

MODULE 3, BMPF7008 WORK BASED LEARNING PROJECT

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GLOSSARY OF TERMS

Term	Definition
<i>Associative mapping</i> , p8	(Of <i>visuospatial mapping</i>) Advocates that pitch perception and discrimination are exclusively auditory in nature, relating to the space dimension by virtue of corresponding vertical estimations
<i>Amusia</i> , p3	Impaired ability with discriminating pitch
<i>Mappable</i> , p3	(In the context of singing), elements of the human voice that can be visually represented in space such as pitch, projection, loudness (literally volume related), dominance (forwardness and focus), or purity (degree of vibrato vs straight and flat sound).
<i>Formally untrained singers</i> , p2, 8	This project will consider 'formally untrained singers' to refer to adult vocalists who only began receiving contemporary commercial music (CCM) voice instruction in adulthood: as such, my study subjects align with this definition.
<i>Multi-, supramodal system</i> , p3	Within such a frame, the brain processes information content regardless of the sensory modality through which a particular stimulus is conveyed (Cecchetti et al., 2016)
<i>Psychophysical luminosity</i> , p8	Sound brightness/ darkness
<i>Shared representation model</i> , p8	(Of <i>visuospatial mapping</i>) Posits that musical pitch is inherently audio-spatial in nature
<i>Visuospatial mapping</i>	(In singing), this is one's ability to observe and reconstruct a sound replica of the original source from perceived sound components

1. **Project proposal form**

Project title: Visuospatial mapping in singing, and its use in voice pedagogy for formally untrained singers

1.1 The Context

Singing in itself is many things: activity, process, recreation, craft. A studied viewpoint offers that singing and musicality are not innate to the human condition but instead some things the mind can—and frequently does, across diverse cultures—readily acquire (Marcus, 2012). Following, perhaps to sing well and skilfully is then less straightforward than one would hope. Singing is both psychological and physiological; its effects correspondingly twofold (Stacey et al, 2002).

Successfully coaching others to sing hence must account for mental and physical aspects. To voice coach is essentially to instruct someone how to apply their body towards achieving an intended singing sound. My project investigates employing visuospatial mapping in singing, with and without gesture, as a guiding device; for intended pitch, sound character, and any other perceptibly *mappable* elements of the human voice.

The nature of the connection between musical and spatial processing remains debatable; for instance, reports fail to consistently show (Tillman et al., 2010; Williamson et al., 2011) that people with *amusia* lack corresponding spatial ability (Douglas & Bilkey, 2007). Further, visuospatial mapping is not exclusive to vertical space locations; other mappable qualities include sound brightness and loudness (Hubbard, 1996; McDermott et al., 2008), and terms connoting emotion, size, sweetness, taste, and temperature (Eitan & Timmers, 2010; Walker & Smith, 1984). Pitch is describable in spatial terms such as “high” or “low”, and pitch discrimination shows significant bias toward spatial gestures indicating upward and downward movement on the vertical axis (Connell et al., 2013). Hence, the manner and extent to which the visuospatial element offers a practical and pedagogical tool for singers bears examining more than just pitch-relation; visuospatial mapping could also guide singers towards shaping their desired vocalising sound character wise: floaty, focussed but wispy, throaty and powerful, and so forth. This study aims to assemble insights on specific ways which the visuospatial element can help refine singers’ output, by analysing their responses to given visuospatial mapping directives during voice coaching sessions.

1.2 The Justification

If audio input is treated as a tangible object with constituent parts, one can reasonably posit that *visuospatial mapping* in singing is one’s ability to observe and reconstruct a sound replica of the original source from perceived components (Mervis et al., 1999); further, by utilising one’s body map, kinesthetic sensibility, and inclusive awareness of inner and outer experience (Allen, 2016). Literary evidence suggests that visuospatial mapping can be helpfully employed towards singers’ vocal production: for instance, several researchers argue that space is represented in a *multi-, supramodal system* that integrates sensory input from vision, touch, sound, and other perceptual modalities to create a common spatial code (Bryant, 1992; Giudice et al, 2011; Lacey, Campbell, & Sathian, 2007; Renier et al., 2009; Struiksma et al, 2009). Further, multiple behavioural studies demonstrate that activating pitch concurrently activates [the notion of] space along the vertical axis (with some cultural variation: Dolscheid et al, 2011; Eitan & Timmers, 2010). This project aims to inspect what ways visuospatial mapping is beneficial or not, specifically for helping singers’ reach desired pitch/vocal sound targets; further, tracking the manner and extent of its helpfulness, which would differ qualitatively for each study subject. Hopefully findings can serve larger research in uncovering the varied practical and pedagogical use of the visuospatial element for singing. Apart from one study attempting to establish how pitched singing corresponds to observed spatial gesture (Connell et al., 2013), there appears a general dearth of literature in this subfield currently—surprising, given that music (Anaya et al., 2017) and relatedly, singing, is widely considered an undertaking that relies on mental and visual-spatial associative

process (Reifinger, Jr, 2013) to a minimally significant extent (see appendix 4.7, p54). Hopefully this project will contribute towards enriching present data.

1.3 Intended Outcome/impact

If there are benefits deriving from utilising visuospatial mapping as a learning and practice tool for singers, this could hint at many applications for their continued, expanded use across singing communities. Visuospatial mapping will certainly not be a blanket solution promising success for all singers; it may not be suitable or indeed desirable, for any and every learner profile. Even where helpful, the extent and variance of help will surely differ between singers: aural, kinesthetic, and visual perceptions are each modalities through which the learning process may be facilitated (Reifinger, Jr, 2013). The strength of a modality in aiding a singer's process and retention of information depends on the favoured perceptual strength(s) of said individual; moreover, this modality 'preference' is not static. As people mature and evolve, so can their strongest modality for learning also shift (Barbe and Milone, 1981).

Yet, visuospatial mapping offers a viable option for diversifying the singer's toolkit. Both easily accessible and low-cost, it does not require extensive logistical hardware or technical investment other than the human brain cooperating with biomotor mechanisms, as triggered by sensory input (Titze, 1994). Visuospatial mapping is eco-friendly with a low carbon footprint, and does not require singers' adherence to any sort of program sequence, nor commitment to a minimum regular usage. As a singing tool, documented study of visuospatial mapping's utility could well lead to a more concrete, systematic offering for voice pedagogues in private coaching, and for multilevel practitioners with diverse singing goals.

1.4 Outlined Objective

To start, I will undertake a literature review of visuospatial mapping's generally perceived effects on singing outcomes. Project fieldwork comprises two main qualitative components: first, a small sample study involving 4 subjects recruited from my own adult CCM voice students; second, additional open-ended interviews occurring during voice coaching with separate private students. With all participants, an opt-in 'permissions' form which also briefly outlines the study objective will be issued at the outset– for respondents to grant consent for their data to be used anonymously in my research process, as well as post analysis (Apr-Jun 2023).

Forms containing both non-exclusive multiple choice options and open ended questions will be administered online to collect subjects' rich data (Feb-Mar 2023) including personal particulars. This time period allows participants time to ponder their responses; the online mode of administration further safeguards participants' anonymity. Data collected will help prime my own researcher observations during one-on-one qualitative subject interviews (Apr-Jun 2023), with regard to considering the 'what' and 'how' of visuospatial mapping serving as a tool for the contemporary adult singer. Detailed content and coding analysis of raw interview responses will ideally provide a basis for outlining areas for further research, besides providing key matter for thematic content analysis (Burnard et al., 2008). I aim to distil processed analysed outcomes into a written report and presentation by July 2023; these will be made available to subjects on request.

1.5 Ethics and Insider Research

Insider research is embedded in social context: an outcome of the unique interplay of people, culture, and practices leading to its undertaking (Shaw, 2010). One notable advantage is that the insider brings specialised knowledge and practical experience to her study; as such, an accompanying command of subject matter authority. That said, it is important to regard one's own work critically and reflectively, while staying receptive to varying perspectives and factors that could skew research data. For example, given the pre-existing coach-to-voice student dynamic, participants might feel obliged to respond to my interview according to what they feel is expected, rather than genuinely sharing their personal experience; however it remains that all voices need to be permitted to be heard (Kitzinger, 1995) honestly. The goal is researcher reflexivity in processing the data, staying true to research cause and intention, questioning one's own assumptions, and being aware of how one's own thoughts, actions and decisions influence what knowledge is sought and perceived (Mason, 2002).

Another drawback of insider-led research is that, as one who immerses closely and frequently in the field, the insider might find it challenging to maintain an objective view of the subject matter; for this reason it is vital that the insider researcher's data gathering is meticulously scrutinised, even more so to safeguard against insider bias and ensure validity (Murray & Lawrence, 2000). Moreover, specific work based research concerned with specialised practice may not bring about results that are precisely adaptable to another similar but unique situation (Lave & Wenger, 1991). A 'fuzzy generalisation' (Bassey, 1999) arising from the particular research project that may have general application in a similar context, is arguably of value to the associated community of practice and the individual researcher: by adding to field research in a way that acknowledges the complexity and nuance inherent between and within social groups.

Semi-structured individual interviews will centre around each participant's experience of the same visuospatial coaching cues offered during hour-long coaching sessions. From the outset participants' confidentiality will be protected, as will sensitive information that may be disclosed; participants' personal data will also be anonymised. On the contingency that interview contents could somehow negatively impact the mental health and wellbeing of participants, all participants will be offered helpline resource information.

1.6 Personal Learning Outcomes

- Harness the experience of implementing current research project to inform future voice pedagogy practice and uncover related subfields for deeper, more extensive research to augment knowledge on visuospatial mapping and singing;
- Apply research findings to empower all singers, especially those newer to the practice, with a reliable, adaptable learning aid for discovering their sound on their singing journeys

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2. **Project report**

Project title:

Visuospatial mapping in singing, and its use in voice pedagogy for formally untrained singers

2.1 Introduction

The precise nature and depth of how music and spatial processing are affiliated is contentious (Tillman et al., 2010; Williamson et al., 2011; Douglas & Bilkey, 2007; Hubbard, 1996; McDermott et al., 2008; Eitan & Timmers, 2010; Walker & Smith, 1984). The bulk of current literature seems intent on the pitch aspect of music: that is, distinguishing whether pitch perception and discrimination are exclusively auditory in nature, relating to the space dimension by *associative mapping* (McDermott et al, 2008; Eitan and Timmers, 2010), or subscribe to a *shared representation model*, which posits that musical pitch is inherently audio-spatial in nature. As a CCM voice practitioner and pedagogue I am more interested however, in the nature and extent to which any sort of visuospatial mapping can serve individuals on their singing journey, and the singing community at large. While existing literature is limited in both scope and volume, it is still useful in providing data that helps fortify current research theorising on the relationship between aural music perception and the spatial dimension.

