THE IMPACT OF ZYGOMATICUS AND ORBICULARIS OCULI ACTIVATION ON VOCAL BRIGHTNESS

Exploring two practical muscle activation strategies with female singers

Word Count
Proposal 655
Report 5788

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Module 3 Work-based Learning Project BMPF7326D

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List of Abbreviations

C	Chopstick between teeth prompts.
CoG	Spectral centre of gravity.
FE	Facial expression, referring to the interpretation of facial postures as being associated with an emotion *(see Appendix 12).*
f_m	Fundamental frequency (Hz).
f_{Rm}	Resonant frequency (Hz).
nf_o	Harmonic frequency (Hz).
F	F-value (F): A ratio used to compare variance between groups to variance within groups; it is interpreted alongside degrees of freedom (df) to assess statistical significance.
F_m	Formant (Hz).
FP	Facial Posture, referring to muscle activation *(see Appendix 12).*
FT	Finger on top teeth prompt.
N	Neutral posture prompt.
ηp^2	Partial eta effect squared effect size. e.g. an ηp² value of 0.441 means that 44.1% of the variance in the outcome can be attributed to that factor.
OOM	Orbicularis oculi muscles.
p	*p-value (p):* The probability that the observed results occurred by chance; values below 0.05 are typically considered statistically significant.
P	Participant.
$P_{bonferroni}$	A p-value that has been adjusted using the Bonferroni correction to reduce the risk of false positives when multiple statistical comparisons are made.
R	Resonance.
S	Smile prompt.
SC	Spectral centroid.
SD	Standard deviation.
SFC	Singers formant cluster.
ZM	Zygomaticus muscles.

Project Proposal

Title

The impact of zygomatic and orbicularis oculi activation on vocal brightness: Exploring two facial muscle activation strategies with female singers.

Context

This quantitative study examines two strategies for enhancing vocal brightness by activating the smile muscles: zygomaticus (ZM) and/or orbicularis oculi (OOM) (Jaffer, Ichesco and Gerstner, 2016) (*see Figure 1)*. Ten amateur female participants (ages 18 - 60) will be drawn from TMA 31, an amateur dramatics and music association of which I am president and data collected at the Salle du Quai in Pibrac.

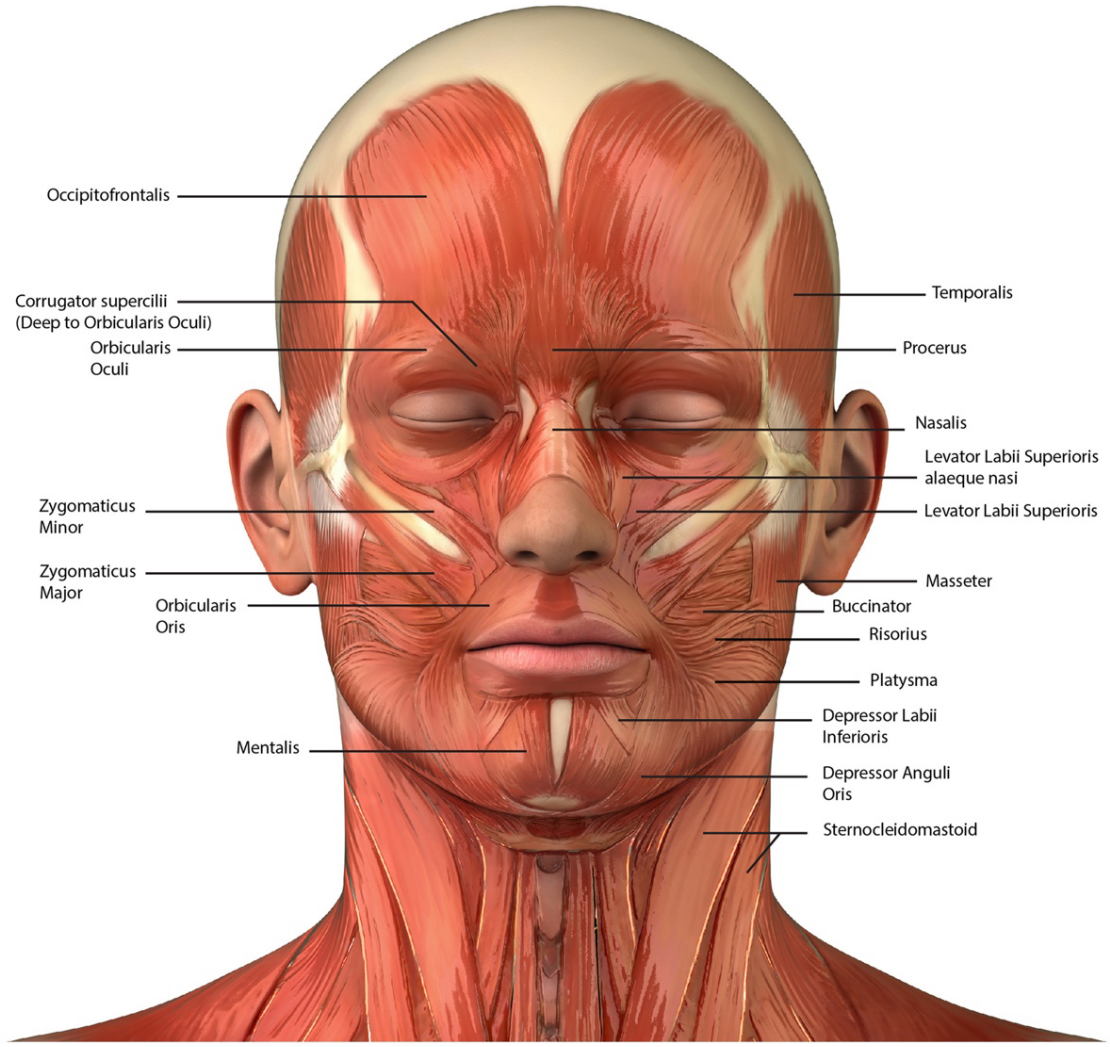


Figure 1. Superficial muscles of the face and neck (Zachary, Gruschak and Newman, 2023).

Justification

McQuade (2016) suggests that activating the ZMs increases acoustic intensity. In my teaching, I encourage smiling to enhance tonal brightness and projection and similar resonance-enhancing techniques are observed in female singers, particularly in the low to mid-frequency range (Weiss, Brown and Morris, 2001; Lyubarskaya et al., 2024). Although not formally studied, one method I use involves placing two fingers on the upper front teeth to engage the ZM and OOMs. This study will compare that technique with a second method – holding a chopstick between the teeth (Strack, Martin and Stepper, 1988) – while using natural smile and neutral facial posture (FP) as control conditions to evaluate their effectiveness *(see Figure 2 and 3).*



Figure 2. Finger - Teeth (FT) strategy.



Figure 3. Chopstick (C) strategy.

Intended Impact

Findings may support current teaching methods and inform new exercises to enhance brightness-related upper harmonics and resonance (Titze, Maxfield and Walker, 2017). Additionally, this study lays groundwork for research helping singers overcome habitual negative FPs.

Outlined Intention

Under a post-positivist paradigm, this study will involve three methods — acoustic analysis, image analysis and literature review — enabling triangulation.

Participants

Only adult female amateurs (18-60) will be included, reducing variability arising from prior vocal training and sex or age-based differences in voice type (Markova et al., 2016).

Design

A **within-subjects 4 x 5 factorial** design (FP prompts and vowels) will reduce participant numbers by using each individual as their own control, minimising variability from anatomical and technique differences (Charness, Gneezy and Kuhn, 2012), and allowing analysis of how vowel articulation affects each strategy's effectiveness.

Prompts

1. Natural smile
2. Neutral
3. Chopstick between teeth
4. Fingers on teeth

Vowels

[a] [e] [i] [o] and [u]

Randomisation of prompts and vowels will reduce psychological bias, and fatigue or sensitisation effects (Charness, Gneezy and Kuhn, 2012).

Methods

Video and audio will be recorded simultaneously with fixed microphone, camera and chair positions, and participants will be asked to limit upper-body movement. Continuous facial muscle activation, using facial markers for tracking, will be captured on video (Young et al., 2002), with analysis of extracted still frames. Audio will undergo acoustic analysis.

Researcher Influence

To avoid mimicry and researcher influence, I will sit beside participants and minimise instructions (Arias, Belin, and Aucouturier, 2018; Coles et al., 2022).

Timeline

Module 3 BMPF7326

Work-based Learning Project (Intermediate)
Vanessa Eve Hirsch 2327695

Project Start: Monday 31/03/2025
Project Finish: Week of 04/08/25

TASK	PROGRESS	START	END
Proposal (660 words +/- 10%)			
Research Methodology	100%	Monday 31/03/2025	Friday 04/04/2025
Research Methods	100%	Monday 31/03/2025	Friday 04/04/2025
Prepare Gannt Timeline	100%	Monday 31/03/2025	Sunday 13/04/2025
Draft Propsal	100%	Monday 31/03/2025	Sunday 20/04/2025
Literature Review for Proposal	100%	Monday 31/03/2025	Sunday 13/04/2025
DEADLINE Submit to Louisa by email	100%	Monday 21/04/2025	Monday 21/04/2025
Planning Research			
Research WASP 2 online	100%	Monday 31/03/2025	Friday 04/04/2025
Research Acoustics	10%	Monday 14/04/2025	Sunday 27/04//2025
Order/organise Equipment Needed	80%	Friday 04/04/2025	Sunday 27/04//2025
Contact Participants (After receiving Ethics Approval)	80%	Monday 14/04/2025	Sunday 27/04//2025
Collect Consent Forms	10%	Monday 21/04/2025	Sunday 27/04//2025
Timetable Participant Sessions	80%	Monday 21/04/2025	Sunday 27/04//2025
Book Rooms	100%	Saturday 26/04//2025	Sunday 27/04//2025
Prepare Research Instrument List	100%	Monday 31/03/2025	Sunday 20/04/2025
Prepare Assets and Script	90%	Monday 21/04/2025	Sunday 27/04//2025
Prepare Information and Consent Form	100%	Monday 31/03/2025	Sunday 13/04/2025
DEADLINE Submit research instruments to Louisa by email	100%	Wednesday 07/05/2025	Wednesday 07/05/2025
DEADLINE Submit Info/Consent form to Louisa by email	100%	Wednesday 07/05/2025	Wednesday 07/05/2025
Experiment			
Briefing Session Online	0%	Saturday 03/05/2025	Sunday 04/04/2025
Execute Experiments	0%	Monday 05/05/2025	Sunday 18/05/2025
Follow up Experiments if required	0%	Monday 26/05/2025	Monday 02/06/2025
Debrief (if participants require)	0%	Saturday 09/08/2025	Sunday 10/08/2025
Collate Data for Analysis	0%	Monday 19/05/2025	Monday 02/06/2025
Literature Review			
Key Word Search	0%	Monday 31/03/2025	Sunday 27/04//2025
Find Papers	0%	Monday 31/03/2025	Sunday 11/05/2025
Read and Evaluate	0%	Monday 31/03/2025	Sunday 04/05/2025
Draft Literature Review for Essay	0%	Monday 31/03/2025	Sunday 08/06/2025
Data Analysis			
Acoustic Analysis	0%	Monday 19/05/2025	Sunday 15/06/2025
Image Analysis	0%	Monday 19/05/2025	Sunday 15/06/2025
Triangulation of Data with Literature Review	0%	Monday 19/05/2025	Sunday 15/06/2025
Draft Analysis for Essay	0%	Monday 02/06/2025	Sunday 29/06/2025
Written Report Project (5400 +/- 10%)			
Write Introduction to Report	0%	Monday 21/04/2025	Sunday 27/04/2025
Combine Anaysis and Lit rev evaluate and write essay	0%	Monday 02/06/2025	Friday 04/07/2025
Write Conclusion	0%	Saturday 05/07/2025	Sunday 06/07/2025
Tidy Up Reference Section, tables and figures	0%	Saturday 05/07/2025	Sunday 06/07/2025
DRAFT ASSIGNMENT DEADLINE Send to tutor		Monday 07/07/2025	Monday 07/07/2025
Rewrite assignment after tutor feedback	0%	Monday 14/07/2025	Thursday 31/08/2025
FINAL ASSIGNMENT DEADLINE Submit via Turnitin (5pm UK)		Friday 01/08/2025	Friday 01/08/2025
Presentation			
Learn How to Create Slides	0%	Monday 30/06/2025	Friday 04/07/2025
Prepare Slides	0%	Monday 14/07/2025	Saturday 26/07/2025
Practice Slide Presentation for Timing	0%	Sunday 27/07/2025	Sunday 03/08/2025
Practice Slide Presentation 15 mins 11:00-11:15	0%	Monday 29/07/2025	Monday 29/07/2025
PRESENTATIONS (un week of - 8 mins +/- 10%)	0%	Monday 04/08/2025	Friday 08/08/2025
DATES TO NOTE (Potential Conflicts)			
Louisa Away on Annual Leave		Monday 21/07/2025	Monday 28/07/2025
Annual Leave		Saturday 05/07/2025	Sunday 12/07/2025
Performance TMA 31 Curtains Up!		Saturday 24/05/2025	Sunday 25/05/2025
Performance TMA 31 S'Cool Hits and Time Trips		Monday 16/06/2025	Wednesday 18/06/2025
Performance English 31 Scene It All: Life and Beyond		Tuesday 10/06/2025	Wednesday 10/06/2025
Performance English 31 Anansi		Wednesday 25/06/2025	Wednesday 25/06/2025
School Reports Writing	0%	Friday 14/06/2025	Friday 20/06/2025

Figure 4. Summary 18/4/25 (see Appendix 4: Figure 4 for full Gannt planning).

Ethics and Risk Mitigation

Hygienic, comfort-tested chopsticks will be used, with hand sanitiser provided. Facial markers will be tested for skin sensitivity and comfort; however, a minor risk of individualised reactions may remain. Data will be pseudonymised and password protected following GDPR rules, and hard copies will be digitalised and promptly destroyed. Informed consent will be sought, and inclusion of facial images will require further consent. Participants will be informed of their right to withdraw. This study will undergo ethical review by the UWTSD ethics committee.

Insider Research

As teacher and president at TMA 31, I acknowledge potential power imbalances. Participants will be assured during briefing that participation is voluntary and without consequence. Consideration will be given to the potential influence of familiarity, which may improve participant comfort but also affect the findings (Mercer, 2007).

Expected Learning Outcomes

- Project management skills.
- Knowledge of acoustics and resonance.
- WASP 2 and Image J tools experience.
- Statistical analysis skills.
- Clarifying current methods.
- Foundations for future research.

Report

Introduction

Does activating the zygomaticus and orbicularis oculi muscles brighten vocal tone in female singers, and are two tested practical activation strategies effective?

As a voice teacher, I promote smiling to brighten tone and improve projection, a facial posture (FP) long employed by singers and pedagogues (McQuade, 2016). Research show that activating the zygomaticus (ZM) and orbicularis oculi (OOM) muscles alters vocal tract resonances, enhancing brightness and projection (Fagel, 2010; McQuade, 2016; Arias, Bellin and Aucouturier, 2018) *(see Figure 1).*

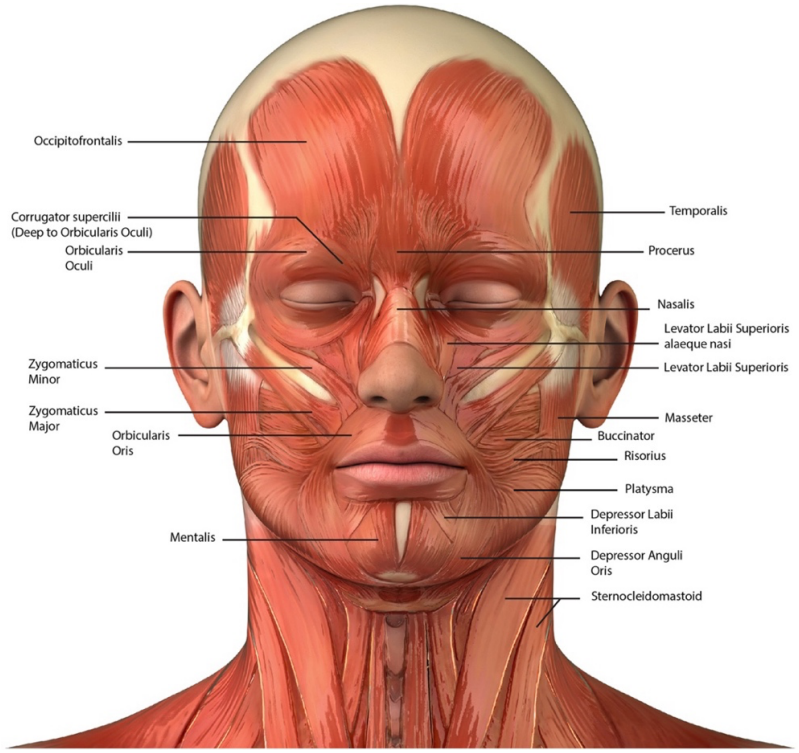


Figure 1. Superficial muscles of the face and neck (Zachary, Gruschak and Newman, 2023).

The exercises I currently use to activate ZM and OOM have been passed down from mentors but remain untested empirically. This study aims to rectify this, evaluating the pedagogical and acoustic validity of two strategies *(see Figure 2 and Figure 3).*

1. **Fingers placed on front teeth (*FT)***
2. **Chopstick held lightly between front teeth *(C)*,** inspired by Strack, Martin and Stepper (1988).

Figure 2. FT Strategy	*Figure 3. C Strategy*
	

FT and *C* were compared with two control conditions: natural smile (*S)* and neutral *(N)* facial postures (FP). Audio recordings were analysed for spectral centroid (SC), a weighted average frequency that reflects tonal brightness (Schubert and Wolfe, 2006; Pearce, Brookes and Mason, 2021) In addition, facial muscle activation was assessed from images via the Facial Action Coding System (FACS) for OOM (AU6) and ZM (AU12) (Ekman, Friesen and Hager, 2002).

Intended Impact

Participation was limited to adult amateur female singers (18-60 years), to reduce impact of anatomical or technique variations (Charness, Gneezy and Kuhn, 2012; Markova et al., 2016). As resonance strategies differ between male and female singers (Henrich, Smith and Wolfe, 2011), this study aims to inform practical approaches for enhancing vocal tract resonance in female singers with potential applications across techniques and genres (Titze, Maxfield and Walker, 2017).

FPs further influence emotional state and social inclusion (Andréasson and Dimberg, 2008; Chang et al., 2014; Arnold and Winkielman, 2021; Coles et al., 2022), making this research a step toward developing techniques to counteract habitual negative FPs while singing.

Expected Learning Outcomes

- Evaluation of existing pedagogical resonance strategies.
- Foundations for further research into facial activation and vocal resonance.
- Professional growth as a practitioner-researcher through:
  - Expanded knowledge of acoustics and resonance.
  - Experience with WASP 2, WaveLab Pro 12, Jamovi and Image J tools.
  - Enhanced project management and statistical analysis skills.

Literature Review

Review Methodology

This review prioritised peer-reviewed literature from 2005 to 2025, following female resonance studies from Weiss, Brown and Morris (2001) and Joliveau, Smith and Wolfe (2004). Earlier papers were included when seminal or where recent alternatives were lacking. Both qualitative and quantitative studies were considered to provide a nuanced understanding of smiling's impact on vocal resonance. Non-peer-reviewed conference papers from leading experts in the field have been included, while grey literature is excluded due to its anecdotal nature and lack of methodological rigour (Franks et al., 2012).

Written from a voice practitioner-researcher perspective, this review begins with an overview of voice production and vowel formants, examining differences in male and female resonance strategies, and exploring the effect of smiling on vocal timbre. Finally, it concludes with a discussion of historical context, research gaps, limitations, future research directions, and this study's contributions to the research area.

Acoustic Notation

Standardised symbolic notation is adopted from Titze et al. (2015) *(see Table 1).*

Harmonics			Resonances			Formants		
Frequency (Hz)	Amplitude (Pa)	Level (dB)	Frequency (Hz)	Level of peak (dB)	Bandwidth (Hz)	Frequency (Hz)	Level of peak (dB)	Bandwidth (Hz)
$(1)f_o$	A_1	L_1	f_{R1}	L_{R1}	B_{R1}	F_1	L_{F1}	B_{F1}
$2f_o$	A_2	L_2	f_{R2}	L_{R2}	B_{R2}	F_2	L_{F2}	B_{F2}
$3f_o$	A_3	L_3	f_{R3}	L_{R3}	B_{R3}	F_3	L_{F3}	B_{F3}
...								
nf_o	A_n	L_n	f_{Rm}	L_{Rm}	B_{Rm}	F_m	L_{Fm}	B_{Fm}

Table. 1 Titze et al. symbolic notation (2015).

Source-filter System

Voice production involves a source-filter system: Vocal folds within the larynx, driven by subglottic airflow, generate sound by vibrating at a fundamental frequency (f_o), while the supralaryngeal vocal tract acts as a filter (Markova et al., 2016). Extending from the larynx to lips, this tract shapes resonance (R) patterns and amplifies certain frequencies (Titze, Maxfield and Walker, 2017) *(see Figure 4).*

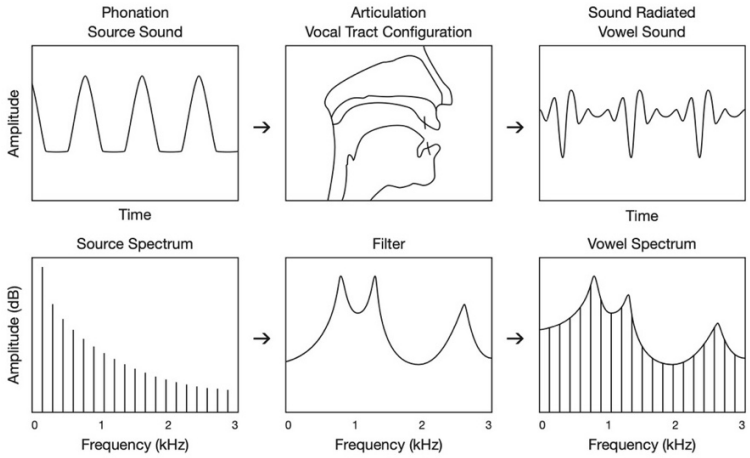


Figure 4. Source, filter and sound (Maurer, 2016).

