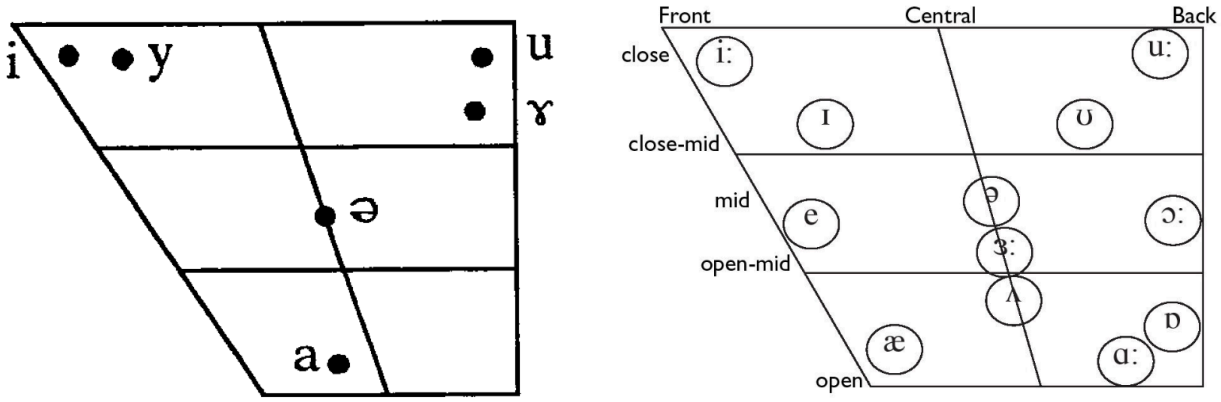


Figure 3: Vowel Chart of Mandarin Chinese on the left side (Lee & Zee, 2003) and IPA Vowel Chart on the right side (Kayes, 2013)

Some Mandarin Chinese singers have problems when singing open vowels, because all the vowels in Mandarin Chinese are supposed to be closed (Zhao, 2019). English vowels are produced through distinct positions of the tongue and use of the articulators that do not correspond to Mandarin (Li, 2018). In a study amongst 300 voice teachers, it is concluded that native Chinese students have the most trouble in pronouncing the vowels /æ/, /ɛ/, /ɪ/, /a/ and /e/ (Lim, 2013).

C. Sounds in Mandarin that are not used in Western languages include (Chu & Petrus, 2021, in: Greschner, 2021; Wang, 2016):
   - Retroflex consonants: consonants that are articulated at the alveolar area by curling the tongue (zh, ch, sh, r).
   - Apical vowels: the tongue remains in the position of the preceding consonant (blade-alveolar and blade-palatal), but without the frication (Sin-wai, 2016). For example, when [i] or [e] is followed by [z], [c], or [s], the sound is produced by raising the tip of the tongue (Lim, 2013).

It can be concluded that differences in tongue position in the pronunciation of Mandarin Chinese versus English can explain the prevalence of tongue tension amongst Chinese singers. Chinese singers seem to have trouble in the pronunciation of certain vowels (Lim, 2013) - [æ], [ɛ], [a] and [e] - that are considered as “belty” vowels (Titze, 2016). The phenomenon of the curled up tongue in belting in Chinese students can not directly be explained from previous research. There is a possibility that the apical vowels - where the tongue stays in the position of the previous consonant - play a part in this, in combination with the retroflex consonants.

3. Methodology (1249 words)

The goal of this study is to examine tongue tension in belting amongst Chinese musical theatre students, by measuring the effectiveness of certain exercises related to reducing tongue tension and finding an optimal tongue position in belt. The effectiveness of the exercises will be measured using both quantitative (spectrographs) and qualitative (observations and semi-structured interview) methods. The design for this study is therefore a convergent mixed methods design, which gathers quantitative and qualitative data separately and the results are compared to see if they (dis)confirm each other (Creswell & Creswell, 2018). Since a practice-based problem lies at the core of this research project, the pragmatic paradigm will be used as the underlying paradigm for this research (Winter, 2020).

3.1 Methods

In the next paragraph, the choice for each of the methods will be elaborated.

3.1.1 Quantitative Research (Spectrographs)

Estill Voice Print Plus (2019, Version 7.2) will be used to record the spectrographs. Spectrographs measure the acoustic parameters of the voice (Koenig, Dunn, & Lacy, 1946). Looking at figure 4, the horizontal x-axis indicates the time. The vertical y-axis represents the frequency (harmonics), while the loudness is represented by the brightness of the color.

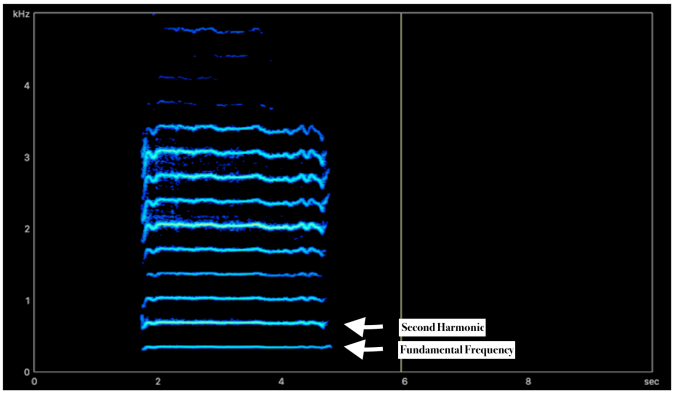


Figure 4: Spectrogram recording (Estill Voiceprint Plus) of the vowel /i/ (November 15, 2022)

Belt quality can be achieved by strengthening the frequency of the second harmonic relative to the fundamental frequency (Titze, 2016). It employs a formant tuning strategy which brings the first formant more towards the second harmonic. This leads to a weaker fundamental frequency compared to classical voice production (Bourne & Garnier, 2012).

Hypothesis 1: The vowels /i/ and /a/ will be easier to belt for Chinese students than /ɛ/ and /e/.

Titze (2018) explains why certain vowels are more suitable for belt using a vowel chart that shows the relationship between first and second formant frequency (Figure 5), where the shaded area shows the vowels that are perceived as being “belty”. However, as can be seen in paragraph 2.3 the vowels /ɛ/ and /e/ don’t exist in Mandarin Chinese, and might therefore result in more tongue tension.

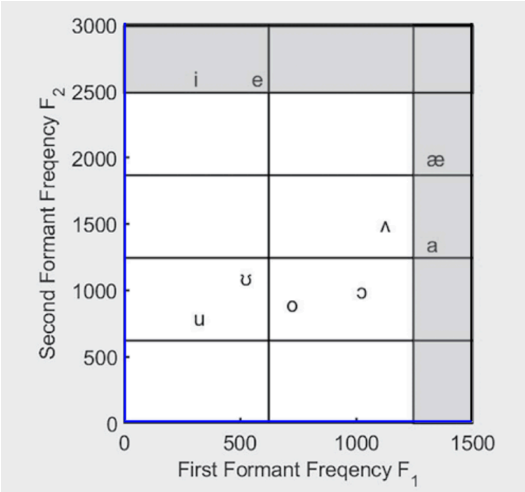


Figure 5: Acoustic Phonetic Vowel Chart (Titze, 2016).

Hypothesis 2: Effective exercises for the correct tongue-placement in belting (high tongue) will show a change in the second formant.

Changes in tongue position alter the shape of the oral cavity, which in turn alters the frequency of resonation (Davids & LaTour, 2021). Steinhauer et al. (2017) give a clear picture of the influence of tongue positions in the first and second formant (Figure 6).

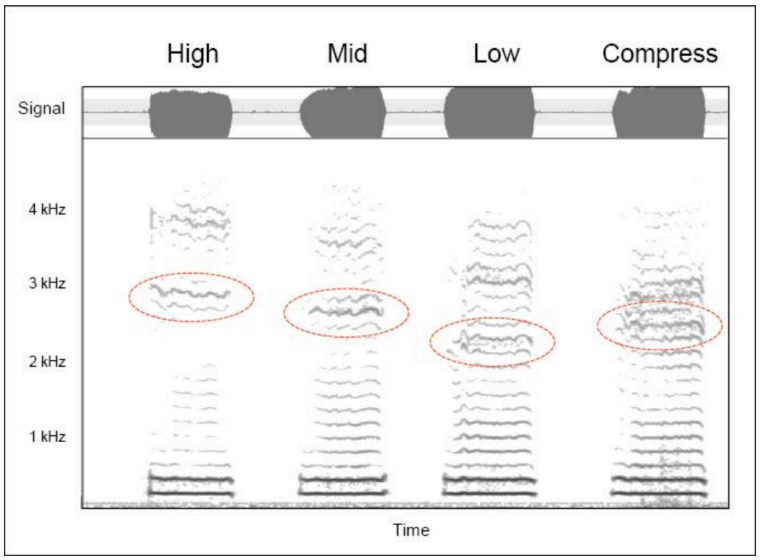


Figure 6: Spectrogram of the vowel /i/ in the four tongue positions of the Estill Voice Model (Steinhauer et al., 2017)

Spectrographs will be used to measure the changes in the first and second formant before and after the intervention, since the first two formants are the most responsive to changes in vocal tract shape (Bozeman, 2013).

3.1.2 Qualitative Research (Observations and Semi-Structured interview

While spectrographs will be used to gather objective quantitative data, observations and semi-structured interviews will be used to collect data to take the experiences and perceptions of the participants into account.

A. *Observations* have been used as the primary source to select participants for this study (see paragraph 3.2). But aural and visual observations are also used during the research to observe physical changes in the participants during the work on vocal exercises that might impact the final results of the research. For example, changes in mouth shape during the intervention exercises might impact the visual data from the spectrographs, without any changes in tongue position happening. Each singer will be observed for 2 sessions: one 90-minute recording session for this research purpose and one regular 1 hour class session. During each session, field notes are taken including written descriptions of what was observed as well as audio-visual materials (Given, 2008).

B. A face-to-face *semi-structured interview* will be used to gather data about the participants 'perspectives and experiences (Flick, 2022). The questions consist of predetermined, but open ended questions (Given, 2008). Since kinaesthetic feedback is not always accurate (McCoy, 2012), the goal of the semi-structured interviews is to see if the students perception of the effectiveness of the exercises translates into the acoustical data from the spectrographs.

3.2 Participant Selection

In the period from September 2022 to October 2022 class observations were used to select suitable participants. Based on the field notes, six participants were selected. Each of the participants represent one of the following categories:

Category A: Students with prevalent tongue tension and the prevalence of a curled up tongue in belting.

Category B: Students that used to have a curled up tongue in belting, but worked with me for several years to reduce the amount of tongue tension. Sometimes they fall back into their old habits.

Category C: Students with prevalent tongue tension in the back of the tongue, but no curled up tongue prevalent.

Two of the six students dropped out before the start of the research, due to reasons outside the research project itself (I.e. lockdown and time commitment). The remaining participants can be categorised as follows (Figure 7).

P1	Chinese (Both parents Chinese)	Chinese	17yo	MT Class for 4 years	Experienced	Category B
P2	Chinese/American (Chinese mom, American dad)	Bilingual	15yo	MT Class for 2 years plus PV	Experienced	Category C
P3	Chinese/American (Chinese mom, American dad)	Bilingual	13yo	MT Class for 6 years plus PV	Natural Belter	Category B
P4	Chinese (Both parents Chinese)	Chinese	14yo	MT Class for 2 years	Just started belting	Category A

Figure 7: Overview of the participants

All participants and their parents signed the informed consent and ethics form prior to the research[1].

3.3 Procedure

All participants started with same 10 minute vocal warming up prior to the recording session. They were instructed to take regular water breaks during the recording session to keep their voices hydrated.

Part 1

Participants were first asked to sing the vowels /i/, /e/, /a/, /ɛ/[2] in belt quality with necessary loudness, on a pitch that they perceived as comfortable.

Part 2

Participants were then asked to sing the following phrase in belt quality in the range G4-D5 in different rounds with 30 seconds rest in between the tasks (Figure 8 and 9).



Figure 8: Vowel Exercise Belt

[1] Appendix C

[2] Appendix D

Round 1	Participants performed the tasks with no other instructions or interventions. After all participants finished, the participants answered the semi-structured questions.
Round 2	Participants were asked to perform the same tasks, while adding a /j/ in front of the vowel. After all participants finished, the participants answered the semi-structured questions.
Round 3	Participants were asked to perform the same tasks, while sticking out the tongue. After all participants finished, the participants answered the semi-structured questions.
Round 4	Participants were asked to perform the same tasks, while holding a straw under the tongue. After all participants finished, the participants answered the semi-structured questions.
Round 5	Participants were asked to perform the same tasks, while receiving clear instructions about the required tongue position (high tongue). After all participants finished, the participants answered the semi-structured questions. The participants also got the chance to add any feedback they didn't share earlier.

Figure 9: Participant tasks with and without interventions

The chosen range (G4-D5) for the exercises corresponds with the traditional female belt range (Roll, 2016; Bourne & Garnier, 2012) The vowels were chosen because they are perceived as suitable vowels for belting (Titze, 2016).

3.4 Ethics and Other Considerations

As mentioned, all participants and their parents signed the consent form prior to the research, to protect the participants from any harm, the right of autonomy and informed consent and to guarantee their privacy and confidentiality (Appendix C; Hammersley & Traianou, 2012).

An ethical consideration for this study can be that of insider research. Although being an insider researcher can limit the credibility of the research (Unluer, 2012), the use of mixed-methods in this study can be seen as cross-validation, or triangulation (Sale et al, 2002). Being an insider researcher can also be beneficial. Bonner and Tolhurst (2002) mention several benefits of insider research - the researcher has a good understanding of the group's culture, has the ability to interact in a natural way and has built an intimacy with the group (Bonner and Tolhurst, 2002). Working with this group of participants for multiple years made sure that a safe space was provided during the study, where they would feel no shame to work on belting within a group environment. Participants are familiar with the language of instructions for performing the tasks - for example the level of loudness that is expected for belting.

Since the research specifically aims at Chinese adolescent participants, stigmatising of this group might be a risk. The goal of this study is to find exercises that work in reducing tongue tension, and to facilitate a positive learning experience for my students. There is no noticeable difference between regular class exercises and the exercises during the study, which reduces the risk of students feeling stigmatised by their origin.

4. Results (2914 words)

In this paragraph the findings of this study are presented, combining both the quantitative research (spectrographic analysis) and the qualitative research (observations and interviews).

4.1 Hypothesis 1: The vowels /i/ and /a/ will be easier to belt for Chinese students than /ɛ/ and /e/.

The participants were asked to sing the vowels /i/, /e/, /a/, /ɛ/ in belt quality - with brightness, loudness/intensity and a (slightly) raised larynx - on a pitch that they perceived as comfortable. The expectations are that the vowel /i/ and /a/ will be the easiest to belt for Chinese students, and the vowel /ɛ/ will be the hardest vowel to belt for this group of participants.

4.1.1 /i/ Vowel

The /i/ vowel is apparent in both Pinyin (phonetic Mandarin Chinese) and Western languages and it can therefore be assumed that the /i/ vowel will be relatively easy to belt out for Chinese students.

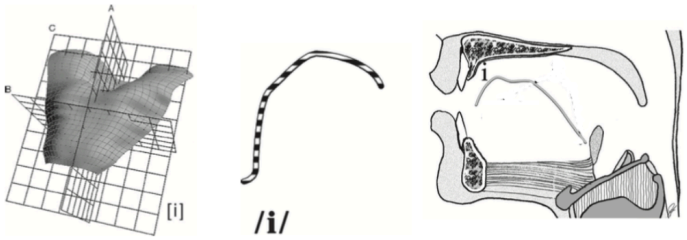


Figure 10: Tongue positioning of the vowel /i/ in a speech configuration (Nair, 2021)

With a raised dorsum and inherent forward placement of the tongue (Nair, 2021; Figure 10), the /i/ vowel has furthermore an ideal tongue positioning for belting. During the observations of this exercise[3], all participants showed a raised tongue dorsum and a dominantly horizontal mouth shape (Figure 11). There were no other remarkable physical observations that might impact the results.

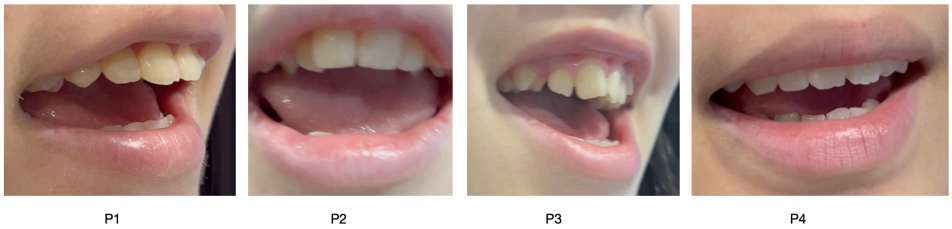


Figure 11: Mouth and tongue positions on the vowel /i/

[3] Appendix E

Acoustically, the first formant of the vowel /i/ is the lowest compared to other vowels, with a high second formant, which is responsible for the clarity of the vowel (Bozeman, 2013).

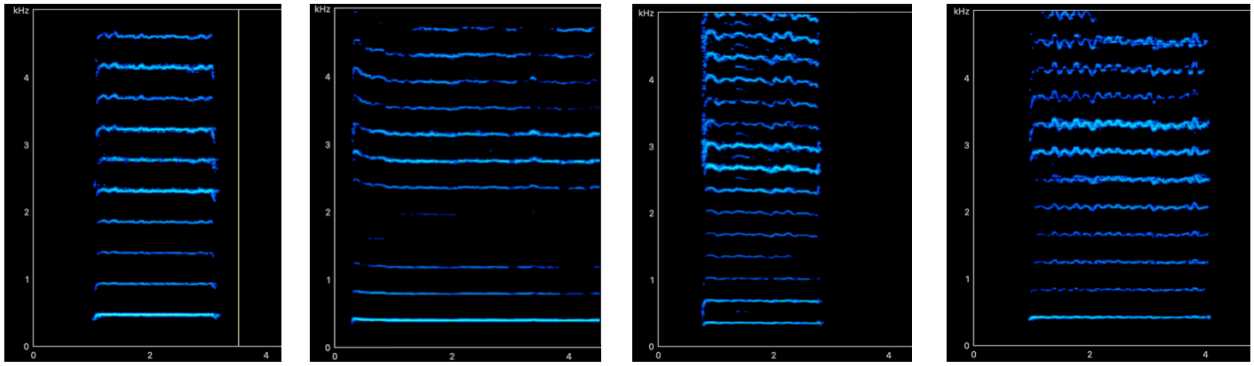


Figure 12: Spectrograph of the /i/ vowel from participant 1 to 4.

Bestebreurtje and Schutte (2000) observed that in the /i/ vowel in belt compared to speech, there is no modification of the second formant, but a slight modification in the first formant, which seems to become detuned from the first harmonic. Looking at the spectrographic data (Figure 12), this is the case with participant 3, showing a weaker fundamental frequency, but a strengthened second harmonic (Titze, 2016, Bozeman, 2013, Bourne & Garnier, 2012).

Flynn at al. (2018) suggest that there are multiple resonance strategies used by singers to produce belt quality. The other participants (P1, P2, P4) show a second strategy (Ballantyne, 2021), where they are improving the second resonance of the vocal tract. This seems to be more in line with the speech pattern for the /i/ vowel (Bestebreurtje & Schutte, 2000). For participant 1, in addition, a high energy peak above 4000 Hz can be seen. The second formant seems to give a boost to the fourth formant as observed by Titze (2018).

There is a noticeable dip in the spectrogram of participant 2 between 1500 and 2000 Hz. However both the observations as well as the feedback from the participant do not seem to give an explanation for this.

4.1.2 /e/ vowel

The /e/ vowel in Mandarin Chinese is pronounced as /ɤ/, and might therefore be more difficult to sing for Chinese students (Choi, 2018).

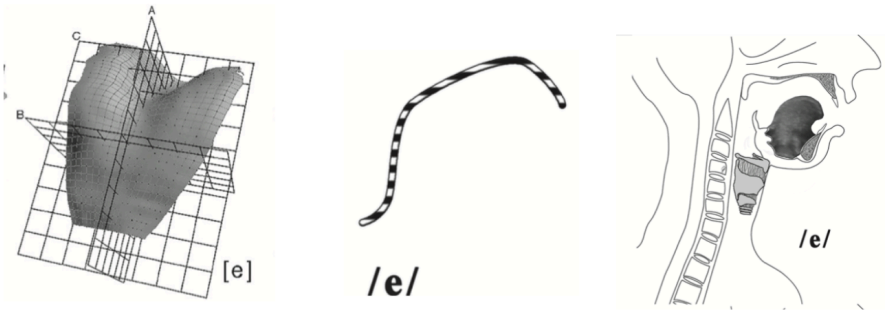


Figure 13: Tongue positioning of the vowel /e/ in a speech configuration (Nair, 2021)

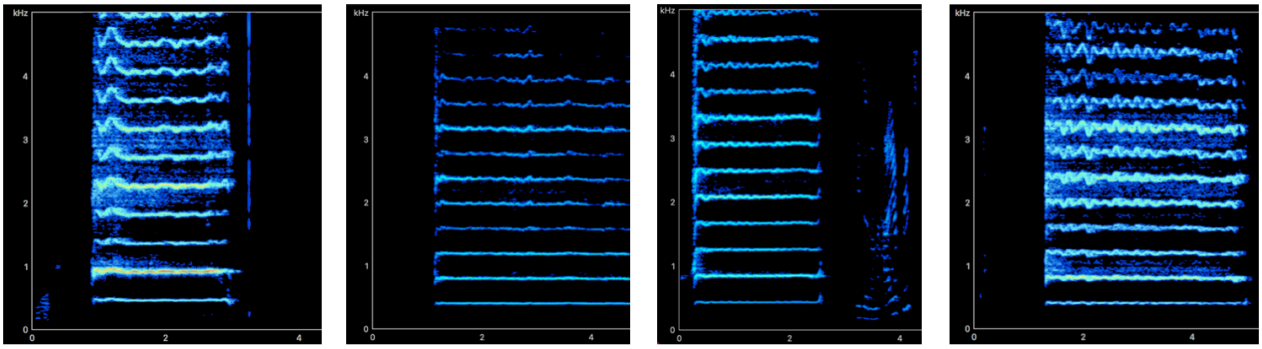


Figure 14: /e/ vowel.

