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COHORT H

MODULE 1 ASSIGNMENT: APPLICATION OF LEARNING IN THE WORKPLACE

TOTAL NUMBER OF WORDS: 4662

RESEARCH TOPIC:

**Tone Deafness vs Amusia—How They are Related: How Tone Deafness is Misleadingly
Applied and Probably Refers to Poor Singing Instead**

(I) LIT REVIEW: 2766 WORDS

1. INTRODUCTION

As a professional singer of mainly Contemporary Commercial Music (CCM) in both live and studio performance for over 15 years, my CCM voice coaching portfolio emerged organically alongside performing work. My students are mostly young adult singers of CCM oriented towards mainstream radio pop—some have limited prior singing experience in choir; yet others underwent some degree of classical music training in childhood; some have neither background. They serve as my ongoing reference point in singing, teaching, and also inspired this research paper: I seek to **clarify the definitions of ‘tone-deafness’ and ‘amusia’ respectively, to (a) understand their interrelation, and (b) inform developing a pedagogic resource for aspiring singers (and their mentors) who struggle with pitch**—which the second part of this paper will address.

Research generally asserts that there is clear differentiation made in the literature between congenital amusia and self-reported tone-deafness (Anderson et al., 2012). Confusion arises however, with more than one study agreeing that the ‘modern’ term congenital amusia is ‘commonly known as tone-deafness’ (Ayotte et al., 2002; Launey et al., 2014; Peretz et al., 2007; Peretz, 2008; Peretz et al., 2009; Peretz and Vuvan, 2017; Pfeifer and Hamann, 2015; Phillips-Silver et al., 2011; Whiteford and Oxenham, 2018). Aside from exploring the implications within ‘self-reported’ tone-deafness, distinguishing between it and congenital amusia appears relatively glossed over by the literature to focus instead on the causes and implications of congenital amusia. Resultantly, the connection between the two has become more confusing: If they are not synonymous conditions, I inquire on their relationship to each other.

2 MOTIVATION AND DIRECTION

During initial lessons, enough of my students have articulated suspecting themselves to be tone-deaf (TD), for it to cultivate a research interest. Self-reports of this condition are often associated with the notion of ‘[cannot] sing’ (Anderson et al., 2012)—it is important to discern being *unable to*, from being *unaccustomed to*. Not regularly engaging in a specialised complex motor task like singing naturally disposes one to be slower at it. To

obtain an optimal gauge of pitch singing proficiency, tempo must be moderated. Occasional singers performing at fast tempo are found to make more errors than professional vocalists; at a slow controlled tempo however, most of these occasional singers sang a familiar melody as accurately as the professionals—in tune and in time (Bella et al., 2007).

From my own student set, around 15 percent exhibited genuine prolonged—over 3 months—struggle with pitch. Moreover, these students *did* eventually show progress with their pitching abilities, despite taking two to three times longer as compared to other learners (appendix R). Having a benchmark statistic for those affirmatively facing music-related struggles like this is useful and empowering for the general public: it will concurrently highlight that proficient singing is absolutely accessible by the majority of society, while viewing self-reports of being TD with more inquisitive scepticism.

I posit that tone-deafness lies in the broader arena of congenital amusia (CA)—it is one manifestation of the condition, where there could exist several (appendix D). Moreover, the consequence of repeatedly conflating these terms across academia—let alone in a lay society—has allowed tone-deafness to be mistaken as the equivalent of congenital amusia. But this is not so. Following: to grasp the concept of tone-deafness, I first examine more closely what amusia entails.

2.1 AMUSIA

Variously called ‘note-deafness’, ‘tone-deafness’, ‘tune-deafness’, and ‘dysmelodia’, the encompassing term ‘congenital amusia’ is more recently used for the same condition that these all refer to, for music-specific impairments (Peretz et al., 2007; Stewart, 2008) an individual is born with (‘congenital’). Congenital amusia (CA) is officially recognized as a neuro-developmental disorder where musical perception and production is lacking, and accounts for various developmental forms that co-exist (Ayotte et al., 2002); its occurrence is an estimated 4 percent of otherwise normal individuals (Anderson et al., 2012; Peretz et al., 2008).