Anatomical and demographic factors such as age and sex affect the properties of both source and filter *(see Figure 5).*

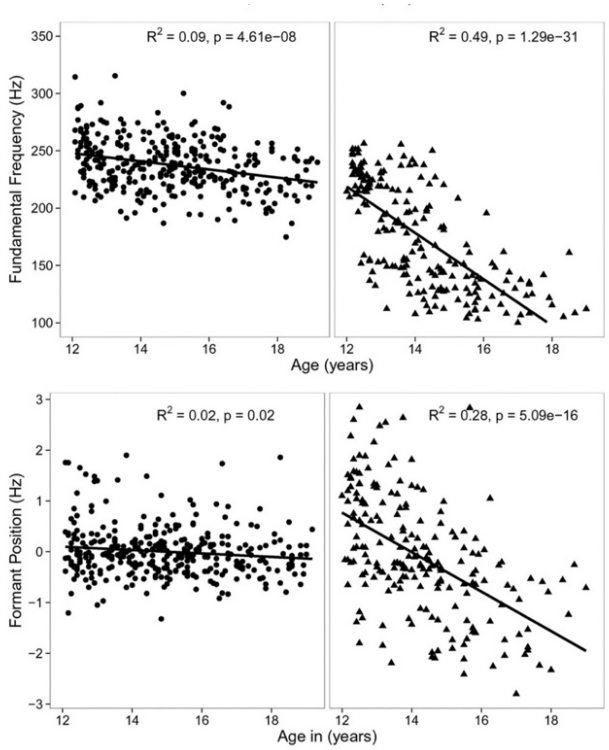


Figure 5. Age variations in f_o and formant position (Markova et al., 2016).

Vowel Formants

Articulatory positioning shapes vocal tract resonances (pharyngeal, oral and nasal), emphasising specific harmonic regions known as formants (F_m) (de Souza et al., 2020). The first two formants (F_1 and F_2) are key to vowel perception and contribute to vocal timbre (Bozeman, 2010; Maurer, 2016; Titze, Maxfield and Walker, 2017). Vowels can be classified by tongue position: vertical (high/low) and horizontal (front/back), which also affects jaw

openness (low/open and high/closed) (Georgeton, Antolik and Fougeron, 2016; Hitch, 2017; Knight and Setter, 2021). Low vowels like [ɑ/a], have higher F_1; high vowels like [i] and [u] have lower F_1. Back vowels ([ɑ] [o] [u]), show lower F_2 while front vowels ([i] [e] [a]) show higher F_2 (Bozeman, 2010; Hitch, 2017) *(see Figures 6 and 7 and Table 2).*

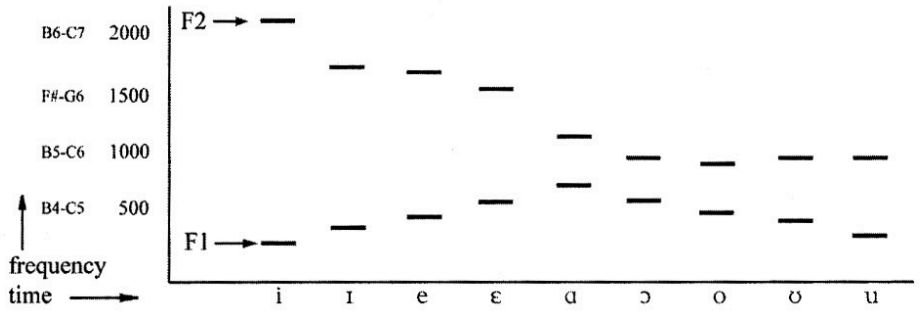


Figure 6. Spectrographic model of male vowel formants (Bozeman, 2010).

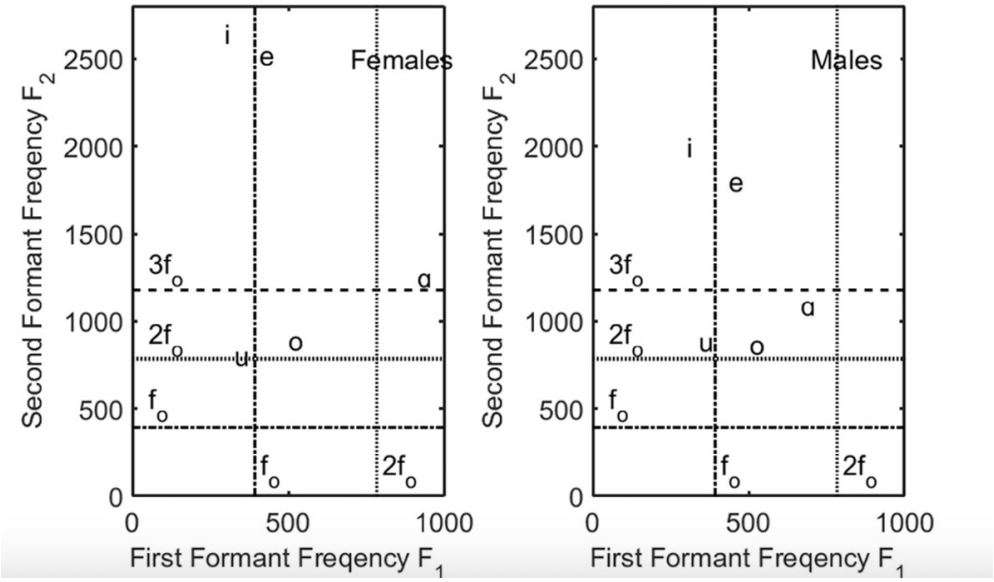


Figure 7. F_1 and F_2 frequencies of [ɑ] [e] [i] [o] and [u] vowels (Titze, Maxfield and Walker, 2017).

High Vowel Sequence	[æ]	[ɛ]	[e]	[ɪ]	[i]
Male F_1	670	550	420	350	280
Female F_1	860	660	504	420	320
Male F_2	1800	1900	2000	2200	2300
Female F_2	2160	2280	2400	2640	2760
Low Vowel Sequence	**[a]**	**[ɔ]**	**[o]**	**[ʊ]**	**[u]**
Male F_1	850	500	360	300	300
Female F_1	1020	600	431	360	370
Male F_2	1610	800	640	610	595
Female F_2	1932	960	768	732	714

Table 2. Approximate F_1 and F_2 by vowel (Titze, 2022).

Resonance Strategies

Resonance or formant tuning (f_{Rm}) enhances vocal efficiency and output by aligning vocal tract resonances with harmonics (nf_o), often by raising f_{R1} to align with f_o (Garnier et al., 2010; Henrich, Smith and Wolfe, 2011; Smith et al., 2013). This requires precise adjustments of the tongue, jaw, and lips – jaw lowering lowers f_{R1}, while tongue elevation raises fR_2 (Vos et al., 2018), and vertical and horizontal lip spreading also contribute (Garnier et al., 2010).

In male singers and females singing lower pitches, harmonics often align naturally with f_{R1} or second f_{R2} (Smith et al., 2013). When f_o exceeds F_1, singers must raise F_1 through vocal tract modifications (Bozeman, 2010; Titze, Maxfield and Walker, 2017), the pitch at which this occurs varies by individual, vowel, and gender (Titze, 2022) (*see Table 2).* MRI studies show that female singers use vertical lip and pharynx widening, jaw opening, and tongue elevation as f_o approaches F_1 (Echternach et al., 2010), with f_{R1} tuning typically starting around 500-600 Hz (C5 – D5) (Garnier et al., 2010). Resonance tuning also plays a key role in register transitions (Bozeman, 2010; Titze, 2022).

Smiling's Effect on Vocal Tract and Timbre

Resonance is affected by vocal tract length, through larynx, tongue and lip position alterations (Fagel, 2010; Titze, Maxfield and Walker, 2017). Smiling shortens the vocal tract through lip spreading and mouth opening, shifting f_{R1} and f_{R2} by 5-10%, increasing high-frequency energy, and raising $2f_o$ and $3f_o$ (Fagel, 2010; Garnier et al., 2010; Kalashnikova, Carignan and Burnham, 2017; Kim et al., 2020; Arias et al., 2020; Shi et al., 2024). When lips are spread, vowel clarity of rounded vowels is maintained through tongue position alterations (Fagel, 2010).

A genuine ‘Duchenne’ smile engages both the orbicularis oculi (OOM) and zygomaticus muscles (ZM) (Ekman, Davidson and Friesen, 1990; Jaffer, Ichesco and Gerstner, 2016), while non-genuine smiles engage only the ZM to a lesser extent (Soussignan, 2002) *(see Figure 8)*. MRI studies show that happy expressions shorten the vocal tract more than angry or sad ones (Kim et al., 2020). Smiling alters vocal timbre (Arias, Bellin and Aucouturier, 2018), and listeners can distinguish smile types by sound alone, even across languages (Drahota, Costall and Reddy, 2008; Quené, Semin and Foroni, 2012), suggesting ZM and OOM activity produces distinct acoustic effects.

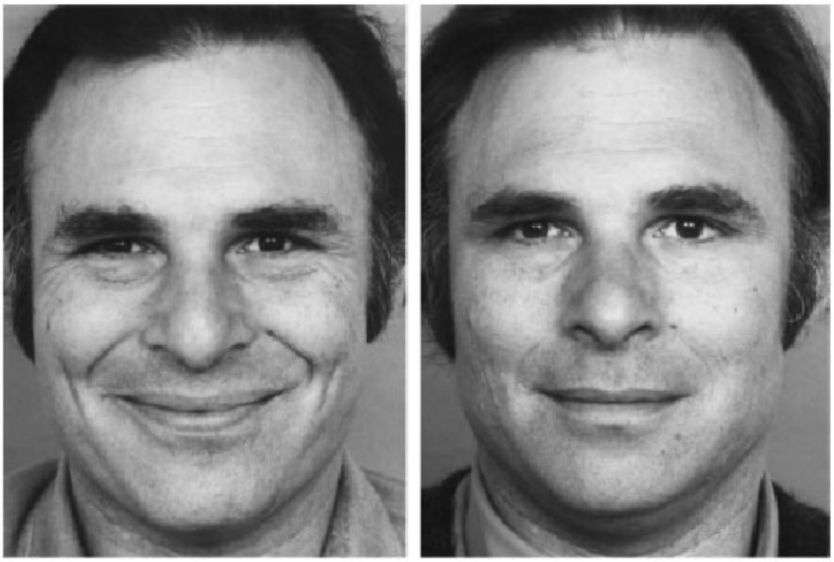


Figure 8. Duchenne vs Non-Duchenne smiles (Ekman, Friesen and Hager., 2002; Salas et al., 2016).

Strack, Martin and Stepper (1988) used a pen-between-teeth method to activate the ZM and OOM, a technique adapted in this study’s *Chopstick* strategy. However, Coles et al (2022) questioned its validity due to possible activation of biting muscles, suggesting alternative methods may be better for activating OOM. Considering the impact of jaw tension and position on vocal tract resonance and brightness (Mautner, 2015), this was carefully monitored in this study.

Shi et al. (2024) found that smiling raised f_{R1}, f_{R2}, f_0 and $2f_o$. However, both f_0 and brightness varied with language, suggesting it influences resonant strategies. Furthermore, loudness produced a stronger effect on brightness than smiling. Therefore, this study considered the impact of volume and language on acoustic outcomes. Additionally, as OOM activation can occur in negative expressions (Kunz, Meixner and Lautenbach, 2019; Girard et al., 2021), the combined activation of both ZM and OOM was monitored.

Evaluation

Although resonance strategies vary across musical genres (Titze, Maxfield and Walker, 2017), much of the existing research has concentrated on Western classical singing (de Souza et al., 2020; Herbst, Story and Meyer, 2023). Moreover, vocal resonance studies have historically centred on male singers (Sundberg, 2001; Echternach et al., 2010). Trained male Western classical singers employ a singer's formant cluster (SFC), a prominent spectral peak around 3 kHz, to enhance vocal projection and resonance (Vampola; Horáček and Laukkanen., 2024). However, evidence of a comparable strategy in female singers remains limited and conflicting (Vos et al., 2018). Weiss, Brown and Morris (2001) proposed a female-specific equivalent particularly evident on low to mid pitches, *Extended Frequency Reinforcement,* which spans a broadband range 2 – 2.5 times greater than males (2.6 – 4.6 kHz), More recently, Vampola, Horáček and Laukkanen (2024) identified SFC-like patterns in female voices below 500 Hz, though with greater variations by vowel and a wider frequency spread. Conversely, de Souza et al (2020, p.7) argue there is a "clear lack" of a singer's formant in women. These divergent findings highlight the need for clearer, gender-specific terminology and further investigation into female vocal resonance strategies.

Recent studies have begun addressing this gap (Vos et al., 2018; de Souza et al., 2020; Lyubarskaya et al., 2024), and this study similarly recognises the unique characteristics of female vocal resonance. Additionally, research in this field has been hindered by inconsistent terminology relating to formants, resonances, and harmonics. To support cross-study clarity, this study adopts the standardised notation system proposed by Titze et al. (2015) *(see Table 1).*

Vocal acoustics research also faces several challenges, including small sample sizes, individual variability, and the complexity and cost of capturing vocal mechanisms (Echternach et al., 2010; Chang et al., 2014; McQuade, 2016; Vampola, Horàček and Laukkanen, 2024). While previous studies have demonstrated a potential role for ZM and OOM activation in enhancing brightness, further research is required to establish effective, genre-specific techniques, especially for female singers. This study contributes by evaluating two practical strategies to support the developing area of female resonance research.

Methodology

Participants

Participants (n=10) were selected in a purposive sample of adult female amateurs aged 18 - 60, thereby reducing variability arising from prior vocal training and sex- or age-based voice differences (Markova et al., 2016).

Participant	Age Range	Voice Type	Prior Training	Which
1	30-40	Soprano	Yes	5 years of tuition at school.
2	40-50	Alto	No	
3	50-60	Soprano	No	
4	40-50	Soprano	No	
5	50-60	Alto	Yes	20 sessions of individual lessons approx. 25 years ago and choral training.
6	18-30	Soprano	No	
7	50-60	Alto	No	
8	50-60	Soprano	Yes	2 years aged 16-18, years, lessons from Eve aged 55, musical theatre and choral training.
9	50-60	Soprano	Yes	3 years.
10	40-50	Soprano	Yes	5 years of private voice tuition.
	Menopausal 45.5%	Soprano 72.7%	Some Training 45.5%	
	Perimenopausal 22.22%	Alto 27.3%	No Training 54.5%	

Table 3a. Taxonomy of participants – self reported.

Participant	Native Language	Second Languages
1	English	French
2	English	French
3	English	French
4	English	French, Italian
5	English	/
6	French	English, Spanish
7	English	French
8	English	French, German, some Dutch
9	French	English
10	English	/

Table 3b. Taxonomy of participants continued.

Post-positivist Quantitative Methodology

This study was guided by a post-positivist (PP) paradigm, reflecting my ontological view that reality is uncertain and best understood probabilistically (Guba and Lincoln, 1994). Grounded in critical realism, it acknowledges values, beliefs and that researcher-participant interactions shape understanding (Guba and Lincoln, 1994; Pretorius, 2024). As an insider practitioner-researcher, I also recognise power imbalances and prior relationships may influence data collection (Mercer, 2007). PP mitigates this risk by emphasising empirical testing and objectivity and additionally reflects on traditional assumptions (Guba and Lincoln, 1994; Pretorius, 2024). Moreover, it provides a scientifically rigorous framework that bridges positivist and interpretivist approaches (Panhwar, Ansari and Shah 2017). Within this framework, this study aimed to (non)falsify the hypothesis that the *FT* and/or *C* strategies activates ZM and/or OOM muscles, enhancing tone brightness and projection in female singers (Guba and Lincoln, 1994; Ryan, 2018).

A quantitative methodology, aligned with PP, was employed to identify patterns and relationships in measurable data, minimise researcher influence and bias, and maintain objectivity (Mackenzie and Knipe, 2006; Hammersley, 2013; Gerring, 2017; McLeod, 2024). Quantitative methods were favoured over qualitative to reduce analytical complexity and

time (Scott, 2024). While this preliminary study excluded interviews and questionnaires, future research may benefit from qualitative insights to deepen understanding in this complex field (Pretorius, 2024).

Design

A **4 x 5 Factorial Within-Subject** design was chosen to enhance statistical validity with a small sample, as each participant served as their own control (Charness, Gneezy and Kuhn, 2012), helping reduce variability from individual vocal anatomy and technique (Markova et al., 2016; Lyubarskaya et al., 2024).

Data collection was randomised across four FP prompts and five vowels to minimise fatigue, psychological bias and sensitisation effects (Charness, Gneezy and Kuhn, 2012).

Independent Variables

Prompts

1. Smile *(S)*
2. Neutral *(N)*
3. Chopstick: Held lightly between teeth *(C)*
4. Fingers: Thumb and first finger held on upper teeth *(FT)*

To minimise researcher influence (Guba and Lincoln, 1994; Pretorius, 2024) and objectively assess ZM and OOM activation, participants received no specific instructions on responding to *S* or *N* prompts (for example, Duchenne or Non-Duchenne smiles). Similarly, *C* and *FT* strategies were demonstrated only during the briefing, not data collection phases.

Vowels

5 vowels ([a] [e] [i] [o] and [u]), sung individually between reference pitches.

Dependent Variables

Acoustics

Spectral centroid (SC)

Muscle Activation

OOM (AU6) and ZM (AU12)

This design, measuring acoustical changes and muscle activation, enabled analysis of how vowel articulation interacts with *C* and *FT* strategies, while two control postures: *S* and *N* allowed comparison against neutral or natural baselines.

Experiment Set Up

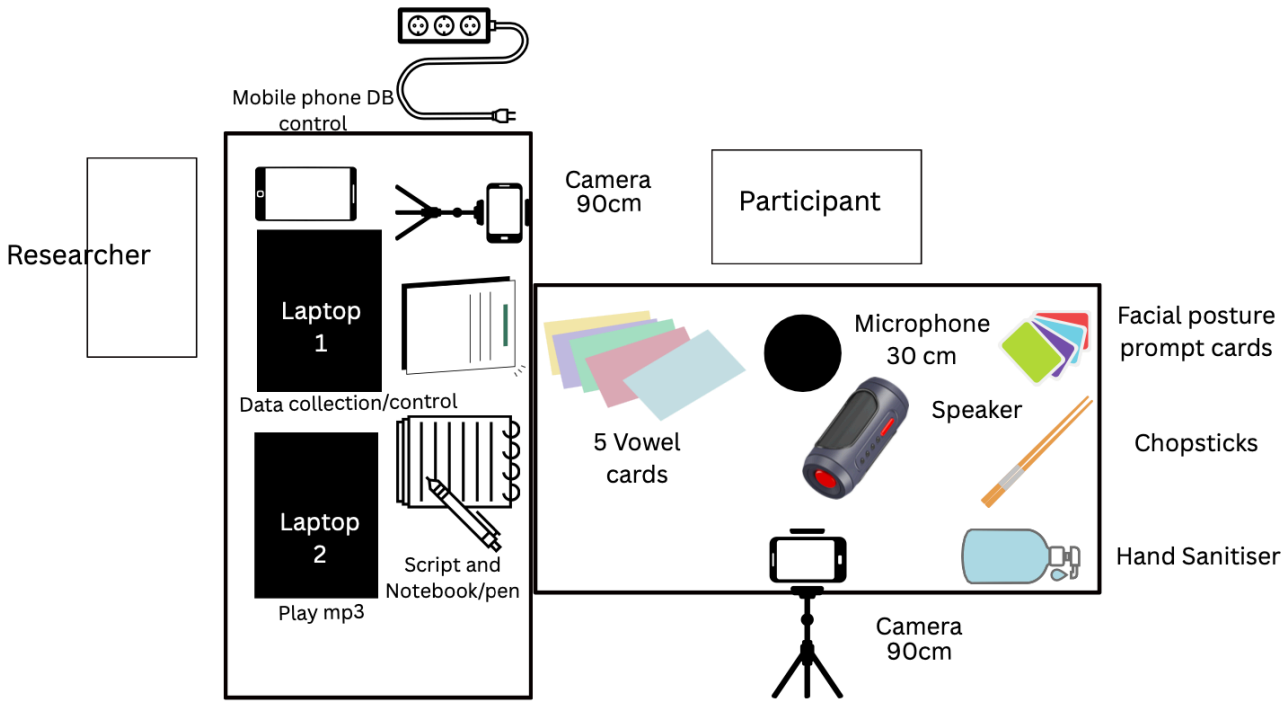


Figure 9. Experiment set up.

Pilot Trial

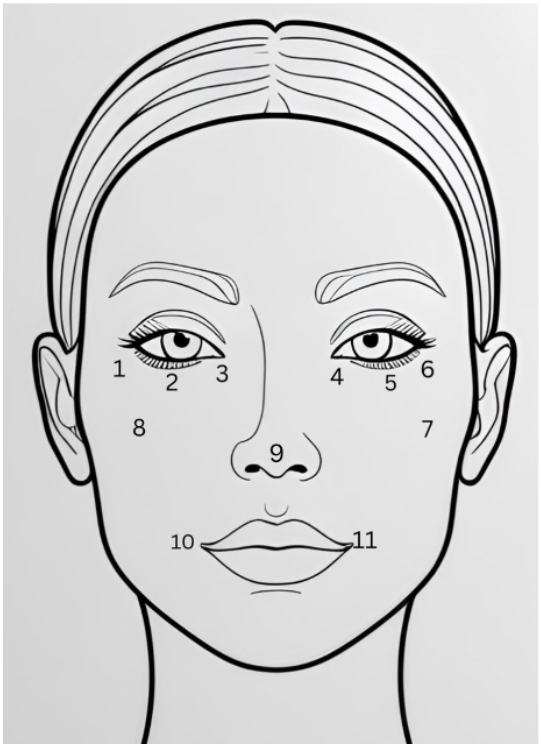
A pilot trial was conducted leading to two adjustments:

- References to facial “expressions” were replaced with “position” or “posture”, in briefing scripts and during the data collection to avoid influencing participant responses.
- A speaker was added to play the reference pitch, ensuring both vocal and synthesised pitches were recorded, aiding monitoring pitch accuracy and facilitating analysis.

Briefing

During this phase a script was used to ensure all participants received identical instructions *(see Appendix 6).* Five IPA vowel cards ([a] [e] [i] [o] and [u]) were shown, and pronunciation clarified via a recording to minimise researcher influence. Participants practiced pronunciation with feedback, mainly for English native speakers unfamiliar with [e] or IPA. *C* and *FT* strategies were demonstrated. A 5 x 330Hz guide pitch recording was played and vowel phonation procedure explained. Black markers tracked ZM, OOM, and oral commissure movements, following Miller, Smith and Shah (2007),Jaffer, Ichesco and

Gerstner (2016), and Weber and Krenn (2017), (*see Appendix 4: Figures 1 and 2).* Marker placement was explained with an image *(see Figure 10)* and verbal consent obtained. Rhinestone markers proved unreliable, therefore water-soluble liquid eyeliner was substituted for all participants. Finally, participants were invited to ask questions.