Looking at the spectrographic data (Figure 14), all the participants seem to use the first formant/ second harmonic strategy, where the second harmonic is strengthened and fundamental frequency is weaker (Titze, 2016, Bozeman, 2013, Bourne & Garnier, 2012). For participant 1 and 4, a change in the background noise might be accountable for the distortion of the picture, since there was no noticeable increase in breathiness of the participants. Participant 2 showed a slight dip in the back of the tongue. This can explain why the second formant is not as strong as in the other participants, due to the change in tongue position and therefore the vocal tract shape.

The /e/ vowel is a favourable vowel amongst researchers and musical theatre singers alike, since it needs less modification than some other vowels (Echternach et al., 2014). Although the /e/ vowel is not apparent in Chinese, the participants seem to have no significant problems with the production of this vowel in belt quality.

4.1.3 /a/ vowel

While the /a/ vowel is an open-back vowel in the English language, it is an open-front vowel in Mandarin Chinese (Lee & Zee, 2003). Although the bright /a/ in Mandarin Chinese only exists in vowel combinations (Zhao, 2019), the mouth shape in the word ài (哎) has a strong megaphone

shape, with a forwarded tongue position, that can help raise the first formant as high as possible (Titze et al., 2011). When comparing the /a/ vowel in belt and speech there seem to be no changes in the position of the first and second formant. It therefore seems a suitable vowel for belting, since it doesn't require tuning of the formants (Bestebreurtje & Schutte, 2000; Echternach et al., 2014, Titze et al, 2011). In Figure 15, it can be seen that the /a/ vowel in English has a relatively high first formant and a relatively low second formant (Howell, 2016).

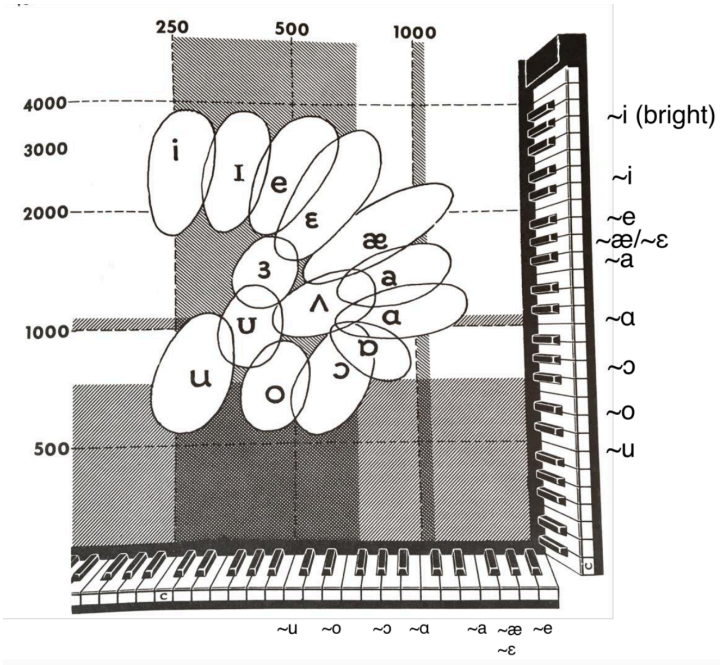
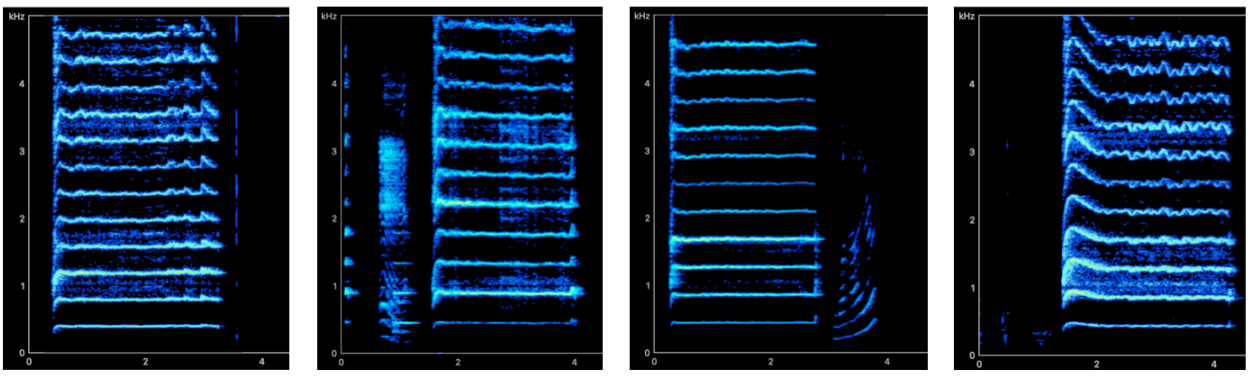


Figure 15: Frequencies for the first (horizontal axis) and second (vertical axis) formants in English (Howell, 2016).

Again we can see that all the participants use the first formant/second harmonic strategy to produce this vowel in belt quality (Figure 16). We also see the relatively high first formant and the relatively low second formant. All participants also show an enhancement of energy in the higher formants.



P1 P2 P3 P4

Figure 16: The /a/ vowel.

4.1.4 /ɛ/ vowel

It can be expected that the /ɛ/ vowel will be the hardest vowel to belt out of the four vowels, since Mandarin Chinese speakers seem to have the most trouble with the correct pronunciation and placement of the vowel (Lim, 2013). The participants all agreed that the /ɛ/ vowel was the hardest to produce.

However, when looking at the spectrographic data, the participants seem to perform the task in a manner that can be expected for an effective belt production on this vowel. We can see that all the participants use the first formant/second harmonic strategy to produce this vowel in belt quality (Figure 17). In all participants an alignment of the F2-H5 can be seen as expected in this vowel (Bestebreurtje & Schutte, 2000).

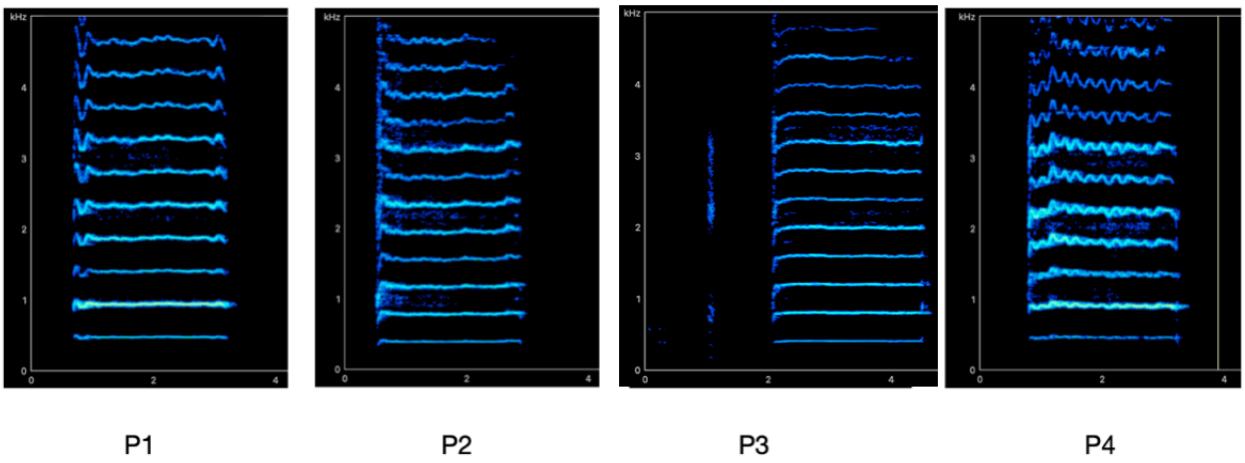


Figure 17: The /ɛ/ vowel.

In the observations, the phenomenon of the curled up tongue was observed in participant 3 during the recording of the exercise (Figure 18). Although the pattern aligns with the F2-H5 pattern, it can be noticed that there is no enhancement in the higher harmonics. Although the loudness was present, the tone colour missed the brassiness and brightness of a typical belt-sound.

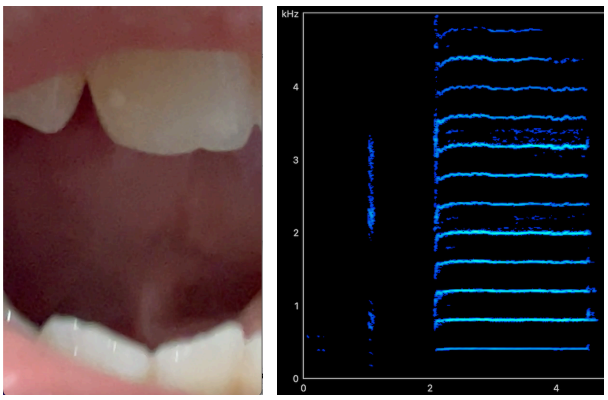


Figure 18: Phenomenon of the curled up tongue.

4.1.5 Conclusion

In conclusion, Hypothesis 1 can partly be confirmed by the findings in this study. The vowels /a/ and /e/ appeared to be the “easiest” to belt for these students. For these two vowels, the participants seemed to favour the first formant/second harmonic resonance strategy. The vowel /ɛ/ appeared to be the hardest vowel, especially from the participants’ point of view. It was also the only vowel where the curled up tongue phenomenon was visible during the recording session.

4.2 Hypothesis 2: Effective exercises for the correct tongue-placement in belting (high tongue) will show a change in the second formant.

Participants were asked to perform the following task in belt quality:

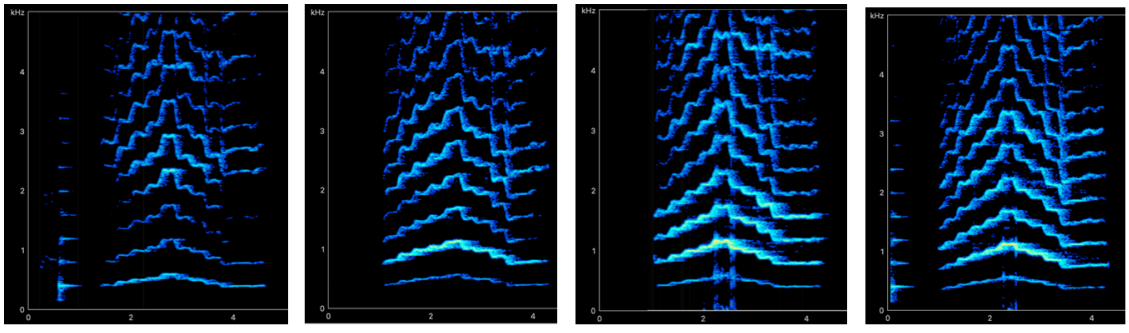


They received the following instructions:
* This study researches belting and tongue positions
* Record some exercises on different vowels
* After every recording, I will ask you some questions. Please answer them honestly.
* You can drink water to keep your voice hydrated and have some rest time in between.

4.2.1 Round 1: No Intervention

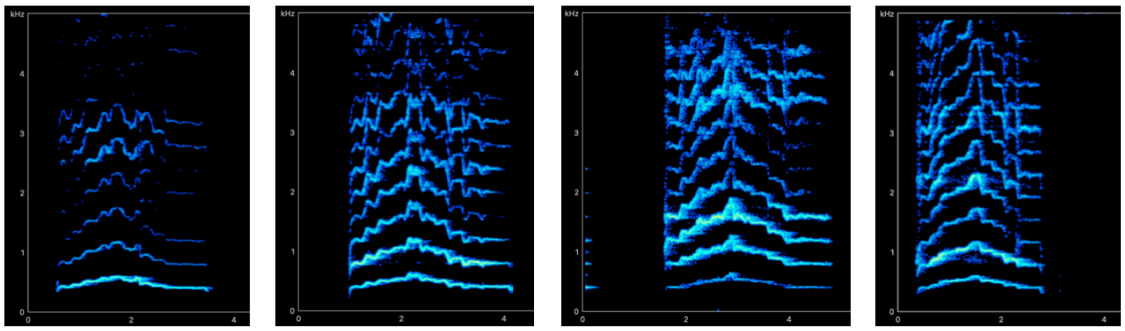
To measure the effectiveness of each exercise, it is important to first look at the spectrographic data without any intervention. For the first task, the participants were therefore asked to sing a phrase in belt quality on the vowels /i/, /e/, /a/ and /ɛ/ from G4 to D5, without any other instructions than the above.

Participant 1



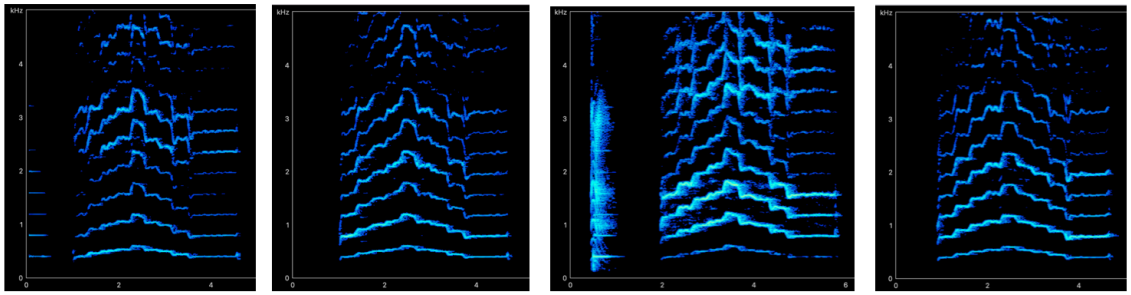
On EE | On AY | On AH | on EH

Participant 2:



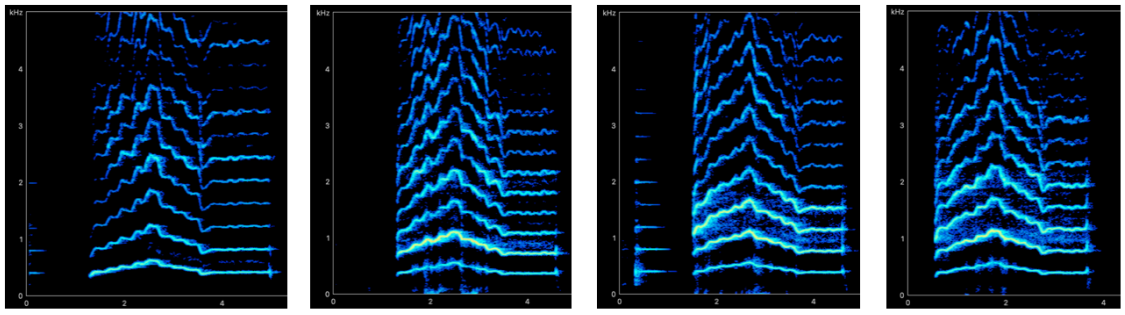
On EE On AY On AH On EH

Participant 3:



On EE On AY On AH On EH

Participant 4:



On EE On AY On AH On EH

If the results from this exercise are compared to the results from hypothesis 1, it is apparent that the participants overall use the first formant/second harmonic strategy. Both the /e/ (AY) and the /a/ (AH) seem to have the best results, which is in agreement with the result from hypothesis 1. The /i/ (EE) seems to have a strong fundamental frequency in all participants, but we see an increase of energy in the second formant.

4.2.2 Intervention 1: Placing a /j/ consonant in front of the vowel[4]

To select the exercises for the interventions, some of my former teachers and respected colleagues were approached and asked for their favourite exercises to work on a correct tongue position (high-forwarded tongue) for belt. This exercise was mentioned by multiple teachers. The idea behind this exercise is that the /j/ consonant will place the tongue in a good starting position for belting (Figure 19). For this task, the participants were thus asked to sing a phrase in belt quality on the consonant-vowel combination /ji/, /je/, /ja/ and /jɛ/ from G4 to D5.

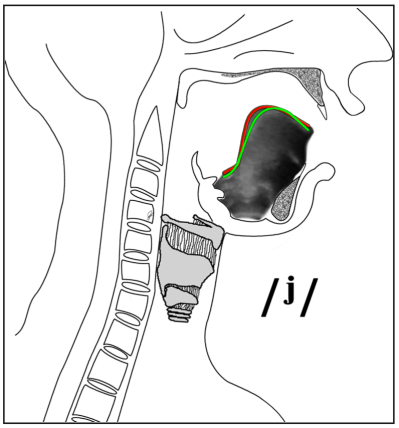


Figure 19: Tongue position on the consonant /j/ (Nair, 2021)

The participants had different opinions about the effectiveness of this exercise. Participant 2 and 3 felt it made it easier to belt out the vowels due to a raised tongue, more widened mouth position and a more forward tongue position. Participant 1 and 4 felt that the exercise made it harder.

As expected in the effective exercises, there are more harmonics in the mid to high frequency, with a higher mid-frequency energy (Titze, 2018). The effectiveness of this exercise for participant 2 was confirmed in the interview, the observations as well as with the spectrographic data. If we compare the spectrographic results of participant 2 with and without intervention, a significant difference in the second formant can be observed (Figure 20). Also the first formant/second harmonic resonance is more apparent after the intervention. Where this resonance strategy was only used in the /a/ and /ɛ/ without intervention, it is visible as resonance strategy in all vowels after the intervention. It did not only strengthen the second formant, but also results in more energy in the higher formants.

[4] Appendix E

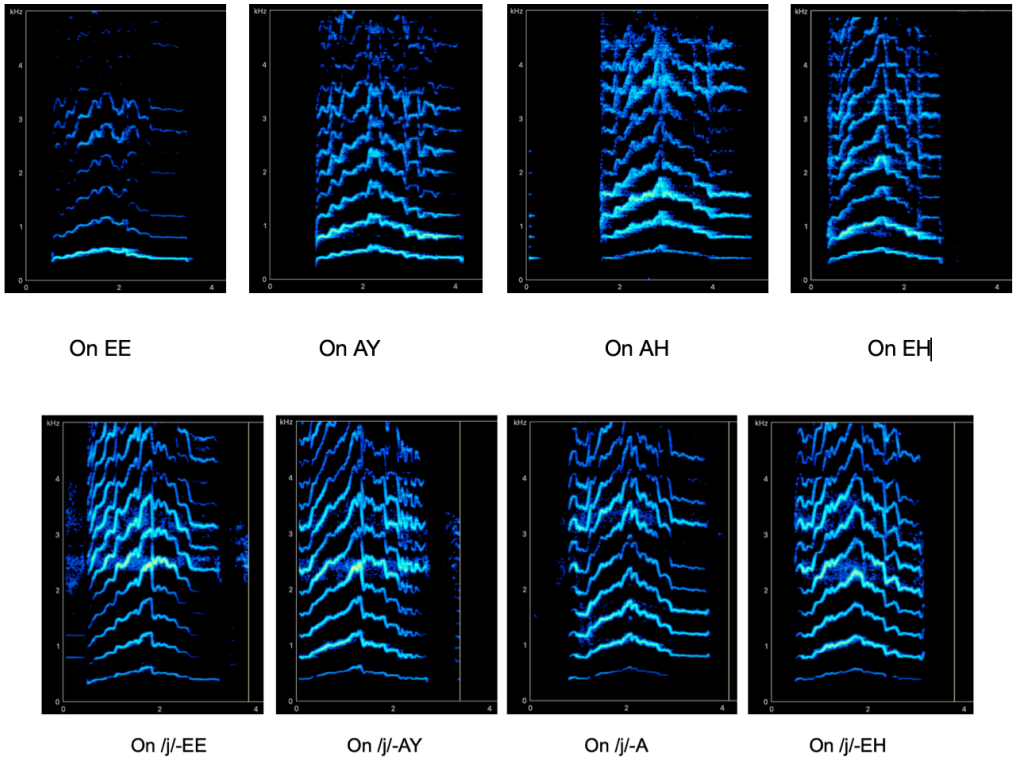


Figure 20: Comparison of spectrograms of Participant 2 without and with intervention.