This lifelong affliction qualifies as a selectively musical handicap that cannot be attributed to low intelligence, impaired hearing, or absence of music instruction (Ayotte et

al., 2002; Cuddy et al., 2005). Affected individuals struggle to sing in tune or dance and tap along to music; cannot recognize iconic tunes from their culture without lyrics; feedback that musical performances sound like a 'din' or a foreign speech; and most strikingly, do not recognize 'off-key' pitches in conventional but unfamiliar melodies (Allen, 1878; Ayotte et al., 2002; Bella and Berkowska, 2009; Stewart, 2008; Hyde and Peretz, 2003 ; Peretz and Vuvan, 2017). These listed traits definitely extend beyond the issues encountered with my own pitch-poor students—further, inaccurate production of pitch intervals can still occur in those without perceptual disorders (Dalla Bella et al., 2007; Wise and Sloboda, 2008).

In contrast to blatantly not recognising iconic songs by their melodies, amusics show no equal struggle in discerning these songs by their spoken lyrics, or in remembering non-musical auditory events (common environmental sounds, speakers' voices) (Ayotte et al., 2002). This strengthens the case for amusia genuinely being a developmental, rather than acquired, disorder (Cuddy et al., 2005).

Current study classifies CA as a pitch- rather than time-related deficiency—with research that argues for variable rhythmic difficulty being a cascade effect of a faulty-pitch processing system (Hyde and Peretz, 2003). Although admittedly, many studies recruit more subjects with tune-oriented deficits—yet recognising developmental shortfalls in timbre and timing are possible (Stewart, 2008). Even the Montreal Battery of Evaluation of Amusia (MBEA) pilot study concurs that the temporal route is less examined than the melodic one (Peretz et al., 2003) (see appendix D). Consequent to causing deficiencies with pitch process, CA affected individuals perform poorly in all tasks requiring recognition and recall of melodies (Ayotte et al., 2002)—they appear to lack the standard intuitive wiring necessary for mapping pitches onto musical scales (Peretz et al., 2007). Hence amusics struggle with discriminating pitch direction, the crucial building block for the representation of melodic contour (Stewart, 2008).

Fine-grained discrimination of pitch (see appendix C) is arguably more relevant to music processing than any sphere. In contrast to large intonation contours used to relay information in speech, music relies more on fine resolution of pitch (Hyde and Peretz, 2003), employing melodic intervals far smaller. The amusic brain is as equally equipped

as the regular brain to perceive fine-grained pitch differences, but restricted awareness of this precise ability results in a disconnect between registering what is heard, and being able to retrieve needed musical pitch knowledge (Peretz et al., 2009; Williamson and Stewart, 2010). Studies comparing the brains of amusics against controls corroborate this, suggesting that amusia is a neural disconnection syndrome where brain areas essential for pitch production are poorly linked to areas essential for conscious access of perceptual information (Loui et al., 2015)—resulting in a limited awareness of pitch difference and related lack of responsiveness to shifts that breach established musical keys (Peretz et al., 2009) in Western music (see appendix B).

Possessing degraded pitch perception jeopardises one's music perception, impairing sensitivity to obvious dissonance (in classical music)—a sensitivity that infants normally possess (Zentner and Kagan, 1996). Identifying dissonance is fundamental to music experience and closely linked to being able to discern fine-grained pitch-differences (Ayotte et al., 2002).

Beyond exhibiting irregularities in musical perception and memory, healthy scholarly debate exists on whether amusics' process of speech and language is normal (Ayotte et al., 2002; Sloboda et al., 2005) or if it is valid to argue for pitch-processing in music and language as sharing common mechanisms (Li et al., 2010) (appendix E).

2.2 PREVALENCE, GENETICS AND NURTURE

Bearing in mind that statistical prevalence is always relative (Peretz and Vuvan, 2017), true amusia is found to be rare among the approximate 15 percent of individuals self-reporting tone-deafness (Cuddy et al., 2005). An official study conducted in 1980 estimated about 4-5 percent of the 'otherwise normal' adult population to suffer hereditary, lifelong congenital amusia (Cuddy et al., 2005; Peretz et al., 2009; Kalmus and Fry, 1980).

A more recent study comprehensively tested 20 000 demographically diverse participants over a 10 year period, revealing that (a) true CA exists in about only 1.5 percent; (b) self-reporting is a reliable measure of CA, provided subjects have known family predisposition; (c) CA cannot be helped by music training; and (d) it manifests

relatively isolated from other cognitive disorders, excepting spatial perception problems (Peretz and Vuvan, 2017).