OOM
1 and 6
Inferior lateral cantus
2 and 5 Inferior centre eye
3 and 4 Inferior medial cantus

ZM
7 and 8 Zygoma

9 Control spot for measurement

10 and 11 Lip commissures

Figure 10. Placement of markers (Miller, Smith and Shah., 2007; Jaffer, Ichesco and Gerstner, 2016; Weber and Krenn, 2017).

Data Collection

Video and audio were recorded simultaneously using:

- Two cameras (iPhone) positioned 90 cm from the participant: one frontal and one lateral. The lateral view was included to capture muscle movement along the anteroposterior axis, which Jaffer, Ichesco and Gerstner (2016) found shows greater displacement when smiling.
- A Blue Yeti microphone, placed 30cm from the participant, connected to a MacBook Pro laptop and WASP2 software.

Equipment and seating positions were marked, and participants were instructed to minimise upper-body movement to standardise distances. Video captured continuous muscle activation (Young et al., 2002), participant movements and reactions to prompts.

Participants were seated upright with feet flat and back touching back of the chair to maintain optimal singing posture and consistent distance from the equipment. Vowel order

was randomised by shuffling five vowel cards and placing them face up before each stage, with four prompt cards laid out in front of participant in a pre-randomised order (*see Appendix 3: Tables 1 and 2)*.

Each participant sang five randomised vowels per prompt, interspersed with five standardised 330Hz (E4) reference pitches. Short pauses separated vowels and reference tones for clarity. Pitch accuracy was monitored using WASP2, aiming a margin of error of less than 1⁄4 tone (325 Hz to 335 Hz), while volume was tracked via the Decibel X app (Shi et al., 2024) with the planned 70-85 dB range lowered to 60-75 dB for all participants.

Before each stage, participants held prompt card to the camera, and the order of vowels was noted to streamline analysis. To avoid blocking the lateral camera view on participant's right, the left hand was used for *FT.*

Only participant and researcher were present during briefing, recording and debriefing to ensure anonymity and reduce noise.

Participant 10 returned to repeat *N* and *C* prompts after the [e] vowel was omitted in the original session.

Analysis

All statistical analyses were conducted using an alpha value of 0.05, indicating a 5% risk of incorrectly concluding that an effect exists when it does not. Correspondingly, p-values less than 0.05 were considered to indicate statistically significant differences.

Spectral Centroid

The spectral centroid (SC), the weighted average frequency of a sound spectrum quantifies tonal brightness (Schubert and Wolfe, 2006; Pearce, Brookes and Mason 2021; Kazazis, Depalle and McAdams, 2022) *(see Figure 11)*. WaveLab Pro 12 was used to calculate the mid-vowel average SC from audio recorded.

$$C = \frac{\sum_{n=1}^{N} f(n)\, x(n)}{\sum_{n=1}^{N} x(n)},$$

Figure 11. Formula for SC calculation (Pearce, Brookes and Mason, 2021).

Also known as the Spectral Centre of Gravity (CoG), SC increases when a set of formants are raised through vocal tract alterations (Jemaa, Ouni and Laprie, 2010). Since smiling alters vocal tract length, SC variations were evident in this study's results *(see Figure 12).*

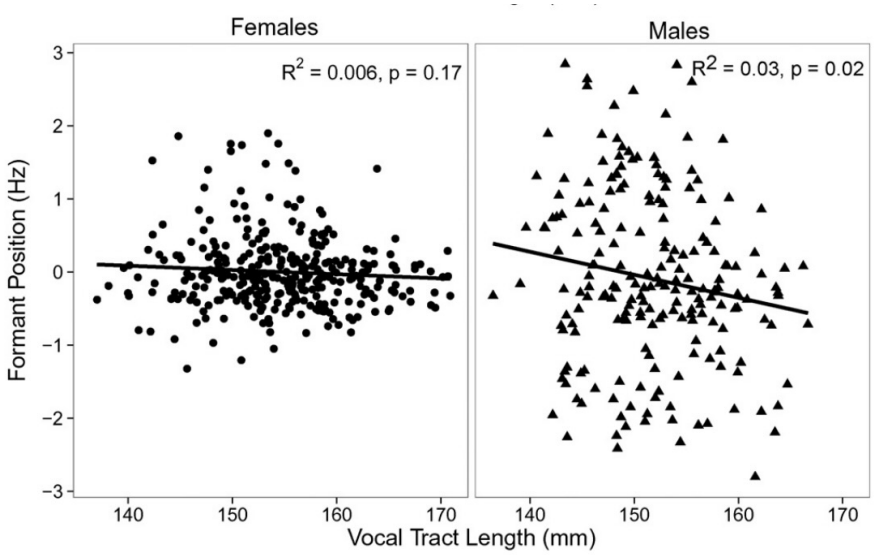


Figure 12. Formant position related to vocal tract length (Markova et al., 2016).

Facial Action Unit Coding

Video was converted into still images using Filmora, capturing peak muscle activation per vowel/prompt. Initially, ImageJ was planned to measure distances between 10 facial marks, but inconsistent scaling across cropped photos and participants movements compromised accuracy. Consequently, the Facial Action Coding System (FACS) (Ekman and Friesen, 1978) was used to code smile-related Action Units (AU).

- AU6 – Cheek Raiser and Lid Compressor (OOM activation)
- AU12 – Lip Corner Puller (ZM activation)
  (Ekman, Friesen and Hager, 2002)

Researcher Influence, Insider Research, and Ethics

Mimicry

Smiles, both visual and auditory, can trigger mimicry and activate ZMs even without visual cues (Andréasson and Dimberg, 2008; Arias, Bellin and Aucouturier, 2018; Arnold and Winkielman, 2021). To avoid influencing participant's FPs, I sat beside them and minimised verbal instructions (Hawk, 2012).

Power imbalance

The insider researcher/participant dynamic and its potential influence were acknowledged during briefing (Costley and Gibbs, 2006; Breen, 2007; Mercer, 2007). Participants were reassured their responses had no personal or professional consequences or benefits and encouraged to respond naturally, without trying to align with perceived expectations.

Hygiene

Individually wrapped chopsticks, hand sanitiser, and facewipes were provided.

Anonymity and Data Security

Data were stored under pseudonyms on protected devices with secure backups. Hard copy consent forms were digitalised and destroyed. Photographic images were stored digitally, and analysis limited to facial areas. Participant images and audio are excluded from this report to protect privacy.

Informed Consent

Informed consent was obtained with an information sheet provided *(see Appendix 5).*

Approval

Ethics approval was granted by the UWTSD Research Ethics Committee (*see Appendix 13)* and approval granted by TMA 31 and the Mairie de Pibrac *(see Appendix 11).*

Use of AI

AI has been employed in this study for the following purposes:

Canva AI

Image creation *(see Figure 10).*

ChatGPT

- Randomisation of prompt order.
- Creation of digitalised 330 Hz guide pitch.
- Clarification of unknown academic terms.
- Assistance in drafting glossary definitions.

Findings

Spectral Centroid

Descriptives

Mean SC

For *S* and *FT* prompts the highest mean SC was measured on an [i] vowel (*S* = 1676 Hz, *FT* = 1539 Hz). However, for *N* and *C* the highest mean SC occurred on an [e] vowel (*N* = 1643 Hz, *C* = 1688 Hz).

The lowest means were measured on rounded vowels: [u] (*N* = 931 Hz, *C* = 1045 Hz, *FT* = 928 Hz), [o] (*S* = 1163 Hz).

Mean versus Median

Several vowels produced slightly higher median scores than mean, with [i] consistently producing a higher value, this suggests that data is negatively skewed *(see Table 4 and Appendix 3: Table 3).*

Prompt	Vowel	Mean SC (Hz)	Median SC (Hz)
S	[i]	1676	1794
N	[a]	1431	1483
	[e]	1643	1708
	[i]	1627	1645
C	[i]	1599	1644
	[u]	1045	1065
FT	[a]	1309	1314
	[e]	1485	1572
	[i]	1539	1677

Table 4. Prompts and vowels with higher median than mean SC value.

Standard Deviation

The largest standard deviation in SC was produced by *S* [u] (*SD* = 642). Additionally, *N* [e] and *C* [i] prompts/vowels both produced a larger standard deviation (*SD* > 420).

(See Appendix 3: Table 3).

ANOVA

A two factor repeated measures ANOVA showed statistically significant differences across prompts, F (3, 27) = 7.09, p = 0.001, and across vowels, F (4, 36) = 31.52, p < .001. However, there was no significant interaction between prompts and vowels, F (12, 108) =

1.01, p = 0.449. Partial eta squared effect sizes indicated that vowels had the greatest impact (ηp2 = 0.778) followed by prompts with a strong effect (ηp2 = 0.441), while the interaction effect was small (ηp2 = 0.101).

(See Appendix 3: Table 4).

Post hoc

Following repeated measures ANOVA, post hoc tests with Bonferroni correction were carried out. This revealed there was a significant difference in SC between the prompts *S* and *FT, t* (9) = 5.249, $p_{bonferroni}$ = 0.003. All vowels produced a higher SC mean on *S* than *FT,* with the mean difference 190.5 greater on average when smiling *(see Table 5, Figure 13 and Appendix 3: Table 5).*

¶	*Mean·Values·–·Spectral·Centroid·(Hz)*¶	
Vowel¶	*S*¶	*FT*¶
[a]¶	1526¶	1309¶
[e]¶	1640¶	1485¶
[i]¶	1676¶	1539¶
[o]¶	1163¶	959¶
[u]¶	1168¶	928¶

Table 5. S versus FT prompt mean SC by vowel.

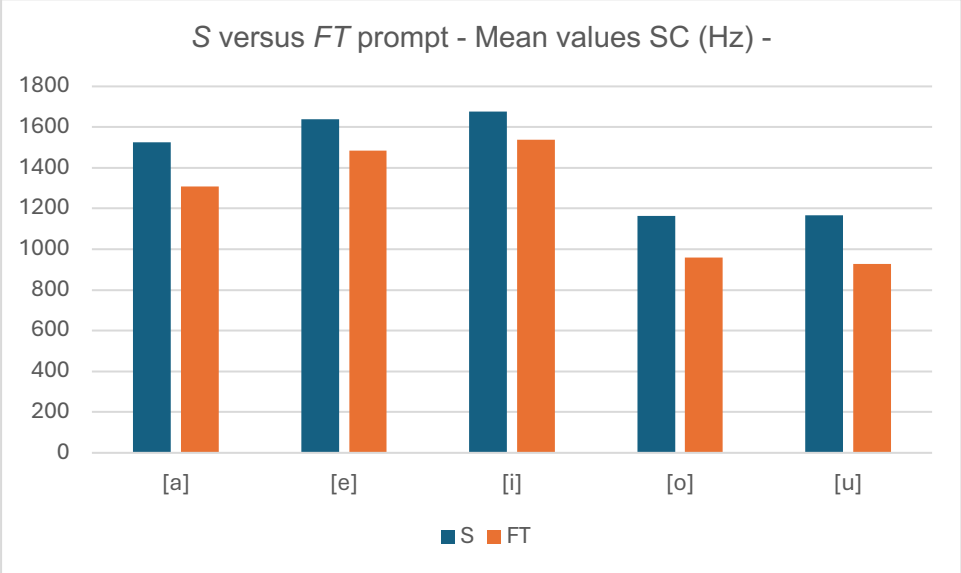


Figure 13. Bar chart S versus FT prompt mean SC by vowel.

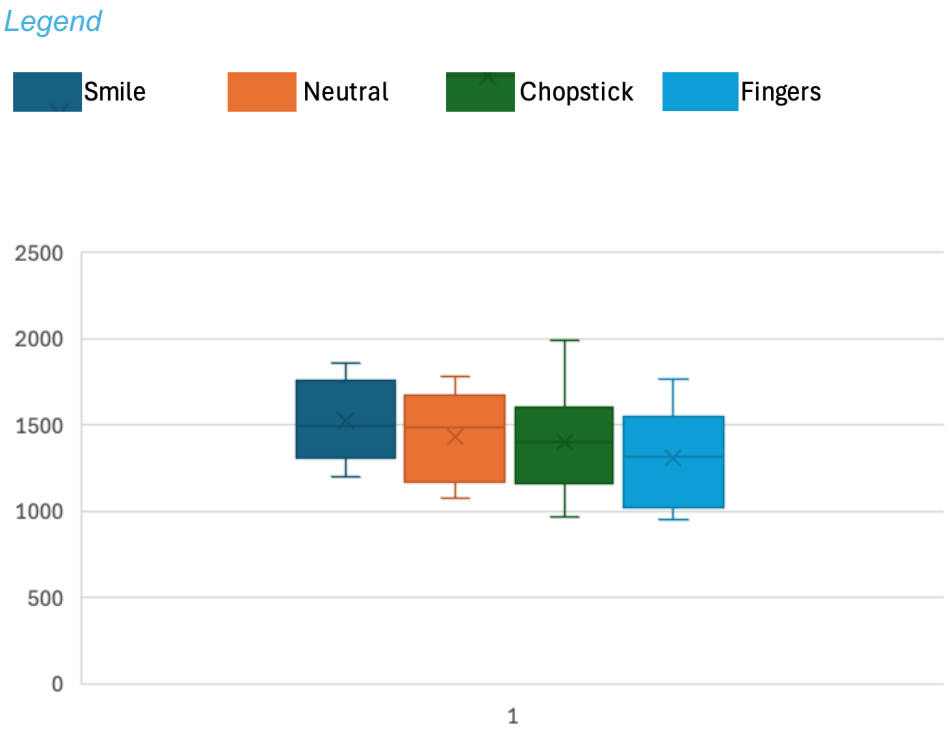


Figure 14. [a].

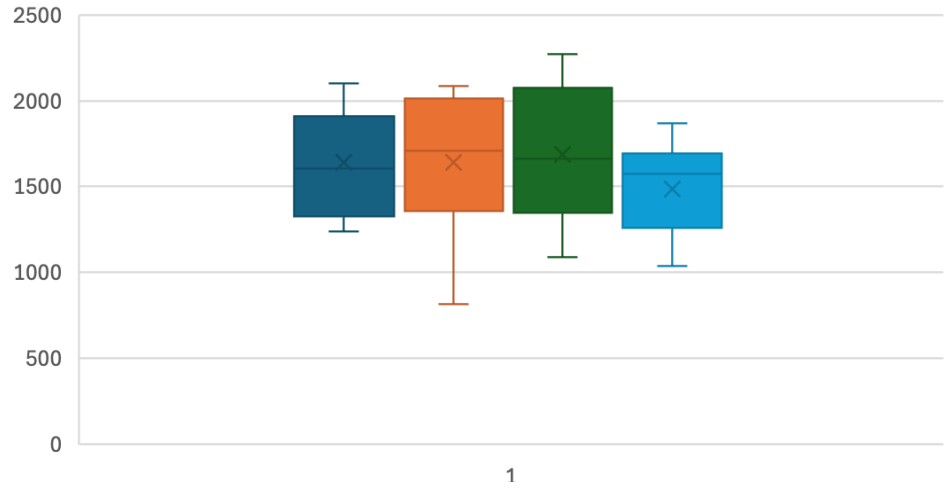


Figure 15. [e].

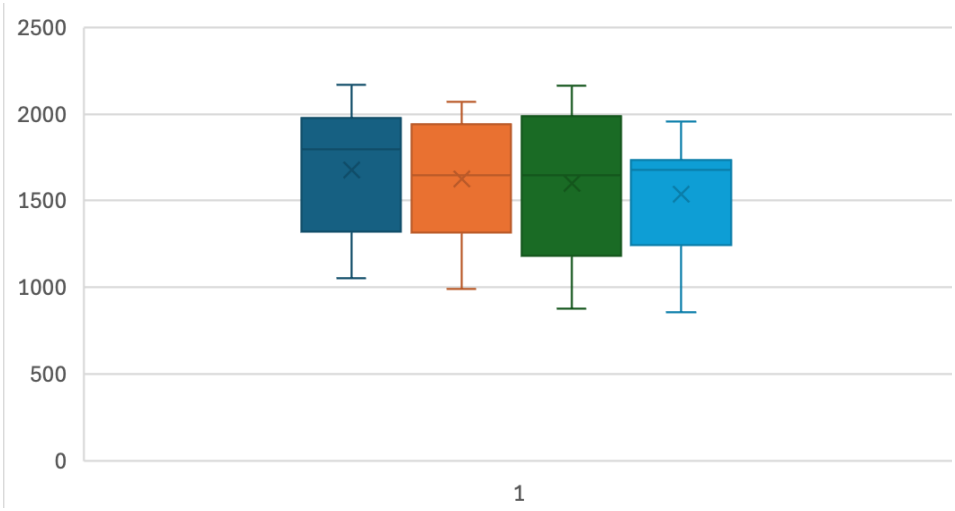


Figure 16. [i].

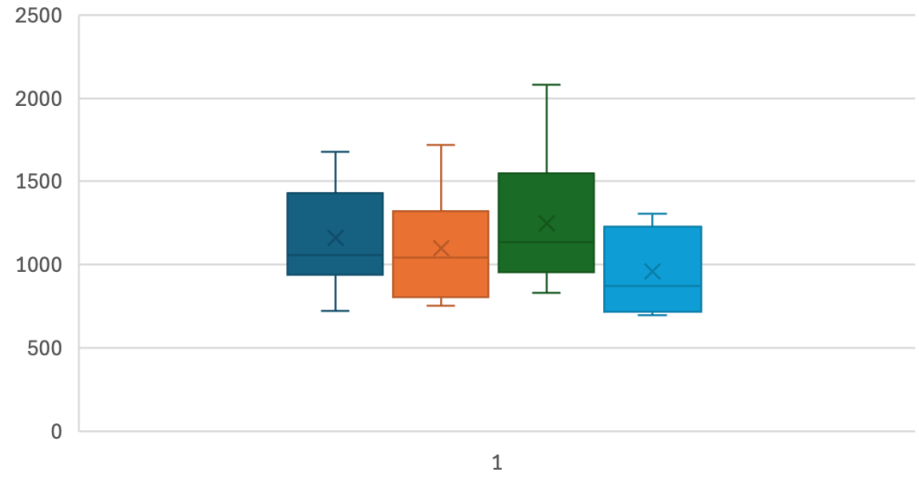


Figure 17. [o].

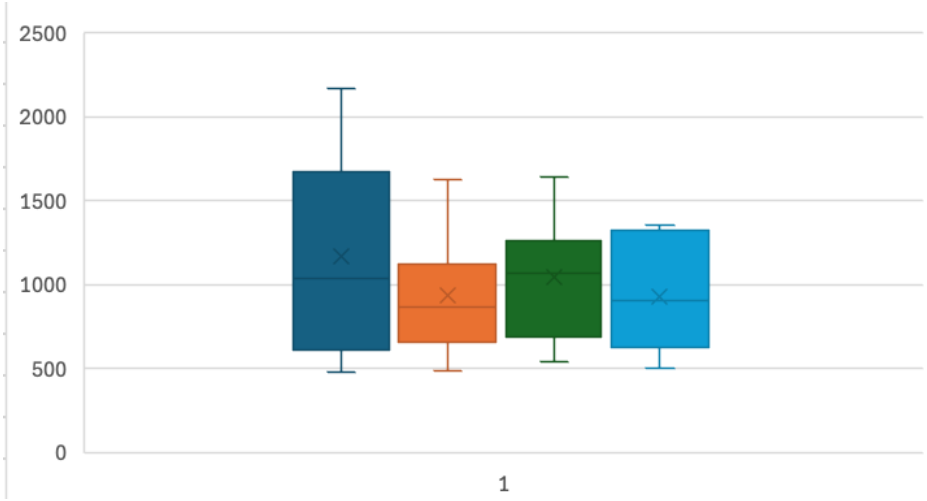


Figure 18. [u].

AU6 and AU12 Muscle Activation

Descriptives

The *S* prompt showed the greatest AU6 and AU12 activation across all vowels (AU6: [a] = 3.00, [e] = 3.00, [i] = 3.20, [o] = 2.70 and [u] = 2.80, AU12: [a] = 3.10, [e] = 3.20, [i] = 3.30, [o] = 3.00 and [u] = 3.10) but also the largest standard deviation (AU 6 [e]: *SD* = 1.56; AU12 [i]: *SD* = 1.34). *FT* showed the greatest activation in both AU6 and AU12 when singing an [i] vowel compared with the other vowels (AU6: *M* = 1.00; AU12: *M* = 1.50). Nevertheless, *FT* saw a slight increase in both AU6 and AU12 activation compared with the *N* prompt on almost all vowels except for [a]/AU6 and [e]/AU12. The *C* prompt saw an increase in AU6 activation from *N* across all vowels but AU12 only on [a], [i] and [u].

AU6

Standard deviations in AU6 activation were greatest for the *S* prompt (1.23 ≤ *SD* ≤ 1.56) with the largest occurring on *S* [e] (*SD* = 1.56). However, *FT* also showed high standard deviation on [i] (*SD* = 1.05) and [u] (*SD* = 1.20).

The highest mean value was measured using *S* [i] (*M* = 3.20). However, the highest median value was measured on *S* [e] (*Mdn* = 4.00).

There was an increase in AU6 activation from *N* on all prompts, except *FT* [a] where activation remained the same. *FT* and *C* strategies, however, produced only slight increases in comparison with *S* (*see Table 6).*

	Neutral	Smile	Chopstick	FT
[a]	0.300	3.00	0.400	0.300
[e]	0.400	3.00	0.800	0.600
[i]	0.600	3.20	1.00	1.00
[o]	0.400	2.70	0.500	0.800
[u]	0.300	2.80	0.800	0.900

Table 6 Mean AU6 activation by vowel/prompt.

Several prompts and vowels produced higher median values than mean, suggesting that there is a negative skew to the data, particularly noticable with *S* which saw higher means on most vowels *(see Table 7 and Appendix 3: Table 6).*

Prompt	Vowel	Mean AU6 Activation	Median AU6 Activation
S	[e]	3.00	4.00
	[i]	3.20	3.50
	[o]	2.70	3.00
	[u]	2.80	3.00
N	[i]	0.600	1.00
C	[e]	0.800	1.00
	[u]	0.800	1.00
FT	[e]	0.600	1.00
	[o]	0.800	1.00
	[u]	0.900	1.00

Table 7. Prompts and vowels AU6 activation with higher median than mean value.