Participant 1 (Figure 21) showed an improvement in the /i/ and /e/ vowel compared to the base line measurement, but didn't show significant changes in the vowels /a/ and /ɛ/. The participant noted that her tongue dorsum was higher and the tongue more forward with the intervention, but also felt that the higher tongue position made it harder to belt, because it "blocked the airway".

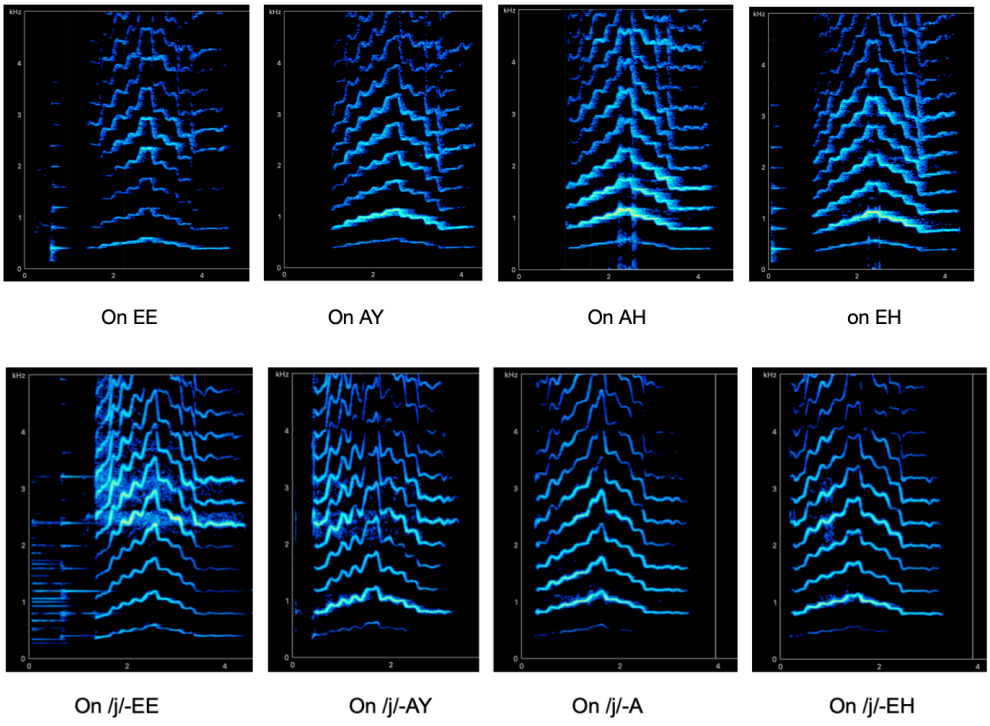


Figure 21: Comparison of spectrograms of Participant 1 without and with intervention

A possible explanation for this sensation is that the /i/ and /e/ vowel have tongue positions closer to the position of the /j/ vowel. Figure 22 shows an MRI scan of the tongue positions in the vowels /i/ and /a/. If these images are compared with the position of the /j/ vowel (figure 19), it is apparent that the /i/ vowel has a closer proximity, which might make it easier to perform the task.

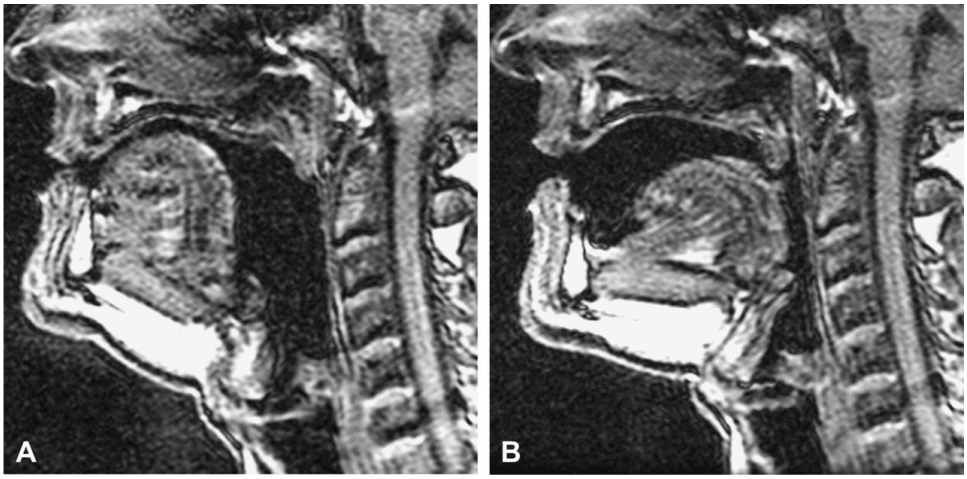


Figure 22: Tongue positions of the Vowel /i/ (left side) and /a/ (right side) (Clement et al., 2007)

4.2.3 Intervention 2: Sticking out the tongue[5]

As Zhao (2019) describes, tongue tension in the back of the tongue is prevalent amongst Mandarin Chinese voice students. The idea behind this exercise is that sticking out the tongue will raise the larynx and reduce tension in the tongue root (Kayes, 2013). The participants can, if preferred, hold the tip of the tongue (with or without a slip of paper) while sticking it out. They will perform the task while belting the vowels /i/, /e/, /a/ and /ɛ/ from G4 to D5.

Participant 2 and 4 noticed that this exercise made it harder for them. This is in line with both the observations and the spectrographic data, except for participant 2's /e/ vowel, that shows a stronger formant tuning.

Participant 1 (Figure 23) shows a stronger second formant on both the /i/ vowel and the /e/ vowel, while the /ɛ/ and /a/ vowel show little difference with and without intervention. It also shows a stronger first formant in the /i/ vowel.

[5] APPENDIX F

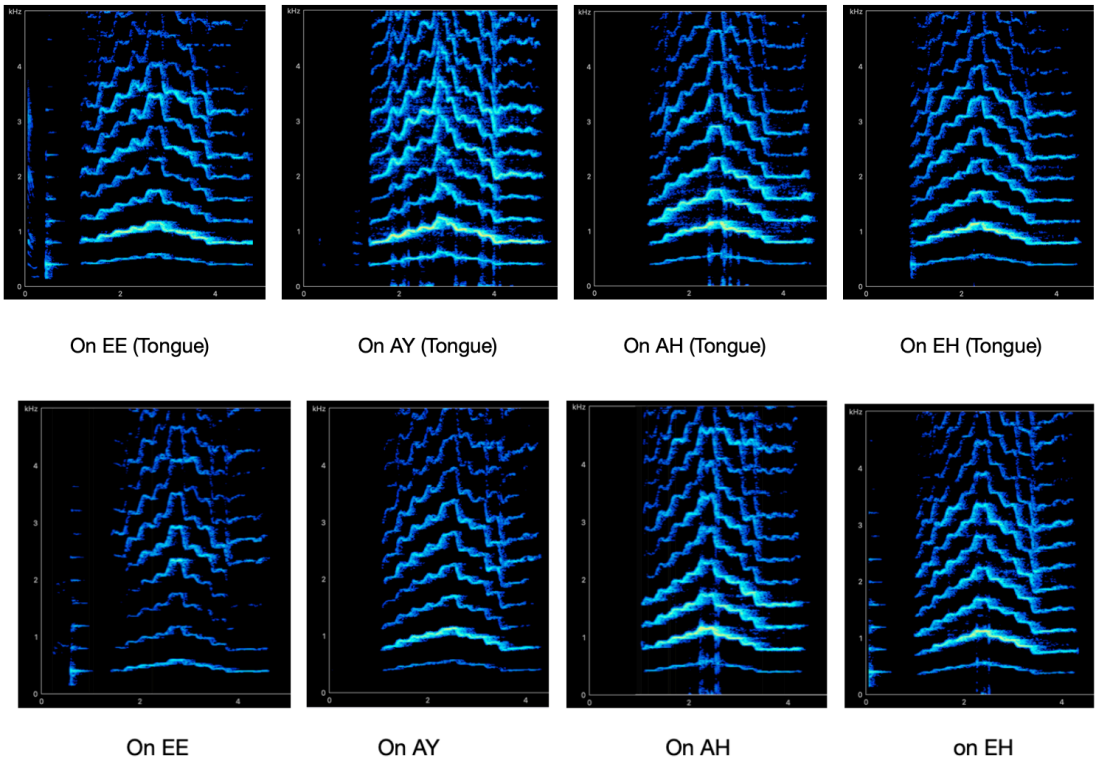


Figure 23: Comparison of spectrograms of Participant 1 with and without intervention

Participant 3 mentioned that “this exercise really helped her to belt out the notes more easily”. This is confirmed in the spectrographic data (Figure 24), except for the /a/ vowel.

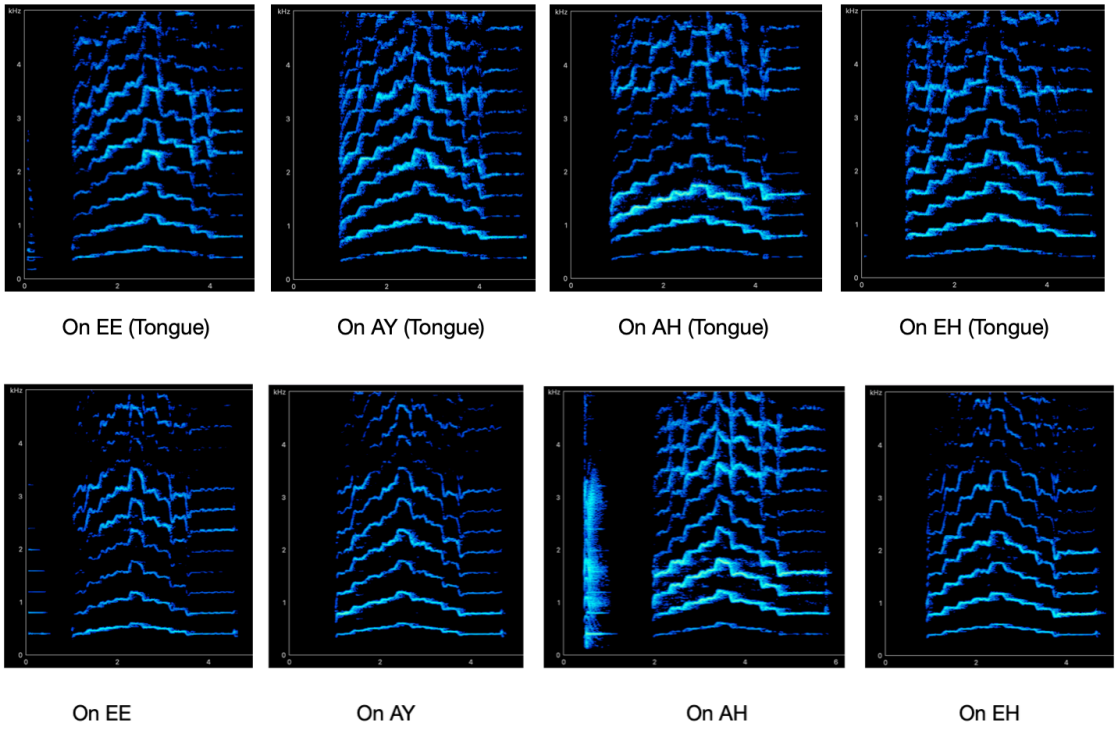


Figure 24: Comparison of spectrograms of Participant 3 with and without intervention

Participant 3 used to suffer a lot from tongue tension in both the root, blade and tip. The sticking out the tongue exercise has helped her in the past to become more aware of the tension in the back of the tongue (pull back) in all voice qualities. The observation shows that the participant sticks out the tongue in combination with a raised tongue dorsum and a more megaphone like mouth shape, which will keep the fundamental and the second harmonic below the first formant (Titze & Worley, 2009).

4.2.3 Intervention 3: Holding A Straw[6]

In this exercise, participants were asked to perform the same tasks (belting the vowels /i/, /e/, /a/ and /ɛ/ from G4 to D5), but this time while holding a straw with a diameter of 5mm under their tongue. The idea behind this exercise is similar to the sticking out the tongue exercise (lifting the root of the tongue), but is asking for more active engagement of the tongue (holding the straw in place).

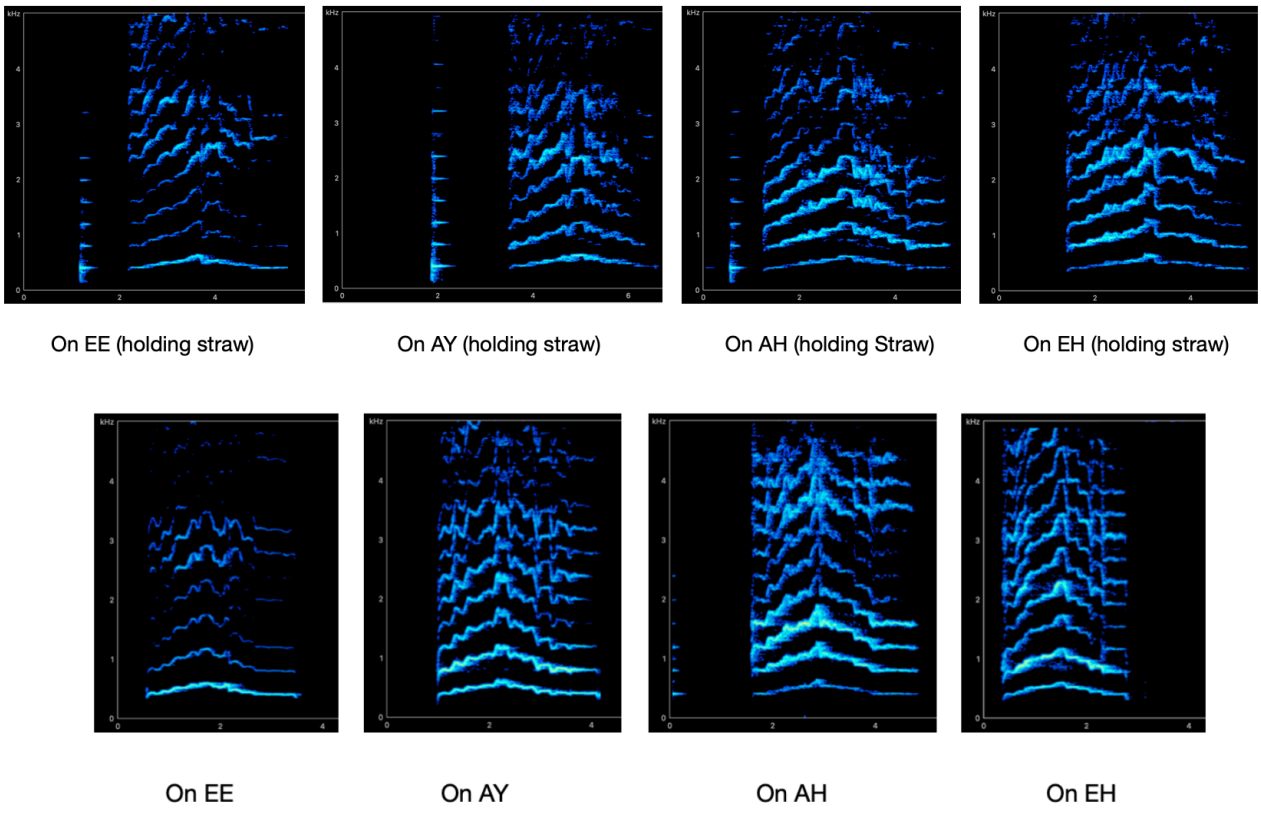


Figure 25: Comparison of spectrograms of Participant 2 with and without intervention

For participant 2 (Figure 25), this intervention was the most problematic, because of the struggle with holding the straw in place. Interesting is that in her own feedback, she mentioned that it made the /i/ and /e/ vowel easier for her.

[6] APPENDIX G

For participant 1 it was the opposite. She found the exercise harder to perform, but from both the observations and spectrographic data, a heightened sharpness was heard and measured in both the /i/, /a/ and /e/ vowel (Figure 26). In the observation, the participants showed a more forward tongue position, which can explain the changes in perceived sharpness.

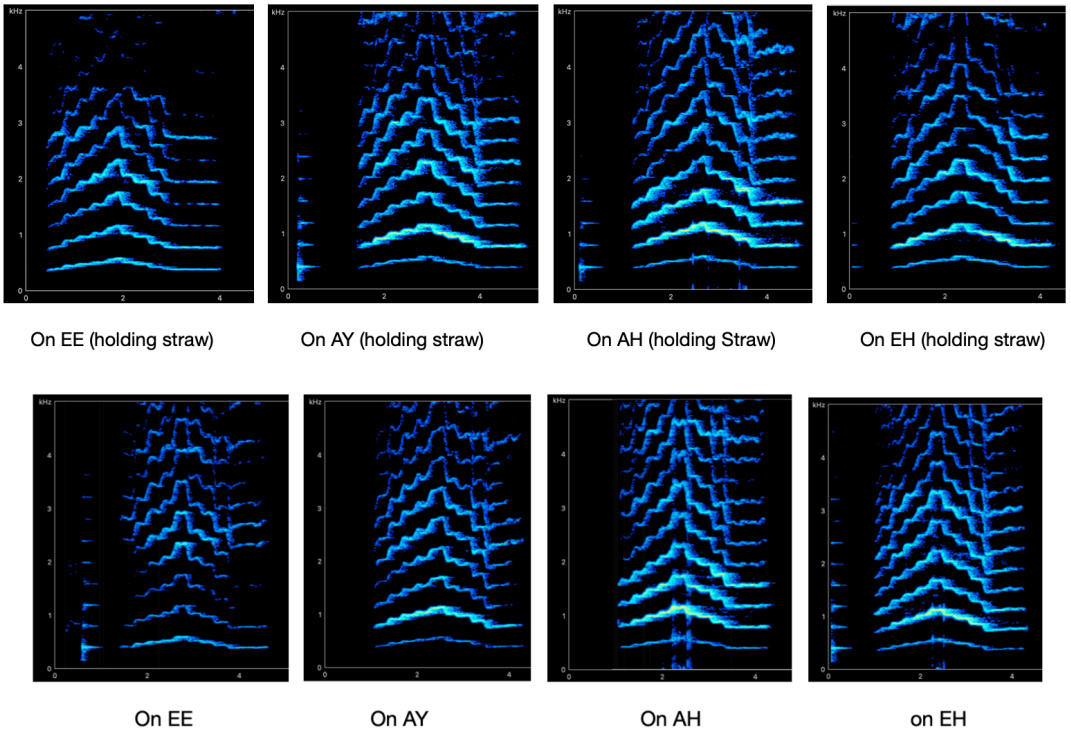


Figure 26: Comparison of spectrograms of Participant 1 with and without intervention

4.2.4 Intervention 4: Explanation about the optimal tongue position[7]

In the final intervention, the participants received a short anatomical explanation about the optimal tongue position in belting, using images and models. They were shown some examples from famous Broadway belters: Ethel Merman, Idina Menzel and Sutton Foster. Then they performed the same exercise as before: belting the vowels /i/, /e/, /a/ and /ɛ/ from G4 to D5.

It is very interesting to see that this exercise was effective for all vowels for all the participants (Figure 27). Participant 1, 2 and 4 experienced the exercise as easier after the intervention, except for the /ɛ/ vowel. Participant 3 found it harder to belt out the notes, because the participant was focused on the tongue position rather than the sound output.

[7] APPENDIX H

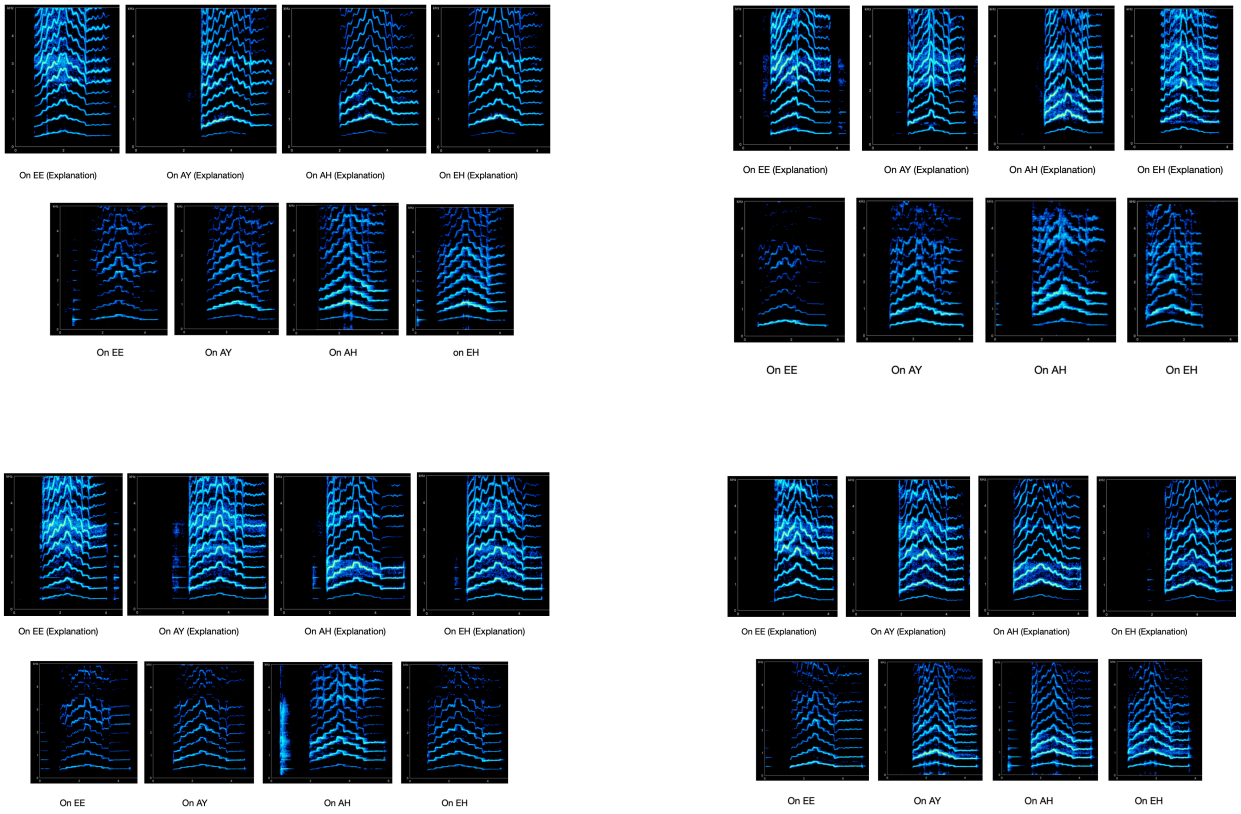


Figure 27: Comparison of spectrograms of all participants with and without intervention - Top left (participant 1), top right (participant 2), bottom left (participant 3), bottom right (participant 4).