For instance, results from some studies show that those who have impaired pitch discrimination also illustrate certain related spatial deficiencies (Douglas and Bilkey, 2007; Särkämö et al. 2009), but this finding is inconsistent across research (Tillman et al., 2010; Williamson et al., 2011). Adding on, respondents have also been recorded to explicitly map a high pitch cue to a high spatial location (Pratt, 1930), and by extension, to project externally onto a visual target (Walker et al., 2010) or make a physical gestural response (Rusconi et al., 2005) in a corresponding high spatial location. Aside from mapping musical pitch to vertical locations in space (Pratt, 1930; (Rusconi et al., 2005), people also report mapping musical pitch to psychophysical luminosity and loudness (Hubbard, 1996; McDermott et al., 2008), and to words describing the following: emotional valence, size, sweetness, texture and temperature (Eitan and Timmers, 2010; Walker and Smith, 1984). These affiliations demonstrate that, although pitch is describable in spatial terms like "high" or "low", this does not guarantee the case for pitch being fundamentally, exclusively, spatial; pitch and space could be but two of many possible associated dimensions. While the full neural involvement for human pitch perception is still not intimately understood (Bendor, 2011), numerous studies concede that space manifests as a compounded, shared outcome arising from various sensory perceptions combined (Bryant, 1992; Giudice et al., 2011; Lacey et al., 2007).

Prior to commencing research, anecdotal discussions with my private singing students on their perceived role of the visuospatial in singing practice definitely encouraged my pursuit of this project. I am genuinely excited by the prospect of visuospatial mapping as a singing and

pedagogic tool. This project aims to qualitatively gather response data on individual participants' perceived experience, that illuminate visuospatial mapping's applications in singing, by addressing these questions:

- Can visuospatial mapping **always** help one sing more accurately and intentionally: in what ways? How does singing without utilising it compare?
- When and how does visuospatial mapping detract from singing progress, if it does?

The main learning outcomes of my study can be outlined as:

- Gaining deeper insight on visuospatial mapping as an intentional, adaptable singing tool for enriching singers' learning and practice toolkit
- Distinguishing when and how visuospatial mapping best applies, against when it might instead hinder one's singing
- Suggesting a blueprint for optimally incorporating visuospatial mapping into the practising voice coach's pedagogical approach

Hence, my study will evaluate the helpfulness of visuospatial mapping in singing via 2 initial templates (appendix 4.4, p27) : (i) envisioning singing sound as dynamic spatial entity according to various suggested imagery, and employing semi-directed gesture to map its production; and (ii) referring to a 2D visual of the same given melody illustrated, placed before the subject for the entire (2nd) session.

2.2 Literature Review

This section examines current research on how music relates to the spatial dimension, particularly the role of pitch height projection, describable sound characteristics and physical gestures in helping singers map their intended sound to space. I consider related sub-areas within the literature inspecting psychomotor processes relevant to music learning and voice practice; these further support the idea of visuospatial mapping's compatibility with human singing processes. Finally, an overview on the established role of visuospatial mapping and its implications on singing is presented, before discussing project methodology.

Visuospatial mapping for pitch imaging

Musical output is generalisable into 2 key areas, the building blocks: pitch and rhythm. Most available literature addresses the pitch-spatial dynamic, with findings asserting that visuospatial movement biases pitch discrimination, and that the biasing effect is spatial in origin (Connell et al, 2013): viewing upward / downward hand gestures influenced study respondents into believing that they had perceived a corresponding change in pitch, even if truthfully pitch remained unchanged. A pitch stimulus has been found to prime its associated spatial location, thereby associating motor facility responses to that location (Rusconi et al., 2005). Over the course of life, cumulative human experience of hearing and using our own voices offers a common understanding of vertical space mapping for vocal pitch, generalisable to pitch of other people's voices or musical instruments.

Counter-claims that we possess inborn pitch-spatial mapping instincts have also been made, from observing infants as young as 3-4 months old (Walker et al., 2010); whether

acquired or innate, pitch-space guided singing outcomes surely offer a convenient, democratic and economic resource in vocal practice and pedagogy: assuming they do help. What could be more beneficial to the larger singing community however, is further investigating how malleable this pitch/space relation is for specific applications of visuospatial mapping; especially in the era of online learning, virtual practice rooms, and the value placed on optimising output in modern society.

Visuospatial mapping as a sensible complement to singing mechanics

Human vocalisations require precise control over vocal and respiratory muscles (Jones and Munhall, 2005); singing is a complex motor feat of a few human systems collaborating in synch, including air pressure between vocal folds, activation level in a network of inner and outer laryngeal muscles, and biomechanical forces from the singer's postural and articulatory adjustment throughout the head and neck area (Titze, 1994). Adding to these sophisticated biomechanisms, the neural aspect of voice production is also essential in singing.

Studies report how the nervous system uses internal models when planning and controlling vocal pitch, with findings on visually guided limb movements indicating that the motor system learns and maintains neural maps between motor commands and sensory feedback (Ghahramani et al., 1996; Imamizu et al., 1995; Thoroughman and Shadmehr, 1999). Several arm-movement studies entailing visuomotor (Ghahramani et al., 1996; Imamizu et al., 1995; Goodbody and Wolpert, 1999; Field et al., 1999; Vetter et al., 1999) and dynamic disruptions (Thoroughman & Shadmehr, 1999; Goodbody and Wolpert, 1999; Shadmehr & Holcomb, 1997; Shadmehr & Moussavi, 2000; Shadmehr & Mussa-Ivaldi, 1994) show that the human motor system acquires and stores neural maps of the relationships among musculature, environment, motor commands, and sensory feedback; our nervous system may then employ these to continuously anticipate and inform the 'internal feedback loop' whenever we intentionally produce the voice. Visuospatial mapping in singing is conceivably then, an extrapolation of these learned neural networks within.

Visuospatial mapping application

A relevant concern is how far the singing system can sustain and adjust itself outside of ideal conditions. When visual or motion feedback is disrupted during feedback motion, the motor system is noted to efficiently self-adapt and generalise learning to other visuospatial (Ghahramani et al., 1996; Imamizu et al., 1995; Field et al., 1999) and force circumstances (Vetter et al., 1999; Shadmehr & Moussavi, 2000): hence supporting visuospatial mapping being a complementary option in the singer's toolkit, and the pedagogue's coaching.

2.3 Methodology

This work-based project seeks qualitative insight on individuals' perceived experiences of applying visuospatial mapping to their singing. At the heart of qualitative research is striving to understand people's diverse individual truths, which contribute a better overall conception or 'knowing' of the richness, breadth and depth of the event or phenomenon under study (Coffey

and Atkinson 1996, Cutcliffe and McKenna 2002). As such my research favours the constructivist view that reality is not concrete and fixed but instead local, mind-dependent, and can be subjectively constructed and altered (Kawulich and Chilisa, 2012). My study also agrees with the defining interpretivist stance that methods of natural and physical science cannot be used to analyse human discourse and action (Dilthey, 1911/1977); moreover that there is “inevitable interpretation” of meanings by both social actors and the researcher, where each individual holds personal values and biases as a result of their unique social situation. This project’s positioning then simultaneously borrows from these compatible realms, accepting that ‘multiple realities’ and ‘socially and historically negotiated meanings’ co-exist (Cresswell, 2013).

Research data sources include:

(i) 4 adult student subjects—their singing experience levels range from absolute beginner to seasoned beginner (appendix 4.4, p27); and

(ii) 2 separate exchanges with 2 other private students (appendix 4.5, p51).

To supplement these primary findings, results from a couple of social media surveys (appendix 4.7, p54) on people’s view of the visuospatial association in singing, also added value to the study.

Individual interviews, both semi-structured and open-ended, were this project’s main data collection methods. I also intended to keep a researcher journal for each of the small study interviewees, but eventually resigned this intention owing to time and resource constraints. This was a first hand lesson on how the data process is more cyclical than linear: initial findings could inform subsequent data collection (Burnard et al., 2008) and alter existing research plans.

Reflexive thought surfaces that in future a focus group style interview could be a valuable method addition for enriching data, while providing cross-current insights; the compact focus group offers a useful means of uncovering ‘sociocultural traits and practices’ (Berg, 2001), and is useful for generating a ‘rich understanding of participants’ experiences’ (Gill et al., 2008, p. 293). While the more traditional one-on-one interview format permits a more specific pursuit of information than possible in a group interview setting, it can however limit the researcher to observe as an objective third party; the back-and-forth dynamic characteristic of focus group interviews is what prompts natural responses from participants; meaningful insights can be gathered from simply witnessing these interactions, without disrupting underlying normative “communal” values (Berg, 2001).

As research interviewer, I conscientiously channelled relevant ‘important skills’: ‘open and emotionally neutral body language, nodding, smiling, looking interested and making encouraging noises (like ‘Mmmm’)’ (Britten, 1999) of acknowledgement and affirmation; the ‘strategic use of silence’, echoing a response or gently probing further for clarification on a response were also employed to encourage participants to share fully, while allowing them time for thought before divulging (Gill et al., 2008). The session interview transcriptions (appendices 4.4, 4.5 p27) protect participant confidentiality by masking identities. The semi-structured sessions (appendix 4.4, p27) comprised a loose question format enquiring on key content points, while allowing for response content flexibility.

When carried out with due rigour, process analysis of collected data is most challenging and time consuming with respect to the entire research project (Jirwe, 2011), not to mention labour-intensive (Pope et al., 1999). The tedious nature of qualitative research arises partly from the process of constant comparison when analysing data. This involves reading and re-reading

data to cement, refine, and reinforce emergent themes; heightening the meaning of the data is an ongoing endeavour.

A strategy of inquiry must serve a purpose (Cohen et al., 2007; Denscombe, 2003), be it solving or improving a situation. To gather comparative feedback on the possible benefits and drawbacks of utilising visuospatial mapping in singing, asking selected subjects to share genuinely about their experiences is needful; to describe in detail and to what degree they feel their singing practice is boosted or reduced. Since music perception and performance share a close relational correspondence (Meister et al, 2004), inspecting these responses can help reveal the latent potential of visuospatial imaging as a tool for singing, and the teaching of it.

Qualitative research favours the context-specific: key to fortifying our understandings of how to teach and learn (Hoepfl, 1997), and providing opportunities to improve practice through the study of experience. A hermeneutic approach to the text transcribed from interviews places priority on individuals' lived world, through sharing in their unique personal insights (Kvale, 1996); phenomenology too, focuses on the world as lived by the person, not the world or reality as something apart (Valle and Halling, 1989), thus making a compatible perspective pairing. In a 'reconstruction of experience and knowledge' (Laverty, 2003), the meanings and functions we imbue language with can then be construed anew.

Especially with qualitative research, triangulation credibly affirms concurrent validity (Campbell and Fiske, 1959) while mitigating bias; it manifests in this study through multiple method devices: a literature review, semi structured individual interviews conducted among a small group, additional open ended interviews, and social media survey polls to supplement initial findings. The non-arbitrary nature of research makes it 'an inescapably ethical enterprise' (Cohen et al., 2007). Deliberate planning for this study prioritised ethical concerns; involved private voice students respondents were drawn from my own pool of adult learners, with experience levels varying from absolute beginner to experienced beginner; they were individually briefed about the study, including its overarching objective and intended data collection methods, and given a suitable window for clarifying doubts, before being requested to fill in an acknowledgement and consent waiver(appendix 4.1, p27) and a couple of initial profile data (appendix 4.2, p27) and music background (appendix 4.3, p27) forms. All collected background data have since been anonymised; in transcribing individual interviews, due diligence was observed to maintain the confidentiality and protect the private identities of participants (Bell, 2010; Denscombe, 2010). All involved were also separately issued support helpline resources, for in case individuals find sharing about their singing experiences, or any segment of the interview exchange, upsetting.