AU12

Standard deviations in AU12 activation were similarly greatest for *S* (0.994 ≤ *SD* ≤ 1.34) (with the largest measured on the *S* [i] (*SD* = 1.34). However, *FT* also showed standard deviation higher than 1 on [i] (*SD* = 1.18) and [u] (*SD* = 1.15).

The highest mean value was measured on *S* [i] (*M* = 3.30) and similarly the highest median value (*Mdn* = 3.50).

AU12 activation increased from *N* vowel equivalents on all *FT* vowels except for [e]. *S* increased AU12 activation on all vowels, whereas *C* activation on rounded vowels decreased with [o] and was the equivalent for [u] when compared with *N.*

Several vowels/prompts produced median values which were higher than the mean suggesting a negative skew (*see Table 8).*

Prompt	Vowel	Mean AU12 Activation	Median AU12Activation
S	[i]	3.30	3.50
N	[e]	0.800	1.00
	[o]	0.700	1.00
C	[e]	0.800	1.00
	[u]	0.900	1.00
FT	[e]	0.800	1.00
	[i]	1.50	2.00

Table 8. Prompts and vowels AU12 activation with higher median than mean value.

(See Figure 19 and Appendix 3: Table 6 and 7).

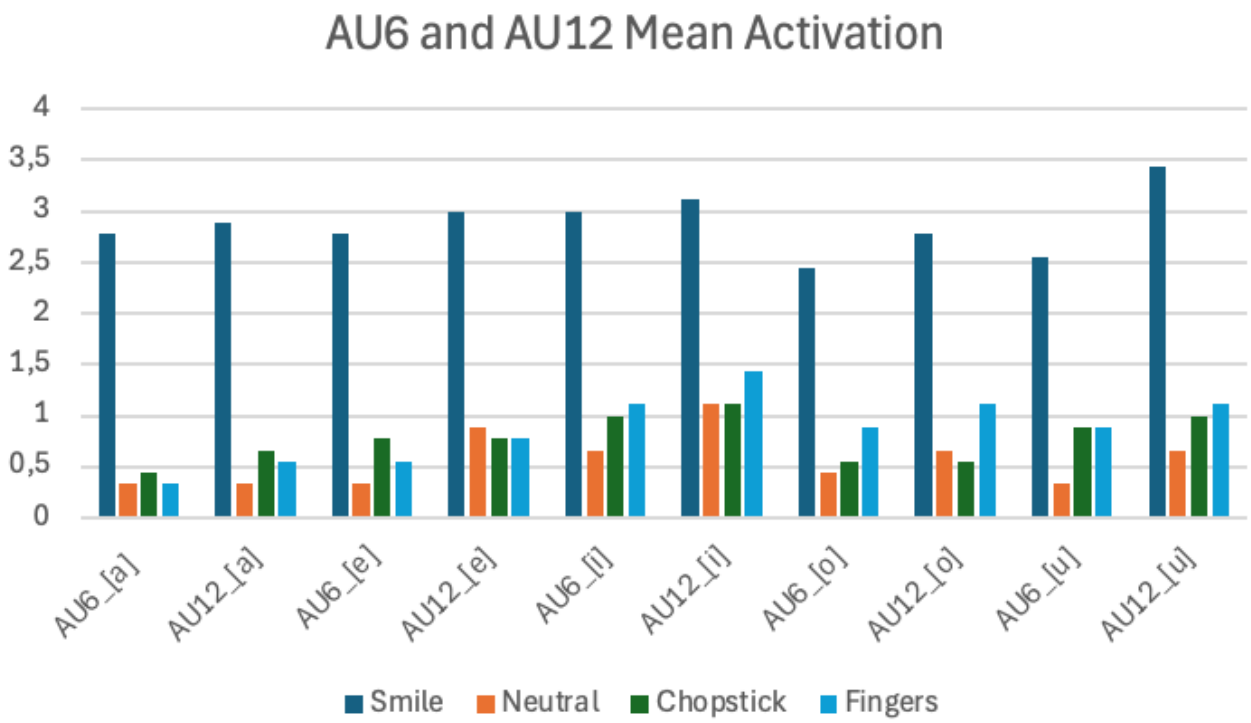


Figure 19. Mean AU6 and AU12 activation prompt/vowel.

ANOVA

A two factor repeated measures ANOVA showed a significant effect of prompt on muscle activation for both AU6, F (3, 27) = 29.154, $p < 0.001$, and AU12, F (3, 27) = 33.530, $p < 0.001$. Similarly, there was a significant effect of vowel on activation for both AU6, F (4, 36) = 3.097, $p = 0.027$, and AU12, F (4,36) = 4.725, $p = 0.004$. There was, however, no significant interaction between prompt and vowel for either AU6, F (12, 108) = 0.906, $p = 0.543$, or AU12, F (12, 108) = 0.902, $p = 0.547$.

Partial eta squared effect sizes indicated prompt had the largest impact on AU6 and AU12 activation (AU6: ηp2 = 0.764, AU12: ηp2 = 0.788), followed by vowel with a moderate effect (AU6: $\eta p^2 = 0.256$, AU12: $\eta p^2 = 0.344$). Interaction effects were small (AU6: $\eta p^2 = 0.091$, AU12: $\eta p^2 = 0.091$) *(See Appendix 3: Table 8 and 9).*

Post hoc

AU 6 and AU12

Following repeated measures ANOVA, post hoc tests with Bonferroni correction were carried out. This revealed the greatest difference in AU 6 and AU12 activation was between *S* and the *N* (AU6: t (9) = 7.320, $p_{bonferroni} < 0.001$, AU12: t (9) = 6.7553, $p_{bonferroni} < 0.001$). The mean difference between *N* and *S* was 2.54 for AU6 and 2.46 for AU12, with higher values observed when smiling *(See Appendix 3: Table 10 and 11 and Appendix 4: Figure 3).*

Discussion

Research supports the notion that activation of the ZM and potentially OOM muscles leads to a brighter vocal tone (Ohala, 1980; Fagel, 2010; McQuade, 2016; Titze, Maxfield and Walker, 2017; Arias, Bellin and Aucouturier, 2018; Dropuljic et al., 2018). In this study, significant differences in SC were observed across prompts, with the largest difference found between *S* and *FT.* The *S* prompt produced the greatest AU6/OOM and AU12/ZM activation and generally highest SC scores, implying that alterations in the vocal tract through lip spreading and jaw opening enhance brightness (Fagel, 2010; Garnier et al., 2010; Kalashnikova, Carignan and Burnham, 2017; Arias, Bellin and Aucouturier, 2018; Kim et al., 2020; Shi et al., 2024). The findings confirm that variations in ZM and OOM activation influence brightness (SC), suggesting that vocal training exercises targeting these muscles could be beneficial for vocal resonance and brightness.

Although *FT* produced the lowest SC scores, it, along with *C,* nevertheless showed higher AU6 and AU12 activation than the *N* prompt. This suggests effectiveness of *C* and *FT* strategies may not be fully reflected by SC measurements in this study. Placement of the hand or chopstick in front of the mouth may have acted as a mute, potentially lowering the recorded SC (Yoshikawa and Nobara, 2017). Upon reflection, covering of the mouth during *FT* or *C* may additionally provide Semi Occluded Vocal Tract (SOVT) benefits; creating supraglottal pressure and reducing phonation threshold pressure (Holm et al., 2025). As *FT* and *C* both encouraged AU6 and AU 12 engagement, increased brightness combined with SOVT benefits could be masked by SC reduction due to muting. Pre- and post-prompt phonation should be assessed in further studies, therefore, to gauge post intervention effects.

The [o] vowel produced a higher SC mean with *C* than *S* prompts. As lip rounding was impaired during *C* or *FT* strategies on rounded vowels ([o] and [u]), the typical SC lowering effect of rounding may have been disrupted (Ohala, 1980; Fagel, 2010; Daugherty and Brunkan, 2013). Whether an increased brightness through inhibition justifies a potential compromise in vowel clarity requires further study. Anecdotally, when the *FT* strategy was taught to me it was employed in alternation between [u] and [i]. It is possible, therefore, that interference with [u] rounding enhanced my perception of brightness. Further research should examine the benefits of these strategies on rounded vowel combinations to clarify this assertion.

The *C* strategy, inspired by Strack, Martin and Stepper (1988), did not reliably elicit AU6/OOM and AU12/ZM activation and occasionally showed none. This reflects findings from Coles et al (2022), who reported mixed outcomes. This leads me to question its

pedagogical value as there were significant limitations observed on this strategy: discomfort, jaw clenching (P1,2,5,8,9 and10) (Coles et al., 2022), FEs resembling disgust (P5), complexity, and vowel production issues.

SC variation between participants was high, with median sometimes exceeded mean values, suggesting a negatively skewed distribution. This implies that a few lower scores reduced averages and suggests larger sample sizes are necessary to clarify true effects.

Potential factors influencing SC variation may have included:

- Smiling slightly during *N* (P3 and 10), failing to smile for *S* (P1), or variations of smiles.
- Psychological and culture factors, for example, frown or sneer muscle engagement (P5) or exaggerated smiles (P10) (Drahota, Costall and Reddy, 2008; Leshin et al., 2024; Shi et al., 2024).
- Differences in chopstick or finger placement.

Moreover, participants received no instructions on finger or chopstick placement and were unaware of the exercises' intended purpose. Future research should therefore measure whether pedagogical preparation might improve effectiveness (Mesmer-Magnus and Viswesvaran, 2010).

Observations

Video analysis revealed additional insights not captured in still images. These suggest that psychological state and participant comfort may influence vocal output. Future research should therefore include qualitative measures, such as questionnaires or interviews to explore these effects and build more nuanced understanding of their impact (Gerring, 2017; Ahmad et al., 2019).

Practical Applications

The findings of this study do not necessarily negate the practical value of these exercises as small sample size, wide distribution, and potential muting effects may have impacted results. Although less effective than a natural smile, both *FT* and *C* increased AU6 and AU12 activation linked to brighter tone and may therefore support students who struggle to smile naturally while singing. Additionally, interference with lip rounding could enhance brightness in rounded vowels and may prove useful in mixed vowel exercises *(see Appendix 4: Figure 5)*.

Of the two, *FT* appears more suitable, offering greater comfort, no need for equipment and less inhibition of vowel articulation.

Future research should explore the role ZM and OOM activation in resonance tuning for female singers, including potential benefits for navigating register transitions and the possible SOVT benefits of *C* and *FT* strategies (Bozeman, 2010; Titze, 2022; Holm et al., 2025).

Limitations

- **Small sample size:** High standard deviation and negative skew could be resolved by increasing sample size.
- **Vowel inaccuracies and Native Language**: Native language influenced vowel production (Baker and Trofimovich, 2005), especially on [e] in English native speakers. Prior training or restricting language of participants would increase accuracy (Shi et al., 2024).
- **Participant variations**: Culture, personality and psychological state may have influenced data (Gunjawate, Ravi and Bellur, 2018). Additionally, voice type, varying vocal techniques, vocal styles (classical/belt), age and hormones (peri-/menopause) may have impacted the results (Titze, Maxfield and Walker, 2017; Shankar et al., 2022). Careful inclusion and exclusion criteria and qualitative data are recommended.
- **Prior Relationships:** Prior-relationships or power dynamics may have affected participant behaviour (Al-Natour, 2011).
- **FACS coding subjectivity:** Potential bias or lack of training could affect AU scoring objectivity (Cohn, Ambadar and Ekman, 2007); multiple coders or automation would increase objectivity.
- **Image Quality:** Camera angles varied, risking misinterpretation; future studies should standardise setup.
- **Recording quality:** Ambient noise and distortion occurred which could be mitigated by careful monitoring of microphone levels and selection of venue.
- **Speaker volume:** Guide pitch loudness varied, possibly influencing response volume. Levels should be standardised in future.
- **Repeated data collection**

  P10 required a second session to record data which potentially affected results. Data should be more carefully monitored in future.

Conclusion

While this study does not provide clear evidence that either the *FT* or *C* strategies reliably enhance vocal brightness, both saw increases in ZM and OOM activation suggesting potential resonance benefits. However, *C* appears less suitable for studio use due to its interference with rounded vowels, potential for discomfort and jaw clenching (Coles et al., 2022), and practical issues related to hygiene and materials required.

Several questions remain for further research. Does *FT* have a lasting impact on brightness once the hand is removed (Yoshikawa and Nobara, 2017; Holm et al., 2025)? Could pre-training improve its effectiveness (Mesmer-Magnus and Viswesvaran, 2010)? Are these strategies beneficial across specific vowel combinations, particularly rounded vowels like [o] and [u] (Titze and Titze, 2013)? Would results differ at other pitches or vocal registers (Henrich, Smith and Wolfe, 2011)? Could alternate sample criteria, larger participant groups or more rigorous approaches produce different outcomes?

Future studies using alternative methodologies and designs may offer clearer insights into the effectiveness of these resonance strategies.

Reflection

Undertaking this study has highlighted the importance of practical voice studio exercises that target the ZM and OOM to enhance vocal brightness. The findings validated many of my current pedagogical approaches but encourage further research into how facial activation interacts with resonance and register transitions. It also expanded my understanding of how resonance strategies differ across genres, voice types and sexes.

Through this process, I deepened my understanding of facial muscle function, FACS coding, and spectral analysis – particularly the role of formants and SC in brightening vocal tone. This growth was supported by hands-on experience with software including WASP 2, WaveLab Pro 12, Jamovi, and ImageJ and explored Praat and VoceVista. I significantly improved my statistical analysis skills, gaining confidence in generating and interpreting descriptive statistics, ANOVA, and post-hoc tests, and selecting clear, effective graphs and charts for data presentation. Learning and adopting a standardised acoustic notation helped me clarify and communicate findings more precisely and consistently (Titze et al., 2015).

From a project management standpoint, learning to create and apply a Gantt chart proved invaluable for mapping key steps, structuring timelines and tracking progress throughout the study.

However, the project also revealed areas for improvement. In future, I would conduct pilot tests in the final data collection venue to avoid unexpected logistical or acoustic issues, and more carefully select data collection and analysis methods to reduce the need for mid-study adjustments and increase accuracy of results.

Some value conflicts became evident during this project. My familiarity with the *FT* prompt posed a potential bias, which was mitigated by applying a PP framework and adhering to the FACS manual (Ekman, Friesen and Hager, 2002). Pre-existing relationships with participants posed a further risk. I balanced scientific rigour with warmth and respect by using a scripted briefing, minimising interaction during data collection, and maintaining friendly rapport before and after each session.

Overall, this project has supported my growth as a practitioner-researcher by deepening my knowledge and strengthening both practical and analytical skills. It has built a foundation for future research and enhanced my practices as a vocal pedagogue committed to evidence-based strategies.

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Appendices

Appendix 1 - Glossary of Terms

Acoustic

Relating to sound or the science of sound; in voice studies it often refers to measurable audio properties such as frequency, amplitude, or resonance.

Duchenne Smile

A genuine smile characterized by the activation of the zygomaticus and orbicularis oculi muscles, producing both mouth and eye movement.

Harmonics

The whole number multiples of the fundamental frequency (f_0); responsible for tonal richness and timbre of sound.

Facial Action Unit (FACS)

A standardized coding system for describing facial movements based on muscle activation. Each "action unit" (AU) corresponds to a specific facial movement (Ekman and Friesen, 1978). To accurately code facial movements, coders require hours of training and dividing scores from multiple coders increases objectivity. A new version of FACS was developed by Eckman, Friesen and Hager (2002).

Fundamental Frequency (f_0)

The lowest frequency of a periodic waveform, perceived as the pitch of the voice.

Formant

A resonance peak in the vocal tract's frequency response. Formants are crucial for the intelligibility and character of vowel sounds.

Formant Tuning

The deliberate adjustment of vocal tract shape to align formants with harmonics or desirable frequencies, enhancing vocal resonance and projection. It is also believed to be important for navigating register changes.

Frequency

The rate at which a sound wave oscillates, measured in Hertz (Hz); determines pitch.

Hz (Hertz)

The unit of frequency, equal to one cycle per second.

ImageJ

An open-source image processing program used for measuring and analysing scientific images.

Jamovi

A free, open-source statistical software with a user-friendly interface, designed for easy data analysis without programming.

Orbicularis Oculi Muscle

A circular muscle surrounding the eye, responsible for closing the eyelids and producing eye crinkling associated with genuine (Duchenne) smiles. Often activated alongside the zygomaticus major in expressions of positive emotion.

Praat

A free, open-source software for analysing, synthesizing, and manipulating speech. Widely used in phonetics and linguistics research for tasks like spectrogram analysis and pitch tracking**.**

Projection

The ability of a voice to carry clearly and powerfully, aided by resonance and breath support.

Registers

Distinct ranges of the singing voice, typically categorized as chest, middle, and head voice, each with unique vocal fold and resonance characteristics.

Resonance

The amplification and enrichment of sound through alterations in the vocal tract.

Singers' Formant Cluster

A cluster of formants (usually F3, F4, and F5) around 2.5–3 kHz that Western classical singers enhance to project their voice.

Spectral Centroid / Centre of Gravity (CoG)

The weighted frequency average of the power spectrum. It is associated with perceived brightness of sound:

– High SC/CoG → bright sound.

– Low SC/CoG → dark sound.

Spectrogram

A visual representation of the spectrum of frequencies in a sound signal over time, commonly used in acoustic analysis.

Vocal Tract

The series of cavities and structures (larynx, pharynx, mouth, and nasal passages) through which the vibration from the vocal folds travels and shaped resonance and vowels through phonation.

VoceVista

A software tool for visualizing and analyzing voice and sound, often used in vocal training. It displays spectrograms, overtones, and pitch, helping users improve vocal technique and understand acoustic feedback. A software tool for visualizing and analysing voice and sound, often used in vocal training. It displays spectrograms, overtones, and pitch, helping users improve vocal technique and understand acoustic feedback.

Timbre

The tone quality or colour of a sound, shaped by harmonics, formants, and other acoustic features beyond pitch and loudness.

WASP 2 (Waveform Annotations, Spectrogram, and Pitch)

A free online or downloadable tool used for acoustic analysis sound.

WaveLab Pro 12

A digital audio editing software used for professional audio mastering and waveform analysis, including analysis of the spectral centroid.

Zygomaticus Muscles

Facial muscles (zygomaticus major and minor) responsible for lifting the corners of the mouth, key to smiling and implicated in brightening vocal tone.

Appendix 2 - List of Abbreviations

C	Chopstick between teeth prompt.
CoG	Spectral centre of gravity.
FE	Facial expression, referring to the interpretation of facial postures as being associated with an emotion *(see Appendix 12).*
f_o	Fundamental frequency (Hz).
f_{Rm}	Resonant frequency (Hz).
ηf_o	Harmonic frequency (Hz).
F	F-value (F): A ratio used to compare variance between groups to variance within groups; it is interpreted alongside degrees of freedom (df) to assess statistical significance.
F_m	Formant (Hz).
FP	Facial posture, referring to muscle activation *(see Appendix 12).*
FT	Finger on top teeth prompt.
N	Neutral posture prompt.
ηp^2	Partial eta effect squared effect size. For example, an ηp² value of 0.441 means that 44.1% of the variance in the outcome can be attributed to that factor.
OOM	Orbicularis oculi muscles.
p	**p-value (p):** The probability that the observed results occurred by chance; values below 0.05 are typically considered statistically significant.
P	Participant.
$P_{bonferroni}$	A p-value that has been adjusted using the Bonferroni correction to reduce the risk of false positives when multiple statistical comparisons are made.
R	Resonance.
S	Smile prompt.
SC	Spectral centroid.
SD	Standard deviation.
SFC	Singers formant cluster.
ZM	Zygomaticus muscles.

Appendix 3 - Tables

Particpant	Order
1	1324
2	3412
3	2314
4	2413
5	1234
6	3241
7	3142
8	4132
9	2143
10	3412

(34 recorded again 05/06)

Table 1. Order of prompts recorded by participants

1. Smile, 2. Neutral, 3. Chopstick, 4. Fingers on Teeth (Randomised by ChatGPT).

Participant	Smile	Neutral	Chopstick	Fingers
1	e,u,o i, a	u, a o, i, e	i,u,o,e,a	o,u,a,i,e
2	i,e,u,o,a	e,o,i,a,u	o,e,a,i,u	i,e,u,o,a
3	o,a,u,e,i	i,a,o,u,e	i,u,o,e,a	i,u,a,e,o
4	o,e,a,u,i	i,e,a,u,o	a,u,e,o, i	u,i,o,e,a
5	u,o,e,i,a	a,i,o,e,u	i,o,e,a,u	e,o,u,a,i
6	a,i,o,u,e	u, i,a,o,e	o,u,i,e,a	a,o,e,u,i
7	o,u,a,i,e	e,u,a,o,i	a,i,u,o,e	u,i,o,a,e
8	o,a,u,i,e	a,e,u,o,i	a,u,e,o,i	i,o,e,a,u
9	u,e,a,o,i	e,o,i,a,u	u,e,a,o,i	e,a,u,o,i
10	e,i,a,o,u	u,i,o,a, e	u,o,i,a,e	e,o,u,i,a

Neutral and Chopstick recorded 18/06

Table 2. Order of the vowels recorded by participants.

Descriptives

	SC_smile_a	SC_smile_e	SC_smile_i	SC_smile_o	SC_smile_u	SC_neutral_a	SC_neutral_e	SC_neutral_i
N	10	10	10	10	10	10	10	10
Missing	0	0	0	0	0	0	0	0
Mean	1526	1640	1676	1163	1168	1431	1643	1627
Median	1491	1606	1794	1057	1038	1483	1708	1645
Standard deviation	239	301	359	314	642	261	421	366
Minimum	1200	1240	1054	720	478	1076	813	990
Maximum	1858	2100	2171	1679	2171	1781	2085	2069
Skewness	0.108	0.0240	–0.465	0.441	0.602	–0.0173	–0.862	–0.360
Std. error skewness	0.687	0.687	0.687	0.687	0.687	0.687	0.687	0.687

SC_neutral_o	SC_neutral_u	SC_chopstick_a	SC_chopstick_e	SC_chopstick_i	SC_chopstick_o	SC_chopstick_u	SC_fingers_a
10	10	10	10	10	10	10	10
0	0	0	0	0	0	0	0
1100	931	1402	1688	1599	1250	1045	1309
1044	863	1397	1662	1644	1136	1065	1314
345	380	312	393	450	386	346	290
751	482	962	1091	874	829	543	949
1722	1627	1988	2272	2163	2079	1641	1762
0.841	1.12	0.455	0.0562	–0.326	1.14	0.204	0.302
0.687	0.687	0.687	0.687	0.687	0.687	0.687	0.687

SC_fingers_e	SC_fingers_i	SC_fingers_o	SC_fingers_u
10	10	10	10
0	0	0	0
1485	1539	959	928
1572	1677	870	900
284	334	254	325
1035	856	696	502
1872	1956	1306	1356
–0.585	–1.06	0.316	0.216
0.687	0.687	0.687	0.687

Table 3. Spectral Centroid, Descriptives by vowel and prompt.