4.2.5 Conclusion

It can be concluded that effective exercises indeed show a change in the second formant, usually showing the formant tuning strategy of the first formant/second harmonic. It can also be concluded that the feedback and experience from the participants are not always reflected in the quantitative data: what they are physically doing is not always the same as what they think they are doing.

The final intervention seems to have great improvements for all participants. However, being an insider-researcher can have positively influenced the results of this intervention. While all the other interventions were new for the participants, this final intervention is in line with how they are normally being taught (using a combination of anatomy supported by practical examples).

With an exception of the final intervention, there is no strategy that fits all participants. A combination of voice pedagogy and voice science can help to find the best approach for each individual student to help them improve their belting.

5. Conclusion and Discussion (433 words)

Although the amount of research around the topic of belting has been increasing rapidly, there is still a long way to go to get a thorough understanding of this voice quality. With more Chinese students that aspire a career in Musical Theatre, it is important that factors such as language development and tongue positions in their native language, are being examined to help them live up to their full potential.

This preliminary study examined the prevalence of tongue tension in Chinese adolescent Musical Theatre students in belting. Some earlier studies have looked at difficulties in singing in Western languages for Mandarin Chinese students and this confirmed the prevalence of tongue tension in these singers. However, these studies mainly focused on problems in classical vocal styles and choir repertoire. Some of these problems are also apparent in belting, and in this study the focus was given to belting on the vowels /i/, /e/, /a/ and /ɛ/.

The participants in this research seemed to use different strategies for belting, but pre-dominantly a first formant/second harmonic strategy for all vowels. The vowels /a/ and /e/ were the preferred vowels for belt quality in this research, which doesn't differ from earlier studies with Western participants, while the sustained /ɛ/ vowel was perceived as the most difficult vowel. During the observations of the vowel /ɛ/, the phenomenon of the curled up tongue, that is often prevalent in beginning Chinese musical theatre students, was observed.

Looking at effective exercises to reduce tongue tension, it can be concluded that certain exercises work for certain individuals, but not for others. In any case, these exercises increased the participants' awareness of the importance of tongue positions in sound production. It was shown that a slight modification of an element in the vocal tract could have a significant impact on voice quality.

This preliminary study has some limitations that need to be mentioned. The limited amount of participants makes it harder to generalise the outcomes of this research. The second limitation is that the participants were women only, while this was not the aim of the research. It will be interesting to see if male participants would use the same resonance strategies as their female counterparts.

This research only focused on vowels. It will be interesting to see where the difficulties lie in vowel-consonant combinations for Chinese singers, since songs are not only composed of vowels. Differences between the consonant production in Mandarin Chinese and Western Languages are even more plentiful than the differences in vowel production, and may have an even greater impact on tongue positions and tongue tension in belting.

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APPENDIX A. Project Proposal

Project Proposal "The prevalence of tongue-tension amongst Chinese adolescent students singing belt and twang"

About the project.

The project title is: "The prevalence of tongue-tension amongst Chinese adolescent students singing belt and twang". The research will be conducted at iStage Academy, based in Shanghai (China). iStage Academy is a bilingual Performing Arts Academy, with students ranging from age 4-60.

This project derives from my Professional Practice. Having worked in Europe, America, Australia and now China, I stumbled upon this phenomenon of the retracted/compressed tongue in belting and twang in over half of my students, whereas a high tongue position is preferred (Steinhauer et al., 2017). It might explain why it is hard for my Chinese students to master these specific styles without the right instructions. The results of this project will be beneficial for my own students, but hopefully also for other aspiring Chinese Musical Theatre artists, touching upon the connection between language acquirement and the impact on vocal training in an international environment.

Personally, I am excited about broadening my knowledge of the use of spectrographs in my classroom. And although I consider belting and twang amongst my specialties as a vocal pedagogue, I haven't zoomed in on the role of the tongue in this process, so it will be fascinating to learn more about this.

Goals and Intentions.

The goal of this project is:

a) to get more insight in why tongue tension (or more specific: a curled up tongue) is so prevalent amongst Chinese adolescent Musical Theatre students.

A literature review will be used to research the desired tongue positions in belt and twang. As the research problem will be introduced, a connection will be made between desired tongue position and language acquisition and tongue positions in the Chinese language, which might explain (part of) this phenomenon. For example, a curled back tongue in a higher position against the hard palate is used to pronounce certain consonant combinations in Mandarin Chinese (Sin-Wai, 2016)

b) to find out what strategies are effective and what strategies have little to no effect in reducing tongue tension.

A mixed-method research will be conducted, using both qualitative and quantitative approaches or methods - with an explicit integration of both quantitative and qualitative aspects (Mertens & Tarsilla, 2015) - to find out what strategies are effective in reducing tongue tension and in attaining a desired tongue position.
Spectrographs, measuring the acoustic parameters of the voice (Nair, 2021; Koenig, Dunn, & Lacy, 1946), will be used to collect quantitative visual data. In belt quality, students will sing a phrase on EE (/i/) and AY (ei/) from G4 to D5. In twang quality, students will sing a phrase on Nyae (/njæ/) from C4 to E5. It will be interesting to see if there is a change in the first and second formant before and after the intervention, since the first two formants are the most responsive to changes in vocal tract shape (Bozeman, 2018). Expected is that there are more harmonics in the mid to high frequency, with a higher mid-frequency energy, if the applied strategies are effective (Titze, 2018).

On the other hand, case studies will be used to gather qualitative data, to see if student experiences are reflected in the visual data. The case studies include student observations during vocal exercises of both tongue positions and other physical factors and a semi-structured interview, where students will be interviewed about what differences they experience applying the different strategies.

Participants and ethical considerations.

For this project, a group of up to 10 participants will be selected. The participants will be students from iStage Academy of Performing Arts. Two participants are students that I am familiar who worked with me for a longer time, that already have applied the different strategies with success. The “novice” participants will be newly enrolled students that might have experience in singing with other teachers, but where tongue tension is very prevalent. Although being an insider researcher can have its disadvantages, it can also be beneficial, since I can interact with the students in a natural way and I already built an intimacy with the group (Breen, 2007).

To protect the participants, I will adhere to the transparency, informed consent, confidentiality and anonymity of the participants. I will mitigate the risks for the participants by storing the interview transcripts on a password protected external hard drive to which only I will have access. I will also devise a strategy that is culturally sensitive, interspersing tongue exercises with other vocal exercises.

Planning

The project timeline is represented in Figure 1.

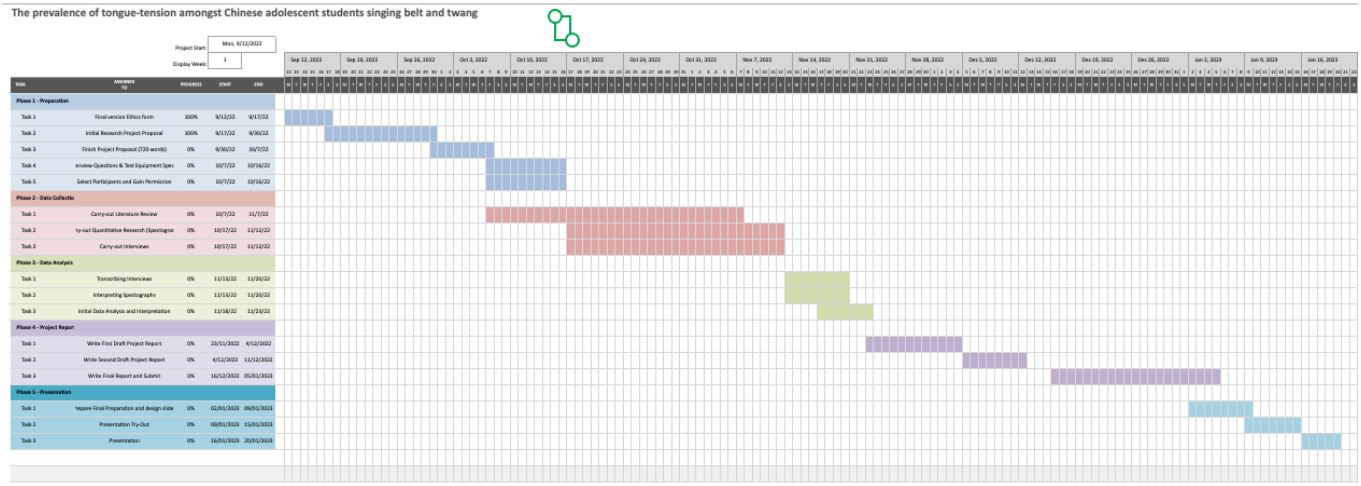


Figure 1: Gantt chart with project time-line.

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APPENDIX B. Ethics Form

APPLICATION FOR ETHICAL APPROVAL

In order for research to result in benefit and minimise risk of harm, it must be conducted ethically. A researcher may not be covered by the University's insurance if ethical approval has not been obtained prior to commencement.

The University follows the OECD Frascati manual definition of **research activity**: "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications". As such this covers activities undertaken by members of staff, postgraduate research students, and both taught postgraduate and undergraduate students working on dissertations/projects.

The individual undertaking the research activity is known as the "principal researcher".

Ethical approval is not required for routine audits, performance reviews, quality assurance studies, testing within normal educational requirements, and literary or artistic criticism.

Please read the notes for guidance before completing ALL sections of the form.

This form must be completed and approved prior to undertaking any research activity. Please see Checklist for details of process for different categories of application.

Delete the Guidance Notes at the end of the form BEFORE submitting your application

SECTION A: About You (Principal Researcher)

1	Full Name:		Karina Renate Bes			
2	Tick all boxes which apply:		Member of staff:	☐	Honorary research fellow:	☐
3	Undergraduate Student	☐	Taught Postgraduate Student	☒	Postgraduate Research Student	☐

4	Institute/Academic Discipline/Centre:	WAPPAR
5	Campus:	Carmarthen
6	E-mail address:	info@karinabes.com
7	Contact Telephone Number:	+8613701648440
	For students:	
8	Student Number:	2117160
9	Programme of Study:	MA in Professional Practice (Voice Pedagogy)

10	Director of Studies/ Supervisor:	Debbie Winter/Louise Emanuel

SECTION B: Approval for Research Activity

1	Has the research activity received approval in principle? (please check the Guidance Notes as to the appropriate approval process for different levels of research by different categories of individual)		**YES**	☒	**NO**	☐
					Date	
2	If Yes, please indicate source of approval (and date where known): ***Approval in principle must be obtained from the relevant source prior to seeking ethical approval***	Research Degrees Committee		☐		
3		Institute Research Committee		☐		
4		Other (write in) WAPPAR Ethics Board Representative		☒		

SECTION C: Internal and External Ethical Guidance Materials

	Please list the core ethical guidance documents that have been referred to during the completion of this form (including any discipline-specific codes of research ethics, and also any specific ethical guidance relating to the proposed methodology). Please tick to confirm that your research proposal adheres to these codes and guidelines.	
1	**UWTSD Research Ethics & Integrity Code of Practice**	☒
2	**UWTSD Research Data Management Policy**	☒
3		☐

SECTION D: External Collaborative Research Activity

1	Does the research activity involve collaborators outside of the University?		**YES**	☐	**NO**	☒
2	If Yes, please provide the name of the external organisation and name and contact details for the main contact person and confirmation this person has consented to their personal data being shared.as part of this collaboration.					
3	Institution					
4	Contact person name					
5	Contact person e-mail address					
6	Has this individual consented to sharing their details on this form?		**YES**	☐	**NO**	☐

7	Are you in receipt of a KESS scholarship?		**YES**	☐	**NO**	☐
8	Is your research externally funded		**YES**	☐	**NO**	☐
9	Are you specifically employed to undertake this research in either a paid or voluntary capacity?	Voluntary	**YES**	☐	**NO**	☐
10		Employed	**YES**	☐	**NO**	☐
11	Is the research being undertaken within an existing UWTSD Athrofa Professional Learning Partnership (APLP)	If YES then the permission question below does not need to be answered.	**YES**	☐	**NO**	☐
12	Permission to undertake the research has been provided by the partner organisation	(If YES attach copy) If NO the application cannot continue	**YES**	☐	**NO**	☐

Where research activity is carried out in collaboration with an external organisation

13	Does this organisation have its own ethics approval system?	**YES**	☐	**NO**	☐
14	If Yes, please attach a copy of any final approval (or interim approval) from the organisation				

SECTION E: Details of Research Activity

1	Indicative title:	The prevalence of tongue-tension amongst Chinese adolescent students singing belt and twang.		
2	Proposed start date:	09-2022	Proposed end date:	01-2023
3	**Introduction to the Research (maximum 300 words)** **Ensure that you write for a <u>Non-Specialist Audience</u> when outlining your response to the three points below:** • *Purpose of Research Activity* • *Proposed Research Question* • *Aims of Research Activity* • *Objectives of Research Activity* Demonstrate, briefly, how **<u>Existing Research</u>** has informed the proposed activity and explain • *What the research activity will add to the body of knowledge* • *How it addresses an area of importance.*			

4	**Purpose of Research Activity** To get more insight in why tongue tension (or more specific: a curled up tongue) is so prevalent amongst Chinese adolescent Musical Theatre students. To find out what strategies are effective and what strategies have little to no effect to reduce tongue tension.
5	**Research Question** What causes the prevalence of tongue-tension in Chinese adolescents singing belt and twang? What can be effective strategies to reduce tongue-tension for these students?
6	**Aims of Research Activity** To develop effective strategies to reduce tongue-tension in Chinese adolescent students, by looking at possible causes for tongue tension (for example the use of a curled back tongue in a higher position against the hard palate to pronounce certain consonant combinations in Mandarin Chinese) To find out how effective the different strategies are, using spectrographs and looking at how students are experiencing the use of these strategies.
7	**Objectives of Research Activity** * to find out more about the preferable tongue-positioning in belt and twang * to use spectrographs to test the effectiveness of different strategies * to make a link with language acquirement as possible cause for the prevalence of tongue tension in certain styles amongst Chinese adolescent students.
8	**Proposed methods (maximum 600 words)** * Provide a brief summary of all the methods that **may** be used in the research activity, making it clear what specific techniques may be used. If methods other than those listed in this section are deemed appropriate later, additional ethical approval for those methods will be needed.

9	1. Spectrographs: A spectrograph is a device that measures the acoustic parameters of the voice. It is standalone, non-invasive and presents data in an electrical format. I will use it to test the effectiveness of certain proposed strategies. Belt: students will sing a phrase on EE (/i/) and AY (ei/) from G4 to D5 Twang: students will sing a phrase on Nyae (/njæ/) from C4 to E5 Before and after intervention. Are there changes in F1 and F2? 2. Literature research: To find out what the most preferable tongue-positions are in belt and twang 3. Case Studies, Including a. Student observations during vocal exercises - Observations of students tongue position Observation of other factors that can play a part (posture, larynx height, lip, jaw, head, neck, anchoring). To enable consistency, the observations will be structured and I will use a template for each student. b. Semi-structured Interview: interviewing students about what differences they experience applying the different strategies. 4. In case literature research is insufficient: Interviews with expert pedagogues about preferred tongue positions. This will take the form of semi structured interviews. I will have a structured format of questions that can be diverted from if interesting points emerge.

10	**Location of research activity** Identify all locations where research activity will take place.
11	Shanghai (this box should expand as you type)
12	**Research activity outside of the UK** If research activity will take place overseas, you are responsible for ensuring that local ethical considerations are complied with and that the relevant permissions are sought. Specify any local guidelines (e.g. from local professional associations/learned societies/ universities) that exist and whether these involve any ethical stipulations beyond those usual in the UK (provide details of any licenses or permissions required). Also specify whether there are any specific ethical issues raised by the local context in which the research activity is taking place, for example, particular cultural and/or legal sensitivities or vulnerabilities of participants.
13	There are no specific local ethical considerations regarding this research. Biomedical research only is governed by Ethics legislation. This is highlighted by The Trust Project below: http://trust-project.eu/wp-content/uploads/2016/03/Chinese-Ethics-Review-System.pdf I will display cultural sensitivity to the singers when looking at the impact of accents on the vocal tract.

14	Use of documentation not in the public domain: Are any documents **NOT** publicly available?	**NO**	☒
		YES	☐
15	If Yes, please provide details here of how you will gain access to specific documentation that is not in the public domain and that this is in accordance with prevailing data protection law of the country in question and England and Wales. *(this box should expand as you type)*		

SECTION F: Scope of Research Activity

1	**Will the research activity include:**	**YES**	**NO**
2	Use of a questionnaire or similar research instrument?	☐	**X**
3	Use of interviews?	**X**	☐
4	Use of diaries?	☐	**X**
5	Participant observation with their knowledge?	**X**	☐
6	Participant observation without their knowledge?	☐	X

7	Use of video or audio recording?	**X**	□
8	Access to personal or confidential information without the participants' specific consent?	□	**X**
9	Administration of any questions, test stimuli, presentation that may be experienced as physically, mentally or emotionally harmful / offensive?	□	**X**
10	Performance of any acts which may cause embarrassment or affect self-esteem?	□	**X**
11	Investigation of participants involved in illegal activities?	□	**X**
12	Use of procedures that involve deception?	□	**X**
13	Administration of any substance, agent or placebo?	□	**X**
14	Working with live vertebrate animals?	□	**X**
15	Other primary data collection methods, please explain in this box For example, 'focus groups'. Please indicate the type of data collection method(s) in this box and tick the accompany box.	**X**	□
16	Details of any other primary data collection method:		

If NO to every question, then the research activity is (ethically) low risk and **may** be exempt from **some** of the following sections (please refer to Guidance Notes).

If YES to any question, then no research activity should be undertaken until full ethical approval has been obtained.

SECTION G: Intended Participants

1	**Who are the intended participants:**	**YES**	**NO**
2	Students or staff at the University?	□	**X**
3	Adults (over the age of 18 and competent to give consent)?	□	**X**
4	Vulnerable adults?	□	**X**
5	Children and Young People under the age of 18? (Consent from Parent, Carer or Guardian will be required)	**X**	□
6	Prisoners?	□	**X**
7	Young offenders?	□	**X**
8	Those who could be considered to have a particularly dependent relationship with the investigator or a gatekeeper?	□	**X**
9	People engaged in illegal activities?	□	**X**
10	Others (please identify specifically any group who may be unable to give consent) please indicate here and tick the appropriate box.		