The notion that one's 'practice-led research' (Candy, 2016) could generate knowledge that augments not only personal practice, but contributes somehow to the larger field, is affirming and empowering, not to mention incentivising (Saidin and Yaacob, 2016), impacting the researcher positively (McClintock and Armston, 2003). As both singing coach and interviewer to my project interviewees, it is not implausible that their responses might be biased and mask their true sentiments due to them feeling self-conscious and even deferential as my students, in conflict of wanting to give honest responses. The interviewing process can be complicated by the assumption among participants that the researcher– being an insider– already has certain answers in mind (Breen, 2007).

Familiarity with research participants could also present a potential problem: sometimes only upon reviewing interview transcriptions might one realise how much of the interactions between researcher and study respondents were unsaid, whereas gaps in meaning are filled in via a

shared understanding of vague comments, implied sentiments, and incomplete statements and descriptions (Kanuha, 2000).

These problematic assertions might be counter-argued by offering that the insider researcher is firstly, not unfamiliar to the study subjects nor to the culture of the subject matter under study; second and consequently, more likely to gain their trust, acceptance, and honest cooperation because she is herself fully involved with participants and their activities (Bonner and Tolhurst, 2002) –it is true that I prefer the term ‘co-investigator’ or ‘co-learner’ to ‘researcher’, because word choices do matter; minimising the ostensible power differential between researching and researched parties is desirable (DeLyser, 2001; Farnsworth, 1996; Harklau and Norwood, 2005)

An interviewer’s key responsibility is to facilitate and guide—whether prompting with subtle cues, injecting humour into the exchange, or simply allowing space in between engagement. I strived to stay out of the interview respondents’ thought-response flow and let them articulate naturally and freely without interruption, only stepping in when they appeared to struggle at length with articulating thoughts, or with intention to nudge the interview direction somewhere.

When approaching from a constructivist and interpretivist perspective, it is necessary to recognise the value-laden nature of the study could be jeopardised by the researcher’s own personal values and biases (Kawulich and Chilisa, 2012). Reflexivity practice is important for staying objective when analysing data—assuming the position of researcher can also function as a neutralising barrier separating the insider from study participants (Breen, 2007). Yet owing to the insider’s close regard for the subject matter under study, it could also happen that data will be treated more meticulously—skewed results would benefit neither researcher, researched subjects, nor research field, aside from being a waste of resources.

The acknowledgement and consent waiver (appendix 4.1, p27) as well as the profile data (appendix 4.2, p27) and music background (appendix 4.3, p27) forms were carefully workshopped before becoming publicly accessible via Google Forms; Open ended questions on the profile data and music background forms enquired on participants’ personal histories with music, and their motivations towards singing: to better place my understanding of subjects’ personalities and backgrounds (Kawulich and Chilisa, 2012) before ‘entering’ the interview space.

Questions fielded during the semi-structured interviews (appendix 4.4, p27) focussed on certain content points but also invited participants’ elaboration to gather more qualitative responses; the open-ended interviews (appendix 4.5, p51) encouraged free response even more, leaving plenty of room for continual open-ended sharing. As such, inductive analysis seemed more appropriate for processing data—content themes materialised *from* the data itself, through systematic sorting and coding of participants’ open-ended responses into emergent categories (Clift and Hancox, 2001). The deductive approach better suits studies where researchers already anticipate participant responses, where predetermined themes help streamline analysis and confirm pattern observations that truly resonate with study goals; the drawback however, is the limit imposed on theme and theory development (Burnard et al., 2008).

2.4 Presentation of findings

The researcher’s primary concern is presenting collected data in a meaningful way (Jirwe, 2011): coding and content analysis aptly serve the qualitative approach, hence my attempts at it in this

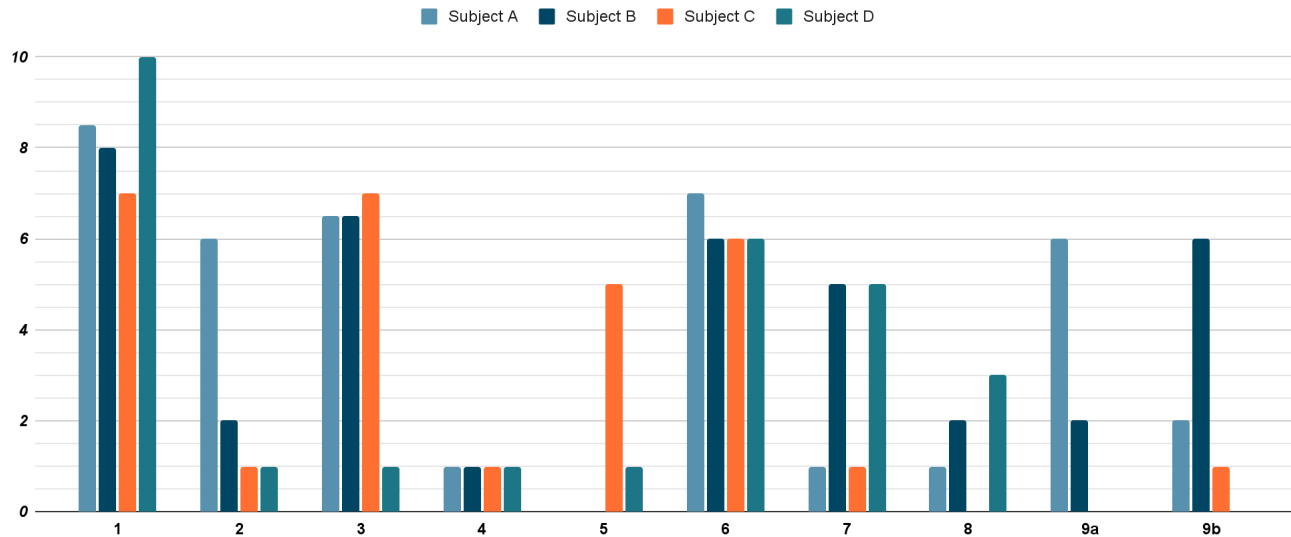
study. Qualitative research is more challenging because it must retain the essence of stories as told by their narrators, while utilising a suitable analytical approach that can bring everything together (Dibley, 2011).

2.4.1 Semi-structured interview responses

The below tables (p11, 2.4.1.1, p12, 2.4.1.2) illustrate an itemised breakdown of chosen subjects' responses on how helpful they found employing the visuospatial element in their singing; each numbered item on the horizontal axis corresponds to a unique visuospatial image or cue issued; the numerical figures numbered 1 to 10 shown on the vertical axes correspond to a unique qualitative phrase describing the extent of helpfulness, from minimal to maximal (2.4.1.1 **VERTICAL AXIS LEGEND**). Each subject was interviewed twice with each session spanning 1 hour, over an approximately 8 week period (Apr-Jun 2023).

A few observations emerge readily from the data in **2.4.1.1**: items 1 and 6 indicate positively that subjects all found it at least moderately helpful, if not more, deliberately training their gaze on a selected visuospatial target; and using their fingers to visually 'place' note pitches along the vertical space axis respectively. Response to items 10 and 11b) in **2.4.1.2** reflect decisively that subjects found it at least a noticeable help, or more, being able to reference a literal 2D illustration to guide their singing, mostly concurring that this was provided the illustration was not within a music notation framework. Granted, over half the subjects interviewed have had zero prior exposure to music theory and notation; that they would feel confused by pitches represented on a foreign looking grid stands to reason. Ultimately, if visuospatial cognition and construction is important for everyday life, bearing in mind the wide range of this ability across individuals (Mervis et al., 1999), interview responses agree that this applies in singing too (appendix 4.4, p27).

2.4.1.1 Benefits of Visuospatial for Singing Interview 1



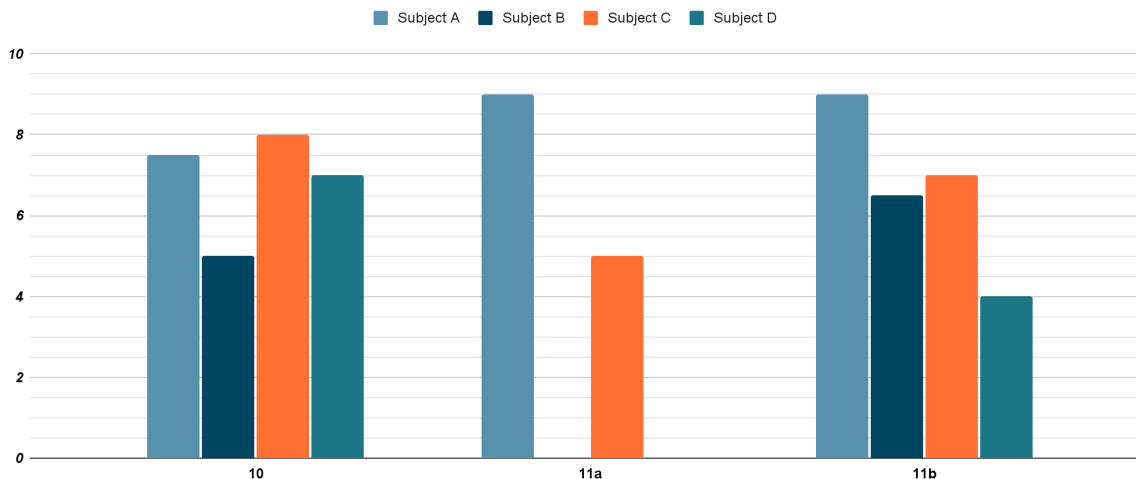
VERTICAL AXIS LEGEND: Numerical score on qualitative extent of helpfulness

0—converse of helpful;
 1—not helpful;
 2—barely helpful;
 3—a little helpful;
 4—a noticeable help;
 5 to 6—a moderate help;
 7 to 8—quite helpful;
 9—an exceptional help;
 10—this has made all the difference to my singing

HORIZONTAL AXIS LEGEND: interview 1 items—how helpful did subject find it when singing, to

- Find a specific fixed visual target 'spot' to 'punch their sound out towards?
- Shake out their head like a wet dog shaking itself dry after a swim?
- Imagine **irrigating** their skull and its cavities with their sound—like the water that farmers use to **irrigate** their land and water its crops; imagine **pouring and channeling more supported breath upwards** from their diaphragm?
- Emulate the motion of '**adjusting your swim goggles**' in an up and out motion i.e. upward and outward
- Use their finger to air-trace the given melody outline, while envisioning projecting their voice into the chosen 'spot' (see #1)?
- Use their finger(s) to help visually locate—high/low—note pitches along the vertical space axis?
- Imagine that they have no forehead and no lower jaw sealing top or bottom of their face... so the airflow through is not restrained on either end?
- Picture their face like a 'cinema' theatre space: with lower notes being produced closer to the cinema's easily accessible main exit door—whereas singing high enough with the pitches is like being seated higher up and seeking the further away exit door... therefore consciously allowing sound more space and time to travel the 'longer' distance?
- a) Picture their sound making a windy 'roller coaster' type shape as it emerges, as [interviewer] air traces this
 - b) Same as 9a) BUT air tracing the 'roller coaster' using their own finger

2.4.1.2 Benefits of Visuospatial for Singing Interview 2



VERTICAL AXIS LEGEND: SAME AS 2.4.1.1

HORIZONTAL AXIS: interview 2 items—how helpful did subject find given 2D illustration reference when singing,

- 10. As a visual guide to follow in producing the given melody, if at all?
- 11. a) With individual melody pitches represented as 'x' on a music staff?
b) With individual melody pitches represented as 'x' in blank space?