(a) is encouraging insofar in verifying how little of the general populace actually suffers CA; (b) and (c) outline respectively that congenital amusia is genetic (Stewart, 2008), and developmental—no amount of musical conditioning relieves it. Studies strongly highlight CA's heritability component (Peretz et al., 2007) (appendix N). There is no evidence for extracurricular music instruction mitigating the severity of congenital amusia, nor singing performance in general—correlation between years of musical education and test performances are generally weak (Peretz and Vuvan, 2017). Ultimately, CA emerges from the interaction of several genes with each other *and* the environment, resulting in overall increased risk for development of this complex disorder (Peretz et al., 2007; Peretz and Vuvan, 2017).

2.3 CLEARING CONFUSION

Tone-deafness is a popular term in Western society, but its referent is ambiguous (Cuddy et al., 2005). This is evident across my research, where 9 of 36 accessed articles (25%) utilised the terms CA and TD interchangeably (appendix U).

According to the literature reviewed for this paper, much confusion arises plausibly also because there is insufficient research consideration granted to other subtypes of amusia that classifiably exist. As the MBEA outlines, music perception comprises both melodic aspect of 'what', as well as temporal aspect of 'when': tone-deafness has its time-scale equivalent, and both deficiencies can coexist (see appendix D). As previously acknowledged, CA does not manifest singularly—its occurrence takes various developmental forms. Yet our current knowledge of CA seems overly focussed on the pitching element of singing, with much support for CA being illustrated by a deficit in musical pitch process, but not musical time (Peretz et al., 2007). In many labs moreover, the test considered most diagnostic of amusia has subjects identify anomalous notes in conventional but unfamiliar melodies (Peretz et al., 2009).

Effective singing however, requires delicate coordination of a trifecta of skills: **perceptual**—pitch matching, interval reproduction, and fine-grained pitch discrimination

ability; **cognitive**—working memory, mindful attention, learning processes; and **motor**—planning, selection, and execution. Struggling to sing in tune could reflect impairment in one or more of these areas (Loui et al., 2015) but need not indicate full-blown inability for aural perception and reproduction.

2.4 SELF REPORTED TONE-DEAFNESS

Subsequently, I attempt a more precise understanding of tone-deafness—much of the confusion surrounding tone-deafness arises simply because both public and academic discourse needs to stop conflating being TD with being a ‘poor-pitch singer’ (Pfordresher and Brown, 2007)—taking longer (than a seasoned professional) to reproduce melodic shape must not be misread for being pitch-deficient.

In one university study, the prevalence of self reported tone-deafness among student volunteer subjects was almost 17 percent (Cuddy et al., 2005). Other studies corroborate similarly, estimating 15 percent of typical populations self-identify as tone-deaf (Himonides et al., 2012); and approximating that 10-15 percent of the general population imitate pitches and melodies inaccurately—so-called ‘poor singers’ (Bella et al., 2011)— by singing quite far from given pitches (Bella et al. 2011). Many of these consider themselves ‘tone-deaf’ (Cuddy et al., 2005). Self-reported tone-deafness could highlight a few things—lack of musical instruction, insufficient interest, or upon diagnostic testing, true shortcomings in various musical subareas (Peretz and Vuvan, 2017).

Many attain adulthood without acquiring considerable music performance skills in singing or instrumentation. Hastily attributing this to being ‘not musical’ however, overlooks the multiple personal, social, and environmental factors that precondition gaining musical competence during one’s formative years—lacking musical achievement does *not* translate into an individual lacking necessary musical capacities. When individuals self-report being TD therefore, it could well be for reasons unrelated to any diagnosable anomaly (Sloboda et al., 2005). According to study responses, formal music instruction does not factor heavily in one’s self-assessment of tone-deafness—the correlation is weak, at best. These statistics might stem simply from individuals simply underestimating their musical competence (Cuddy et al., 2005; Peretz et al., 2003). What they reference instead could be poor-pitch singing.

If individuals self-reporting as TD actually mean to reference poor pitch singing, it implies that faulty perception is to blame. Findings suggest however, that instead of perceptual, motor, or memory system problems, poor pitch singing results from mismapping of pitch onto action (Pfordresher and Brown, 2007). Further, many vocal challenges present as a consequence of mismapping—in executing complex skills-based tasks like singing, where we *think* things are—as opposed to where they actually are—greatly affects how we *perceive* and *respond* (Moss, 2022). I extend this argument to pitching: where we *think* pitches *are*, needs to line up closely with where they *actually are*, both sequentially and along the imaginary vertical axis, in order for pitch mapping to succeed.