11	Other – please indicate here: (this box should expand as you type)	☐	**X**

12	**Participant numbers and source** Provide an estimate of the expected number of participants. How will you identify participants and how will they be recruited?	
13	How many participants are expected?	I expect to use up to 10 participants for the case study. *(this box should expand as you type)*
14	Who will the participants be?	The participants will be students from the Performing Arts Academy (iStage Academy) where I teach. If I interview other teachers relating to belt teaching, I will draw from my existing community. *(this box should expand as you type)*
15	How will you identify the participants?	I will select the participants by using two students that I am familiar with that worked with me for a longer time, that already have applied the different strategies with success. I will select the "novice" participants from newly enrolled students that have experience in singing with other teachers, but where tongue tension is very prevalent. I will draw from my immediate teaching community for teachers of belt. *(this box should expand as you type)*

16	**Information for participants:**	**YES**	**NO**	**N/A**
17	Will you describe the main research procedures to participants in advance, so that they are informed about what to expect?	☒	☐	☐
18	Will you tell participants that their participation is voluntary?	☒	☐	☐
19	Will you obtain written consent for participation?	☒	☐	☐
20	Will you explain to participants that refusal to participate in the research will not affect their treatment or education (if relevant)?	☒	☐	☐
21	If the research is observational, will you ask participants for their consent to being observed?	☒	☐	☐
22	Will you tell participants that they may withdraw from the research at any time and for any reason?	☒	☐	☐
23	With questionnaires, will you give participants the option of omitting questions they do not want to answer?	☐	☐	☒

24	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	☒	☐	☐
25	Will you debrief participants at the end of their participation, in a way appropriate to the type of research undertaken?	☒	☐	☐
26	If NO to any of above questions, please give an explanation			
27	. *(this box should expand as you type)*			

28	**Information for participants:**	**YES**	**NO**	**N/A**
29	Will participants be paid?	☐	☒	☐
30	Is specialist electrical or other equipment to be used with participants?	☒	☐	☐
31	Are there any financial or other interests to the investigator or University arising from this study?	☐	☒	☐
32	Will the research activity involve deliberately misleading participants in any way, or the partial or full concealment of the specific study aims?	☐	☒	☐
33	If YES to any question, please provide full details			
34	I will use my Mac computer with an external microphone for the spectrograph analysis using both voce vista and Estill Voiceprint. I will also record the participants interview using my iPhone voice memos. *(this box should expand as you type)*			

SECTION H: Anticipated Risks

1	**Outline any anticipated risks that may adversely affect any of the participants, the researchers and/or the University, and the steps that will be taken to address them.** If you have completed a full risk assessment (for example as required by a laboratory, or external research collaborator) you may append that to this form.		
2	**Full risk assessment completed and appended?**	**Yes**	☐
		No	☒
3	**Risks to participants** For example: emotional distress, financial disclosure, physical harm, transfer of personal data, sensitive organisational information		

4	Risk to Participant: The student interviews will be recorded and transcribed, so personal data will be used. Risk of tongue shaming and affirmation of cultural differences *(this box should expand as you type)*	*How will you mitigate the Risk to Participant* I will store the information on a password protected external hard drive to which only I will have access. Tongue exercises are incorporated into a range of other exercises. All pupils need to develop an awareness of the tongue as it is a significant factor in both vocal health and vocal quality. I will devise a strategy that is culturally sensitive, interspersing tongue exercises with other vocal exercises. *(this box should expand as you type)*
5	If research activity may include sensitive, embarrassing or upsetting topics (e.g. sexual activity, drug use) or issues likely to disclose information requiring further action (e.g. criminal activity), give details of the procedures to deal with these issues, including any support/advice (e.g. helpline numbers) to be offered to participants. Note that where applicable, consent procedures should make it clear that if something potentially or actually illegal is discovered in the course of a project, it may need to be disclosed to the proper authorities	
	N/A *(this box should expand as you type)*	
6	**Risks to investigator** For example: personal safety, physical harm, emotional distress, risk of accusation of harm/impropriety, conflict of interest	
	Risk to Investigator: There may be risk of emotional distress trying to balance a busy work schedule with this intensive research project. *(this box should expand as you type)*	*How will you mitigate the Risk to Investigator:* I will take good care of myself and stay true to deadlines that I will set for myself. *(this box should expand as you type)*
7	**University/institutional risks** For example: adverse publicity, financial loss, data protection	
	Risk to University: The risk to the University will be data protection. *(this box should expand as you type)*	*How will you mitigate the Risk to University:* All data will be destroyed after conducting the research.

8	**Disclosure and Barring Service**			
9	If the research activity involves children or vulnerable adults, a Disclosure and Barring Service (DBS) certificate must be obtained before any contact with such participants.	**YES**	**NO**	**N/A**
10	Does your research require you to hold a current DBS Certificate?	**X**	☐	☐

SECTION I: Feedback, Consent and Confidentiality

1	**Feedback** What de-briefing and feedback will be provided to participants, how will this be done and when?
	I will provide both students and parents with my email-address in case they have further questions. They will be offered to read the final research report. *(this box should expand as you type)*
2	**Informed consent** Describe the arrangements to inform potential participants, before providing consent, of what is involved in participating. Describe the arrangements for participants to provide full consent before data collection begins. If gaining consent in this way is inappropriate, explain how consent will be obtained and recorded in accordance with prevailing data protection legislation.
	I will inform all participants and their parents, before gaining their full consent, of the expectations and time involvement of the research project. The students and parents will sign the formal consent form in person. *(this box should expand as you type)*
3	**Confidentiality / Anonymity** Set out how anonymity of participants and confidentiality will be ensured in any outputs. If anonymity is not being offered, explain why this is the case.
	I will keep the names and organisation unnamed in the final research paper. The collected data will be stored on a password protected external drive that only I have access to.

SECTION J: Data Protection and Storage

In completing this section refer to the University's Research Data Management Policy and the extensive resources on the University's Research Data Management web pages (http://uwtsd.ac.uk/library/research-data-management/).

1	Does the research activity involve personal data (as defined by the General Data Protection Regulation 2016 "GDPR" and the Data Protection Act 2018 "DPA")?	**YES**	**NO**
	"Personal data" *means any information relating to an identified or identifiable natural person ('data subject'). An identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.*	**X**	☐
2	If YES, provide a description of the data and explain why this data needs to be collected:		

	The personal data collected in this research are audio recordings of the participants and visual recordings (spectographs) from the participants. The student names and ages, as well as their nationality will also be collected. *(this box should expand as you type)*		
3	Does it involve special category data (as defined by the GDPR)?	**YES**	**NO**
	"Special category data" *means sensitive personal data consisting of information as to the data subjects' –* *(a) racial or ethnic origin,* *(b) political opinions,* *(c) religious beliefs or other beliefs of a similar nature,* *(d) membership of a trade union (within the meaning of the Trade Union and Labour Relations (Consolidation) Act 1992),* *(e) physical or mental health or condition,* *(f) sexual life,* *(g) genetics,* *(h) biometric data (as used for ID purposes),*	**X**	☐
4	If YES, provide a description of the special category data and explain why this data needs to be collected:		
	The ethnicity of the students will be used as one of the factors to select participants. I work in an international environment, but the research specifically aims at Chinese adolescent participants. *(this box should expand as you type)*		

5	Will the research activity involve storing personal data and/or special category data on one of the following:	**YES**	**NO**
6	Manual files (i.e. in paper form)?	**X**	☐
7	University computers?	☐	**X**
8	Private company computers?	☐	**X**
9	Home or other personal computers?	**X**	☐
10	Laptop computers/ CDs/ Portable disk-drives/ memory sticks?	**X**	☐
11	"Cloud" storage or websites?	☐	**X**
12	Other – specify:	☐	**X**
13	For all stored data, explain the measures in place to ensure the security of the data collected, data confidentiality, including details of password protection, encryption, anonymisation and pseudonymisation:		
	All data will be stored on a password protected external hard drive. All participants will be given a unique identifier to ensure confidentiality and this list will be kept securely in the password protected folder. *(this box should expand as you type)*		

14	**All Data Storage**		
15	Will the research activity involve any of the following activities:	**YES**	**NO**
16	Electronic transfer of data in any form?	**X**	□
17	Sharing of data with others at the University?	□	**X**
18	Sharing of data with other organisations?	□	**X**
19	Export of data outside the European Union or importing of data from outside the UK?	**X**	□
20	Use of personal addresses, postcodes, faxes, emails or telephone numbers?	□	**X**
21	Publication of data that might allow identification of individuals?	□	**X**
22	Use of data management system?	□	□**x**
23	Data archiving?	□	□**x**
24	If YES to any question, please provide full details, explaining how this will be conducted in accordance with the GDPR and DPA (and/or any international equivalent):		
	All data will be stored on a password protected external hard drive.All data transfers will be encrypted and password protected. All participants will be given a unique identifier to ensure confidentiality and this list will be kept securely in the password protected folder. The data will be stored until the completion of the project and then deleted. In accordance with the DPA2018, participants will have the right to ask to see what data is held relating to them, and this data will be deleted immediately if the participant requests this, in which case the data will not be used in the project. *(this box should expand as you type)*		
25	List all who will have access to the data generated by the research activity:		
	Just me (principal researcher) *(this box should expand as you type)*		
26	List who will have control of, and act as custodian(s) for, data generated by the research activity:		
	Just me (principal researcher) *(this box should expand as you type)*		
27	Give details of data storage arrangements, including security measures in place to protect the data, where data will be stored, how long for, and in what form. Will data be archived – if so how and if not why not.		
	The external hard drive used to store or transfer data will be password protected, and will be reformatted at the end of the project in order to destroy the data. It will only be used for this specific research project. The data will be stored until the completion of the project and then deleted. *(this box should expand as you type)*		
28	Please indicate if your data will be stored in the UWTSD Research Data Repository (see https://researchdata.uwtsd.ac.uk/). If so please explain. (*Most relevant to academic staff*)		

	N/A *(this box should expand as you type)*		
29	Confirm that you have read the UWTSD guidance on data management (see https://www.uwtsd.ac.uk/library/research-data-management/)	**YES**	**X**
		NO	□
30	Confirm that you are aware that you need to keep all data until after your research has completed or the end of your funding	**YES**	**X**
		NO	□

SECTION K: Declaration

31	The information which I have provided is correct and complete to the best of my knowledge. I have attempted to identify any risks and issues related to the research activity and acknowledge my obligations and the rights of the participants. In submitting this application I hereby confirm that I undertake to ensure that the above named research activity will meet the University's Research Ethics and Integrity Code of Practice which is published on the website: https://www.uwtsd.ac.uk/research/research-ethics/		
	Signature of applicant:	Karina Renate Bes	**Date:** August 1, 2022

For STUDENT Submissions:

32	Director of Studies/ Supervisor:		**Date:**
33	Signature:		

For STAFF Submissions:

34	Academic Director/ Assistant Dean:		**Date:**
35	Signature:		

Checklist: Please complete the checklist below to ensure that you have completed the form according to the guidelines and attached any required documentation:

X	I have read the guidance notes supplied before completing the form.
X	I have completed **ALL RELEVANT** sections of the form in full.
X	I confirm that the research activity has received approval in principle

□	I have attached a copy of final/interim approval from external organisation (**where appropriate**)
□	I have attached a full risk assessment (and have NOT completed Section H of this form) (where appropriate) *ONLY TICK IF YOU HAVE **ATTACHED A FULL RISK ASSESSMENT***
X	I understand that it is my responsibility to ensure that the above named research activity will meet the University's Research Ethics and Integrity Code of Practice.
X	I understand that before commencing data collection all documents aimed at respondents (including information sheets, consent forms, questionnaires, interview schedules etc.) must be confirmed by the DoS/Supervisor, module tutor or Academic Director.
X	I have deleted the guidance notes before submitting the PG2 for consideration

RESEARCH STUDENTS AND STAFF ONLY
All communications relating to this application during its processing must be in writing and emailed to pgresearch@uwtsd.ac.uk , with the title 'Ethical Approval' followed by your name. You will be informed of the outcome of your claim by email; therefore it is important that you check your University and personal email accounts regularly**.**

~~**STUDENTS ON UNDERGRADUATE OR TAUGHT MASTERS PROGRAMMES**~~ should submit this form (and receive the outcome) via systems explained to you by the supervisor/ module leader.

This form is available electronically from the Academic Office web pages: https://www.uwtsd.ac.uk/academic-office/appendices-and-forms/

APPENDIX C. Consent Form

About this study

Title of Study:	"The prevalence of tongue-tension amongst Chinese adolescent students singing belt and twang"
Researcher:	Karina Bes
Contact Info:	13701648440, karina.bes@istageacademy.com
University:	MA Voice Pedagogy at the University of Trinity St. David
Place of Study:	iStage Academy, 889 Shangcheng Road, Shanghai.
Purpose of study:	To to get more insight in why tongue tension (or more specific: a curled up tongue) is so prevalent amongst Chinese adolescent Musical Theatre students. To research effective strategies to reduce tongue tension amongst Chinese adolescent students singing belt and twang.
Procedures:	Participants participate in a practical session, where their voice will be recorded using Estill Voiceprint Plus and Voce vista to gather spectrographic data. Participants participate in a semi-structured interview, where participants will be interviewed about what differences they experience applying the different strategies. Participants will be observed during their group class, during vocal exercises on the use of both tongue positions and other physical factors
Time Frame:	The data collection will take place in October and November 2022.

Consent Form

- I..... voluntarily agree to participate in this research study.
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.
- I understand that I can withdraw permission to use data from the spectrographs, within two weeks after they are obtained, in which case the material will be deleted
- I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.
- I understand that participation involves a) spectrograph recordings, b) interview and c) student observation during my regular class.
- I understand that I will not benefit directly from participating in this research.
- I agree to my interview being audio-recorded.
- I agree that my vocal exercises will be recorded using Estill Voiceprint Plus and Voce Vista.
- I understand that all information I provide for this study will be treated confidentially.
- I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.
- I understand that disguised extracts from my interview may be quoted in a research paper.
- I understand that if I inform the researcher that myself or someone else is at risk of harm they may have to report this to the relevant authorities - they will discuss this with me first but may be required to report with or without my permission.
- I understand that signed consent forms will be retained in a close drawer in the researchers office and original audio recordings and visual spectrograph recordings will be retained in a password protected USB drive that only I have access to. The data will be stored until the completion of the project (February 2023) and then deleted.

- I understand that under freedom of information legalisation I am entitled to access the information I have provided at any time while it is in storage as specified above.

- I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

Signature of participant ---------- Date ——————

Signature of parent ---------- Date ——————

I believe the participant is giving informed consent to participate in this study

Signature of researcher ---------- Date ——————

APPENDIX D. IPA (International Phonetic Alphabet)

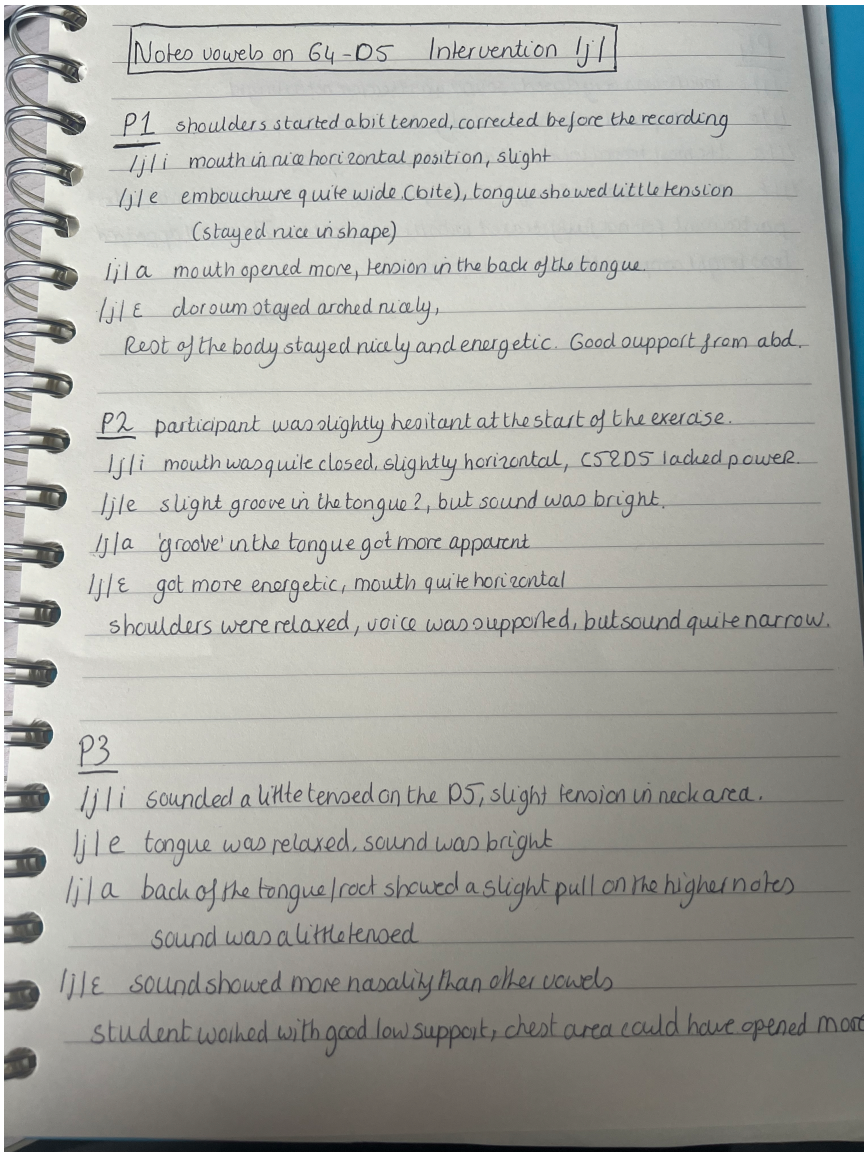
An overview of the vowels and consonants used in this study

IPA Symbol	English Example	Mandarin Example
[i]	Feet, He	滴 dī (drop), 笔 bǐ (pencil)
[e]	Base, Hey	Doesn't exist, but approaches the vowel combination /ei/, as in 北 běi (north)
[ɛ]	Pet, Bet	Doesn't exist
[a]	(Pak the Cah - Boston), Aha	八 bā (eight), 拉 lā (pull)
[j]	You	Doesn't exist

IPA Table (Davids and LaTour, 2021; Smith, 2007, and Choi, 2018)

APPENDIX E. Intervention 1: Placing a /j/ vowel in front

Field Notes

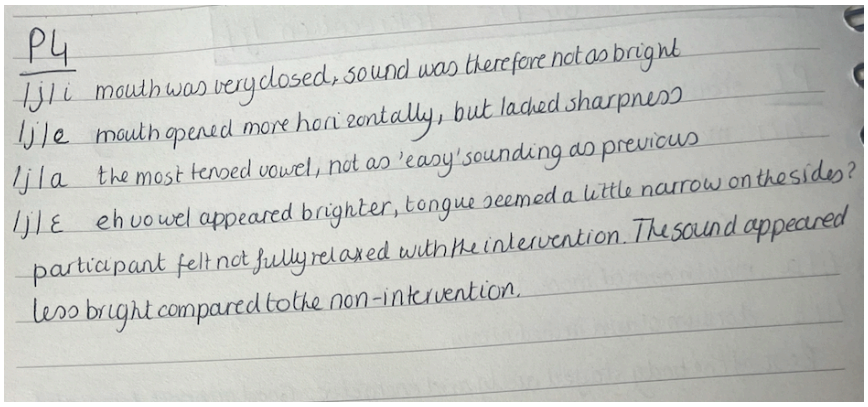


Notes vowels on G4-D5 Intervention /j/

P1 shoulders started a bit tensed, corrected before the recording
/j/i mouth in nice horizontal position, slight
/j/e embouchure quite wide (bite), tongue showed little tension (stayed nice in shape)
/j/a mouth opened more, tension in the back of the tongue.
/j/ɛ dorsum stayed arched nicely,
Rest of the body stayed nicely and energetic. Good support from abd.

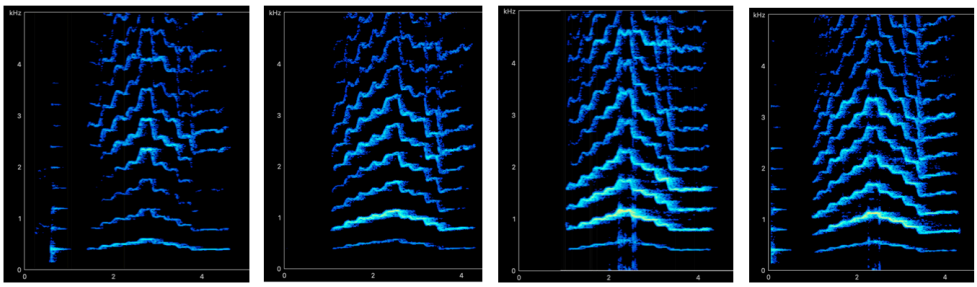
P2 participant was slightly hesitant at the start of the exercise.
/j/i mouth was quite closed, slightly horizontal, C5 2D5 lacked power.
/j/e slight groove in the tongue?, but sound was bright.
/j/a 'groove' in the tongue got more apparent
/j/ɛ got more energetic, mouth quite horizontal
shoulders were relaxed, voice was supported, but sound quite narrow.

P3
/j/i sounded a little tensed on the D5, slight tension in neck area.
/j/e tongue was relaxed, sound was bright
/j/a back of the tongue/root showed a slight pull on the higher notes sound was a little tensed
/j/ɛ sound showed more nasality than other vowels
student worked with good low support, chest area could have opened mor

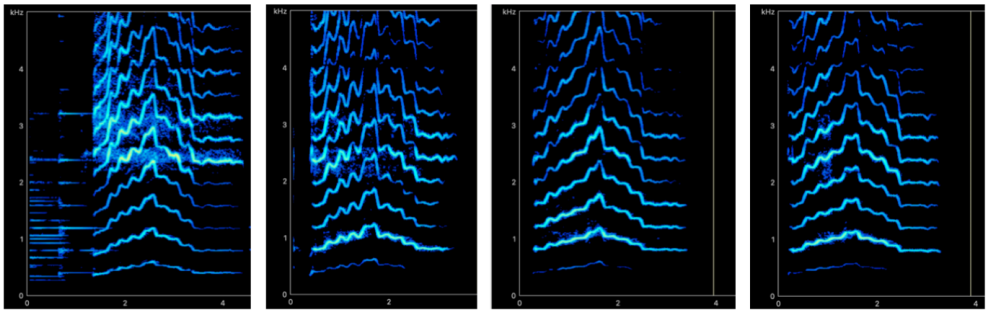


P4
/j/i mouth was very closed, sound was therefore not as bright
/j/e mouth opened more horizontally, but lacked sharpness
/j/a the most tensed vowel, not as 'easy' sounding as previous
/j/ɛ eh vowel appeared brighter, tongue seemed a little narrow on the sides?
participant felt not fully relaxed with the intervention. The sound appeared less bright compared to the non-intervention.