2.4.2 Semi-structured interview responses—analysis (appendix 4.4, p27)

Inductive analysis of responses was conducted via coding the data; themes emerged by assembling similar phrase responses with approximately the same meaning—these were then assigned a descriptive summary word or statement (Barrett, 2007; Gill et al., 2008) such as, 'pitch guidance' or 'voice production' to identify common threads across responses.

Perceived benefits of employing the visuospatial element in singing: mapping for pitch guidance, voice production, and more

Notably, all 4 subjects found it useful for their voice production (i) finding a fixed and specific visuospatial focus to aim their singing and (ii) being fed image- and space- related diction words such as 'pour' and 'lift'.

Positive feedback was received from half the participants on the effectiveness of visuospatial mapping gestures for pitch guiding (appendix 4.4, p27): "My voice wants to match what it knows is going on" with the vertical height being indicated, and one reflecting that "it helps with [prompting me to sing higher]".

The provision of a 2D visual illustration drew mixed responses, with one subject sharing that it helped her both with "[production] support and pitch wise" and another admitting that being able to see the given melody rescued her from having to 'remember the tune' – alluding to how visuospatial reference could also be of use for serving and training music memory.

Perceived pitfalls/conditionalities of employing the visuospatial element in singing

Alongside above advantages of visuospatial mapping, respondents also noted certain dependencies of these advantages: for instance, having a visuospatial focus requires that it be 'fixed and specific'; 'something generic and indistinguishable' and 'vague' would negatively impact efficacy; certain image- and space- related diction cues were also unhelpful: "With 'lean' into the sound I'm just gonna [literally] lean", shrugged one participant.

As earlier noted, use of the 2D visual illustration returned split sentiments; a majority of 3 respondents decisively declared their preference for a visual reference of the given melody illustrated **sans** the inclusion of a music staff, which they found more stressful and distracting than helpful–understandable on the account these subjects are not trained in music theory and cannot read music notation.

Half the participants also indicated not being in favour of air-tracing the given melody with their own finger, claiming to be distracted and overwhelmed by having to multitask–calling into question to what extent the individual's innate learning profile makes them compatible or incompatible with visuospatial mapping; the remaining half of participants did not make decisively positive or negative statements regarding finger-air-tracing the melody, instead asserting that they preferred the option of using their own finger rather than seeing mine, "because in a way I'm (flowing and) freeing myself".

2.4.3 Open-ended interview responses

The below table is a summarised content analysis of two separate open-ended interviews with individuals distinct from those in the semi-structured interviews. To clarify, these were not part of my initial research framework; their content was not only highly relevant, but also too rich and insightful to omit, causing me to swiftly seek these individuals' verbal and signed (ethics form) consent during our exchanges, before officially including this data set. The responses here contributed by subjects E and F help shed detail on how they each utilise visuospatial mapping, based on their perception of its helpfulness in various aspects of singing (see appendix 4.5, p51).

Responses corroborate earlier findings on the positive effects that visuospatial mapping offers singers in areas like pitching and voice production; further, subjects also illuminate new theoretical categories where visuospatial mapping could serve singing, including 'singing confidence' and 'rhythm/timing'. Unlike other instruments, the voice cannot simply be seen with the naked eye (Lillis, 2020), and direct sensory access to the vocal mechanism and anatomy is not possible (McKinney, 1994); apart from representing sound in observable space, visuospatial mapping also helps singers visualise gestures that happen within their singing anatomy and body in general (Lillis, 2020), as evident from subject responses in table 2.4.3.1. The case for visuospatial mapping's efficacy is arguable on the assertion that one's body map can be effective whether unconsciously or consciously employed (Allen, 2016), as can one's kinesthetic sensibility: whether " **'in my face' reference**" or "**when some part of [singer's] arm is moving to guide [their] sound**" and inform their intended voice production.

2.4.3.1

Positive benefits of visuospatial thought/gesture/observations executed by singer, paraphrased

Aspect of singing/ Interviewee's perceived positive benefit	Subject E:	Subject F:
<i>Pitch guidance</i>	Hand gestures in space help me with the pitch intervals	I can envision each pitch more precisely [as though they are different individual steps on a scale], which helps me to be more accurate in producing the pitches too
<i>Voice production precision</i>	It gives me better awareness of what is the next note that I land on	If I want the pitches to be connected more smoothly, or go faster/slower, or have more energetic or powerful character , I emulate that imagined "motion" with my finger or hand in space in front of me
<i>Singing confidence</i>	Provides an ' in my face ' reference for what given melody to produce/reproduce	
<i>Voice projection/ focus</i>	I'm trying to imagine the air circulating within my face-like convection currents	When I point and 'jab' forward more fiercely or deliberately drag my finger backwards from where I am facing, my voice instinctively wants to copy that information into the sound being produced; Forward/backward motion [gestures] help to help shape a more robust or laid back sound To help me see how to project my sound outward... when I use my finger to point and motion, my response will be faster and more precise, and my sound production better too
<i>Rhythm/ timing</i>		When [I realise] I'm not singing in time, sometimes I will use my fingers or hand to tap and motion... when some part of my arm is moving to guide my sound it is easier to understand what and how to produce with my voice [to stay in tempo]—after all it is my own body

2.4.4 Random Social Media Survey Responses

Verifying the feedback gathered from both semi-structured and open-ended individual interviews, are the responses collected from social media surveys (see appendix 4.7, p54): this method was added to strengthen research triangulation, for credibly supplementing initial data analysis implications.

Two rounds of 24 hour timed polls launched at separate times, open to the public en masse; the first surveyed people's general perspective on the importance of mental visual association in singing, offering self-explanatory response options including 'very important' (43%), 'quite important' (20%), 'somewhat important' (13%), and 'not that important' (23%); the remaining 1% could not be retrieved by the platform, leaving me to surmise that it must have been divided into minute decimal figures among the prior categories, which the survey platform is not sophisticated enough to track. Response elaboration was requested from those who chose the former three answer options. Brief explanations revealed visuospatial imagery as important for pitch, with the specific imagery of "a basketball going up and over into a hoop when reaching for high notes"; and for better emoting and storytelling, when for example envisioning "a waterfall or a serene mountain" to convey the notion of peace.

The 2nd poll bluntly asked people if they found visuospatial mapping via hand gestures helpful or not for singing; the positive response margin was 6 out of 10 respondents, or 60 percent; it subsequently invited people to agree with, disagree with, or share their thoughts on the statement "we can use vertical space to help sing music pitch": received responses offered that vertical space helps them "not to go flat" or that their hand moving downwards "helps me keep my support".

2.4.5 Conclusions and recommendations

The primary objective of this work-based project was to investigate the feasibility of employing the visuospatial element as a learning and practice tool for singers, as perceived by amateur singers; and unpack its potential scope/varied applications for helping singers and singing pedagogues optimise singing. Various visuospatial mapping functionalities illustrate benefits that differ in content and impact strength from singer to singer, across subjects interviewed, and further supported by public social media survey findings (appendices 4.4, 4.5, 4.7). While certain significant pitfalls of visuospatial mapping for singing have also been uncovered, owing to project constraints including time and scale, present findings can be considered preliminary; more data study is needed to formulate any hypothesis that could even attempt at a generalisation (Cohen et al., 2007).

Findings from all research methods clearly imply that there are benefits and limiting conditionalities to consider in employing visuospatial mapping when singing (appendices 4.4, 4.5, 4.8). Overall, participant response to visuospatial mapping reflects positive associations with employing it to aid singing, especially in pitch and voice production/projection aspects. This aligns with reports that visual and kinesthetic senses are more prevalent for singers (DeSantis et al., 2021). However, this is countered by the need to consider learner profiles (Mervis, 1999) particularly abilities in visuospatial cognition and construction, and adapting visuospatial mapping

to each unique learner so that it is optimally helpful; singers undoubtedly have their respective learning preferences and inclinations. Moreover, possessing a certain singing proficiency is conceivably needed for visuospatial mapping to effectively enhance rather than distract singing: absolute beginners could well end up feeling distracted and overwhelmed by needing to multitask (appendix 4.4, p27), on top of addressing singing itself.

Employing visuospatial mapping in singing proffers ostensible benefits to voice production in terms of precision and accuracy, not to mention one's singing confidence (section 2.4.3)—and these preliminary findings hint at varied applications for continuing and developing their use in the singing and related pedagogical community. While it is notable that certain benefits appear to occur conditionally, depending on the individual's profile, innate and developed abilities, and learning inclinations, visuospatial mapping is advantageous in that it is cost- and environment effective, and does not require logistics apart from the human mind and body hence being easily accessible to all. On the assumption that singing practice is occurring in person with the average healthy, fully-limbed and mobile adult singer, it is impartial to age and starting ability. It can be easily incorporated into both institutional and private practice—the Kodaly method which incorporates the Western 'sol-fa' or 'solfege' sound-to-syllable system (see appendix 4.8, p57) taught widely at elementary school level, already makes the potential case for visuospatial mapping as a music learning tool; not only is it 'sound-to-syllable', but in fact 'syllable-to-visuospatial' hand gesture where hand positions in space are as significant as the hand shapes themselves, in representing pitches (*The Kodaly Handbook*. 2022/2023).

The expression of visuospatial mapping via body gestures is hardly foreign to human attempts at expression; gesture discharges cognitive and communicative functions that language is insufficient for, rendering an abstract idea in human-scale, embodied terms that most importantly, generates the sense that 'an as yet immaterial enterprise is a palpable reality' (Paul, 2021), such as singing.

Some areas for further investigation have surfaced through this research:

- What effect does the particular voice coach have on the success of visuospatial mapping as a learning tool? How can the pedagogue guide effective application of visuospatial mapping for singers?
- What would a successful lesson incorporating visuospatial mapping look like—content- and format-wise?
- Is there potential for designing a progression/regression sliding scale for customising visuospatial mapping lesson formats according to learner profiles— to account for varied individual musical and learning inclinations, and vocal abilities?