Further, having non-accustomed singers perform singing tasks at a reduced pace is an optimal performance condition—research attests that the majority of occasional non-professional singers are able to sing a familiar melody in tune and in time, as long as it is performed at a slow tempo. Further, singing at a slow tempo to a metronome improves pitch (and time) accuracy: occasional singers performed as accurately as the professional singers (Bella et al., 2007).

Establishing a reference pathway to chart a new singer’s developmental timeline will help identify poor singers—lest they be dismissed for amusic or worse, allowed to believe that they are (Loui et al. , 2015)—and better address their specific needs.

As with CA, the discussion of poor singing must not be limited to solely pitch weakness—it does not systematically compromise all measures of singing proficiency(Bella and Berkowska, 2009). Poor singers are generally impaired on the pitch dimension (Bella and Berkowska, 2009), exhibiting inaccurate production of pitch intervals or pitch transposition (Bella et al., 2007), with a co-occurring deficit in rhythm perception in about 50 percent of cases (Pfeifer and Hamann, 2015) —although pitch accuracy or time accuracy could present as selectively impaired (Bella and Berkowska, 2009) (appendix P)

2.5 DIAGNOSTICS

A present concern emerges with efforts to diagnose CA—there is no consistently

accepted definition for accurate singing and relatedly, singing performance—across the literature, scoring accurate singing varies based on various education or scientific objectives (Loui et al., 2015). Barring that, in this section I list six current test options (appendix A) for conclusively ruling out amusia in individuals, and discuss other issues that arise with testing for CA. These diagnostic procedures include

- (i) the Montreal Battery of Evaluation of Amusia (MBEA, Peretz et al., 2003; Peretz et al., 2007; Sloboda et al., 2005);
- (ii) The Sung Performance Battery (SPB; Bella and Berkowska, 2009);
- (iii) The Seattle Singing Accuracy Protocol (SSAP) (Loui et al., 2015);
- (iv) The Goldsmith Musical Sophistication Index (GoldSMI, Müllensiefen et al., 2014);
- (v) The Distorted Tune Test (DTT, Peretz and Vuvan, 2017); and
- (vi) The Online Test (Peretz et al., 2008)

Of these, the MBEA is arguably the most widely recognised (Peretz et al., 2003).

3. CONCLUSION AND OUTLOOK

The study of disordered musical development is an important reminder of fundamental abilities we often overlook—it also grants a niche opportunity to explore how musical perceptual ability develops from both biology and conditioning, into an intricate and essential human behaviour (Stewart, 2008). That acknowledged, I restate that more concerted efforts to collectively distinguish between CA and TD must begin with research discourses, to avoid further confusing an already hazy public dialogue. Further, standardised CA testing requirements across studies—including the recruitment of participants—and systematically grouping studies according to scientific and educational intents, would aid in more credible data drawn.

Besides increasing depth, scope, and thoroughness of the current dialogue on CA, researching potential subtypes of amusia will reveal their affinity, and how they may affect other essential neuro-functions (Stewart, 2008)—from a research standpoint. From a psycho-educational perspective, scrutinising which aspects of CA might be adaptable is important, to inform potential remediation programmes (Anderson et al., 2012) and support more holistic voice training; voice educators will gain resources to better

understand the nature and development of various singing difficulties and in so doing, workshop neurologically-informed approaches to better address these issues.

Finally, while the community lacks consistent standards for singing accuracy, our ability to identify different causes or solutions to poor-pitch singing is reduced (Loui et al. , 2015). In future study, I aim to understand *how* aspiring poor-pitch singers might still continue to pursue singing; I aim to test and identify a **standardised toolkit**—by also further researching the implied association between pitch and spatial perception deficiencies found in 20 percent of CA cases (Peretz et al., 2008) —for aiding new singers specifically with pitch-weakness.

(II) 4 CRITICAL REFLECTION: 1896 WORDS

For conceptual perspectives to be developed and deepened, clarifying what experiences mean—to the self and to larger society—is an essential process (Boyd and Fales, 1983). In accordance with Dewey (1933) stating that ‘doubt and uncertainty are essential elements of reflective practice’, the research outlined in (I) was laborious—it alternated between feeling messy, conflicting, even convoluted. Admittedly, its process also evoked a positive chain effect: my findings on CA, and the revelation that tone-deafness is a common misnomer for poor pitching, served stimulus to convert ‘routine action’—of habitual teaching practice—into ‘reflective action’—systematic observation and testing of ideas to improve teaching practice. I appreciate Borton’s (1970) theorising on critical reflection for its clarity and simplicity, but agree most with Kolb (1975) that experiential learning is a cyclical process (appendix W) and will be employing his model to guide future research.