Participant 1 (Intervention 1)



On EE | On AY | On AH | on EH



On /j/-EE | On /j/-AY | On /j/-A | On /j/-EH

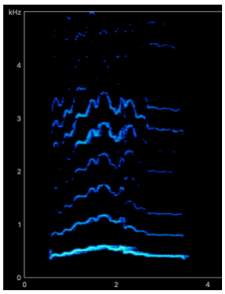
Did you notice any difference in your tongue position?
When I place the Y in front. I think my tongue goes more in front.

And did placing the /j/ vowel in front made it easier? Or Harder?
Harder, because I move my tongue more in front and lift it up. I think it's kind of blocking the airway.

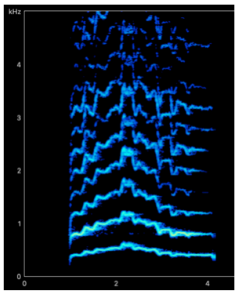
Were the instructions clear?
Yes

Did you notice any other physical changes?
No

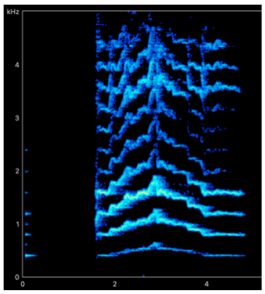
Participant 2 (Intervention 1)



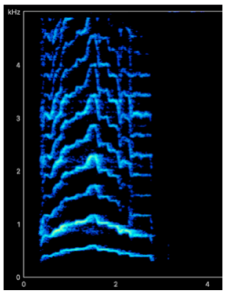
On EE



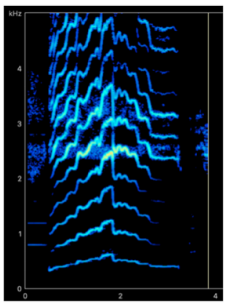
On AY



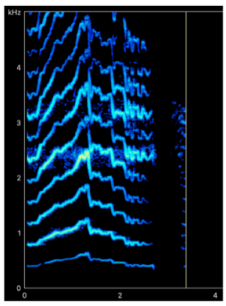
On AH



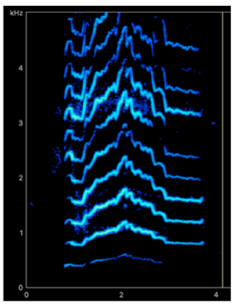
On EH



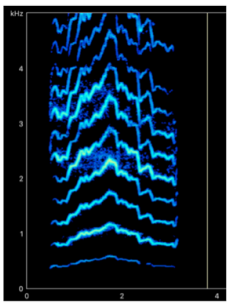
On /j/-EE



On /j/-AY



On /j/-A



On /j/-EH

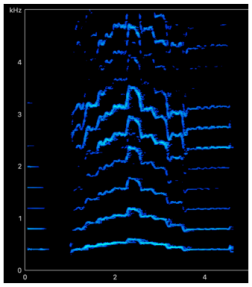
Did you notice any difference in your tongue position?
No.

And did placing the /j/ vowel in front made it easier? Or Harder?
Easier. I'm not sure why, but I feel like when I added a Y sound in front of it, I put more power into it, which made it easier to hit the high notes.

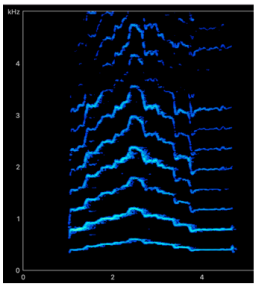
Were the instructions clear?
Yes

Did you notice any other physical changes?
I think my mouth opened wider

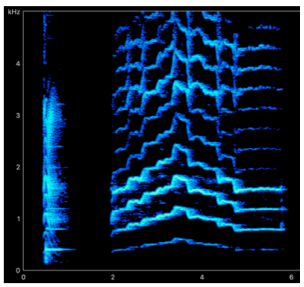
Participant 3 (Intervention 1)



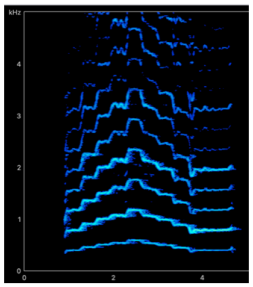
On EE



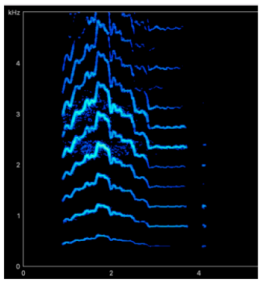
On AY



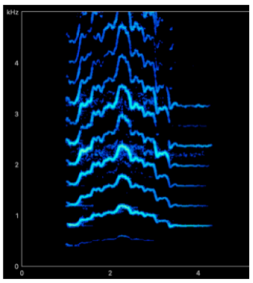
On AH



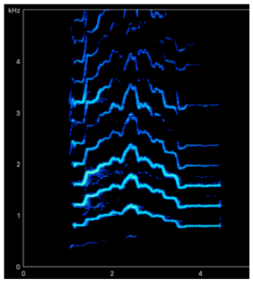
On EH



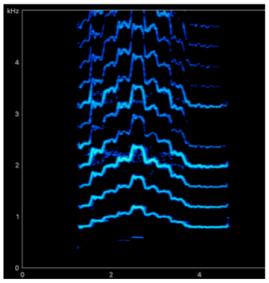
On /j/EE



On /j/AY



On /j/AH



On /j/EH

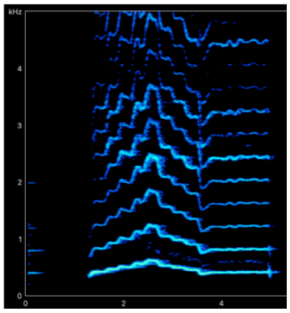
Did you notice any difference in your tongue position?
Yes, it was, during the j-EH's, that my tongue lifted more.

And did placing the /j/ vowel in front made it easier? Or Harder?
It made it easier because with the Y- it sort of let me slide into it more.

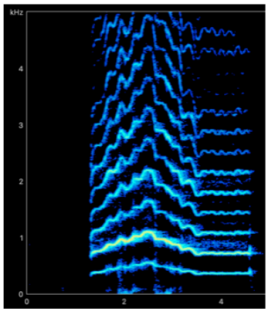
Were the instructions clear?
Yes

Did you notice any other physical changes?
Yes, my mouth also opened wider.

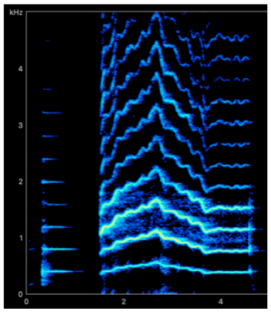
Participant 4 (Intervention 1)



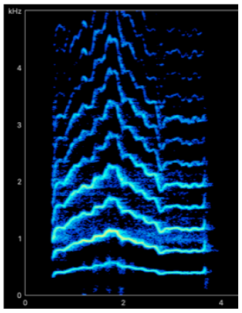
On EE



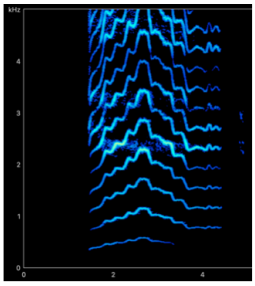
On AY



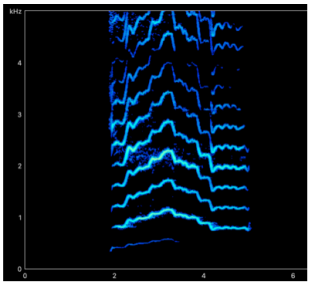
On AH



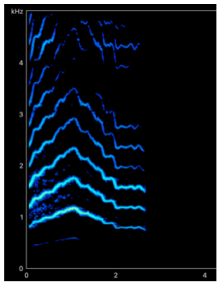
On EH



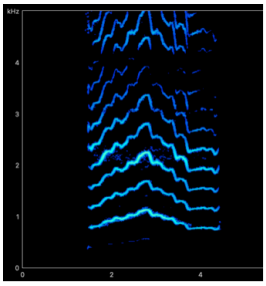
On /j/EE



On /j/AY



On /j/AH



On /j/EH

Did you notice any difference in your tongue position?
Not really.

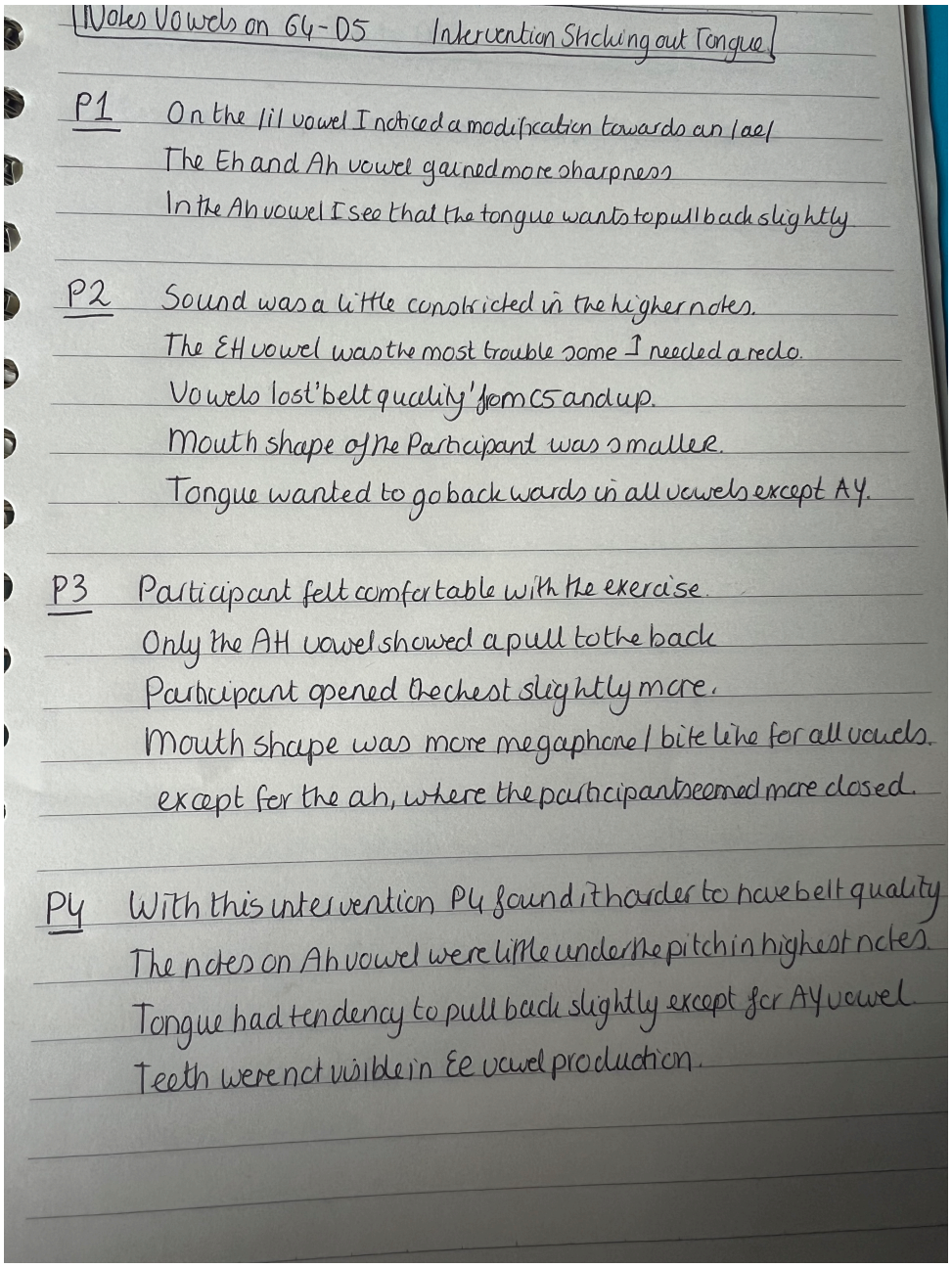
And did placing the /j/ vowel in front made it easier? Or Harder?
Harder. It's harder for me to lift the tongue.

Were the instructions clear?
Yes

Did you notice any other physical changes?
No

APPENDIX F. Intervention 2 (Sticking out the tongue)

Field Notes



Notes Vowels on G4-D5 Intervention Sticking out Tongue

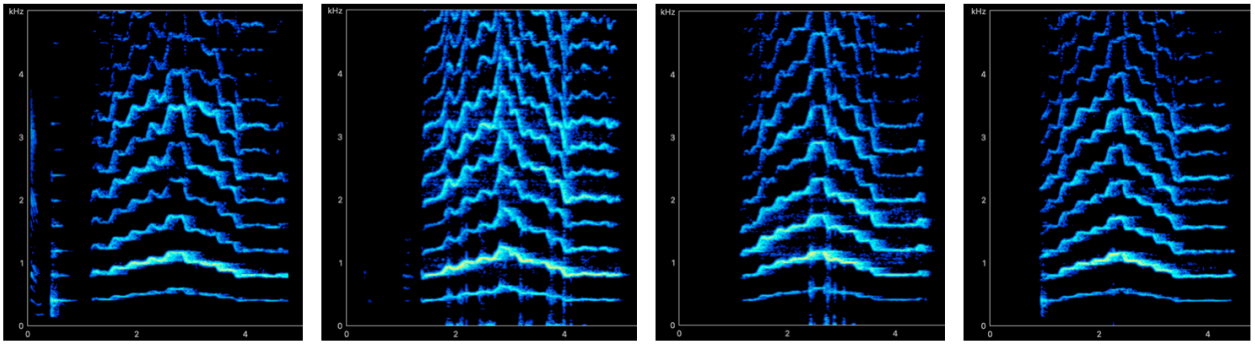
P1 On the /i/ vowel I noticed a modification towards an /ae/
The Eh and Ah vowel gained more sharpness
In the Ah vowel I see that the tongue wants to pull back slightly

P2 Sound was a little constricted in the higher notes.
The EH vowel was the most trouble some I needed a redo.
Vowels lost 'belt quality' from C5 and up.
Mouth shape of the Participant was smaller.
Tongue wanted to go backwards in all vowels except AY.

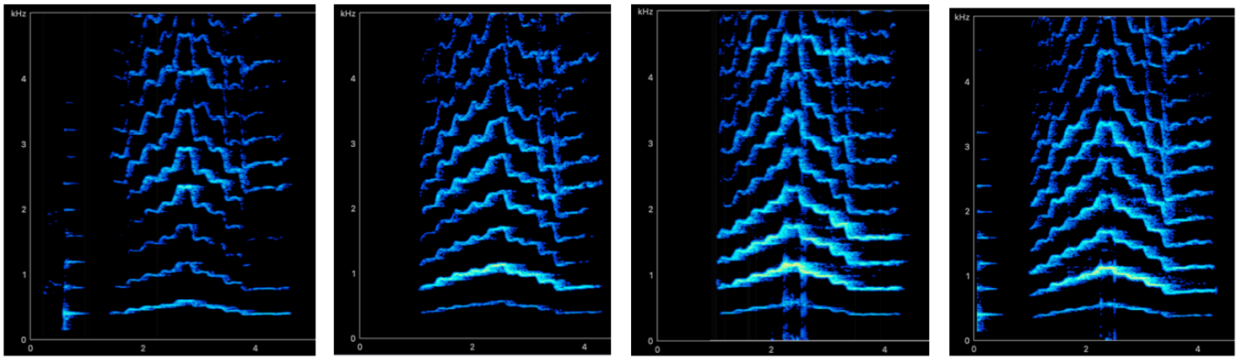
P3 Participant felt comfortable with the exercise.
Only the AH vowel showed a pull to the back
Participant opened the chest slightly more.
Mouth shape was more megaphone / bite like for all vowels.
except for the ah, where the participant seemed more closed.

P4 With this intervention P4 found it harder to have belt quality
The notes on Ah vowel were little under the pitch in highest notes.
Tongue had tendency to pull back slightly except for AY vowel.
Teeth were not visible in Ee vowel production.

Participant 1 (Intervention 2)



On EE (Tongue) On AY (Tongue) On AH (Tongue) On EH (Tongue)



On EE On AY On AH on EH

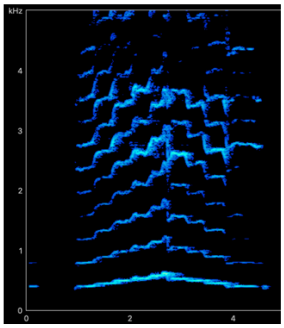
Did you notice any difference in your tongue position?
In the previous exercises, I used to put the back of my tongue up, lifted it up. Now I am sticking it out, I can't do that anymore.

Did sticking out the tongue made it easier? Or harder?
For the first vowel it's harder. For the rest of them, it’s easier.

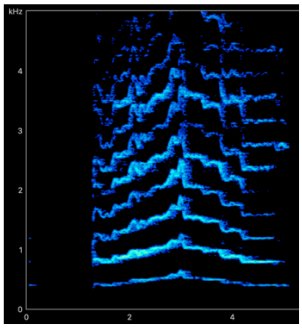
Were the instructions clear?
Yes

Did you notice any other physical changes?
I think I opened my mouth wider.

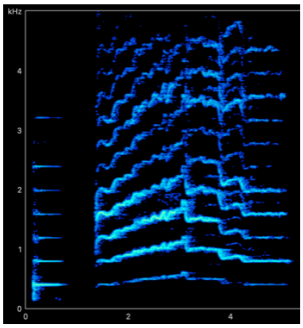
Participant 2 (Intervention 2)



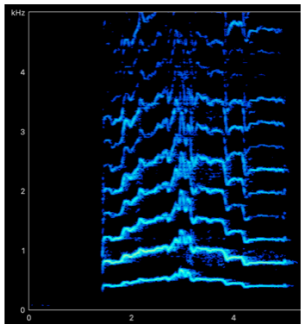
On EE (Tongue)



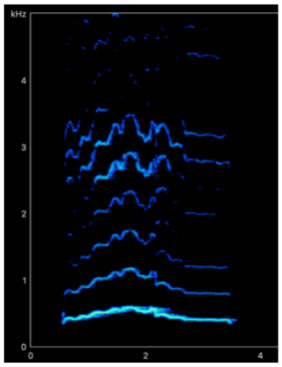
On AY (Tongue)



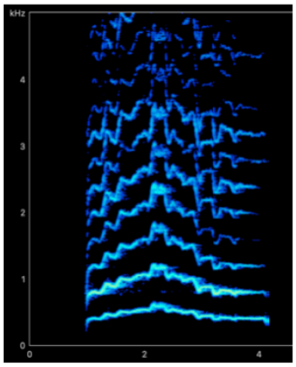
On AH (Tongue)



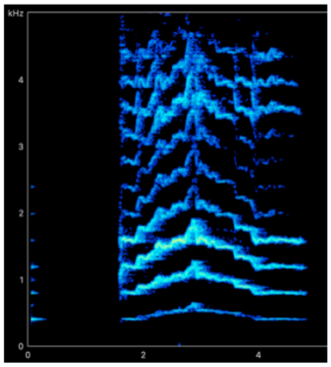
On EH (Tongue)



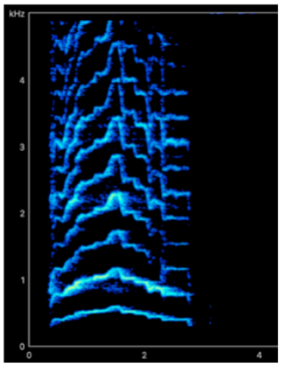
On EE



On AY



On AH



On EH

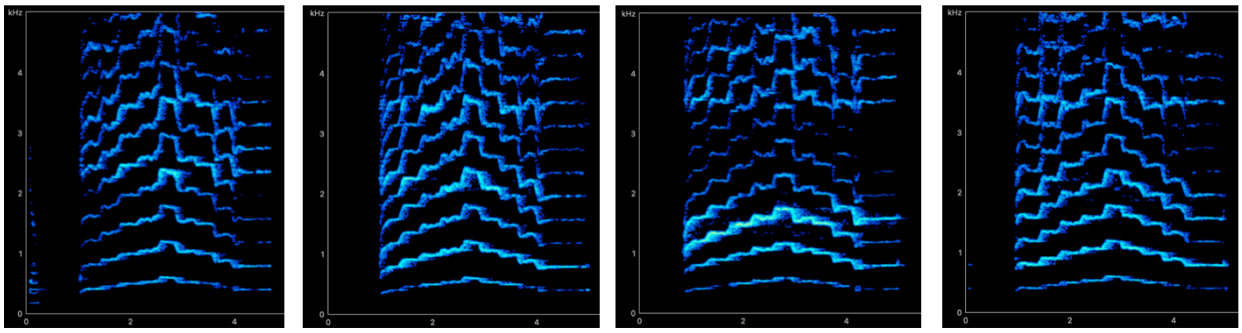
Did you notice any difference in your tongue position?
Yes. It went lower in the back.