The research process has felt baffling and circular at times, given the tedious nature of data collection and analysis, and the immense volume of reading necessary; but it provided ample opportunity to reflect on action and learn from experience (Dewey, 1910). Beyond investigating visuospatial mapping, this project has highlighted areas in my singing and teaching practice to relook and explore. Professional development is a fulfilling continual journey, and the prospect of improving and developing my practice is one I anticipate, despite challenges that will surely surface.

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4. **Appendices**

[Click here for Appendix 4.1 Project outline/ acknowledgement waiver sample form](#)

[Click here for Appendix 4.2 Initial data on small study subjects' individual profiles– sample form](#)

[Click for Appendix 4.3 Music background form on study subjects' individual music experience– sample form](#)

Appendix 4.4: Lesson semi-structured subject interview transcriptions, round 1 and 2

- A total of 4 selected participants each contributed 2 hours of interviews, split between a first and second interview over the April-June 2023 period; most subjects interviewed with a 2-3 week interval between interview rounds; only subject C had a 2nd interview with a far wider interval between first and second interview than the others owing to time constraints
- ***Legend** for subjects to qualitatively describing helpfulness:
 - 0 converse of helpful;**
 - 1 not helpful;**
 - 2 barely helpful;**
 - 3 a little helpful;**
 - 4 a noticeable help;**
 - 5-6 a moderate help;**
 - 7-8 quite helpful;**
 - 9 an exceptional help;**
 - 10 this has made all the difference to my singing**

GW aka Subject A , 3 April 2023, session (i)				
Item	Verbal instruction/ cue item for seeding visuospatial setting or scenario	Helpfulness of item from 1–10*	Paraphrased comments Legend: <i>italics</i> represent interview subject's remarks; <u>Underlined words</u> denote my own spoken remarks	Initial coding framework
1	Find a specific fixed visual target– your 'spot' – to punch your exhale/sending your sound out towards			
		8.5	<i>Having a spot helps... but it has to be a small object... or some object–not something generic and indistinguishable</i>	- Comparative perceptions of pinpointing visuospatial reference/none for singing - Specifying preferences when employing visuospatial reference; positive and negative notions
2	Shake out your head and relax your jaw like a dog shaking itself dry, how would you rate this 'wet dog emerging from water' visualisation?	6		
3	Imagine you are irrigating your skull and its cavities with your sound... pour more support from your diaphragm	6.5	For the specific phrase 'irrigating your face' <i>Makes me think... like trying to activate rather than relax too much.</i> Helps her to stay 'primed'	- Perceptions/ effect of visual images offered by verb diction choices - Positive notions of usefulness of image related diction
			<i>Specific words like 'pour' are helpful... with 'lean' into the sound– I'm just gonna [literally] lean.</i>	- Negative notions of diction /diction preferences with issuing image related diction
4	Thinking of the motion of adjusting 'swim goggles' in an 'up and out' motion i.e. upward and forward	1		

5	Try using your finger [to make a shape outline in the air] now and find that spot that you have chosen, and send your sound there with your finger [jabbing forward]	0		
6	On whether using your finger is helpful for finding your note pitches: if in space you can see how high or low your finger is, does it aid your pitch location somehow?	7	<i>This one helps—like if i'm moving, i can feel like i'm trying to go higher, it helps with making me go "it's time to move, time to stretch it out a little bit"... and my eye is sort of following the height of the hand as well</i>	
7	Imagine that you have no forehead and no lower jaw (on 'meh')... like [those people] in Kill Bill where their heads are chopped off and then for some reason your jaw is also not a constraint... and there's only the middle section of your face existing... so your face's air flow is not restrained on either end	1	<i>In fact i feel like i can't move, with no top and no bottom [to my face]</i>	- Negative notions of diction choices /diction preferences with issuing image related diction
8	The low vs high 'cinema door' analogy: with the lower notes it's more in our CD register, it's closer to the main cinema exit door, just right there... so if we wanna access it we just open our mouth literally and the pitch/ sound is found with not much effort—whereas if you want to go [the octave] higher, it's like your seat is higher up, you're seeking that further away exit door, and you have to allow	1		

	your sound to travel up up up, and consciously create more space for it... because you have to allow yourself the extra travel space and time; the mentality is 'Because I need to go higher up now, it is necessary to create more space and allow myself more travel distance'			
9a)	Imagine that your sound is making a windy roller coaster shape as it emerges—which I am finger tracing in air	6		
9b)	When subject finger traces roller coaster shape in air by themselves	2		
19 April 2023, session (ii): using the whiteboard/staff—convention is that illustrated height corresponds to pitch DRAWN, LINKED PITCHES SHAPE IN 3/4: <i>Do re mi, mi re do/ fa re, mi do</i>				
	Verbal survey of participants' experience/ personal assessment of literal illustrated visuospatial representation for mapping assigned singing melody	Helpfulness of item from 1–10*	Paraphrased comments Legend: <i>italics</i> represent interview subject's remarks; <u>Underlined words</u> denote my own spoken remarks	
10	Which helps more—visual illustration by itself, or having BOTH illustration AND finger tracing shape of pitches in the air? Would you say it's better to just focus on what you heard, or	7.5	<i>I think being able to look at something is helpful; you [air tracing] is actually distracting for me... for me it is better to air trace myself than trying to watch you—you think you're showing me because from your view it seems that way whereas it doesn't look the same where I'm seeing it from</i>	- Comparative perception of visuospatial referencing / visuospatial mapping using bodily gesture - Comparative perception of observing visuospatial mapping live/ using own body for visuospatial mapping

	being able to look at something is helpful?		<i>It's actually quite helpful;</i>	- Learning mode preference
			<u>(on the case for air tracing being not so helpful)</u> I realised at some point i got jerkier (with my air tracing) and then your production also got jerkier	
11a)	Compare seeing this give melody [illustration] within the music staff framework– do you feel like it's better with?	9	<i>But there is no difference between having [staff and no staff] supporting illustration – (she doesn't read music)</i>	- Perceptions of visuospatial mapping in literal observable 2D form - Positive notions of visuospatial mapping in literal observable 2D form
11b)	Against seeing the same illustration NOT using the music staff			

V aka subject B, 3 April 2023, session (i)				
Item	Verbal instruction/ cue item for seeding visuospatial setting or scenario	Helpfulness of item from 1–10*	Paraphrased comments Legend: <i>italics</i> represent interview subject's remarks; <u>Underlined words</u> denote my own spoken remarks	Initial coding framework
1	Find a specific fixed visual target– your ' spot '– to punch your exhale/sending your sound out towards	8		
	Does adding a sound e.g. exhaling on a 'hah' make it easier to punch out your diaphragm support?		<i>Yes; also finding a fixed specific visual focus point is helpful, rather than one that is vague and generic</i>	- Comparative perceptions of pinpointing visuospatial reference/none for singing - Specifying preferences when employing visuospatial reference; positive and negative notions

2	Shake out your head and relax your jaw like a dog shaking itself dry, how would you rate this 'wet dog emerging from water' visualisation?	2	<i>Not so helpful... I think it's more that I'm compressing and tensing myself than anything... and need to relax (so I can elongate)</i>	- Negative notions of suggested visuospatial image - Specifying preferences when employing visuospatial image reference
	So what do you tell yourself to decompress?		<i>I consciously centre myself... by imagining my inner system as a long echo chamber pipe</i>	- Positive notions of (conjuring inner) visuospatial image
3	Imagine you are irrigating your skull and its cavities with your sound... pour more support from your diaphragm	6.5	<i>Yes, phrases like 'lift your face mask' and 'pour your support in' help—mostly anything that reminds me to open up helps;</i> <i>I feel like if I'm imagining myself as an echo chamber it helps to centre my sound production... then I can feel the sound... moving through my bones—whereas directing my sound focus outward just makes me try to shout.</i>	
	Whereas being told to fix your gaze and punch out your sound...?		<i>I almost feel the need to shout... the need to raise my volume... having a visual point definitely helps—otherwise I'm just floating in the air—but if I try to hit/ project it, then I have a tendency to cramp and shout and want to control it. Beyond a certain point I just want to focus on lengthening and the flow of the sound.</i>	
	Think of maintaining a yawn height, no matter what you're singing		[on my observation that her jaw seemed to tense up a bit following this cue] <i>I think i was consciously trying to stretch it—to make the height</i>	
	Can we speculatively deduce at this point that it is more helpful for you to think of upwards motion with your sound than an outwards motion?		<i>Yes, because then i'm consciously elongating myself</i>	

4	Thinking of the motion of adjusting 'swim goggles' in an 'up and out' motion i.e. upward and forward	1		
5	Try using your finger [to make a shape outline in the air] now and find that spot that you have chosen, and send your sound there with your finger [jabbing forward]	0	?	
	Do you feel like your sound is 'stopping' at a certain point—like there's a wall that it's meeting?		<i>I think if I try to focus on projecting, I'm not relaxing... I'm putting in a lot of effort to try and achieve that; whereas if I'm telling myself to enjoy the sound, then it feels like I'm naturally lengthening more and feeling the sound more</i>	
6	On whether using your finger is helpful for finding your note pitches: if in space you can see how high or low your finger is, does it aid your pitch location somehow?	6	<i>Yes, helpful... helps to encourage me to go higher... like my voice wants to match what it knows is going on with (the height) my finger is illustrating</i>	- Perception of visuospatial mapping using own hand gesture - Positive notion of visuospatial mapping using own body
7	Imagine that you have no forehead and no lower jaw (on 'meh')... like [those people] in Kill Bill where their heads are chopped off and then for some reason your jaw is also not a constraint... and there's only the middle section of your face existing... so your face's air flow is not restrained on either end	5	<i>It is helpful.. it helps me to elongate</i>	- Positive notion suggested visuospatial image reference
8	The low vs high 'cinema door' analogy: with the lower notes it's more in our CD	2		

	register, it's closer to the main cinema exit door, just right there... so if we wanna access it we just open our mouth literally and the pitch/ sound is found with not much effort—whereas if you want to go [the octave] higher, it's like your seat is higher up, you're seeking that further away exit door, and you have to allow your sound to travel up up up, and consciously create more space for it... because you have to allow yourself the extra travel space and time; the mentality is 'Because I need to go higher up now, it is necessary to create more space and allow myself more travel distance'			
9a)	Imagine that your sound is making a windy roller coaster shape as it emerges—which I am finger tracing in air	0		
9b)	When subject finger traces roller coaster shape in air by themselves	6	<i>Yes [the hand motion] is helpful—it comes naturally... I guess maybe it's also part of how the individual talks... if you tend to use your hands [to gesture] like i do; i think it's easier if [i do the motion] because in a way i'm (flowing and) freeing myself versus if i try to follow your finger, it's another thing for me to concentrate on; moving is definitely helpful e.g. swaying my body ;</i>	- Positive notion of visuospatial mapping using bodily gesture - Comparative perception of observing visuospatial mapping live/ using own body for visuospatial mapping - Learning mode/ individual profile preference
24 April 2023, session (ii): using the whiteboard/staff—convention is that illustrated height corresponds to				