My research post rumination can be aptly summed into three *reflective observations*:

- (i) **The research process eventually took on an exasperatingly circular dynamic owing to extensive technical jargon and repetitive, dense text;**
- (ii) **Concurrently, many studies provide a wealth of data and information relevant to CA, while further investigation of being TD in and of itself is subsumed under the larger CA focus;**

(iii) In addition, varying perspectives across the literature occasionally implied conflicting views—leading to frustration, and an inconclusive research outcome.

Ultimately much about CA and tone-deafness—respectively as well as comparatively—was meaningfully revealed. I realise now that to demand a clear-cut boundary between terms, is frequently not as straightforward as laying out their similarities and differences. To adopt a critical lens is to question use of terminology: the term ‘congenital amusia’ does not acknowledge disordered musical abilities’ many possible manifestations, as much as referring purely to *amusia*—“congenital” denotes a (presence from birth) time period, rather than attributable cause (Peretz et al., 2008). Choice of diction does matter for creating space within existing conversations to include alternate perspectives alongside a dominant one. On one end, scrutiny of the literature generally indicates that any discussion of amusia must mutually include tone-deafness, because it is an inextricable—arguably the most diagnostic behavioural indicator (Ayotte et al., 2002)—characteristic of the former condition.

Yet, the notion of self-reporting has significantly varied credibility for assessing tone-deafness and by extension, CA: one could be an informed individual, aware of a family history associating CA type musical disorders; one could well also be self-reporting with no solid grounds other than their own self-evaluation. The latter scenario is not uncommon among new adult singers, and it is these reports I endeavour to disprove. Post-research, my response strategy with students claiming to be TD will definitely be applying a broader and more systematic approach.

My research topic is motivated by *affecting concrete experiences* of teaching so far, but also by genuine keenness to develop community resources for serving a need— my present singing students, and potential others in future, who face similar pitching struggles. Since beginning to teach I have sought clarity and assurance on the murky fine line between providing rational structured support for singers’ pitching issues, versus imposing my own experience and expectation of it onto my charges.

4.1 Future learning: Considerations and Personal development plan (PDP)

In order to focus my research, this section will preclude the category of temporal perception disorders i.e. individuals who have issues with vocalising in tempo.

Two important considerations on *abstractly conceiving* how to **construct a meaningful model for representing and assisting pitch** are that (i) no 2 voices (and anatomies) are exactly identical; and (ii) learning the vocal instrument is a task whose complexity is compounded by the blunt fact that it cannot be visibly adjusted—all the calibration and correction has to be accomplished by thought connecting to internal wiring. Prototyping such an educational aid cannot undermine these intricacies, and is an intimidating prospect bound to be iterative, cyclical and greatly time-consuming.

In pursuit of better understanding the implications of poor-pitch perception and production as well as designing a **structured pitch introduction model** for new singers, my PDP aims to *actively experiment* addressing **three main learning goals**:

- (i) **mirror a suitable MBEA-proxy diagnostic test** (appendix A), **adapted for an educational, home context**—that pedagogues can utilise in cases of suspected amusia; and subsequently utilise to better organise and address the **specific struggles and learning style (inclinations)** of pitch-poor beginning singers
- (ii) test and identify **2 reliable pitch- and vocal production- aid tactics** that can be easily employed as tools to help pitch poor singers get comfortable and confident with exploring pitch
- (iii) study trial **a concise set of self-crafted practice drills** over 8 weeks for giving pitch poor singers a starting leg up. This ‘starter-kit programme’ should be adaptable—to keep pace with singers’ progress—and easy to sustainably incorporate into one’s lifestyle.

4.1.1 INITIAL SURVEY OF STUDENTS & NOTES ON THOSE IDENTIFIED TO HAVE POOR PITCH

This subsection describes an ideal scenario of how my research would manifest: after deciding on an appropriate MBEA proxy, I would recruit sample test cases from all students encountered in the past 3 teaching years—some still taking regular lessons with me, some being coached elsewhere, and some who have entirely ceased getting

coaching. From a total of 19 singers (appendix R), I have identified 3 out of a total of 19 potential subjects* as suspected cases for disordered musical perception based on substantial lesson interactions occurring upwards of a 3 month period. This translates to an approximate 15.8 percent of all students thus encountered. Whether these students really have chronic pitch deficient perception or some manifestation of CA needs verification.