Did sticking out the tongue made it easier? Or harder?
I'd say it made it harder. I'm not sure why. But it was harder for me to go higher when my mouth stayed open with my tongue out.

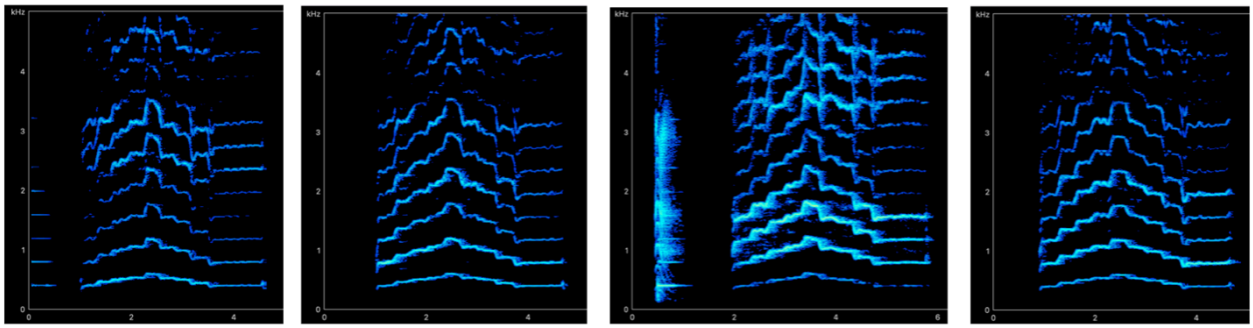
Were the instructions clear?
Yes.

Did you notice any other physical changes?
I'd also say my mouth got wider.

Participant 3 (Intervention 2)



On EE (Tongue) On AY (Tongue) On AH (Tongue) On EH (Tongue)



On EE On AY On AH On EH

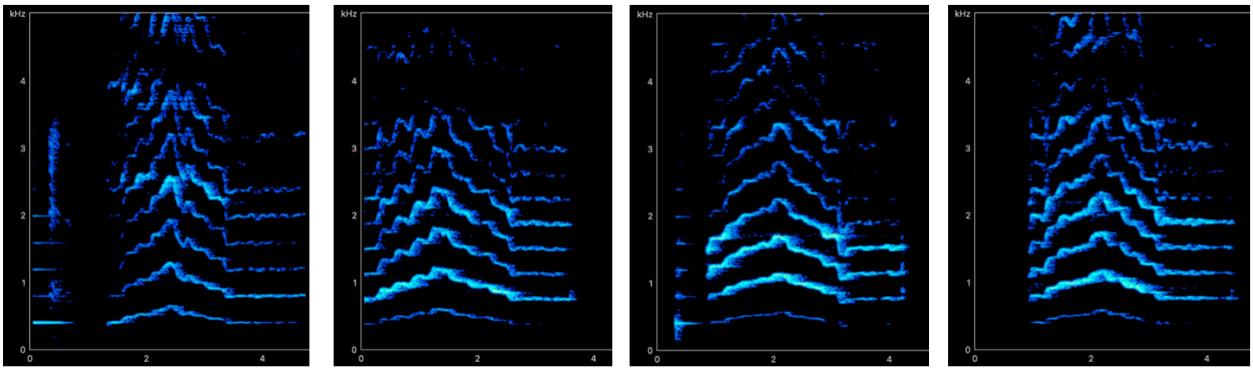
Did you notice any difference in your tongue position?
The back of my tongue was down because I was pulling my tongue out.

Did sticking out the tongue made it easier? Or harder?
Easier. (*And why?*) I'm not exactly sure why, but I think it might have to do with like how the airflow is really like clear. And everything just comes out a lot easier.

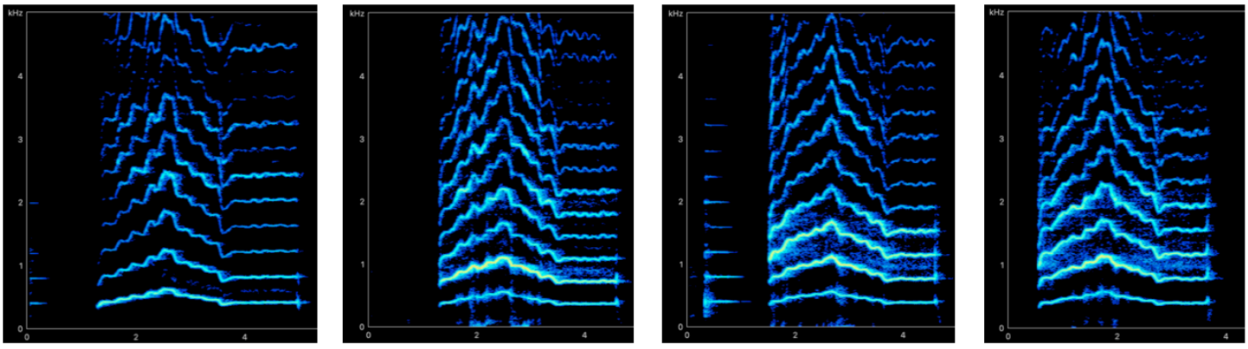
Were the instructions clear?
Yes.

Did you notice any other physical changes?
Yeah, my mouth was wider.

Participant 4 (Intervention 2)



On EE (Tongue) On AY (Tongue) On AH (Tongue) On EH (Tongue)



On EE On AY On AH On EH

Did you notice any difference in your tongue position?
Yes. So my tongue is more sticky.

Did sticking out the tongue made it easier? Or harder?
Harder, because I cannot, I think, I cannot pronounce the sound more clearly.

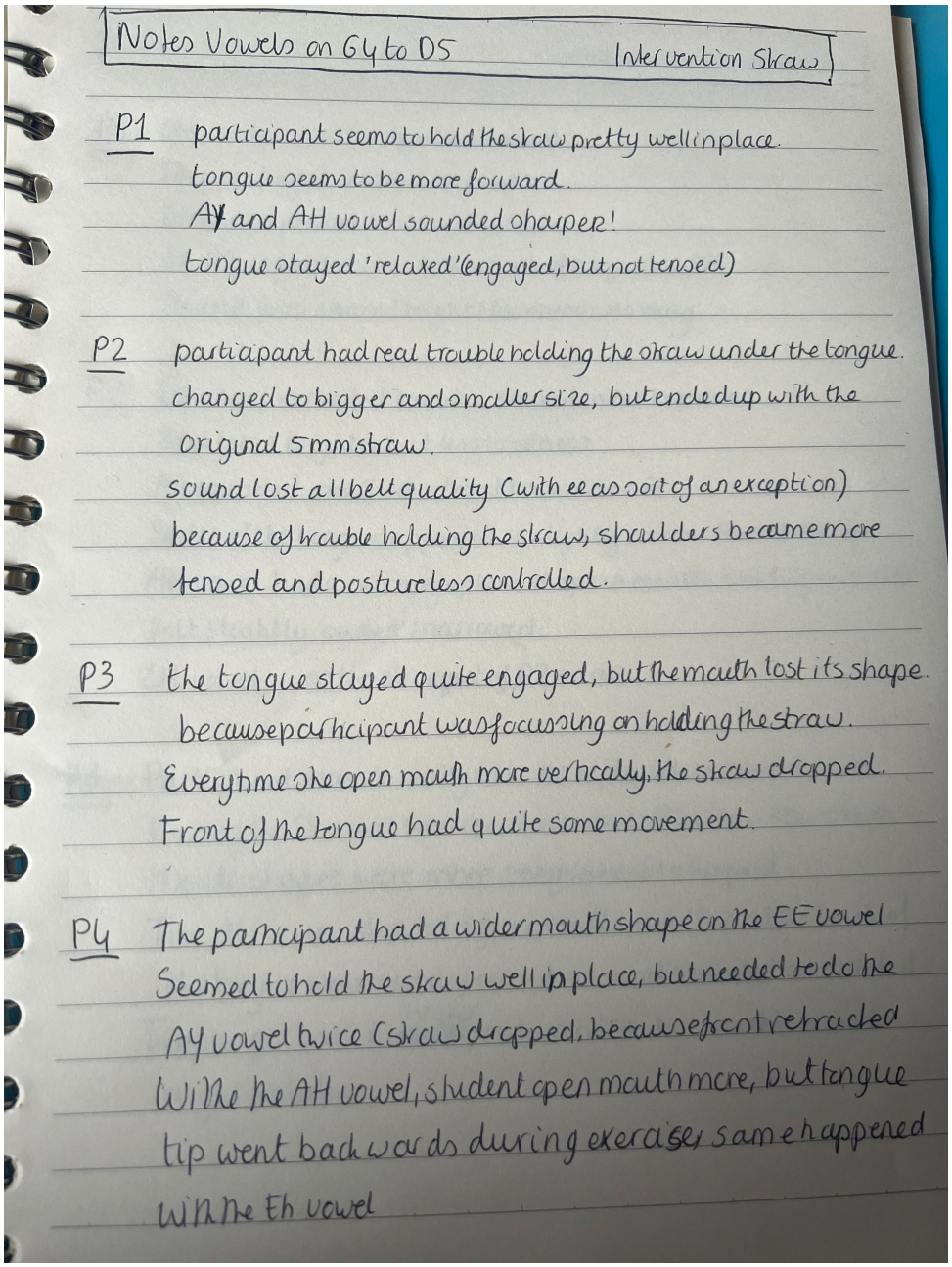
Were the instructions clear?
Yes.

Did you notice any other physical changes?
I think my mouth opened a little wider.

APPENDIX G. Intervention 3 (Holding a straw under the tongue)



Field Notes



Notes Vowels on G4 to D5 Intervention Straw

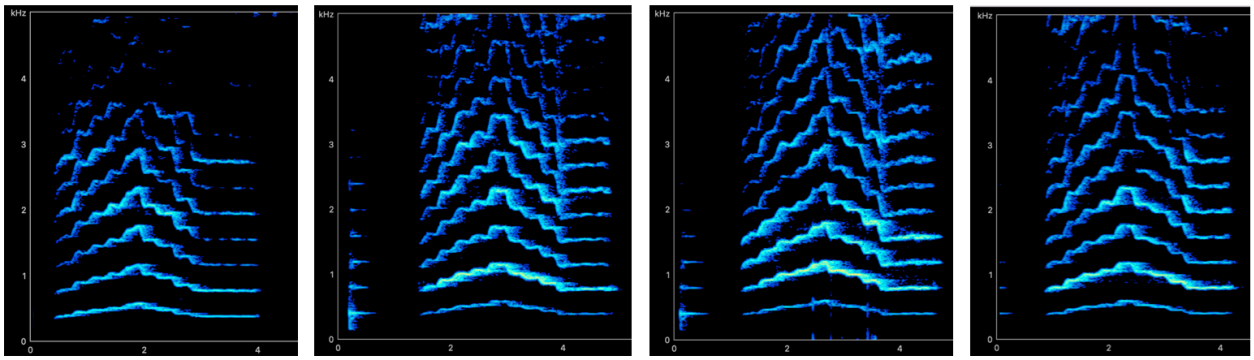
P1 participant seems to hold the straw pretty well in place.
tongue seems to be more forward.
AY and AH vowel sounded sharper!
tongue stayed 'relaxed' (engaged, but not tensed)

P2 participant had real trouble holding the straw under the tongue.
changed to bigger and smaller size, but ended up with the original 5mm straw.
sound lost all bell quality (with ee as sort of an exception)
because of trouble holding the straw, shoulders became more tensed and posture less controlled.

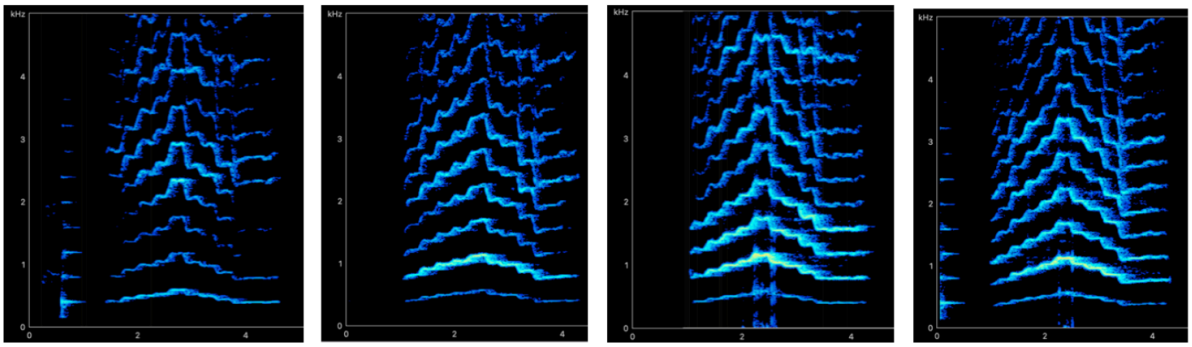
P3 the tongue stayed quite engaged, but the mouth lost its shape.
because participant was focussing on holding the straw.
Everytime she open mouth more vertically, the straw dropped.
Front of the tongue had quite some movement.

P4 The participant had a wider mouth shape on the EE vowel
Seemed to hold the straw well in place, but needed to do the AY vowel twice (straw dropped, because front retracted
With the AH vowel, student open mouth more, but tongue tip went backwards during exercise, same happened with the Eh vowel

Participant 1 (Intervention 3)



On EE (holding straw) On AY (holding straw) On AH (holding Straw) On EH (holding straw)



On EE On AY On AH on EH

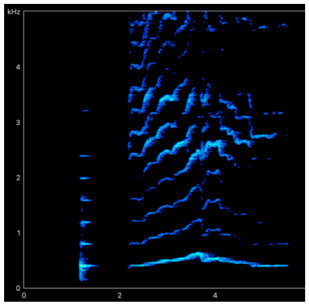
Did you notice any difference in your tongue position?
In the back, in the middle, I tried to lift it up. So the front part goes down to hold the straw.

Did holding a straw under the tongue made it easier? Or harder?
Harder. Because you have to keep the straw in your mouth and also sing. It gave a less clear sound.

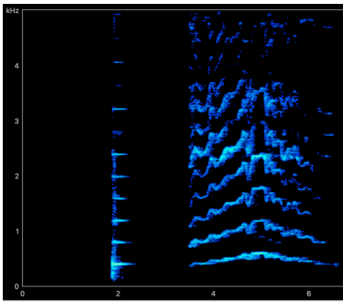
Were the instructions clear?
Yes.

Did you notice any other physical changes?
No.

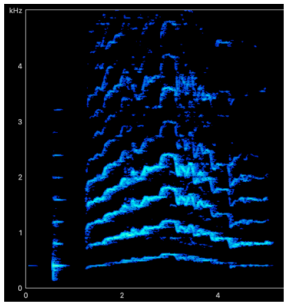
Participant 2 (Intervention 3)



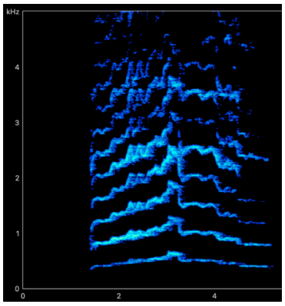
On EE (holding straw)



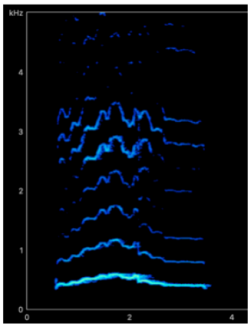
On AY (holding straw)



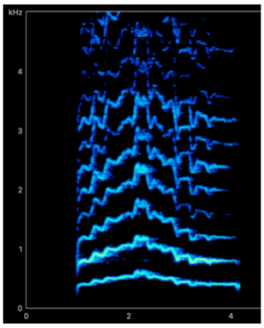
On AH (holding Straw)



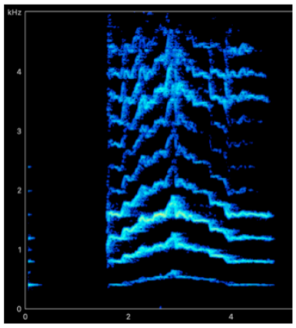
On EH (holding straw)



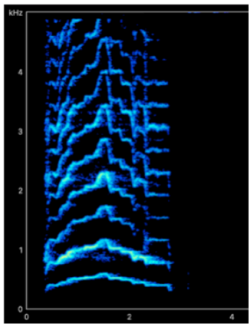
On EE



On AY



On AH



On EH

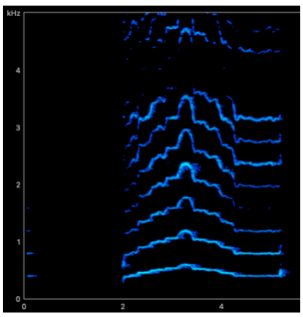
Did you notice any difference in your tongue position?
Yes. The back went up more, and the front went down.

Did holding a straw under the tongue made it easier? Or harder?
I'd say for like the first two vowels, they are actually way easier that way. But for the the other ones, it just got harder.

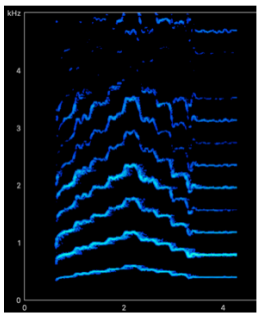
Were the instructions clear?
Yes.

Did you notice any other physical changes?
it's just that my tongue was closer to the …

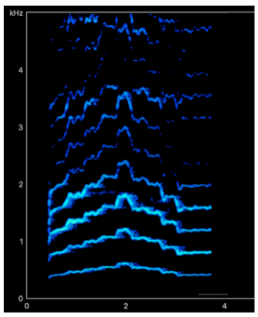
Participant 3 (Intervention 3)



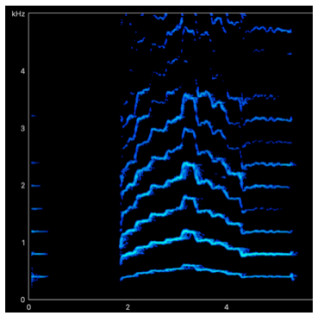
On EE (holding straw)



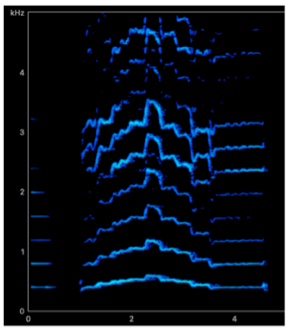
On AY (holding straw)



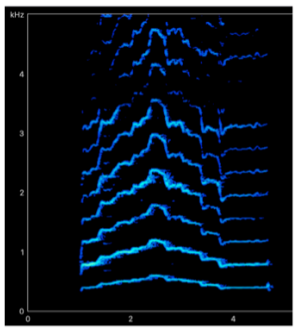
On AH (holding Straw)



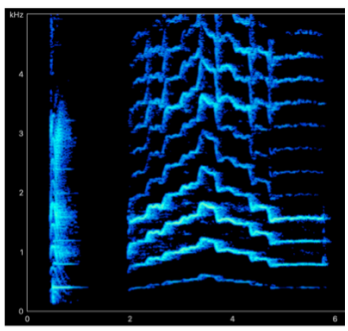
On EH (holding straw)



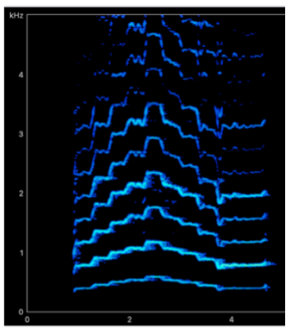
On EE



On AY



On AH



On EH

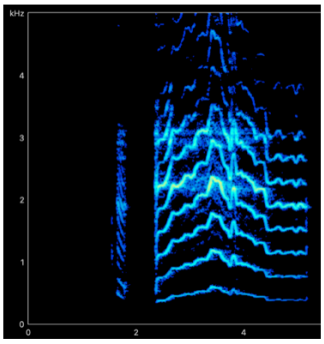
Did you notice any difference in your tongue position?
The back of my tongue was like, more relaxed, because there was probably like less tension on it because the front of my tongue was holding like the straw. But it was like, more relaxed.

Did holding a straw under the tongue made it easier? Or harder?
It was like sort of like the same as the first exercise. It was harder to like keep the straw in my mouth. But it's like the same to sing.

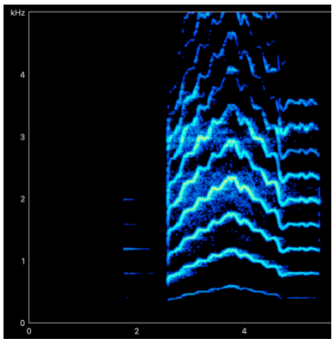
Were the instructions clear?
Yes.