pitchDRAWN, LINKED PITCHES SHAPE IN 3/4: *Do re mi, mi re do/ fa re, mi do*

	Verbal instructive survey of participants' experience/ personal assessment of literal illustrated visuospatial representation for mapping assigned singing melody	Helpfulness of item from 1–10*	Paraphrased comments Legend: <i>italics</i> represent interview subject's remarks; <u>Underlined words</u> denote my own spoken remarks	Initial coding framework
	Inviting you to look at this whiteboard here... these V marks stand for a breath taken... [introduces the basic idea of a staff]. Please check out these X which indicate [pitch sung over time]... basically I'd like you to see 1) where X fall on the same level; 2) there's something to be said about length of note held; 3) this is the halfway point of the shape; so if we follow convention, the higher the line is the higher placed/pitched would be, and vice versa when the note is lower placed			
10	In general, is it safe to say you find having to look at something like a visually illustrated shape more distracting or more helpful—with illustration in blank space?	5	<i>It does help... because if not then I would have to remember the tune</i>	
11a)	When I ask you to compare [illustrated shape on whiteboard] between having the given melody illustrated using a	4	<i>Without the staff for me... When I have this [illustrated shape on the whiteboard] i'm more focussed on reading it than on [projecting...] myself, my body... yeah it's a distraction in a sense...maybe because I'm not</i>	

	music staff framework, which might be better?		<i>musically inclined, because I don't know how to read notes—so it takes a little bit more to read.</i>	
11b)	With illustration NOT using the music staff?	0	<i>But [the staff] distracts, because I'm trying to make sure that I'm pitching the notes correctly, at the right levels etc... I'm less stressed about having to adhere to a particular set of rules in the 'staff world'... again maybe it's because I don't read music and don't know the theory at all</i>	

HP aka Subject C , 4 April 2023				
Item	Verbal instruction/ cue item for seeding visuospatial setting or scenario	Helpfulness of item from 1–10*	Paraphrased comments Legend: <i>italics</i> represent interview subject's remarks; <u>Underlined words</u> denote my own spoken remarks	Initial coding framework
1	Find a specific fixed visual target– your ' spot '– to punch your exhale/sending your sound out towards	7	<i>Helpful if specific and fixed</i>	- Perspective on pinpointing visuospatial reference - Positive notion of pinpointing visuospatial reference
2	Shake out your head and relax your jaw like a dog shaking itself dry, how would you rate this 'wet dog emerging from water' visualisation?	1	<i>Not really helpful—what was helpful was cue to 'don't push it, like just relax' [don't push it allow it to rise]</i>	- Comparative perspective/ specifying preference on visual image related diction cues
	So what do you tell yourself to decompress?		<i>I consciously centre myself... by imagining my inner system as a long echo chamber</i>	- Specifying preference on (self-conjured) visuospatial image related diction cues
3	Imagine yourself beginning to send out the air/sound, imagine where it's travelling through—and don't be lazy with your face mask	7	<i>Yes—and when you talk about the teeth not meeting, or vibrations... i understand 'lengthening'</i>	- Perspective on/ interpretation of visuospatial related imagery issued - Perspective on visuospatial image related diction choices issued

	Imagine you are irrigating your skull and its cavities with your sound... pour more support from your diaphragm—specific diction like ‘pour’ as opposed to me just telling you ‘add more of this’			
	Can we speculatively deduce at this point that it is more helpful for you to think of upwards motion with your sound than an outwards motion?		<i>[thinking] UP is more helpful</i>	- Specifying preference on issued visuospatial (direction) cues
4	Thinking of the motion of adjusting ‘swim goggles’ in an ‘up and out’ motion i.e. upward and forward	1	<i>It’s more when you demo the actual sound/ motion that I can emulate the (live audio) reference... I’m more of a hear and feel type of learner</i>	- Specifying learning mode preference
5	Try using your finger [to make a shape outline in the air] now and find that spot that you have chosen, and send your sound there with your finger [jabbing forward]	5	<i>Helps a wee bit ... When you [jab] in accompaniment to your sound you will want to be louder</i>	- Perspective on applying visuospatial mapping using own body - Positive notion of applying visuospatial bodily mapping using own body - Visuospatial mapping specifically guiding quality of voice production loudness
	Do you feel like your sound is ‘stopping’ at a certain point—like there’s a wall that it’s meeting?			
6	On whether using your finger is helpful for finding your note pitches: if in space you can see how high or low your finger is, does it aid your pitch location somehow?	6		

7	Imagine that you have no forehead and no lower jaw (on 'meh')... like [those people] in Kill Bill where their heads are chopped off and then for some reason your jaw is also not a constraint... and there's only the middle section of your face existing... so your face's air flow is not restrained on either end	1	<i>Less helpful... I was imagining I'm yawning more</i>	
8	The low vs high 'cinema door' analogy: with the lower notes it's more in our CD register, it's closer to the main cinema exit door, just right there... so if we wanna access it we just open our mouth literally and the pitch/ sound is found with not much effort—whereas if you want to go [the octave] higher, it's like your seat is higher up, you're seeking that further away exit door, and you have to allow your sound to travel up up up, and consciously create more space for it... because you have to allow yourself the extra travel space and time; the mentality is 'Because I need to go higher up now, it is necessary to create more space and allow myself more travel distance'	0		
9a)	Imagine that your sound is making a windy roller coaster	0		

	shape as it emerges—which I am finger tracing in air			
9b)	When subject finger traces roller coaster shape in air by themselves	1	<i>I'm actually distracting myself</i>	- Negative notion of visuospatial mapping using own body gesture
8 June 2023, session (ii): using the whiteboard/staff—convention is that illustrated height corresponds to pitch DRAWN, LINKED PITCHES SHAPE IN 3/4: <i>Do re mi, mi re do/ fa re, mi do</i>				
	Verbal survey of participants' experience/ personal assessment of literal illustrated visuospatial representation for mapping assigned singing melody	Subject rating helpfulness of item from 1–10*	Paraphrased comments Legend: <i>italics</i> represent interview subject's remarks; <u>Underlined words</u> denote my own spoken remarks	Initial coding framework
	Inviting you to look at this whiteboard here... these V marks stand for a breath taken... [introduces the basic idea of a staff]. Please check out these X which indicate [pitch sung over time]... basically I'd like you to see 1) where X fall on the same level; 2) there's something to be said about length of note held; 3) this is the halfway point of the shape; so if we follow convention, the higher the line is the higher placed/pitched would be, and vice versa when the note is lower placed			
10	If we're testing [the whiteboard illustrated shape on the staff] purely for being an aid in pitching—when you look at this shape that shows you what you're	8	<i>Yeah it does make a difference... cuz it's like looking at [music] notes... it helps me to focus both support and pitch wise</i>	

	meant to sing, does it make a difference? And how?			
			<i>I can read music...</i>	
11a)	Which did you find more useful for illustrating the given melody– pitches represented within the music staff?	5	<i>I guess when you put the actual notes [next to each other] on the staff... the x-es in blank space make a clearer, more dramatic shape in comparison... I wonder if my pitching is less accurate with the staff because I realise the pitches are much closer to each other than I thought;</i>	
11b)	Or x-es NOT within the music staff?	7	<i>Not too much difference for whether x-es are illustrated on the staff, or blank space</i>	
++ 12	When I [air trace] the given melody shape with my finger, is it more distracting or more helpful for you? And between the two options is there a stark contrast in usefulness?	2	<i>I prefer just the whiteboard visual illustration... your finger air tracing the shape is really distracting, sorry! Because I got to follow you, then I got to anticipate where you're going next... while trying to keep to the original given singing melody</i>	
13	Now I'm going to [air trace] the given melody shape while playing it on the keys on the other hand–you can keep referring to the illustrated shape on the whiteboard if you want–how helpful or distracting is this?	0	<u>Ok I was a distraction, and I know it too–clearly</u>	
14	Did [the staff shape illustration] help you with your timing? Because you can see how high/ low the notes might be–but to see the spacing in between pitches, did it help you to produce the rhythm more correctly (instead of singing a straight rhythm maybe you could reproduce the syncopations)?		<i>I guess when you put the actual notes [next to each other] on the staff... the x-es in blank space make a clearer, more dramatic shape in comparison... I wonder if my pitching is less accurate with the staff because I realise the pitches are much closer to each other than I thought;</i> <i>Not too much difference for whether x-es are illustrated on the staff, or blank space</i>	

15	What if you just sing the shape of the given melody as represented by the (vector) arrow direction disregarding the pitch x-es (individual pitches that make up the shape) for now? How helpful do you find the arrow indicating directional movement as compared to the graphic melody shape?	0	<i>Inconsequential</i>	
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ST aka Subject D , 7 April 2023, session (i)				
Item	Verbal instruction/ cue item for seeding visuospatial setting or scenario	Subject rating helpfulness of item from 1–10*	Paraphrased comments Legend: <i>italics</i> represent interview subject's remarks; <u>Underlined words</u> denote my own spoken remarks	Initial coding framework
1	Find a <i>specific</i> fixed visual target– your ' <i>spot</i> '– to punch your exhale/sending your sound out towards	10	<i>As long as the cue instructs towards a 'specific' and 'fixed' visual focus</i>	- Preference on pinpointing visuospatial reference/ positive and negative notions
2	Shake out your head and relax your jaw like a dog shaking itself dry, how would you rate this 'wet dog emerging from water' visualisation?	1		
3	Imagine yourself beginning to send out the air/sound, imagine where it's travelling through–and don't be lazy with your face mask Imagine you are <i>irrigating</i> your skull	1		

	and its cavities with your sound... <i>pour</i> more support from your diaphragm-specific diction like 'pour' as opposed to me just telling you 'add more of this'			
	Imagine that your breath supporting the sound out up and through is like the water that farmers use to IRRIGATE their land and water the crops		<i>'Meh' is an accessible and good warm up sound for me</i>	
4	Thinking of the motion of adjusting 'swim goggles' in an 'up and out' motion i.e. upward and forward	1		
5	Try using your finger [to make a shape outline in the air] now and find that spot that you have chosen, and send your sound there with your finger [jabbing forward]	1		
	Do you feel like your sound is 'stopping' at a certain point—like there's a wall that it's meeting?			
6	On whether using your finger is helpful for finding your note pitches: if in space you can see how high or low your finger is, does it aid your pitch location somehow?	6		
7	Imagine that you have no forehead and no lower jaw (on	5	<i>Neutral—not helpful, not distracting either</i>	- Perspective on visuospatial image reference issued