Pre-test phase, it is noteworthy observation that subjects who are weakest with pitch perception are the same ones who seem most convinced about pursuing singing and or, are perhaps blissfully oblivious to their poor pitch; conversely, it is the singers who have stronger pitching abilities who are more doubtful—even if not insecure about—their ability .

Of 5 students initially found to require extra pitch guidance, I had the opportunity to work with 3 of them for five months minimally. Also within the 5, one standalone case bears mentioning, if only to act as a study control testifying that some degree of pitch struggle is not uncommon with singing, even in music-proficient individuals with considerable instrumental training (appendix R). **AI**, as he will be known, also serves as a reminder that familiarising with the vocal instrument is an entirely unique and non-template adhering journey for every individual; to me, his process exemplifies how the practice of pitch mapping is painful for an initial (indefinite) period. Beyond the ‘hump’, I believe that the majority of ‘occasional’ hobbyist singers realise suddenly that pitching is markedly more accessible, even efficient: progress sometimes sneaks.

4.1.2 (i) MBEA proxy & profiling specific pitch struggles/ learning styles

My home-friendly diagnostic assessment will essentially mirror the ‘novel’ Online Test (Peretz et al., 2008) in both content and test conditions. In line with my focus on addressing pitch struggles, I will adhere to the view that amusia is more typically expressed by a deficiency in perceiving musical pitch, rather than musical time (Kalmus and Fry, 1980; Peretz et al., 2008). Hence, my priority in diagnostic testing would be the ‘mistuned’ and ‘off-key’ components of MBEA testing—although the ‘off-beat’ subtest will still apply for a more comprehensive assessment—coupled with questions for surveying an individual’s personal and musical background. (appendix A).

4.1.3 (ii) Testing pitch- and production- aid tactics

The learning devices I would like to document testing as pitch-aids include a mix of visuospatial and kinesthetic oriented approaches: facial and articulator adjustments; visuospatial imagery; body pitch mapping; vocalising; body movement; and visual representation (appendix R). Some are exercises I have already been incorporating during my private coaching practice, from which I get to observe students' individual learning preferences—also important for determining what generally works best all round, with new singers. It must be noted these listed categories are intended to simultaneously complement the required singing assignment—in this set of proposed tactics, body movement is the most extreme option because it sometimes distracts more than it helps.

4.1.4 (iii) Module- and time- sensitive 8 week 'pitch-starter kit' programme trial

Based on the previous subsection's trial findings, I will incorporate the tactics generally found to be most effective—individual, not categorical, drills—into the third and final learning goal in my PDP, the 8 week 'pitch-starter' kit programme (appendix T).

On the premise that recruiting my intended participants is successful, I will workshop a '101' introductory type curriculum for instilling notions of pitch to aspiring but pitch-weak singers. An ideal timeline would see the 8 weeks commencing in the last week of April 2022, to be completed by the last week of June—end of May would mark the approximate halfway mark. If all goes according to plan, my programme trial's end findings will tie in nicely with fulfilling module 2's (Undertaking Research in the Workplace) July deadline.

Bearing in mind that every individual's vocal instrument is unique, as is their learning capacity, I am fully prepared to customise the starter kit to meet each subject's entry point—it is meant less as a one-size 'method' tool and more as a buffet spread of possibilities for improving one's pitching; I also acknowledge that progress rate will vary per case, and individual struggles will not occur nor be overcome uniformly. Expectedly, documentation of each participant's progress track to follow work in progress on a weekly basis will be carried out to record and track developments. Gathering participant feedback on a consistent weekly basis across the 8 weeks is also of highest priority, for improving the programme.

4.2 Measures of success

Broadly speaking, my rubrics for pitch progress can be outlined as:

- (i) ability to efficiently match a given pitch;
- (ii) ability to sustain a given pitch over a given number of counts;
- (iii) ability to reproduce given pitch intervals;
- (iv) ability to efficiently recall and reproduce an assigned melodic shape, whose complexity is increased progressively;
- (v) and finally, ability to pitch and sing a suitably chosen song first with and then without, having the melody playing along.