Spectral centroid

Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p	η^2_p
Prompt	1.02e+6	3	340610	7.09	0.001	0.441
Residual	1.30e+6	27	48059			
Vowels	1.22e+7	4	3.06e+6	31.52	<.001	0.778
Residual	3.49e+6	36	96942			
Prompt ✻ Vowels	387730	12	32311	1.01	0.449	0.101
Residual	3.47e+6	108	32131			

Note. Type 3 Sums of Squares

[3]

Table 4. Spectral Centroid, ANOVA prompt, vowel and prompt/vowel.

Post Hoc Comparisons - Prompt

Comparison			Mean Difference	SE	df	t	$p_{bonferroni}$
Prompt		Prompt					
Smile	-	Neutral	88.2	47.8	9.00	1.844	0.590
	-	Chopstick	38.0	44.4	9.00	0.856	1.000
	-	Fingers	190.5	36.3	9.00	5.249	0.003
Neutral	-	Chopstick	–50.2	45.3	9.00	–1.109	1.000
	-	Fingers	102.3	37.5	9.00	2.725	0.141
Chopstick	-	Fingers	152.5	50.0	9.00	3.049	0.083

Table 5. Spectral Centroid, Post hoc with Bonferroni correction.

Descriptives

	AU6_smile_a	AU6_smile_e	AU6_smile_i	AU6_smile_o	AU6_smile_u	AU6_neutral_a	AU6_neutral_e
N	10	10	10	10	10	10	10
Missing	0	0	0	0	0	0	0
Mean	3.00	3.00	3.20	2.70	2.80	0.300	0.400
Median	3.00	4.00	3.50	3.00	3.00	0.00	0.00
Standard deviation	1.33	1.56	1.23	1.49	1.40	0.483	0.699
Minimum	1	1	1	0	1	0	0
Maximum	5	5	5	5	5	1	2
Skewness	–0.352	–0.436	–0.467	–0.360	–0.171	1.04	1.66
Std. error skewness	0.687	0.687	0.687	0.687	0.687	0.687	0.687

AU6_neutral_i	AU6_neutral_o	AU6_neutral_u	AU6_Chopstick_a	AU6_Chopstick_e	AU6_Chopstick_i	AU6_Chopstick_o
10	10	10	10	10	10	10
0	0	0	0	0	0	0
0.600	0.400	0.300	0.400	0.800	1.00	0.500
1.00	0.00	0.00	0.00	1.00	1.00	0.500
0.516	0.516	0.483	0.516	0.789	0.471	0.527
0	0	0	0	0	0	0
1	1	1	1	2	2	1
–0.484	0.484	1.04	0.484	0.407	0.00	0.00
0.687	0.687	0.687	0.687	0.687	0.687	0.687

AU6_Chopstick_u	AU6_Finger_a	AU6_Finger_e	AU6_Finger_i	AU6_Finger_o	AU6_Finger_u
10	10	10	10	10	10
0	0	0	0	0	0
0.800	0.300	0.600	1.00	0.800	0.900
1.00	0.00	1.00	1.00	1.00	1.00
0.422	0.483	0.516	1.05	0.632	1.20
0	0	0	0	0	0
1	1	1	3	2	4
–1.78	1.04	–0.484	0.712	0.132	2.18
0.687	0.687	0.687	0.687	0.687	0.687

Table 6. AU6 Descriptives.

Descriptives

	AU12_smile_a	AU12_smile_e	AU12_smile_i	AU12_smile_o	AU12_smile_u	AU12_Neutral_a	AU12_Neutral_e
N	10	10	10	10	10	10	10
Missing	0	0	0	0	0	0	0
Mean	3.10	3.20	3.30	3.00	3.10	0.300	0.800
Median	3.00	3.00	3.50	3.00	3.00	0.00	1.00
Standard deviation	1.20	1.03	1.34	1.05	0.994	0.483	0.632
Minimum	1	2	1	1	2	0	0
Maximum	5	5	5	5	5	1	2
Skewness	–0.233	0.272	–0.334	0.00	0.610	1.04	0.132
Std. error skewness	0.687	0.687	0.687	0.687	0.687	0.687	0.687

AU12_Neutral_i	AU12_Neutral_o	AU12_Neutral_u	AU12_Chopstick_a	AU12_Chopstick_e	AU12_Chopstick_i	AU12_Chopstick_o
10	10	10	10	10	10	10
0	0	0	0	0	0	0
1.00	0.700	0.600	0.600	0.800	1.10	0.500
1.00	1.00	0.500	0.500	1.00	1.00	0.500
0.816	0.483	0.699	0.699	0.632	0.876	0.527
0	0	0	0	0	0	0
2	1	2	2	2	3	1
0.00	–1.04	0.780	0.780	0.132	1.02	0.00
0.687	0.687	0.687	0.687	0.687	0.687	0.687

AU12_Chopstick_u	AU12_Finger_a	AU12_Finger_e	AU12_Finger_i	AU12_Finger_o	AU12_Finger_u
10	10	10	10	10	10
0	0	0	0	0	0
0.900	0.500	0.800	1.50	1.10	1.00
1.00	0.500	1.00	2.00	1.00	1.00
0.568	0.527	0.789	1.18	0.568	1.15
0	0	0	0	0	0
2	1	2	3	2	4
–0.0911	0.00	0.407	–0.255	0.0911	2.17
0.687	0.687	0.687	0.687	0.687	0.687

Table 7. AU 12 Descriptives.

Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p	η^2_p
Prompt	207.38	3	69.127	29.154	<.001	0.764
Residual	64.02	27	2.371			
Vowel	4.48	4	1.120	3.097	0.027	0.256
Residual	13.02	36	0.362			
Prompt ✻ Vowel	3.12	12	0.260	0.906	0.543	0.091
Residual	30.98	108	0.287			

Note. Type 3 Sums of Squares

[3]

Table 8. AU6 ANOVA, prompt, vowel and vowel/prompt.

Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p	η^2_p
Prompt	205.33	3	68.445	33.530	<.001	0.788
Residual	55.12	27	2.041			
Vowels	7.47	4	1.868	4.725	0.004	0.344
Residual	14.23	36	0.395			
Prompt ✻ Vowels	3.49	12	0.291	0.902	0.547	0.091
Residual	34.81	108	0.322			

Note. Type 3 Sums of Squares

[3]

Table 9. AU12 ANOVA, prompt, vowel and vowel/prompt.

Post Hoc Comparisons - Prompt

Comparison							
Prompt		Prompt	Mean Difference	SE	df	t	$p_{bonferroni}$
Smile	-	Neutral	2.5400	0.376	9.00	6.7553	<.001
	-	Chopstick	2.2400	0.432	9.00	5.1871	0.003
	-	Fingers	2.2200	0.380	9.00	5.8421	0.001
Neutral	-	Chopstick	–0.3000	0.116	9.00	–2.5767	0.179
	-	Fingers	–0.3200	0.207	9.00	–1.5460	0.939
Chopstick	-	Fingers	–0.0200	0.201	9.00	–0.0995	1.000

Table 10. AU 6, Post hoc prompts with Bonferroni correction.

Comparison							
Prompt		Prompt	Mean Difference	SE	df	t	$p_{bonferroni}$
Smile	-	Neutral	2.460	0.3361	9.00	7.320	<.001
	-	Chopsticks	2.360	0.3263	9.00	7.232	<.001
	-	Fingers	2.160	0.3436	9.00	6.287	<.001
Neutral	-	Chopsticks	–0.100	0.0803	9.00	–1.246	1.000
	-	Fingers	–0.300	0.2910	9.00	–1.031	1.000
Chopsticks	-	Fingers	–0.200	0.2477	9.00	–0.808	1.000

Post Hoc Comparisons - Vowels

Table 11. AU 12 Post hoc, prompts with Bonferroni correction.

Appendix 4 - Figures

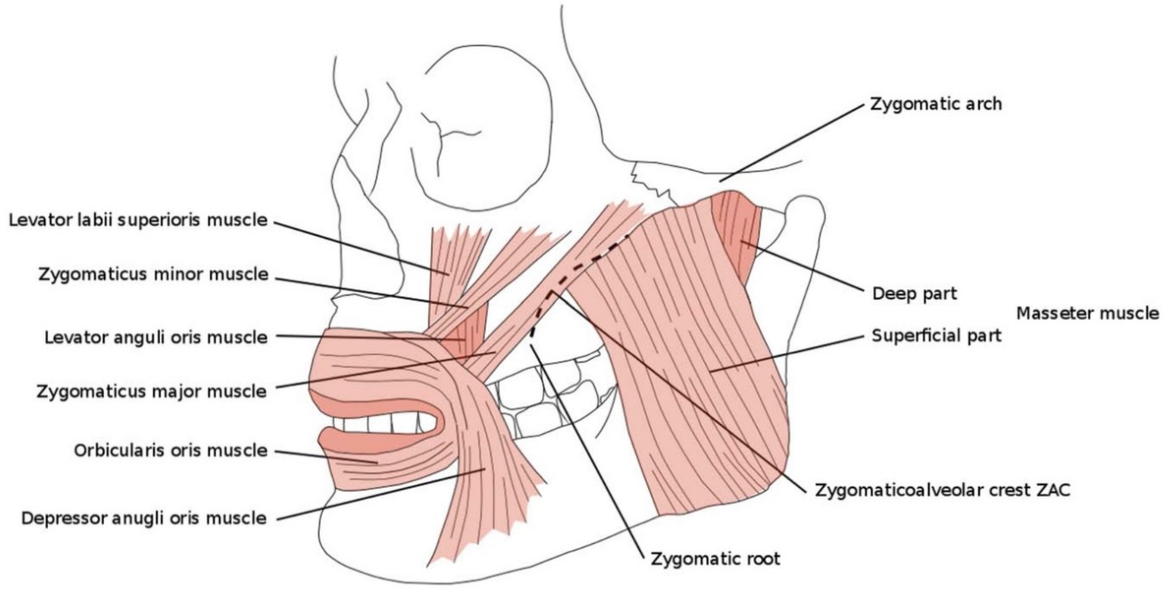


Figure 1. Location of Zygomatic muscles (Weber and Krenn, 2017).

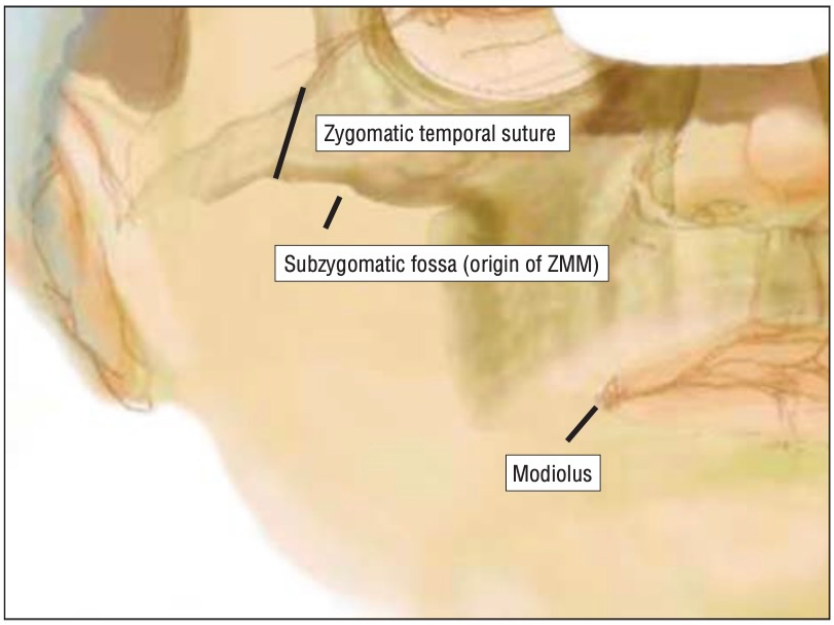


Figure 5. The subzygomatic fossa is located posterior and inferior to the malar eminence and anterior to the zygomatic temporal suture (adapted from Mowlavi and Wilhelmi[14]). ZMM indicates zygomaticus major muscle.

Figure 2. Origin of Zygomaticus Major (Miller, Smith and Shah, 2007).

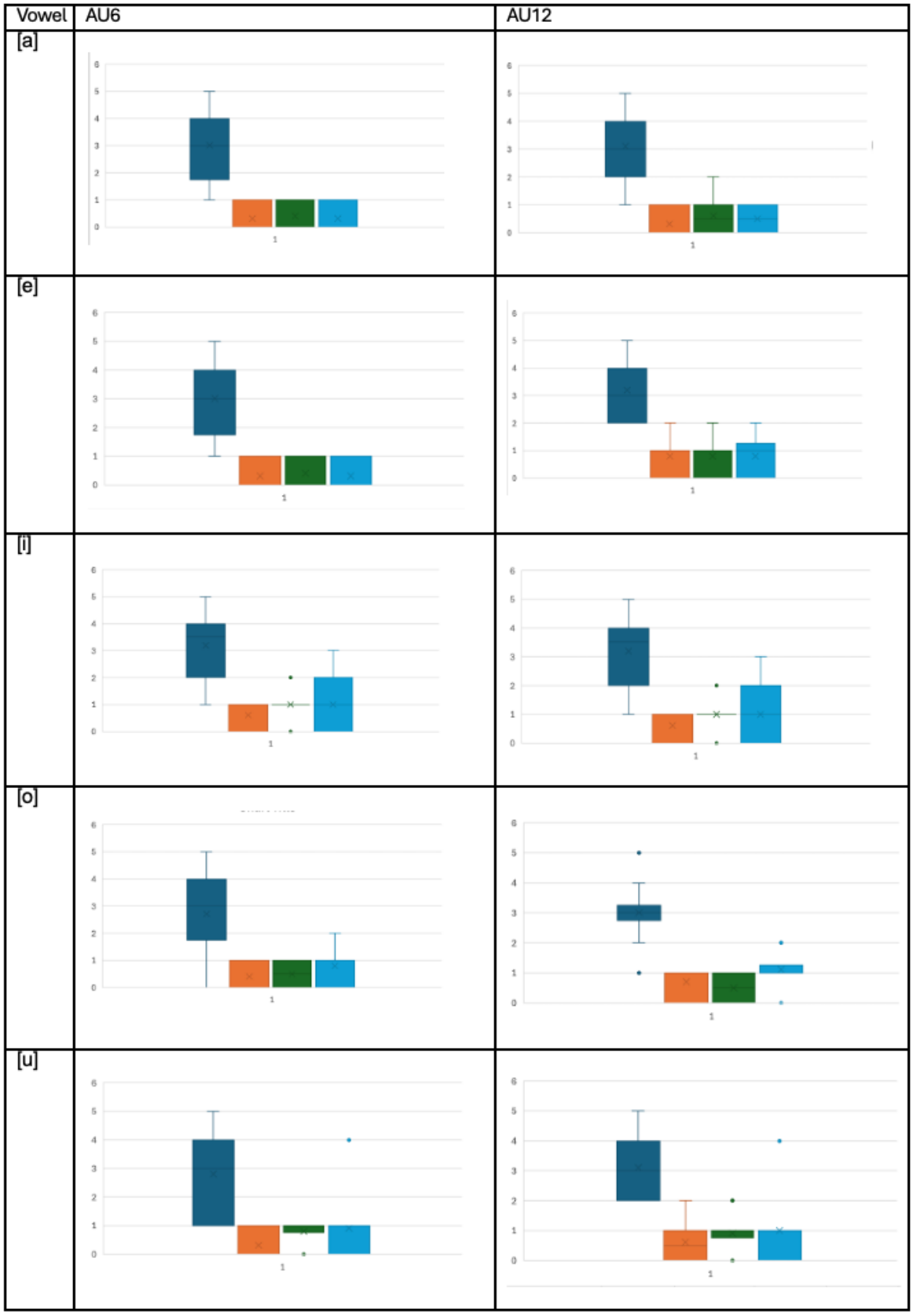


Figure 3. Box Plots AU6 and AU12 activation vowel/prompt.

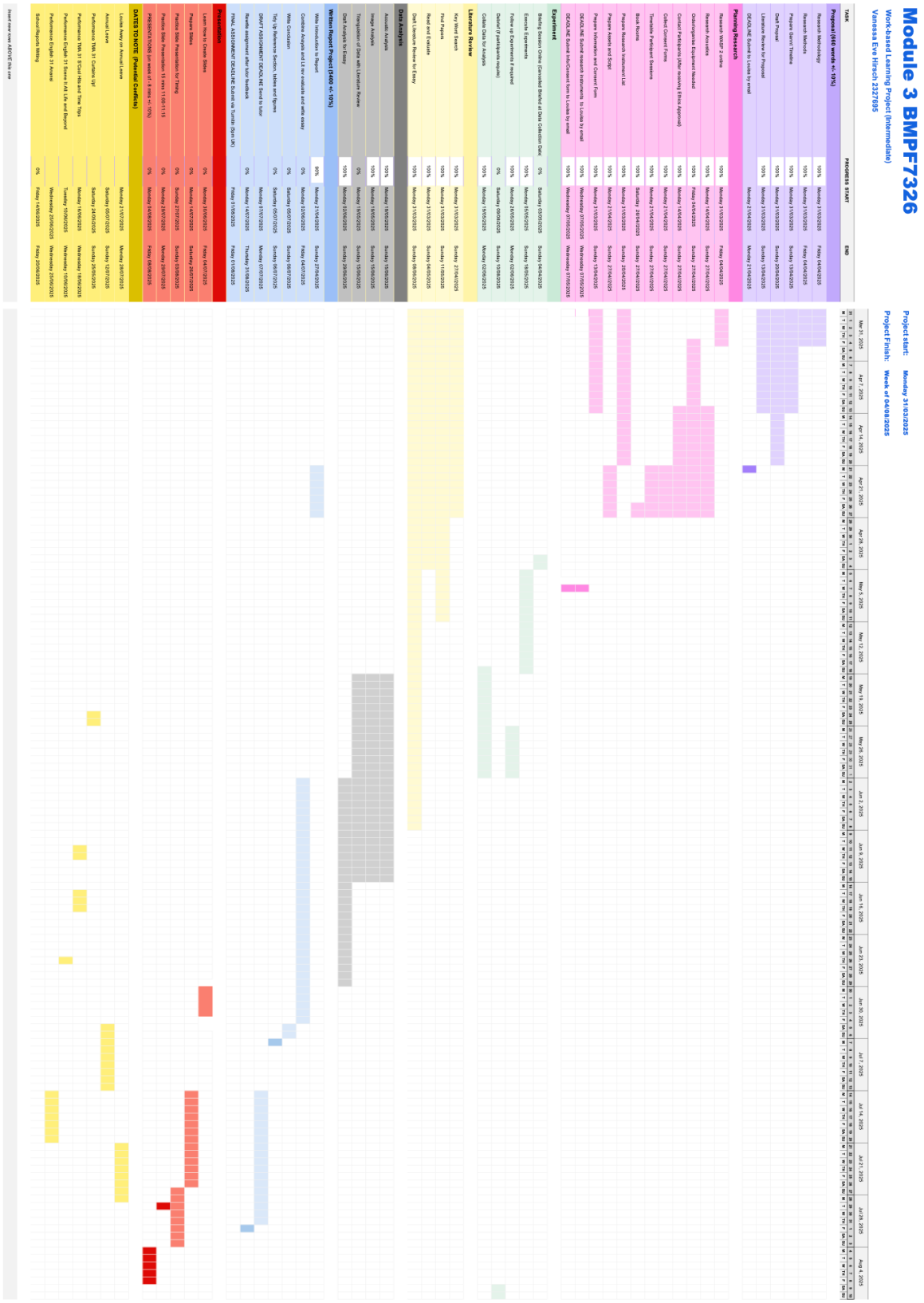


Figure 4. Gannt Timeline for project.

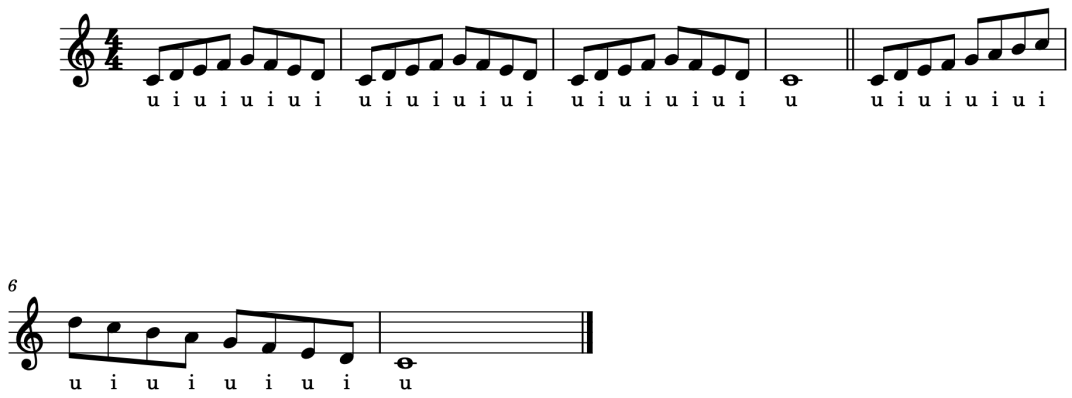


Figure 5. [u] and [i] alternation. Example exercises for use with FT for brightening rounded vowels.