	'meh')... like [those people] in Kill Bill where their heads are chopped off and then for some reason your jaw is also not a constraint... and there's only the middle section of your face existing... so your face's air flow is not restrained on either end			
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8	The low vs high 'cinema door' analogy: with the lower notes it's more in our CD register, it's closer to the main cinema exit door, just right there... so if we wanna access it we just open our mouth literally and the pitch/sound is found with not much effort—whereas if you want to go [the octave] higher, it's like your seat is higher up, you're seeking that further away exit door, and you have to allow your sound to travel up up up, and consciously create more space for it... because you have to allow yourself the extra travel space and time; the mentality is 'Because I need to go higher up now, it is necessary to create more space and allow myself more travel distance'	3		
9a)	Imagine that your sound is making a	0	<i>Does not help, is distracting</i>	- Negative notion of visuospatial mapping

	windy roller coaster shape as it emerges—which I am finger tracing in air			
9b)	When subject finger traces roller coaster shape in air by themselves	0	<i>Even worse—there are too many things to think of at once</i>	- Negative notion of visuospatial mapping using own body
19 April 2023, session (ii): using the whiteboard/staff—convention is that illustrated height corresponds to pitch DRAWN, LINKED PITCHES SHAPE IN 3/4: <i>Do re mi, mi re do/ fa re, mi do</i>				
	Verbal survey of participants' experience/ personal assessment of literal illustrated visuospatial representation for mapping assigned singing melody	Helpfulness of item from 1–10*	Paraphrased comments Legend: <i>italics</i> represent interview subject's remarks; <u>Underlined words</u> denote my own spoken remarks	Initial coding framework
10	If we're testing [the whiteboard illustrated shape on the staff] purely for being an aid in pitching—when you look at this shape that shows you what you're meant to sing, does it make a difference? And how?	7	<i>It only helped me for the second [half of the shape]; the first half I actually can already visualise...</i> <i>[to see the shape was better than to not have anything, specifically with the second half of the given pitches in shape]</i>	
			<u>I realised that when you looked at the illustrated shape—rather than not— you were able to keep time a little better as well</u>	
11a)	Which did you find more useful to producing singing— x-es representing given melody note pitches shown within the music staff?	0	<i>Actually the staff is more distracting than just having x-es [illustrate the shape] in blank space</i>	
11b)	Or x-es NOT shown using the music staff?	4	<i>It was better, like actually helpful, with [the shape illustration]</i>	
++ 12	Did [the staff shape illustration] help you	7		

	with your timing? Because you can see how high/ low the notes might be—but to see the spacing in between pitches, did it help you to produce the rhythm more correctly (instead of singing a straight rhythm maybe you could reproduce the syncopations)?			
13a)	When I [air trace] the given melody shape with my finger, is it more distracting or more helpful for you? And between the two options is there a stark contrast in usefulness?	0	<i>I actually ignored your hand ... because I didn't want to be distracted...</i>	
			<u>I realised sometimes when i'm jerky with my air tracing then the (singer's) singing will get jerkier as well</u>	
13b)	Now I'm going to [air trace] the given melody shape while playing it on the keys on the other hand—you can keep referring to the illustrated shape on the whiteboard if you want—how helpful or distracting is this?	0	<i>Distracting</i>	
14	What if you just sing the shape of the given melody as represented by the (vector) arrow direction without looking at the x-es (individual pitches that make up the shape)? How helpful do you find the arrow indicating directional		<i>I prefer the graph with the x-es in SPACE NOT STAFF</i>	

	movement as compared to the graphic melody shape?			
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The table below consolidates subjects' individual experiences on the series of visuospatial mapping cues they were assigned over the interview sessions, attempting to code certain phrases according to perceived common meaning; remarks boxed in green imply positive notions; remarks boxed in red highlight a negative notion or attached conditionality; remarks boxed in blue indicate a reflective observation; yellow highlights an associated aspect of singing that responses to given cues allude to.

4.4.1
Comparison of positive and negative notions on visuospatial thought/gesture cues offered wrt to implied aspect of singing, paraphrased

Aspect of singing/ subject	Subject A	Subject B	Subject C	Subject D
	PERCEPTION(S)			
<i>Voice production</i>				
CUE: Fixing a visuospatial focus	Having a spot helps—but it has to be a small object	Finding a fixed specific visual focus point is helpful,	Helpful if specific and fixed [spot]	As long as the cue instructs towards a 'specific' and 'fixed' visual focus
	–Not something generic and indistinguishable	Rather than one that is vague and generic		
CUE: Image-related diction choices associating with space	Specific words like 'pour' are helpful	Phrases like 'lift your face mask' and 'pour your support in' help—mostly anything that reminds me to open up helps	What was helpful was cue to 'don't push [the sound], like just relax [it up]'	

	With 'lean' into the sound I'm just gonna [literally] lean	If I'm imagining myself as an echo chamber it helps to centre my sound production... whereas directing my sound focus outward just makes me try to shout	[thinking] UP is more helpful	
CUE: Finger motion/ gesture in space		If I try to focus on projecting, I'm not relaxing...; whereas if I'm telling myself to enjoy the sound, then it feels like I'm naturally lengthening more and feeling the sound more	Helps a wee bit ... When you [finger jab] in accompaniment to your sound you will want to be louder	
<i>Pitch guidance</i>				
Hand (gesture) height	If I'm moving... my eye is sort of following the height of my hand as well... I can feel like I'm trying to go higher, it helps with [prompting me to sing higher]	My voice wants to match what it knows is going on with (the height) my finger is illustrating		
CUE: Provision of 2D illustration			When you put the actual notes [next to each other] on	

			the staff... the [pitches represented] in blank space make a clearer, more dramatic shape in comparison... I wonder if my pitching is less accurate with the staff because I realise the pitches are much closer to each other than I thought	
CUE: Provision of music notation based 2D illustration		[The music staff] distracts, because I'm trying to make sure that I'm pitching the notes correctly, at the right levels etc... I'm less stressed about having to adhere to a particular set of rules [without it]... maybe it's because I don't read music	[The 2D illustration reference] helps me to focus both support and pitch wise	Actually the [music] staff is more distracting than just having 'x-es' [illustrate the melody shape] in blank space
Music/ pitch memory				
		It does help... because if not then I would		

		have to remember the tune		
CUE: Air-tracing given melody with finger	Being able to look at something is actually quite helpful... for me it is better to air trace myself–	It's easier if [I do the motion] because in a way I'm (flowing and) freeing myself–	I'm actually distracting myself [by attempting to air trace the melody with my finger]	I actually ignored your hand... because I didn't want to be distracted [by trying to follow your finger air tracing]; [Attempting to air trace the melody with my finger,] there are too many things to think of at once
	Than watch [someone]	If I try to follow your finger, it's another thing for me to concentrate on;	I prefer just the [2D] visual illustration... your finger air tracing the melody shape is really distracting... Because I got to follow you, then I got to anticipate where you're going next... while trying to keep to the	It was better, like actually helpful, with [the melody shape illustration] in blank space

			original given singing melody	
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Appendix 4.5 Open-ended Interviews

INDIVIDUALS ON THE USE OF VISUOSPATIAL HAND GESTURES TO MAP THE VOICE

4.5.1. 3 June 2023

Interviewer (I): I saw you moving your hand just now and I noticed that you actually do it quite a lot... What is the utility of the hand motions in space for you?

Subject E (E) : *The intervals.*

I: So when you move your hand according to the shape you want to make... does it give you more information?

E: *It gives me better awareness of what is the next note that I land on...*

I: Because in a way it is forcing you to continually refer right? Like it's giving you an actual in your face reference for what you should be 'creating' with your melody, correct?

E: Yes *exactly*

~

I: What does the function of circling and spinning your finger around do?

E: *I'm trying to imagine the air circulating within my face—we need convection currents in our heads! [laughter]*

I: Do you find that helps you alot? On a scale of 'super helpful!' to 'quite helpful' to 'somewhat helpful'...to 'helpful according to each person's preference and please don't quote me on this'?

E: *I do think it helps me... but would definitely recommend it as helpful only according to each person's preference.*

4.5.2. 14 June 2023 (as transcribed from mandarin Chinese)

Interviewer (I): When you use your finger [to trace the air] 1) what are you doing?; and 2) how does it help you?

Subject F (F): *When I use my finger firstly it helps me firstly to visually see each pitch more precisely [as though they are different individual steps on a scale], which helps me to be more accurate in producing the pitches too; and if I want the pitches to be connected more smoothly, or*

go faster/slower, or have more energetic or powerful character, I emulate that imagined “motion” with my finger or hand in space before me—

I: So a more vigorous forward motion with your finger is helpful for your vocal production?

F: *Yes, like when I point and ‘jab’ forward more fiercely or deliberately drag my finger backwards from where I am facing, my voice instinctively wants to copy that information into the sound being produced...*

I: So it's not just guiding pitch with the height axis... but also guiding how forward or hidden [in your face] and backward you intend for your sound to be...? What about the width/broadness of your sound?

F: *Definitely mapping sound pitch to vertical height helps, and forward/backward motions to help shape a more robust or laid back sound— moving [my finger] from side to side is kind of strange and I don't remember myself doing it... it doesn't seem like it would help with producing sound more in a certain way.*

I: Have you always used finger/ hand gestures to aid your singing?

F: *I have used them from before, just not as consistently or conscientiously before studying music and singing... but now, after becoming more aware that pitch imprecision is a weakness of mine and also because you suggested hand gestures as a possible helpful tool— I deliberately employ my finger to help me see how to project my sound outward... when I use my finger to point and motion, my response will be faster and more precise, and my sound production better too.*

I: **Does your finger/hand always instinctively know how to make the guiding gesture... or are you consciously informing the gesture with an image in your mind?**

F: ***I'm not... consciously producing the gesture by planning it alot... it comes out naturally the way it does, expressed according to my intuitive brain, and I think everyone would produce a different gesture.***

I: So the finger helps you with understanding the height, depth and shape of the given melody to sing—which in turn helps you express this melody better using your own voice... Does it help with your sense of rhythm/timing too?

F: *Yes—and yes it does also help some with my rhythm/timing. For instance when I'm aware of not singing in time, sometimes I will use my fingers or hand to tap and motion... when some part of my arm is moving to guide my sound it is easier to understand what to produce with my voice—after all it is my own body! And so I'm more sensitive and responsive with the information process, but at the same time it is only for me to know and refer to... other people would not feel or might not even notice these self-directed signals, in the same way. I feel like this is a big help for me.*

I: In conclusion, do you feel using your finger/hand to gesture gives you valuable data in a few important areas of voice sound production, which then helps what your ears perceive to be processed more efficiently and effectively by your brain—so you can better produce your intended sound?