Did you notice any other physical changes?
My mouth is smaller.

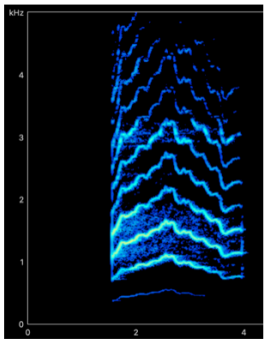
Participant 4 (Intervention 3)



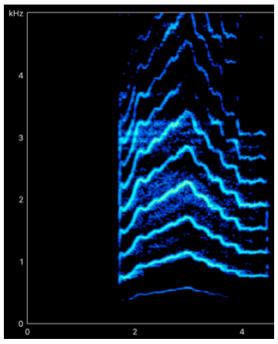
On EE (holding straw)



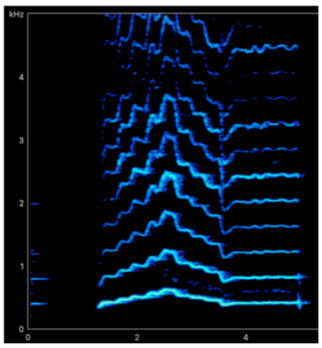
On AY (holding straw)



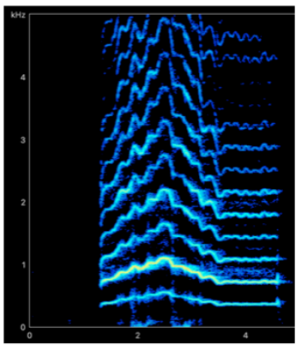
On AH (holding Straw)



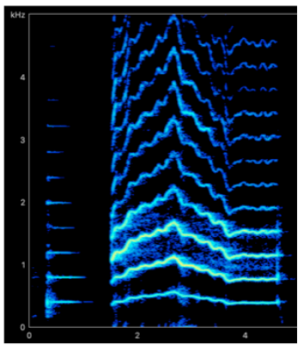
On EH (holding straw)



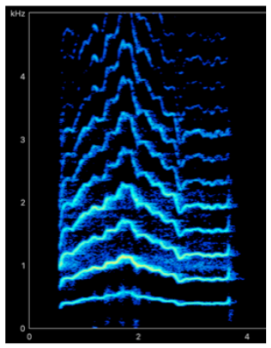
On EE



On AY



On AH



On EH

Did you notice any difference in your tongue position?
Not so much. Like is quite the same as the first one.

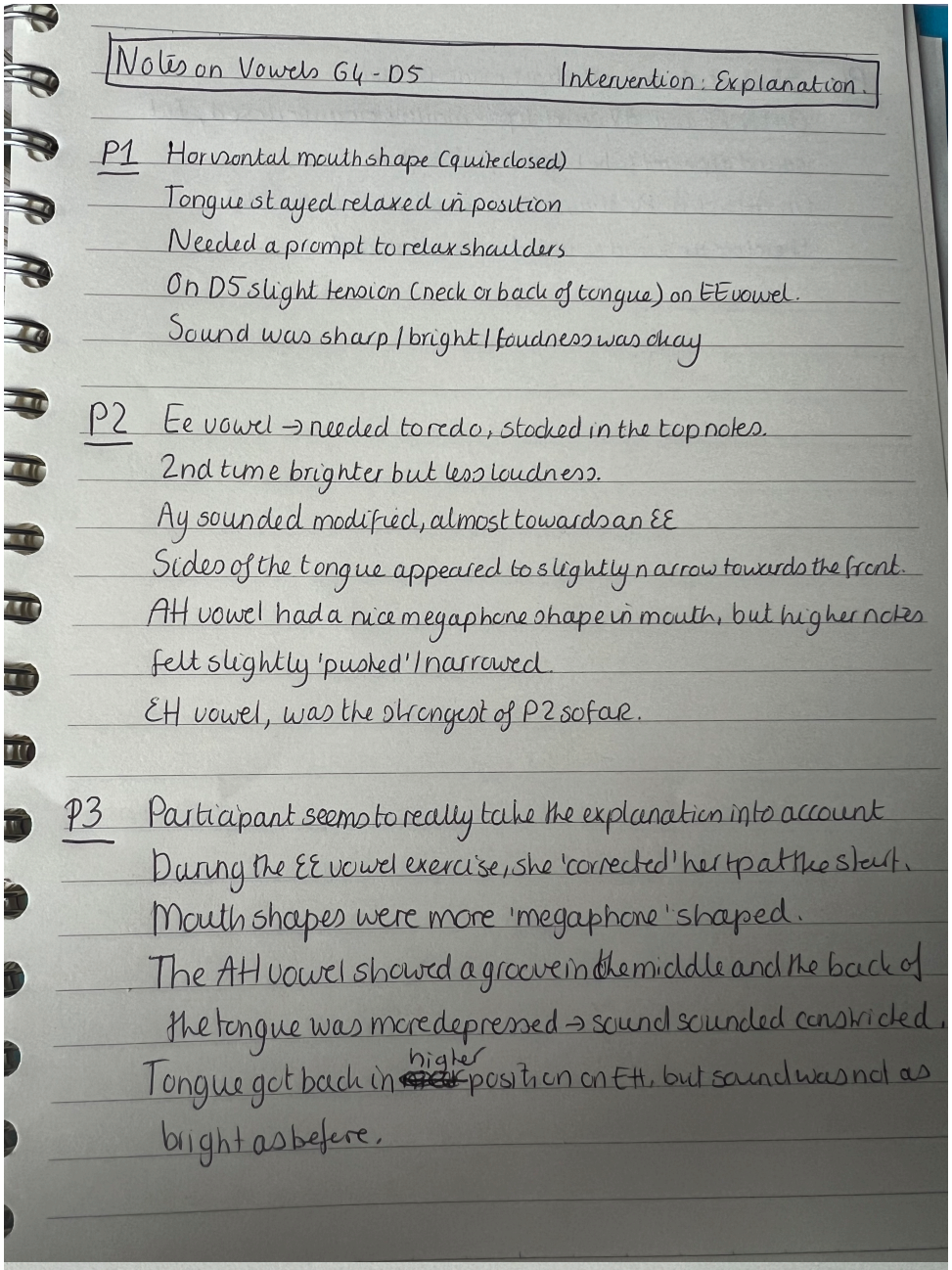
Did holding a straw under the tongue made it easier? Or harder?
Hard to do. Basically because you need to hold the straw and also need to sing.

Were the instructions clear?
Yes.

Did you notice any other physical changes?
Uhm, not really.

APPENDIX H. Intervention 4 (Explanation about the correct tongue positioning)

Field Notes



Notes on Vowels G4 - D5 Intervention: Explanation.

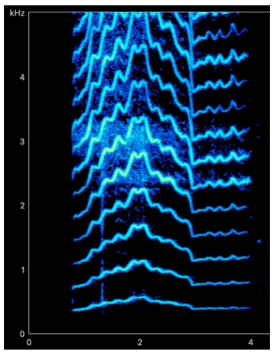
P1 Horizontal mouth shape (quite closed)
Tongue stayed relaxed in position
Needed a prompt to relax shoulders
On D5 slight tension (neck or back of tongue) on EE vowel.
Sound was sharp / bright / loudness was okay

P2 Ee vowel → needed to redo, stacked in the top notes.
2nd time brighter but less loudness.
Ay sounded modified, almost towards an EE
Sides of the tongue appeared to slightly narrow towards the front.
AH vowel had a nice megaphone shape in mouth, but higher notes felt slightly 'pushed' / narrowed.
EH vowel, was the strongest of P2 so far.

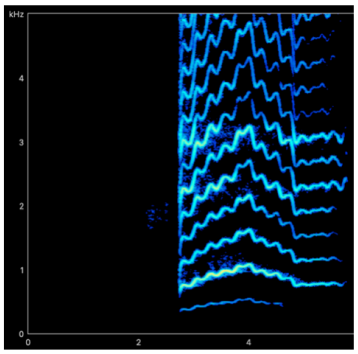
P3 Participant seems to really take the explanation into account
During the EE vowel exercise, she 'corrected' her tp at the start.
Mouth shapes were more 'megaphone' shaped.
The AH vowel showed a groove in the middle and the back of the tongue was more depressed → sound sounded constricted.
Tongue got back in ~~the~~ higher position on EH, but sound was not as bright as before.

P4 Student started with slight mucus blokade.
On the EE and AY vowel lips & mouth were quite closed, but sound appeared to be brighter than before.
On AH en EH P4 strained her neck a little ('turtle neck')
therefore the sound sounded more constricted.

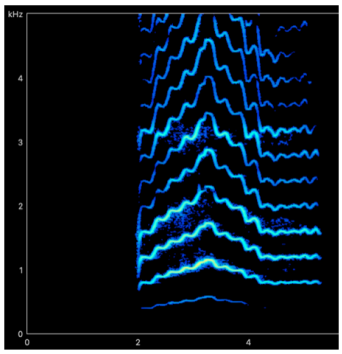
Participant 1 (Intervention 4)



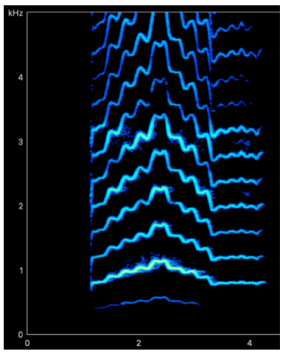
On EE (Explanation)



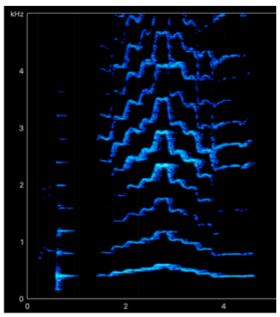
On AY (Explanation)



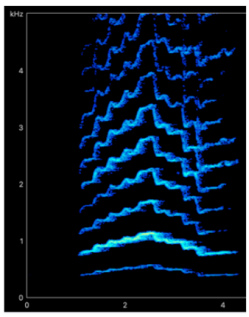
On AH (Explanation)



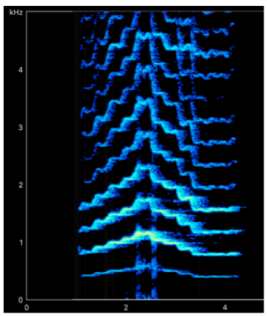
On EH (Explanation)



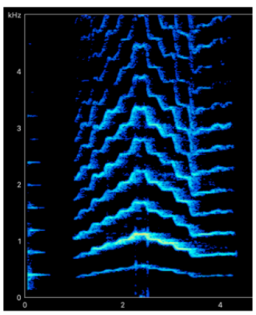
On EE



On AY



On AH



on EH

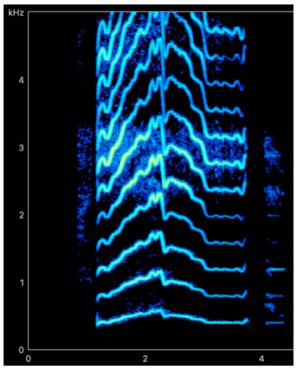
Did you notice any difference in your tongue position?
So I was trying to put my tongue against my back teeth.

Did the explanation made it easier? Or harder?
I think some of them were easier. (*Can you recall which one were easier and which one were harder?*) I think the last one eh was a little harder, the rest was easier.

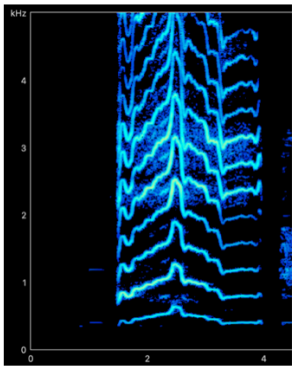
Were the instructions clear?
Yes.

Did you notice any other physical changes?
No

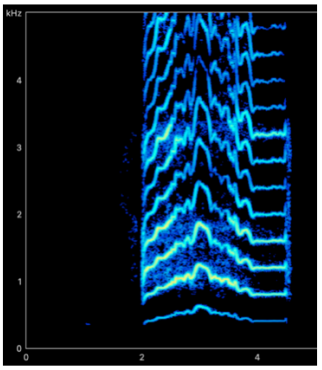
Participant 2 (Intervention 4)



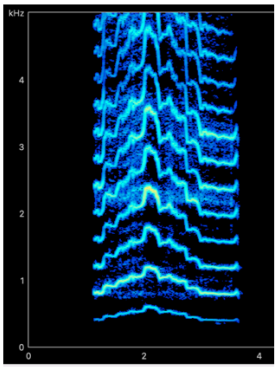
On EE (Explanation)



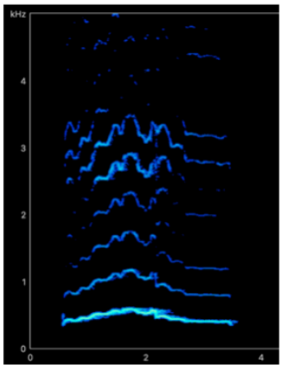
On AY (Explanation)



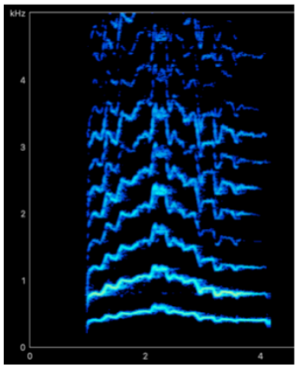
On AH (Explanation)



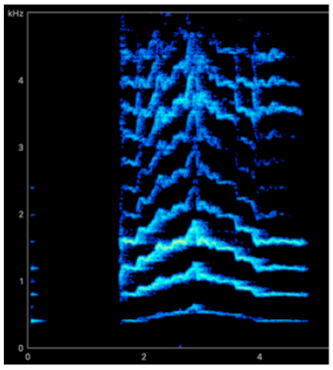
On EH (Explanation)



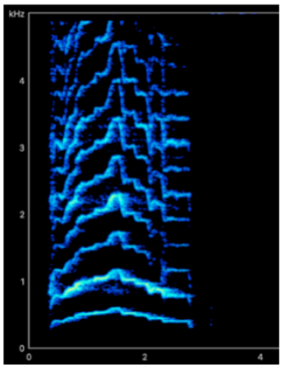
On EE



On AY



On AH



On EH

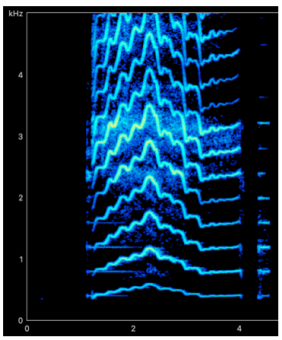
Did you notice any difference in your tongue position?
Yes. Generally just that like, the tongue cuts the molars. The middle part would go down more I think, but like the back would sometimes go up.

Did the explanation made it easier? Or harder?
I say for some I made it easier, for others have made it harder. I don't know if I remember exactly which ones were easier, but I feel like the ones that were more like ee, like wider were easier.

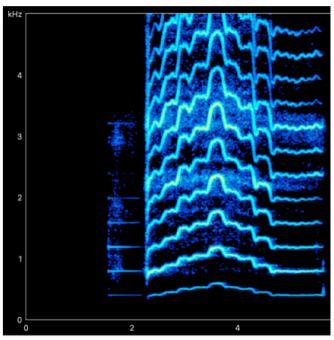
Were the instructions clear?
Yes

Did you notice any other physical changes?
Um, I feel like my mouth didn't open as wide.

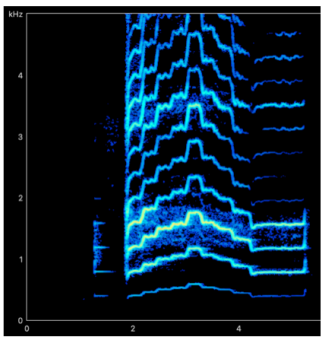
Participant 3 (Intervention 4)



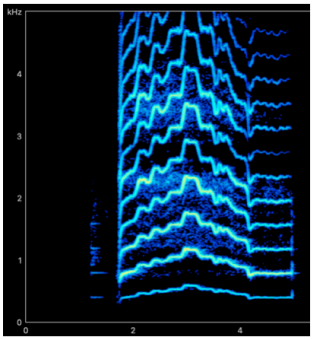
On EE (Explanation)



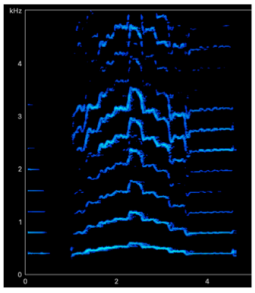
On AY (Explanation)



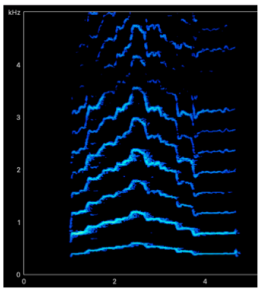
On AH (Explanation)



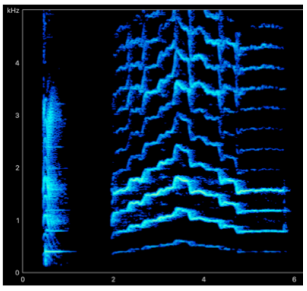
On EH (Explanation)



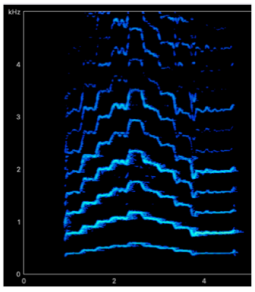
On EE



On AY



On AH



On EH

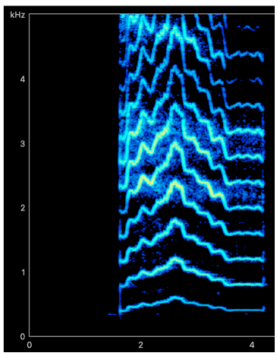
Did you notice any difference in your tongue position?
Yeah, just like the entire position of the tongue.

Did the explanation made it easier? Or harder?
Harder. *(What made it harder?)* I think because I was like, very focused on like, trying to keep my tongue in that position. Also like, because since my, my tongue was trying to touch the top of my teeth, it didn't allow my mouth to be very open. So it was sort of harder to get the sound out.

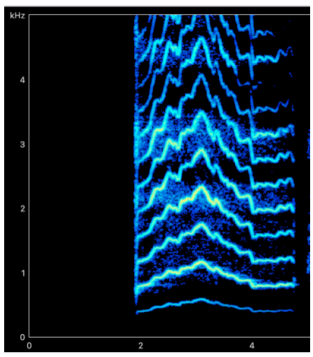
Were the instructions clear?
Yes

Did you notice any other physical changes?
My mouth was smaller.

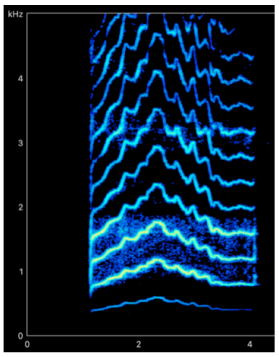
Participant 4 (Intervention 4)



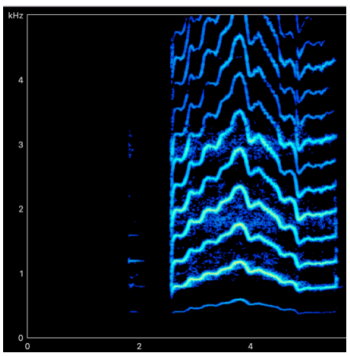
On EE (Explanation)



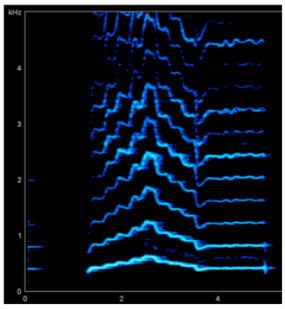
On AY (Explanation)



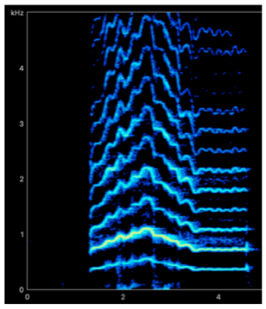
On AH (Explanation)



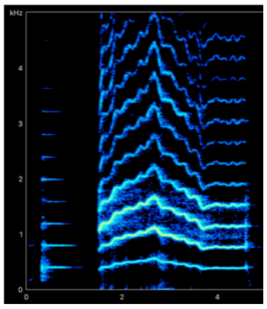
On EH (Explanation)



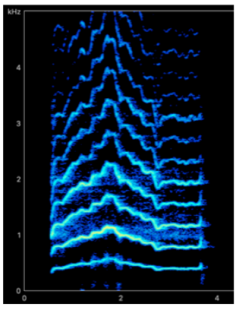
On EE



On AY



On AH



On EH

Did you notice any difference in your tongue position?
Like the last three, stayed the same, the first was different.

Did the explanation made it easier? Or harder?
Easier.

Were the instructions clear?
Yes

Did you notice any other physical changes?
No.