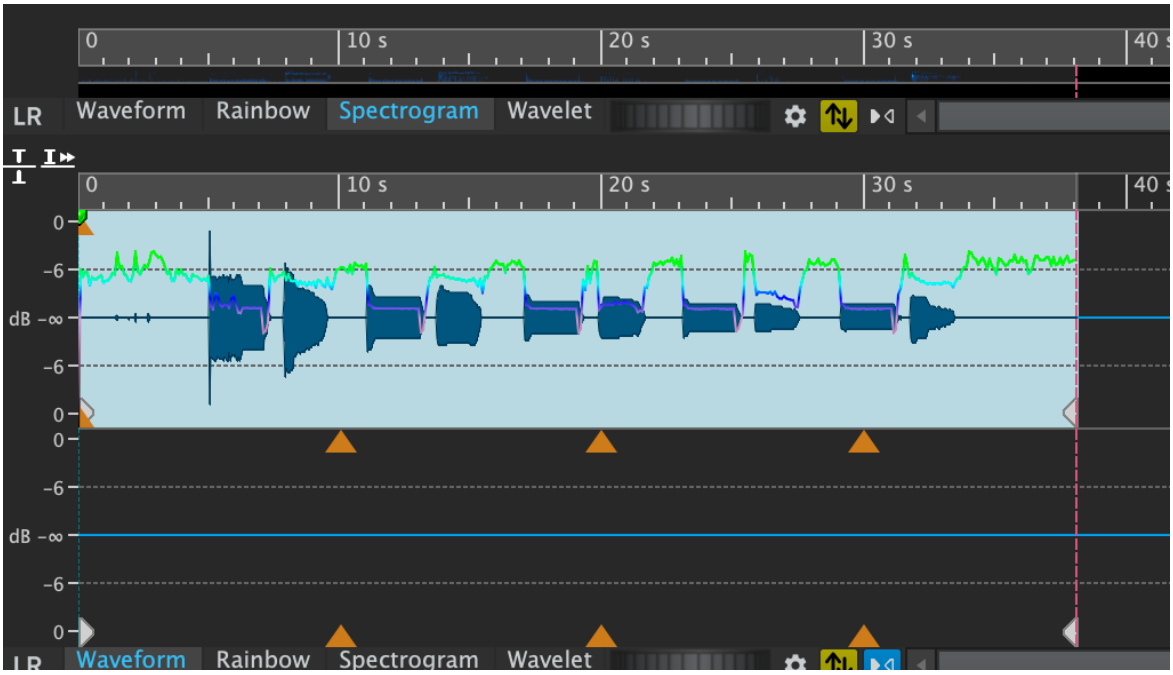


Figure 6. WaveLab Pro 12 sample P2 S.

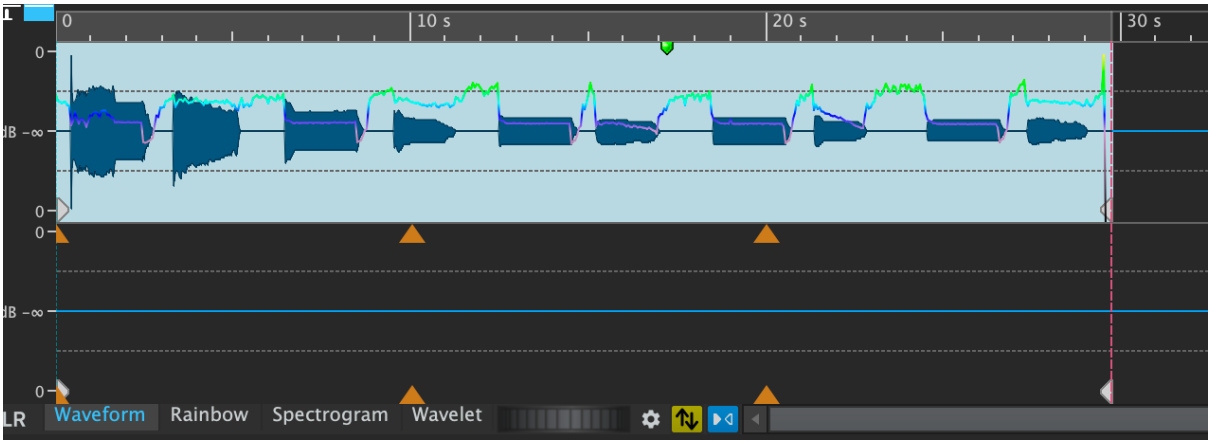


Figure 7. Wavelab Pro 12 sample P2 FT.

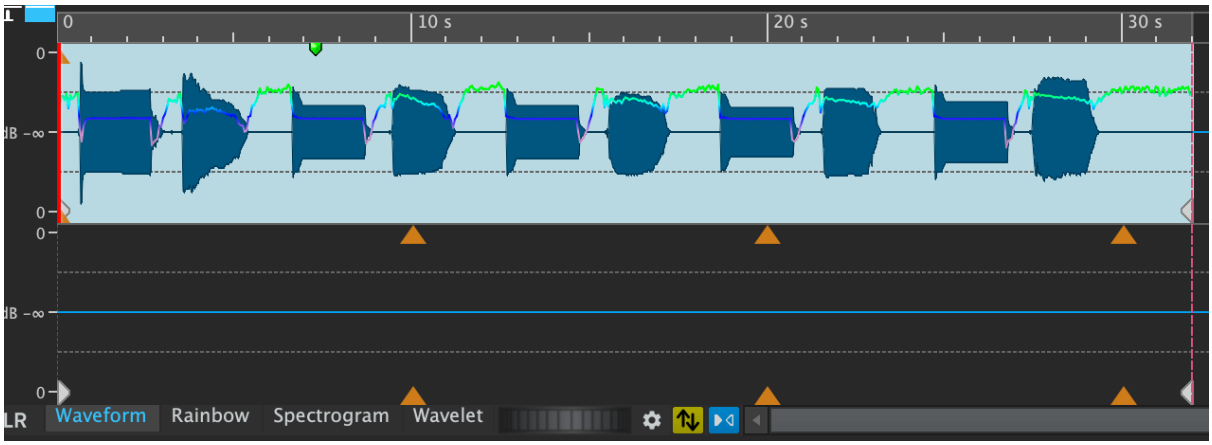


Figure 8. WaveLab Pro 12 sample P10 C.

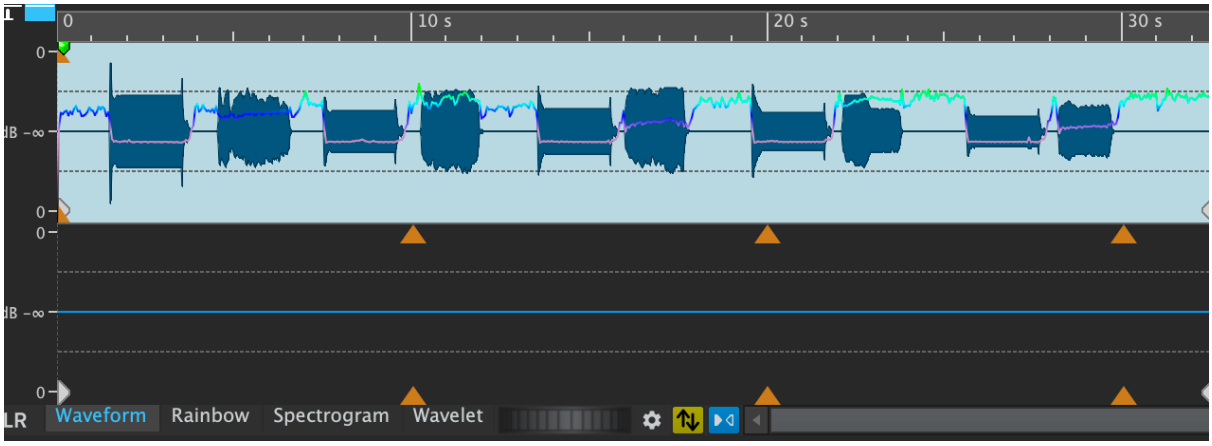


Figure 9. WaveLab Pro 12 sample P5 N.

Appendix 5 - Information Sheet

Eve Hirsch
905 Chemin de las Néous
Lasserre-Pradère
31530, France

06 45 01 39 05
eve@butterflyvocal.fr

Participation in a Master's Experiment in Vocal Pedagogy

I would like to invite you to participate in an experiment in the context of my master's studies in professional practices in vocal pedagogy at the Voice Study Centre (VSC) in conjunction with the University of Wales Trinity St David (UWTSD). This study has been approved by the University of Wales Trinity St David Research Ethics Committee.

You have been selected from TMA 31 association members and students of the Butterfly Vocal Studio and your support in this project would be greatly appreciated. Participation, however, is purely voluntary and, therefore, refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled, and you may discontinue participation at any time without any repercussions.

This study aims to observe 10 adult female (18-60 years) amateur singers while singing. Your participation, taking approx. 30 mins, would help further the field of academic understanding in vocal pedagogy and the development of practical applications for voice studios.

Thank you in advance for your time in considering taking part in the study.

Description of the Research

Title: A quantitative study of 10 amateur female adult singers exploring the validity of two facial muscle activation acoustic strategies.

Aim: To test the effects of two practical strategies on facial muscle activation and vocal tone and compare them to control facial postures. The results will add to existing academic research by exploring the influence of facial expressions on sung vocal tone. There is considerable academic support to the notion that facial expressions can additionally affect

mood, social inclusion, and empathy. This experiment is, therefore, a first step towards a long- term goal of understanding the impact of facial expressions on singers. These primary findings will be used to inform my future research, hopefully resulting in the development of practical strategies which improve singer vocal tone, communication of emotions, personal experience while singing and social inclusion.

Procedure – Experiment:

There will be several phases of data collection
1) A controlled neutral expression
2) An instructed natural smile
3) 'Pen' between teeth exercise
4) Fingers placed on front teeth exercises.

Photographic data will be collected simultaneously with audio/acoustic data during each of these 4 facial expressions while vocalising on a specified series of vowels, dynamic (volume) and frequency (pitch). Changes in facial muscle engagement will be recorded with a video camera to collect progressions of muscle movements and to check distance from the microphone and camera is maintained. Still images will be taken from this video at a later stage. Acoustical measurements and audio of the vocalised sound will be recorded with subsequent analysis of the data looking at both muscle engagement and the harmonic spectrum.

Methods of Data Collection

Participants will have easy to remove, skin sensitive spots placed on their face to help quantify the measurement of the engagement of specific muscles.

The "Pen" exercise comes from earlier research (Strack, Martin and Stepper 1988; Soussignan 2002)- This will be replaced by an individually packed, hygienic and comfortable chopstick in this experiment. During the fingers on teeth exercise, hand sanitiser will be provided for participants to ensure hygiene is maintained.

Vocalisations will be recorded using a Yeti Blue mic and a MacBook Pro laptop and analysed through WASP 2 acoustical analysis
https://www.speechandhearing.net/laboratory/wasp/

Location of research

Either in my private voice studio (Lasserre-Pradère) or in a communal room from the Mairie de Pibrac, the Salle du Quai. Logistics will be discussed with selected participants individually.

Time commitment

Participation in this experiment should take approx. 30 mins at a time and date convenient to you.

How your information and data gathered through participation will be used

GDPR rules will apply to the storage, collection and processing of your data. You have the right to withdraw from this experiment at any time and have the right to request to view or withdraw your data. Consent is sort prior to collection of data and photographic images will only be published with your written consent.

All data will be password secured on my personal laptop and backed up to a personal external hard drive which is likewise password protected. Hard copies will be digitalized at the earliest possibility and subsequently destroyed. Your stored data will be destroyed at the end of my master's studies in 2027.

Your data will be stored under a pseudonym providing anonymity. Your identity would only be known if you agree to the inclusion of your photographic images. These will be limited however the area of the face concerned excluding hair or other body parts of the participant.

How data will be shared and with whom

Data will be shared with the Voice Study Centre and University of Wales Trinity St David tutors and markers. Additionally, your data may be used for additional research, if appropriate and you will be notified in this case.

Risks and Discomforts

I have sought to mitigate potential risks to participants. This includes privacy and hygiene during the experiment, secure data storage of your information and anonymity of your data.

Potential risks to you could be the recognition of your participation by others were your photographic image to be used in my essay with your consent.

The marker dots and “pen” substitute will be sterilized and tested in advance for comfort, ease of removal and skin sensitivity. Despite this there may be a small risk of individualized reactions or discomfort.

Follow Up

You will be notified of the results and may request copies of the final study and any reports or publications which arise from your participation if you wish. I will be available for a debrief after the conclusion of my research should you have any questions or concerns following the experiment.

Contact

You may contact me at any time at eve@butterflyvocal.fr for answers to questions regarding the research.

Should any of the information in this document change your renewed consent would be sought.

Appendix 6 - Briefing Script

Thank you for agreeing to participate in this experiment. I would like to explain the process of this simple experiment to you now. I will be open to answering any questions or concerns you may have at the end of the briefing.

In this experiment you will sit upright on a chair, your feet flat on the floor and your back resting on the back of the chair *(demonstrate).* This is in an aim to maintain an optimal singing posture while maintaining a standardised distance from the research equipment between each participant. For this reason, you should minimise movements of your upper body during the collection of data.

You will be asked to shuffle a deck of 5 vowel cards and lay them faceup in a line on the table in front of you. This will create a randomised order in which you will sing 5 vowels. You will then be asked to vocalise on these vowels while employing 5 different facial postures.

I will play the pronunciation of the vowels to you now and am happy to repeat them at any stage in the experiment if you are unsure of the pronunciation. A recording has been chosen for this task to minimise researcher influence on your response during data collection: [a] [e] [i] [o] and [u]) *(play recording)*

At each stage I will let you know which facial position to employ, and the order of this will be randomised between participants.

The 4 stages are:

1) Smiling
2) Neutral
3) With a chopstick held lightly between front teeth *(demonstrate)*
4) With thumb and first finger held on upper teeth – Left Hand *(demonstrate)*

You should sing each stage in the order of the cards on the table. Please hold each card briefly to the cameras in between facial positions for ease of analysis.

You will be played 5 pitches (330hz/E4) – (*play pitch recording)*. You should aim to maintain this pitch at a consistent moderate volume (60-75Db) for the duration of the data collection stage. Vowels should be sung for 4 counts each and a short break must be made between vowels and synthesised pitch to aid analysis.

The success of each stage will be controlled by me prior to commencing with a new stage.

Vowel cards will be reshuffled by you between each stage to create a new randomised order of vowels. I will note the order of the vowels before commencing data collection.

During execution of each stage, video and audio data will be simultaneously collected. Twos cameras (frontal and side view) and a microphone will be placed at a predetermined distance from you the participant, with the position of the table, chair and camera marked on the floor in white tape to ensure a standardised distance is maintained between participants.

I will mark your face to aid in analysis at the following points *(show image) (see Figure 10).*

I will sit alongside so that I do not influence your responses during data collection.

After competition of the experiment by all participants the acoustic spectrum and facial muscle activation will be analysed.

As your voice teacher/president of the association -researcher, I want to acknowledge that our existing relationship may influence how you respond during this study. It is important to emphasise that there are no right or wrong answers, and no response will result in benefit or consequence, either personally or professionally. Please aim to respond as naturally and authentically as possible, rather than attempting to align with what you believe I might expect or prefer. This will ensure the validity and integrity of the research findings.

The final report should be available for you to read by the beginning of August 2025.

Do you have any questions or concerns you would like to ask or discuss now?

Appendix 7 - Research Tools

Experiment Equipment

- Blue Yeti Microphone
- 2 x MacBook Pro
- 3 x iPhones (2 x cameras and1 x dB app)
- 2 x Camera stands
- JBL Speaker
- Chargers
- Extension cable/multiplug bank
- Extension audio cable
- Briefing script *(see Appendix 6)*
- Alcohol based hand sanitiser for Finger on Teeth exercise.
- Chopsticks individually wrapped
- Rhinestone facial markers/water soluable eyeliner
- Reference image of facial marks *(see Figure 1)*
- Pre—recorded vowel pronunciation ([ɑ], [e] [i] [o] and [u])
- Vowel cards to aid randomisation ([ɑ], [e] [i] [o] and [u])
- MP3 of pitch sample 330hz
- Disponsible cup of water for participant comfort
- White masking tape for marking distance of microphone, chair and camera
- Chairs x 2 and Tables x 2 (participant and researcher)
- Paper/Pen for notes

Apps and software

Data collection

- WASP 2 online (data collection and pitch accuracy control)
- Decibel X app on phone

Analysis

- WaveLab Pro 12
- Filmora software on laptop (Still image extraction and editing)
- ImageJ, VoceVista, Praat , WASP 2 – used in trial analysis
- Jamovi

Appendix 8 - FACS Coding Scores

AU6 [a]	Smile	Neutral	Chopstick	Fingers
Participant				
1	1	0	0	0
2	3	1	1	0
3	4	1	0	1
4	4	1	1	1
5	1	0	1	0
6	3	0	0	1
7	4	0	1	0
8	2	0	0	0
9	3	0	0	0
10	5	0	0	0

AU12 [a]	Smile	Neutral	Chopstick	Fingers
Participant				
1	1	0	0	1
2	3	1	2	0
3	4	0	1	1
4	4	1	1	1
5	2	1	1	0
6	3	0	0	1
7	3	0	1	0
8	2	0	0	0
9	4	0	0	1
10	5	0	0	0

AU6 [e]	Smile	Neutral	Chopstick	Fingers
Participant				
1	1	0	1	0
2	1	0	2	1
3	4	1	0	1
4	4	2	2	0
5	1	0	1	0
6	4	0	0	1
7	4	0	1	1
8	2	0	0	0
9	4	0	0	1
10	5	1	1	1

AU12 [e]	Smile	Neutral	Chopstick	Fingers
Participant				
1	2	0	1	1
2	2	1	1	0
3	4	1	0	1
4	4	2	2	0
5	2	1	1	1
6	4	1	1	0
7	3	1	1	2
8	3	1	0	0
9	3	0	0	2
10	5	0	1	1

AU6 [i]	Smile	Neutral	Chopstick	Fingers
Participant				
1	2	0	1	2
2	3	1	1	1
3	4	1	2	3
4	4	1	1	0
5	1	0	1	0
6	4	1	1	1
7	4	1	1	2
8	3	1	1	0
9	2	0	0	1
10	5	0	1	0

AU12 [i]	Smile	Neutral	Chopstick	Fingers
Participant				
1	2	0	0	2
2	3	2	2	2
3	4	1	3	3
4	5	2	1	0
5	2	1	1	0
6	4	1	1	1
7	4	2	1	3
8	3	1	1	0
9	1	0	0	2
10	5	0	1	2

AU6 [o]	Smile	Neutral	Chopstick	Fingers
Participant				
1	0	0	0	1
2	2	0	1	0
3	3	1	1	1
4	4	1	1	1
5	1	0	0	1
6	4	1	1	1
7	3	0	0	2
8	3	1	1	0
9	2	0	0	1
10	5	0	0	0

AU12 [o]	Smile	Neutral	Chopstick	Fingers
Participant				
1	1	0	0	1
2	3	1	1	1
3	3	1	1	1
4	4	1	1	1
5	2	1	1	2
6	3	1	1	1
7	3	0	0	2
8	3	1	0	0
9	3	0	0	1
10	5	1	0	1

AU6 [u]	Smile	Neutral	Chopstick	Fingers
Participant				
1	1	0	1	1
2	3	0	1	0
3	4	1	1	1
4	3	1	1	1
5	1	0	1	0
6	3	0	1	1
7	4	0	1	4
8	1	1	1	0
9	3	0	0	0
10	5	0	0	1

AU12 [u]	Smile	Neutral	Chopstick	Fingers
Participant				
1	2	0	1	1
2	3	1	1	0
3	4	1	1	1
4	3	2	2	1
5	2	1	1	1
6	3	0	1	1
7	4	0	1	4
8	2	1	1	0
9	3	0	0	0
10	5	0	0	1

Figure 1. SC scores by prompt and vowel.

Appendix 9 - Spectral Centroid Scores

[a]	*S* Lowest	*S* Highest	*N* Lowest	*N* Highest	*C* Lowest	*C* Highest	*FT* Lowest	*FT* Highest
Participant								
1	1390	1621	1539	1733	1513	1874	1171	1453
2	1695	2021	1558	1979	1344	1703	1620	1903
3	1074	1325	1050	1293	1159	1418	900	1174
4	1649	1799	1454	1557	1424	1585	1295	1529
5	1220	1431	906	1245	1081	1350	1065	1193
6	1377	1475	1173	1261	857	1067	904	993
7	1349	1602	1444	1475	1082	1285	1169	1464
8	1504	1826	1400	1686	1403	1744	1604	1809
9	1116	1355	1021	1280	980	1186	856	1093
10	1636	2048	1576	1985	1774	2202	1360	1620

[e]	*S* Lowest	*S* Highest	*N* Lowest	*N* Highest	*C* Lowest	*C* Highest	*FT* Lowest	*FT* Highest
Participant								
1	1625	2070	1672	2201	1971	2260	1456	1905
2	1819	2068	1935	2234	1602	2198	1416	2048
3	1223	1478	1202	1638	1227	1449	861	1209
4	675	1832	1522	1662	1655	1896	1383	1738
5	1376	1735	699	926	1451	1646	1204	1456
6	1532	1672	1448	1636	1264	1439	1288	1446
7	1534	1685	1609	2040	1301	1558	1340	1826
8	1955	2245	1915	2084	1803	2315	1501	1793
9	1102	1378	1037	1282	934	1248	919	1170
10	1659	2137	1862	2246	1967	2577	1755	1988

[i]	*S* Lowest	*S* Highest	*N* Lowest	*N* Highest	*C* Lowest	*C* Highest	*FT* Lowest	*FT* Highest
Participant								
1	1689	2243	1541	2278	1877	2448	1405	1942
2	1525	2498	1584	2469	1609	2262	1507	2405
3	1207	1463	1169	1475	1012	1436	1013	1514
4	1707	1896	1337	1577	1661	1788	1709	1850
5	1606	1978	1475	2319	1102	1691	1414	1946
6	1181	1387	1220	1391	939	1176	1102	1251
7	1415	1685	1334	1584	1423	1705	1325	1839
8	1882	2460	1828	2309	1905	2285	1604	1809
9	931	1176	837	1143	802	946	765	947
10	1470	2122	1449	2211	1698	2206	1400	2037

[o]	*S* Lowest	*S* Highest	*N* Lowest	*N* Highest	*C* Lowest	*C* Highest	*FT* Lowest	*FT* Highest
Participant								
1	1449	1708	1601	1842	1447	1656	1074	1377
2	951	1310	1047	1302	1014	1490	620	788
3	868	1097	683	886	859	1181	636	807
4	1205	1450	1123	1208	1190	1434	1126	1328
5	780	1070	699	926	1451	1646	619	772
6	934	1002	802	879	902	1007	797	845
7	842	1038	837	1008	837	1066	867	969
8	1193	1569	1132	1327	934	1065	1211	1400
9	618	821	708	794	702	956	694	821
10	1310	2048	1228	1977	1622	2536	1068	1369

[u]	*S* Lowest	*S* Highest	*N* Lowest	*N* Highest	*C* Lowest	*C* Highest	*FT* Lowest	*FT* Highest
Participant								
1	1312	1561	1520	1733	1417	1864	1151	1561
2	715	939	688	998	961	1227	651	1404
3	483	543	725	1039	619	713	543	620
4	1165	1331	858	970	953	1119	749	913
5	514	883	584	682	895	1142	654	788
6	601	676	639	690	638	744	596	676
7	1469	1546	1423	1705	1334	1584	1195	1478
8	1882	2460	669	794	934	1289	1211	1422
9	451	505	452	511	483	603	461	543
10	1745	2574	846	1103	1028	1350	890	1049

Figure 1. AU6 and AU12 activation scores by prompt and vowel.