F: *Yes definitely—to a considerable extent.*

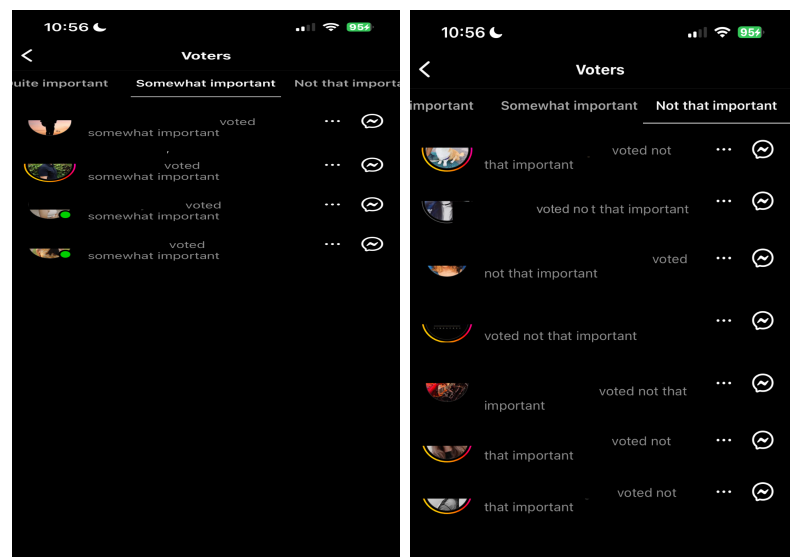
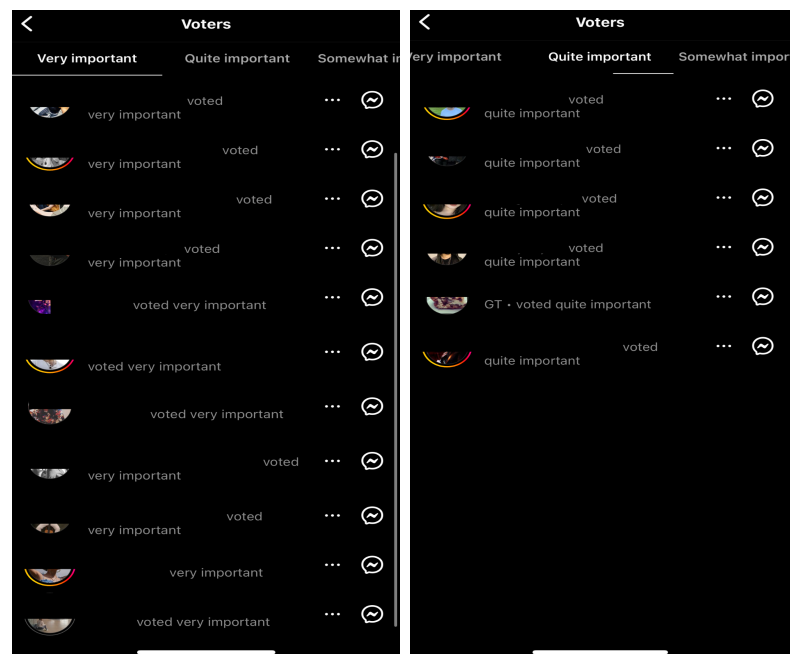
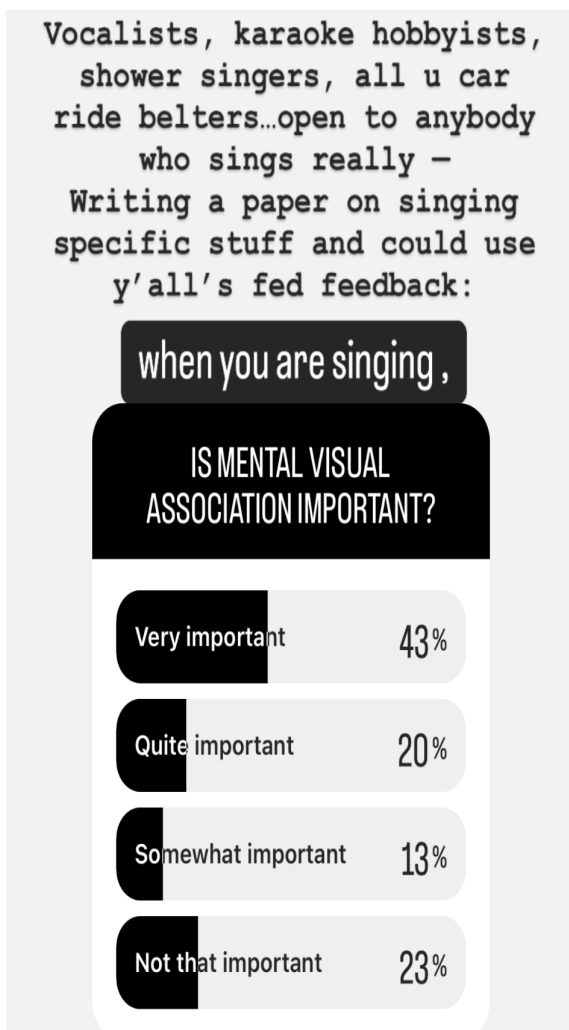
[Click for Appendix 4.6 Ethics form](#)

Appendix 4.7 Random social media (IG story) survey response

13 June 2023

4.7.1 Perceptions on importance of mental visual association in singing

4.7.1.1 11 voted 'very important'; **4.7.1.2** 6 voted 'quite important'; **4.7.1.3** 4 voted 'somewhat important'; **4.7.1.4** 7 voted 'not that important'



NOW. Unless you chose the last "not that important" option in my previous poll...



To you, mental visual association when singing is important... impt HOW?

Type something...

Thank you all in advance
for lending me your
thoughts & opinions 💜

4.7.2 Query on importance of mental visual associations of singing individuals

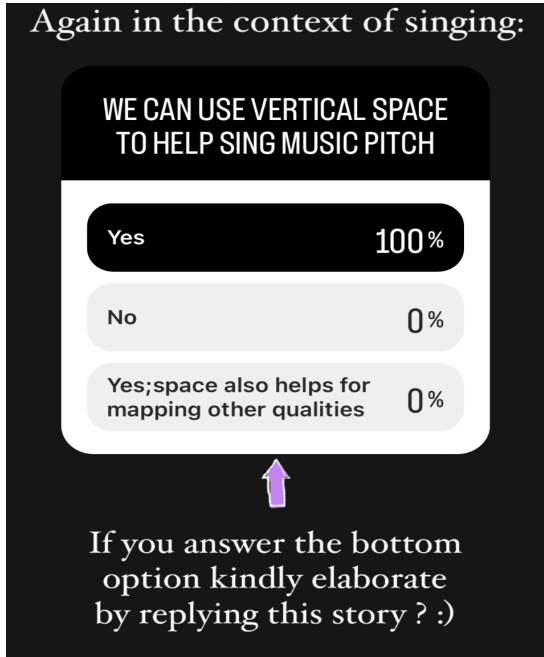
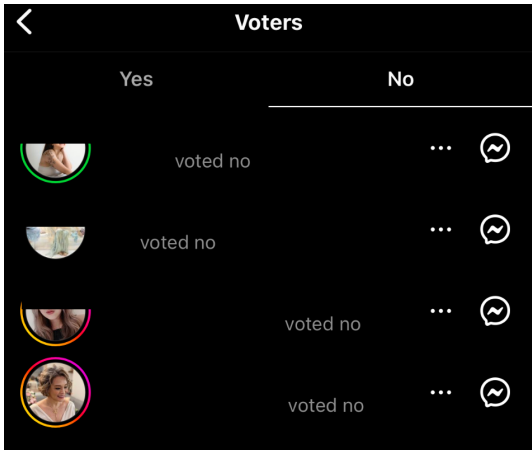
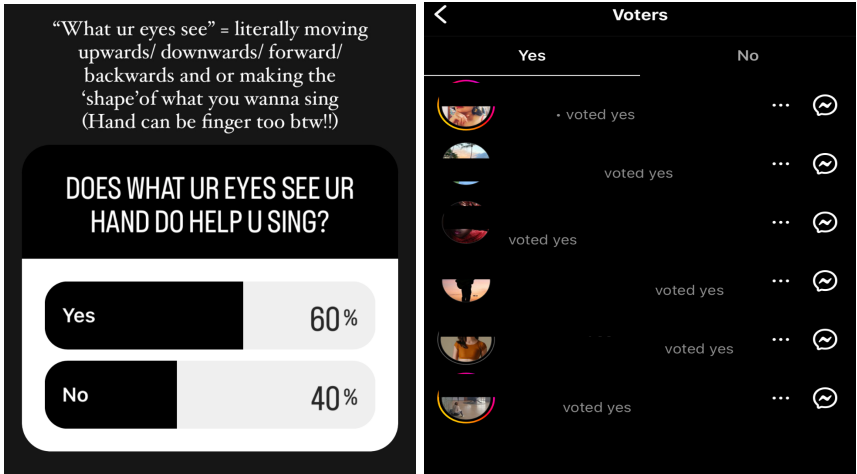
4.7.2.1 Qualitative mental visual associations of singing individuals

Responses

D Peace, hope etc. Even if it's not a person but a place like a waterfall or serene mountain Reply >	D It definitely helps to hone in the emotion felt in the song/performance - anger, love, peace... Reply >
TP I always imagine a basketball going up and over into a hoop when reaching for high notes Reply >	JS To emote the song well. It's a job hazard though. Ripping off band aids to past failed r'ships Reply >
G depends on track! but if my purpose for singing was to tell a story, i see an image!! Reply >	JH Hitting high notes Reply >
ZH A pic speaks a thousand words. Also gives a sense/recollection of the experience, and thus feeling Reply >	L For me it's mostly to remember lyrics! Reply >

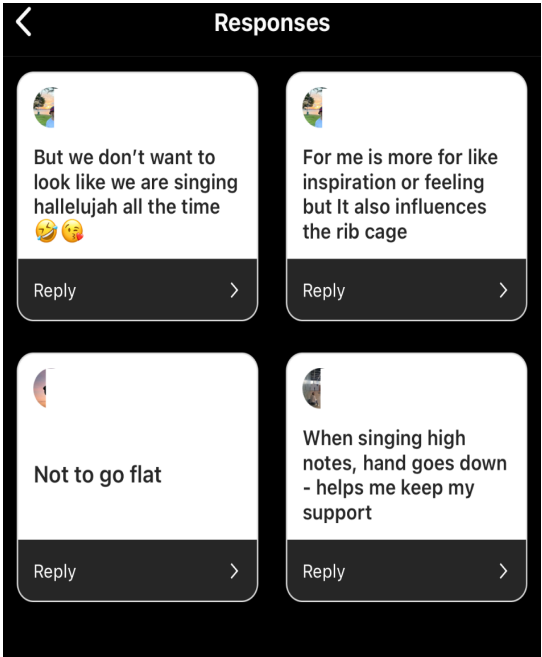
16 June 2023

4.7.3 Helpfulness of observable visuospatial mapping; 4.7.3.1 6 voted 'yes'; 4.7.3.2 4 voted 'no';



4.7.4 Specific helpfulness of vertical space for mapping music pitch

4.7.4.1 Qualitative vertical space associations of individuals when singing



Appendix 4.8 Tonic solfege or 'sol-fa' system

The principle is that an easily singable syllable, for example, do, re, mi, fa, or sol, is assigned to each of the seven pitches of the diatonic scale. However, in contrast to non-Western systems, these pitch-syllable pairs do not have any acoustic similarities. The practice of this solfège system can be traced back to Guido d'Arezzo, a famous music theoretician in the first half of the eleventh century, and it is mainly used for intonation exercises in singing lessons and for training auditory imagery until the present day.