Appendix 10 - Redacted Consent Forms

Eve Hirsch
905 Chemin de las Néous
Lasserre-Pradère
31530, France
06 45 01 39 05
eve@butterflyvocal.fr

Title: A quantitative study of 10 amateur female adult singers exploring the validity of two facial muscle activation acoustic strategies.

Consent to take part in research

I, [redacted] .....(please print) voluntarily agree to participate in this research study.

- I understand that even if I agree to participate now, I can withdraw at any time.
- I understand that I can refuse to answer any question involved during the research process without any consequences of any kind.
- 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 I will not benefit directly from participating in this research.
- I understand that participation involves vocalising to 5 vowels while engaging two strategies of facial muscle activation and two control facial expressions.
- I agree to my vocalisations being audio-recorded
- I agree to the acoustic analysis of my vocalisations.
- I agree to video images being recorded during the experiment.
- I agree to the use of experimental tools outlined in writing (*chopstick and rhinestones)*
- 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 which participation reveal my identity.
- I understand that disguised data from my participation may be quoted in Eve Hirsch's MA assignments and presentations during her MA studies.
- I understand that selected photo images may be included in the final study but that the participation concerned will be notified and consent sort before its inclusion and that in the case of inclusion efforts will be made to limit the image to include only those features involved in this study.
- 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.

Signed [redacted]

At TOULOUSE

Date 23/04/2025

Eve Hirsch
905 Chemin de las Néous
Lasserre-Pradère
31530, France
06 45 01 39 05
eve@butterflyvocal.fr

Title: A quantitative study of 10 amateur female adult singers exploring the validity of two facial muscle activation acoustic strategies.

Consent to take part in research

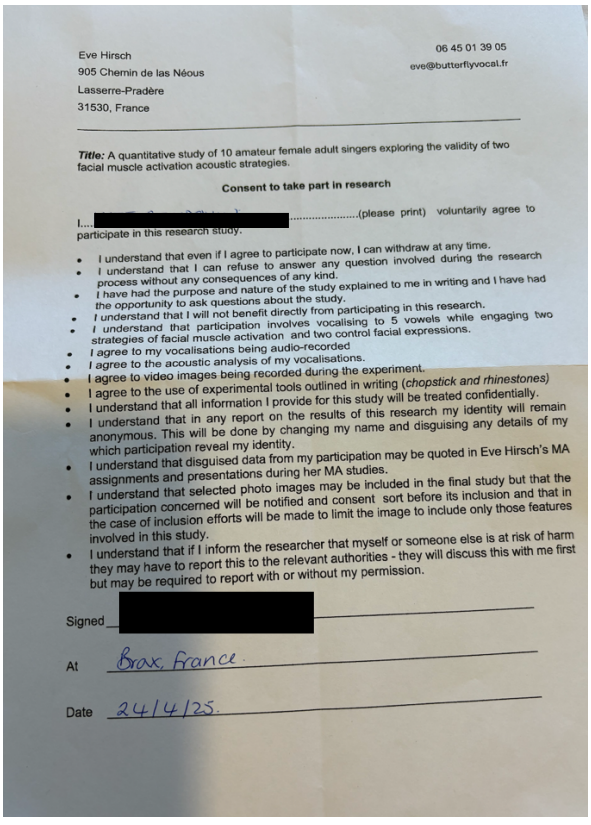
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Signed [redacted]

At PIBRAC

Date 26 April, 2025



Eve Hirsch
905 Chemin de las Néous
Lasserre-Pradère
31530, France
06 45 01 39 05
eve@butterflyvocal.fr

Title: A quantitative study of 10 amateur female adult singers exploring the validity of two facial muscle activation acoustic strategies.

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Signed [redacted]

At Brax, France.

Date 24/4/25.

Eve Hirsch
905 Chemin de las Néous
Lasserre-Pradère
31530, France
06 45 01 39 05
eve@butterflyvocal.fr

Title: A quantitative study of 10 amateur female adult singers exploring the validity of two facial muscle activation acoustic strategies.

Consent to take part in research

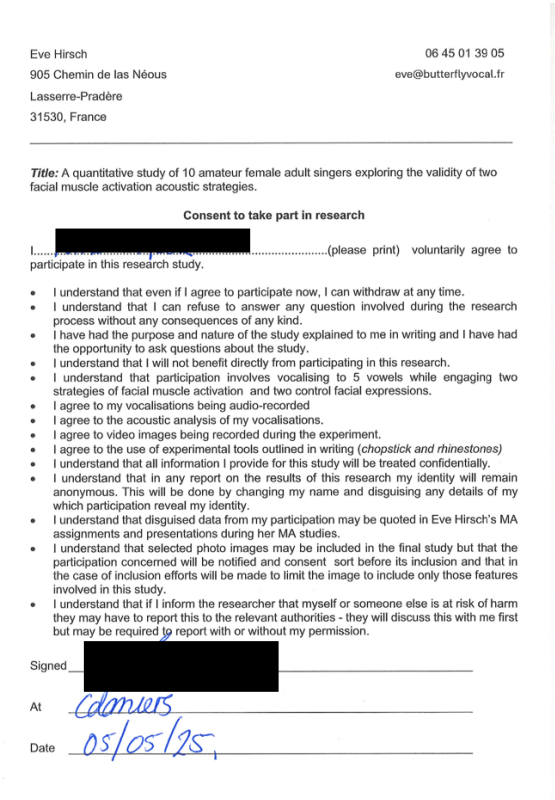
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Signed [redacted]

At Plaisance du Touch

Date 26/04/25



Eve Hirsch
905 Chemin de las Néous
Lasserre-Pradère
31530, France

06 45 01 39 05
eve@butterflyvocal.fr

Title: A quantitative study of 10 amateur female adult singers exploring the validity of two facial muscle activation acoustic strategies.

Consent to take part in research

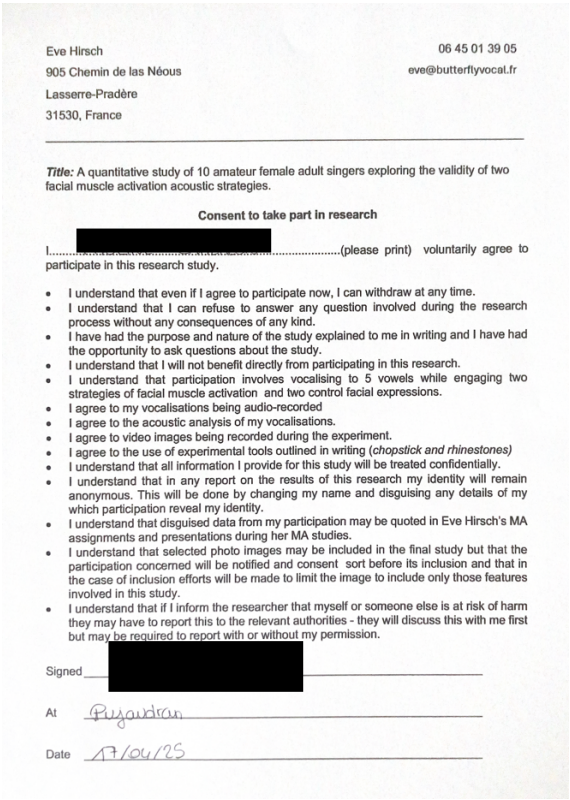
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Signed [redacted]

At Edinburgh

Date 05/05/25



Eve Hirsch
905 Chemin de las Néous
Lasserre-Pradère
31530, France

06 45 01 39 05
eve@butterflyvocal.fr

Title: A quantitative study of 10 amateur female adult singers exploring the validity of two facial muscle activation acoustic strategies.

Consent to take part in research

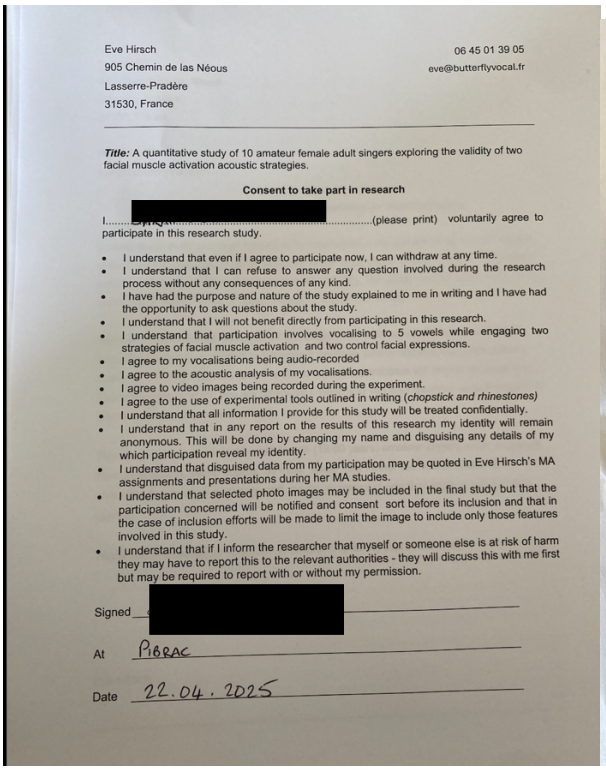
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Signed [redacted]

At Pujaudran

Date 17/04/25



Eve Hirsch
905 Chemin de las Néous
Lasserre-Pradère
31530, France

06 45 01 39 05
eve@butterflyvocal.fr

Title: A quantitative study of 10 amateur female adult singers exploring the validity of two facial muscle activation acoustic strategies.

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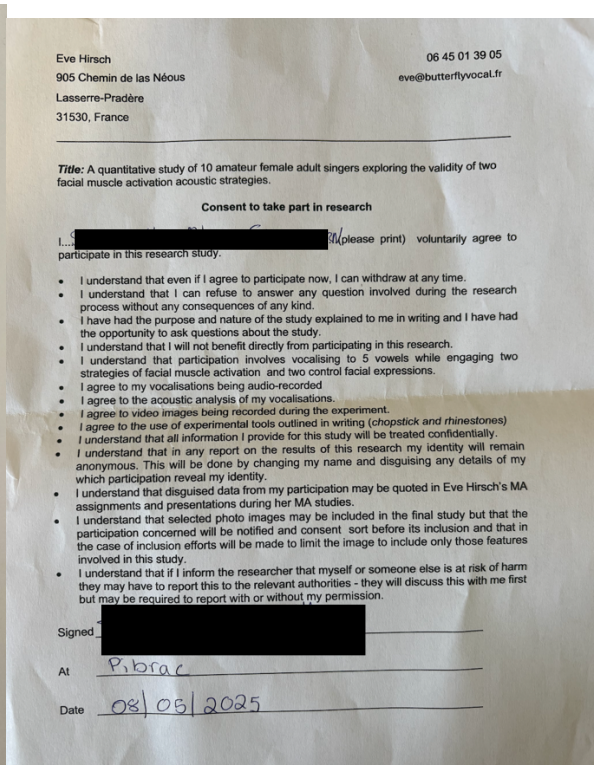
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- I understand that disguised data from my participation may be quoted in Eve Hirsch's MA assignments and presentations during her MA studies.
- I understand that selected photo images may be included in the final study but that the participation concerned will be notified and consent sort before its inclusion and that in the case of inclusion efforts will be made to limit the image to include only those features involved in this study.
- 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.

Signed [redacted]

At PIBRAC

Date 22.04.2025



Eve Hirsch
905 Chemin de las Néous
Lasserre-Pradère
31530, France

06 45 01 39 05
eve@butterflyvocal.fr

Title: A quantitative study of 10 amateur female adult singers exploring the validity of two facial muscle activation acoustic strategies.

Consent to take part in research

I [redacted] (please print) voluntarily agree to participate in this research study.

- I understand that even if I agree to participate now, I can withdraw at any time.
- I understand that I can refuse to answer any question involved during the research process without any consequences of any kind.
- 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 I will not benefit directly from participating in this research.
- I understand that participation involves vocalising to 5 vowels while engaging two strategies of facial muscle activation and two control facial expressions.
- I agree to my vocalisations being audio-recorded
- I agree to the acoustic analysis of my vocalisations.
- I agree to video images being recorded during the experiment.
- I agree to the use of experimental tools outlined in writing (*chopstick and rhinestones)*
- 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 which participation reveal my identity.
- I understand that disguised data from my participation may be quoted in Eve Hirsch's MA assignments and presentations during her MA studies.
- I understand that selected photo images may be included in the final study but that the participation concerned will be notified and consent sort before its inclusion and that in the case of inclusion efforts will be made to limit the image to include only those features involved in this study.
- 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.

Signed [redacted]

At Pibrac

Date 08/05/2025

Eve Hirsch
905 Chemin de las Néous
Lasserre-Pradère
31530, France

06 45 01 39 05
eve@butterflyvocal.fr

Title: A quantitative study of 10 amateur female adult singers exploring the validity of two facial muscle activation acoustic strategies.

Consent to take part in research

I.....[redacted].....(please print) voluntarily agree to participate in this research study.

- I understand that even if I agree to participate now, I can withdraw at any time.
- I understand that I can refuse to answer any question involved during the research process without any consequences of any kind.
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- 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 which participation reveal my identity.
- I understand that disguised data from my participation may be quoted in Eve Hirsch's MA assignments and presentations during her MA studies.
- I understand that selected photo images may be included in the final study but that the participation concerned will be notified and consent sort before its inclusion and that in the case of inclusion efforts will be made to limit the image to include only those features involved in this study.
- 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.

Signed [redacted]

At Pihac

Date 8.05.2025

Eve Hirsch
905 Chemin de las Néous
Lasserre-Pradère
31530, France

06 45 01 39 05
eve@butterflyvocal.fr

Title: A quantitative study of 10 amateur female adult singers exploring the validity of two facial muscle activation acoustic strategies.

Consent to take part in research

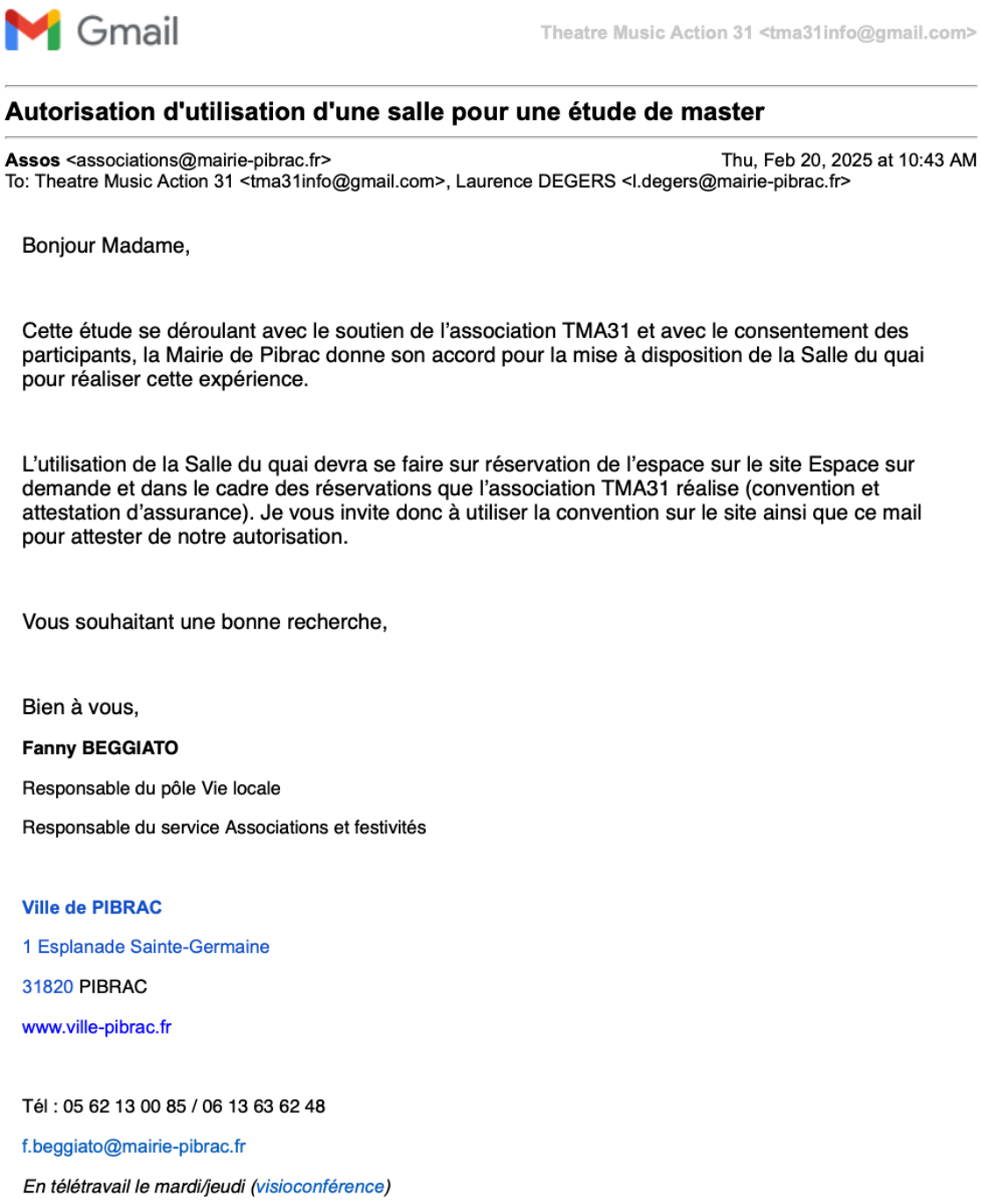
I.....[redacted].....(please print) voluntarily agree to participate in this research study.

- I understand that even if I agree to participate now, I can withdraw at any time.
- I understand that I can refuse to answer any question involved during the research process without any consequences of any kind.
- 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 I will not benefit directly from participating in this research.
- I understand that participation involves vocalising to 5 vowels while engaging two strategies of facial muscle activation and two control facial expressions.
- I agree to my vocalisations being audio-recorded
- I agree to the acoustic analysis of my vocalisations.
- I agree to video images being recorded during the experiment.
- I agree to the use of experimental tools outlined in writing (*chopstick and rhinestones)*
- 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 which participation reveal my identity.
- I understand that disguised data from my participation may be quoted in Eve Hirsch's MA assignments and presentations during her MA studies.
- I understand that selected photo images may be included in the final study but that the participation concerned will be notified and consent sort before its inclusion and that in the case of inclusion efforts will be made to limit the image to include only those features involved in this study.
- 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.

Signed [redacted]

At 11:40

Date 4/23/25



Gmail Theatre Music Action 31 <tma31info@gmail.com>

Autorisation d'utilisation d'une salle pour une étude de master

Assos <associations@mairie-pibrac.fr> Thu, Feb 20, 2025 at 10:43 AM
To: Theatre Music Action 31 <tma31info@gmail.com>, Laurence DEGERS <l.degers@mairie-pibrac.fr>

Bonjour Madame,

Cette étude se déroulant avec le soutien de l'association TMA31 et avec le consentement des participants, la Mairie de Pibrac donne son accord pour la mise à disposition de la Salle du quai pour réaliser cette expérience.

L'utilisation de la Salle du quai devra se faire sur réservation de l'espace sur le site Espace sur demande et dans le cadre des réservations que l'association TMA31 réalise (convention et attestation d'assurance). Je vous invite donc à utiliser la convention sur le site ainsi que ce mail pour attester de notre autorisation.

Vous souhaitant une bonne recherche,

Bien à vous,

Fanny BEGGIATO

Responsable du pôle Vie locale

Responsable du service Associations et festivités

Ville de PIBRAC

1 Esplanade Sainte-Germaine

31820 PIBRAC

www.ville-pibrac.fr

Tél : 05 62 13 00 85 / 06 13 63 62 48

f.beggiato@mairie-pibrac.fr

En télétravail le mardi/jeudi (visioconférence)

Figure 1. Approval from Maire de Pibrac to use the Salle du Quai for experiment venue.



Association Theatre Music Action 31
6 Chemin de la Bergerie
31820, Pibrac
France

Dear UWTSD,

Regarding the Research Project 'Zygomatic and orbicularis oculi muscle engagement (Duchenne Smile) effect on vocal tone: Examination of two possible strategies'. The committee of TMA 31, hereby confirms that they approve of the research proposed about facial expressions' effects on vocal tone and possible practical strategie to be carried out by Vanessa Eve Hirsch vocal pedagogue with TMA 31 members between March and July of 2025. This includes experiments at 905 Chemin de las Néous, Lasserre-Pradère and in the rooms provided by the mairie de Pibrac in Pibrac.

Your sincerely,



President of the association TMA 31

Figure 2. Approval from TMA 31 to contact members of the association as participants and to use the rooms of the Mairie de Pibrac.

Appendix 12 - Miscellenous

Omission of Raw Data

To preserve participant privacy and anonymity, I have not included audio samples or images of participants in the report or appendices of this study. Technical restrictions additionally make it impractical to include images from every WaveLab Pro 21 analysis step. Instead, I have included sample images to show the analysis process using WaveLab Pro 12 to calculate the mid-vowel SC.

Nevertheless, all raw data audio samples and images have been safely stored should queries arise regarding the data in this study. However, should images or audio be required further consent would need to be sort from the participants.

Facial Posture vs Facial Expression

In her book *How Emotions Are Made*, Lisa Feldman Barrett (2017) argues that emotions are constructed through predictive processes in the brain's body-budgeting systems and are shaped by culture rather than being universally identical facial muscle configurations. Based on this view, I use the term *Facial Posture* to describe facial muscle activation, separating it from any emotional interpretation. When referring to interpretation of a facial posture as an emotion, I use the term *Facial Expression.*

Appendix 13 - Ethics Form

Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

PG2 / E1 FORM

APPLICATION FOR ETHICAL APPROVAL

RESEARCH STUDENTS This form is to be completed by the student within **SIX** months for full-time students and **TWELVE** months for part time students, after the commencement of the research degree or following progression to Part Two of your course. Once complete, submit this form via the ***MyTSD Doctoral College Portal*** at (https://mytsd.uwtsd.ac.uk). This document is also available in Welsh.
RESEARCH 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.
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.

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.

SECTION A: About You (Principal Researcher)

1	Full Name:		Vanessa Eve Hirsch			
2	Tick all boxes that apply:		Member of staff:	☐	Honorary research fellow:	☐
	Undergraduate Student	☐	Taught Postgraduate Student	☒	Postgraduate Research Student	☐

3	Institute/Academic Discipline/Centre:	WAPPAR
4	Campus:	Camarthen
5	E-mail address:	eve@butterflyvocal.fr
6	Contact Telephone Number:	+33(0)645013905
	For students:	

7	Student Number:	2327695
8	Programme of Study:	MA Professional Practice (Voice Pedagogy)
9	Director of Studies/Supervisor:	Louise Emanuel/Julie Crossman/Debbie Winter

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		☐		
		Institute Research Committee		☐		
		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, location-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. You may add rows to this table if needed.	
1	**UWTSD Research Ethics & Integrity Code of Practice**	☒
2	**UWTSD Research Data Management Policy**	☒
3	*[List any other relevant documents here]* *RGPD (GDPR) Règlement general sur la protection des données (EU)* *Guide Practique RGPD*	☒

SECTION D: External Collaborative Research Activity

If there are external collaborators then you should gain consent from the contact persons to share their personal data with the university. If there are no external collaborators then leave this section blank and continue to section E.

1	Institution					
2	Contact person name					
3	Contact person e-mail address					
4	Is your research externally funded?		**YES**	☐	**NO**	☐
5	Are you in receipt of a KESS scholarship?		**YES**	☐	**NO**	☐
6	Are you specifically employed to undertake this research in either a paid or voluntary capacity?	Voluntary	**YES**	☐	**NO**	☐
7		Employed	**YES**	☐	**NO**	☐

8	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**	☐
9	Has 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

10	Does this organisation have its own ethics approval system?	**YES**	☐	**NO**	☐
	If Yes, please attach a copy of any final approval (or interim approval) from the organisation (this may be a copy of an email if appropriate).				

SECTION E: Details of Research Activity

1	Indicative title:	Zygomatic and orbicularis oculi muscle engagement (Duchenne Smile) effect on vocal tone: Examination of two possible strategies.		
2	Proposed start date:	31 March 2025	Proposed end date:	15th September 2025
	Introduction to the Research (maximum 300 words per section) **Ensure that you write for a <u>Non-Specialist Audience</u> when outlining your response to the 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.*			
3	**Purpose of Research Activity**. Research into the effects of facial expression on vocal tone and the communication of emotions has largely focused on studying the spoken voice. This study aims, therefore, to add to the existing research by exploring the influence of facial expressions on sung vocal tone. Furthermore, there is academic support to the notion that facial expressions can additionally affect mood, social inclusion, and empathy. This study is a first step towards the long-term goal of understanding the impact of facial expressions on singers. These primary findings will be used to inform future research, resulting in the development of practical strategies which improve singer vocal tone, communication of emotions and personal experience while singing. (this box should expand as you type)			
4	**Research Question** Does engaging the zygomatic muscles with the orbicularis oculi (Duchenne smile) brighten sung vocal tone? An examination of two possible strategies. (this box should expand as you type)			
5	**Aims of Research Activity** This research aims to assess the scientific validity of two specific vocal exercises currently used by the voice practitioner community to brighten vocal tone. The study will evaluate whether these exercises engage the zygomatic and orbicularis muscles (Duchenne smile) and how this might influence sung vocal tone. The aim is to gauge whether quantitative data supports the use of these			

	exercises in the vocal studio. Furthermore, the research aims to determine if there is academic support for this notion, comparing the findings with a literature review of related research on spoken voice to determine whether similar effects are observed in singing. The findings of this study will be used in future research into whether smiling while singing enhances the singer's experience and potentially developing practical exercises which help students correct habitual negative facial expressions, thereby improving mood and communication. (this box should expand as you type)
6	**Objectives of Research Activity** This research aims to study 10 adult female (18-60 years) amateur singers while vocalising sung tone and employing various facial expressions to measure whether contracting the zygomatic and orbicularis oculi muscles brightens sung vocal tone. Furthermore, it seeks to gauge the effectiveness of two practical strategies. There will be several phases 1) control neutral expression 2) instructed natural smile 3) 'Pen' between teeth exercise 4) Fingers placed on front teeth exercises. Images and acoustical data will be discretely collected during each of these 4 facial expressions while vocalising to a specific vowel, dynamic and frequency. The data collected will be still photographs and video recordings of facial expressions (points will be marked on the participant's face to aid measurement and comparison of the degree of muscular movement between expressions). Acoustical measurements of the vocalised sound will be taken with subsequent analysis of the data looking specifically at the increase/decrease in upper harmonics related to brightness of tone. (this box should expand as you type)
	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. You do not need to justify the methods here, but should instead describe how you intend to collect the data necessary for you to complete your project.
7	1) **Literature review** of existing related research **Quantitative Methods** 2) **Recordings:** Participants will be asked to stand a fixed distance away from an external microphone (Blue Yeti) and instructed to vocalise a pre-defined single vowel and frequency for a pre-defined duration while employing one of the 4 facial states mentioned earlier. The required frequency to be sung will be played directly before commencing vocalisation and a signal will be given by the researcher to start and stop vocalising. Samples will be collected using a MacBook Pro and acoustical measurements taken by employing WASP 2 software. 3) **Observations (photo/video):** Participants will have spots placed on their face (zygomatic muscles – cheeks and orbicularis – around eyes) to help quantify the measurement of muscular engagement. These will be selected and tested for ease of removal and skin sensitivity prior to use with the participants. Expressions will be recorded with still photos using a camera and additionally video footage will be taken to collect action units of muscle movements and to provide a second data set to check accuracy of photos. Photographic data will be collected simultaneously with the acoustical data. This data will be compared to gauge the effectiveness of the two specific practical strategies explored (pen between teeth and fingers on teeth) and this will be further compared with the control neutral facial expression and a genuine smile without employing strategies. *While the "Pen" suggestion comes from early research from both Soussignan and Strack, Martin and Stepper, care will be taken to ensure an object is provided which is hygienic and safe for*

	participants. During the fingers on teeth exercise, hand sanitiser will be provided for participants to ensure hygiene during this exercise. (this box should expand as you type)
	Location of research activity Identify all locations where research activity will take place.
8	In private voice studio (905 Chemin de las néous, 31530 Lasserre-Pradère, France). This is an freestanding house which is separate from others and provides quiet and privacy. Some research will take place in the Salle du Quai (1 impasse de la Gare, 31820 Pibrac, France) which is a communal from from the Mairie de Pibrac which is quiet and provides privacy to the participants. (this box should expand as you type)
	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. If you live in the country where you will do the research then please state this.
9	I live and will be researching in Toulouse, France and am familiar with the venues mentioned above. France follows the guidelines of the EU with regards to GDPR data protection. See the attached guidelines 1) French National Charter for Research Integrity 2) Loi no 2012-300 du 5 mars 2012 relative aux recherches impliguant la personne humaine. Written permission has been sought from the Mairie de Pibrac before using the Salle du Quai for conducting experiments. Participants will largely be sourced through the association (TMA 31) of which the researcher is president and written permission has already been sought from the board. (See attached). Additional participants may be sought through the researcher's private teaching practice. There are no minor or vulnerable participants involved in this study. *(this box should expand as you type)*

10	Use of documentation not in the public domain: Are any documents **NOT** publicly available?	**NO**	☒
		YES	☐
11	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 the current data protection law of the country in question and that of England and Wales. *(this box should expand as you type)*		

	Does your research relate to one or more of the seven aims of the Well-being of Future Generations (Wales) Act 2015?	**YES**	**NO**
12	A prosperous Wales	☐	☒
13	A resilient Wales	☐	☒
14	A healthier Wales	☐	☒

15	A more equal Wales	☐	☒
16	A Wales of cohesive communities	☐	☒
17	A Wales of vibrant culture and thriving Welsh language	☐	☒
18	A globally responsible Wales	☐	☒
19	If YES to any of the above, please give details:		
	(this box should expand as you type)		

SECTION F: Scope of Research Activity

	Will the research activity include:	**YES**	**NO**
1	Use of a questionnaire or similar research instrument?	☐	☒
2	Use of interviews?	☐	☒
3	Use of focus groups?	☐	☒
4	Use of participant diaries?	☐	☒
5	Use of video or audio recording?	☒	☐
6	Use of computer-generated log files?	☒	☐
7	Participant observation with their knowledge?	☒	☐
8	Participant observation without their knowledge?	☐	☒
9	Access to personal or confidential information without the participants' specific consent?	☐	☒
10	Administration of any questions, test stimuli, presentation that may be experienced as physically, mentally or emotionally harmful / offensive?	☐	☒
11	Performance of any acts which may cause embarrassment or affect self-esteem?	☐	☒
12	Investigation of participants involved in illegal activities?	☐	☒
13	Use of procedures that involve deception?	☐	☒
14	Administration of any substance, agent or placebo?	☐	☒
15	Working with live vertebrate animals?	☐	☒
16	Procedures that may have a negative impact on the environment?	☐	☒
17	Other primary data collection methods. Please indicate the type of data collection method(s) below.		
	Details of any other primary data collection method: WASP 2 acoustical analysis https://www.speechandhearing.net/laboratory/wasp/ Spots attached to face at the location of zygomatic and orbicularis muscles. Two methods will be trialed a removable plaster/sticker or water soluable marker/facepaint. (this box should expand as you type)	☒	☐

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

If there are no participants then do not complete this section, but go directly to section H.

	Who are the intended participants:	**YES**	**NO**
1	Students or staff at the University?	☐	☒
2	Adults (over the age of 18 and competent to give consent)?	☒	☐
3	Vulnerable adults?	☐	☒
4	Children and Young People under the age of 18? (Consent from Parent, Carer or Guardian will be required)	☐	☒
5	Prisoners?	☐	☒
6	Young offenders?	☐	☒
7	Those who could be considered to have a particularly dependent relationship with the investigator or a gatekeeper?	☐	☒
8	People engaged in illegal activities?	☐	☒
9	Others. Please indicate the participants below, and specifically any group who may be unable to give consent.		
	Details of any other participant groups: (this box should expand as you type)	☐	☒

	Participant numbers and source Provide an estimate of the expected number of participants. How will you identify participants and how will they be recruited?	
10	How many participants are expected?	10 *(this box should expand as you type)*
11	Who will the participants be?	Amateur adult (18-60) female anglophone singers from TMA 31 association and private teaching studio. *(this box should expand as you type)*
12	How will you identify the participants?	Participants will be contacted via email or phone using the contacts lists of the association and researcher's private studio and participation will be voluntary. Potential participants are most likely already known by the researcher. *(this box should expand as you type)*

	Information for participants:	YES	NO	N/A
13	Will you describe the main research procedures to participants in advance, so that they are informed about what to expect?	☒	☐	☐
14	Will you tell participants that their participation is voluntary?	☒	☐	☐
15	Will you obtain written consent for participation?	☒	☐	☐
16	Will you explain to participants that refusal to participate in the research will not affect their treatment or education (if relevant)?	☒	☐	☐
17	If the research is observational, will you ask participants for their consent to being observed?	☒	☐	☐
18	Will you tell participants that they may withdraw from the research at any time and for any reason?	☒	☐	☐
19	With questionnaires, will you give participants the option of omitting questions they do not want to answer?	☐	☐	☒
20	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	☒	☐	☐
21	Will you debrief participants at the end of their participation, in a way appropriate to the type of research undertaken?	☒	☐	☐
22	If NO to any of above questions, please give an explanation			
	(this box should expand as you type)			

	Information for participants:	YES	NO	N/A
24	Will participants be paid?	☐	☒	☐
25	Is specialist electrical or other equipment to be used with participants?	☒	☐	☐
26	Are there any financial or other interests to the investigator or University arising from this study?	☐	☒	☐
27	Will the research activity involve deliberately misleading participants in any way, or the partial or full concealment of the specific study aims?	☒	☐	☐
28	If YES to any question, please provide full details			
	25. Equipment : Blue Yeti Microphone, MacBook Pro and WASP 2 https://www.speechandhearing.net/laboratory/wasp/. Steralised "pen" object for placing between teeth. 27. Participants will not be informed that acoustic analysis will be to assess the brighteness of the tone. This is to avoid participants artificially aiming for a brighter tone to please the researcher. Instead they will be informed generally that an acoustical analysis will be undertaken on the vocal tone. Neither will they be informed that facial expressions studied relate to a smile but will instead inform them that we will measure facial movements generally. This is to avoid participants believing they need to create a smile when testing the effectiveness of strategies to engage the zygomatic and orbicularis oculi muscles.*(this box should expand as you type)*			

SECTION H: Anticipated Risks

	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.		
1	**Full risk assessment completed and appended?**	**Yes**	☐
		No	☒
2	**Risks to participants** For example: sector-specific health & safety, emotional distress, financial disclosure, physical harm, transfer of personal data, sensitive organisational information		
	Risk to participants:	*How you will mitigate the risk to participants:*	
	Hygiene	Providing steraliser and cleaning objects before use.	
	Anonymity	Pseudonyms will be used for participants	
	Emotional discomfort/Embarassment	Participants will be tested individually without an audience other than the researcher	
	Physical discomfort	Researcher will check that participant is comfortable when employing strategies which involve manipulation of the facial expression. Spots on the face will be tested for ease of removal, comfort and sensitivity prior to use.	
	Vocal discomfort	The researcher will check the vocal comfort of the participant after each phase.	
	Security and management of data storage	Data will be stored locally on a passsword protected device and saved under a pseudonym. Any online or printed data will be destroyed as soon as it can be converted to a local device. Data backup will be an external harddrive which is likewise password protected. Data will be kept anonymously until the end of the researcher's masters studies to be used on subsequent studies but will be destroyed afterwards.	
	Emotional distress	A preliminary discussion will be conducted to explain the research, experiment and a written information sheet will be handed out. The aim is that prior knowledge of the process will avoid emotional distress. After each phase the researcher will check the comfort level of the participant and only proceed to the next phase when they are ready. A debrief after the experiments will be conducted to ensure participant's well being and they will be invited to contact the researcher should they have any concerns after the experiments.	
	Violation of Autonomy	Participants will complete a consent form before the study begins and after a full briefing of the study is conducted with the participant.	
	(this box should expand as you type)	*(this box should expand as you type)*	

3	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)*	
4	**Risks to the investigator** For example: personal health & safety, physical harm, emotional distress, risk of accusation of harm/impropriety, conflict of interest	
	Risk to the investigator: Hygiene Theft of materials Risk of accusation of harm/impropriety Safety *(this box should expand as you type)*	*How you will mitigate the risk to the investigator:* Steralisation of hands after each participant Keeping a distance from singer while vocalising The door will be locked during each experiment to avoid third parties entering the venue. Participants will be asked to apply spots directly to their own face and to place "pen" in mouth to avoid researcher having to touch the participant. Participants will be known to the researcher diminishing the likelyhood of physical harm. *(this box should expand as you type)*
5	**University/institutional risks** For example: adverse publicity, financial loss, data protection	
	Risk to the University: Adverse publicity Financial loss Reputation Ethics *(this box should expand as you type)*	*How you will mitigate the risk to the University:* Participants will be informed that the researcher is responsible for their conduct during the experiment and that ethical approval has been sought. Researcher's professional insurance will cover researcher's conduct. Punctuality, organisation, clarity and preparation will be ensured to create a professional impression when representing the university. Ethical concerns will remain at the forefront of the researchers mind while conducting research to ensure the wellbeing of both the participant and research and protect the universities interests. These concerns including refraining from fabrication, falsification, plagiarism or undisclosure of conflicts of interest. Participants will be fully informed, consent sought and data protected and destroyed at the end of the researcher's studies.*(this box should expand as you type)*
6	**Environmental risks** For example: accidental spillage of pollutants, damage to local ecosystems	
	Risk to the environment: Risks are minimal: Steraliser and "pen" objects which can only be used once Excess use of paper *(this box should expand as you type)*	*How you will mitigate the risk to environment:* Where possible "pen" objects will be retained and steralised for use for another purpose afterwards. Alcohol hand steraliser bottles will be disposed of in the recylcling bin. Where possible information will be communicated digitally and printing will be recto/verso *(this box should expand as you type)*

	Disclosure and Barring Service			
	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
7	Does your research require you to hold a current DBS Certificate?	☐	☒	☐
8	If YES, please give the certificate number. If the certificate number is not available please write "Pending"; in this case any ethical approval will be subject to providing the appropriate certificate number.			

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?
	There will be an online debriefing following shortly after completion of all experiments which will disclose that the study was concerned with a smile expression and its effects on brightness of tone. Participants will be invited to ask questions or express concerns. They will be reminded of their right to withdraw their data at any time and assured that they will remain anonymous. Participants will be provided with the researcher's email address if they are interested in obtaining future results or details. *(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.
	Participants will be fully informed of the process involved in the experiments, and how and which data will be collected during a pre-experiment interview. They will be informed that audio recordings and photos/video images will be collected and that they will be subsequently analysed for the acoustical spectrum and measurements of facial muscle movements. They will be fully informed of data management/storage (safety, anonymity and duration) and their rights to withdrawal at any time. A written consent form and information sheet will be presented to them to be signed before participation which will ensure GDPR concerns are also addressed. This letter will be approved by the module tutor before it is used. *(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.
	All data will be saved under a pseudonym and these will be used if needed in reports. The only document with participant's real name will be their consent form. Experiments will be paced apart to ensure that only one participant is present at a time. Should any images be needed for the final report, additional permissions will be sought from the participants concerned for its use. *(this box should expand as you type)*

SECTION J: Data Protection and Storage

	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
1	***"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. Any video or audio recordings of participants is considered to be personal data.		
	If YES, provide a description of the data and explain why this data needs to be collected:		
2	Photos/videos – to measure muscle movements. The images will include only the participant's face: eyes, cheeks, forehead and mouth regions. Audio recordings – To measure acoustical spectrum Email address – For communication with the participant Personal details – Age in case there are differences in measurements related to age Consent forms – To ensure participants are fully informed and willing and to protect researcher *(this box should expand as you type)*		
	Does it involve special category data (as defined by the GDPR)?	**YES**	**NO**
3	***"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),*	☐	☒
	If YES, provide a description of the special category data and explain why this data needs to be collected:		
4	*(this box should expand as you type)*		

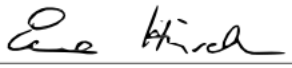
	Will data from the research activity (collected data, drafts of the thesis, or materials for publication) be stored in any of the following ways?	**YES**	**NO**
5	Manual files (i.e. in paper form)?	☒	☐
6	University computers?	☐	☒
7	Private company computers?	☐	☒
8	Home or other personal computers?	☐	☒
9	Laptop computers/ CDs/ Portable disk-drives/ memory sticks?	☒	☐
10	"Cloud" storage or websites?	☒	☐
11	Other – specify:	☐	☐
12	For all stored data, explain the measures in place to ensure the security of the data collected, data confidentiality, including details of backup procedures, password protection, encryption, anonymisation and pseudonymisation:		
	Online WASP 2 acoutical https://www.speechandhearing.net/laboratory/wasp/ data will be created and stored under a pseudonym. Once data and images have been downloaded to local computer, data will be deleted from the website. Paper consent forms will be digitalised and physical forms destroyed at the earliest possibility. These, along with audio and visual files, to be stored digitally on a local MacBook Pro device which is password protected. Backup is to a personal external drive which is likewise password protected Any USB sticks used to store or transfer data will also be password protected.		

	(this box should expand as you type)

	Data Protection		
	Will the research activity involve any of the following activities:	YES	NO
13	Electronic transfer of data in any form?	☒	☐
14	Sharing of data with others at the University outside of the immediate research team?	☐	☒
15	Sharing of data with other organisations?	☐	☒
16	Export of data outside the UK or importing of data from outside the UK?	☒	☐
17	Use of personal addresses, postcodes, faxes, emails or telephone numbers?	☒	☐
18	Publication of data that might allow identification of individuals?	☒	☐
19	Use of data management system?	☐	☒
20	Data archiving?	☐	☒
21	If YES to any question, please provide full details, explaining how this will be conducted in accordance with the GDPR and Data Protection Act (2018) (and any international equivalents, where appropriate):		
	13 – Transfer from camera and from WASP 2 website to local device. Transfer to external harddrive for backup. 16 – Researcher is based in France and research is conducted there and will be shared with the research supervisor in the UK 17 – Emails and phone numbers will be collected for correspondence with participants. 18 – Photos may be used in final report but only with informed consent of participant involved. All data will be kept on password protected devices MacBook Pro and external harddrive. Any transfers of data will be encrypted and password protected. All data will be stored until the end of researcher's masters studies as the data will be used to inform research in subsequent modules. Upon completion of the masters the data will be destroyed. In accordance with the GDPR and Data Protection Act (2018) participants 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)*		
22	List all who will have access to the data generated by the research activity:		
	The principal researcher and the Voice Study Center Tutor. Photos and acoustical spectrum images may be included in the report and in subsequent presentations but only with prior permission from the participant involved. *(this box should expand as you type)*		
23	List who will have control of, and act as custodian(s) for, data generated by the research activity:		
	The principal researcher *(this box should expand as you type)*		
24	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.		
	Data will be stored on a password protected personal laptop (MacBook Pro) and on an external harddrive for backup which is likewise password protected. All transfer or storage of data on a USB		

	stick will be password protected and will be reformatted at the end of the project in order to destroy the data. The data will be stored until the completion of the researcher's masters studies and then deleted. *(this box should expand as you type)*		
25	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)*		
	NO *(this box should expand as you type)*		
26	Confirm that you have read the UWTSD guidance on data management (see https://www.uwtsd.ac.uk/library/research-data-management/)	**YES**	☒
27	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**	☒

SECTION K: Declaration

	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/		
1	**Signature of applicant:**		**Date:** 23/02/2025

For STUDENT Submissions:

2	Director of Studies/Supervisor:	Laura James	**Date:** **11.4.25**
3	Signature:	Laura James	

For STAFF Submissions:

4	Academic Director/ Assistant Dean:		**Date:**
5	Signature:		

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

☒	I have read the guidance notes supplied before completing the form.
☒	I have completed **ALL RELEVANT** sections of the form in full.
☒	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 (where appropriate) *ONLY TICK IF YOU HAVE* ***ATTACHED A FULL RISK ASSESSMENT***
☒	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.
☒	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.

RESEARCH STUDENTS ONLY
Once complete, submit this form via the **MyTSD Doctoral College Portal** at (https://mytsd.uwtsd.ac.uk).

RESEARCH 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.

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.