Not all of these points will be practised from week 1 as that could be overwhelming for some at the beginning—building up familiarity with pitch mapping weekly will better place an individual's confidence, dexterity, and stamina, especially with (iv) and (v).

With acquiring singing skill, one cannot expect the initial progress curve to be steepest—the converse might be true, with progress jumping in pace only past a certain point, as earlier mentioned.

If participants are able to independently and proficiently accomplish tasks (i) to (iv) on their own by the trial period's conclusion, I would consider it success—(v) can take considerably longer than 8 weeks, even for individuals with above-average pitch-proficiency. Moreover, if a minimum of 3 out of 5 test subjects report successful, I will be encouraged to expand the trial testing sample to further verify its efficacy.

Additionally, apart from the initial round of MBEA proxy testing, I aim to test participants' proficiency twice more, via the same Online Test—during week 5 and after the final session in week 8. Beyond this point I expect to be able to progressively increase their pitch practice difficulty by the week. By the concluding week's lesson, I will test participants' proficiency in this respect for the final time—with the hope that their results are indicative of improvement in pitching, both individually and across the five participants.

Works Cited

- Albouy, Philippe, et al. "Impaired pitch perception and memory in congenital amusia: the deficit starts in the auditory cortex." *Brain. A Journal of Neurology*, vol. 136, 2013, pp. 1639-1661.
- Anderson, Susan, et al. "Congenital amusia: is there potential for learning?" *Annals of the New York Academy of Sciences*, 2012.
- Ayotte, Julie, et al. "Congenital Amusia. A group study of adults afflicted with a music-specific disorder." *Brain*, vol. 2002, no. 125, pp. 238-251.
- Bella, Simone Dalla, et al. "Disorders of pitch production in tone deafness." *Frontiers in Psychology. Auditory Cognitive Neuroscience*, vol. 2, no. 164, 2011.
- Bella, Simone Dalla, et al. "Singing Proficiency in the General Population." *Acoustical Society of America*, vol. 121, no. 2, 2007, pp. 1182-1189.
- Boyd, Evelyn M., and Ann W. Fales. "Reflective Learning: Key to Learning from Experience." vol. 23, no. 2, 1983.
- Chase, Samuel. "What Is A Key in Music? | HelloMusicTheory." *Hello Music Theory*, 26 January 2021, <https://hellomusictheory.com/learn/keys/>. Accessed 11 April 2022.
- Cuddy, Lola L., et al. "Musical Difficulties are Rare. A Study of "Tone Deafness" among University Students." *Annals of the New York Academy of Sciences*, vol. 1060, 2005, pp. 311-324.
- Dalla Bella, Simone, et al. "Disorders of pitch production in tone deafness." *Frontiers in Psychology*, vol. 2, no. 164, 2011.
- Dalla Bella, Simone, and Magdalena Berkowska. "Singing Proficiency in the Majority. Normality and "Phenotypes" of Poor Singing." *New York Academy of Sciences*, vol. The Neurosciences and Music III - Disorders and Plasticity, no. 1169, 2009, pp. 99-107.
- DeVoto, Mark. "key | music | Britannica." *Encyclopedia Britannica*, <https://www.britannica.com/art/key-music>. Accessed 11 April 2022.

- Fries, Wolfgang, and Andrew A. Swihart. "Disturbance of rhythm sense following right hemisphere damage." *Neuropsychologia*, vol. 28, no. 12, 1990, pp. 1317-1323.
- Goulet, Genevieve Mignault, et al. "Congenital Amusia Persists in the Developing Brain After Daily Music Listening." *Plos One*, vol. 7, no. 5, 2012.
- Grant, Allen. "Note-deafness." *Mind*, vol. 3, no. 10, 1878.
- Himonides, Evangelos, et al. "Is there potential for learning in amusia? A study of the effect of singing intervention of congenital amusia." *Annals of the New York Academy of Sciences*, no. April, 2012.
- Hyde, Krista L., and Isabelle Peretz. "'Out-of-Pitch' but 'Still-in-Time'. An Auditory Psychophysical Study in Congenital Amusic Adults." *New York Academy of Sciences*, vol. 999, 2003, pp. 173-176.
- Kalmus, H., and D. B. Fry. "On tune deafness (dysmelodia): frequency, development, genetics, and musical background." *Annals of human genetics*, vol. 43, no. 4, 1980, pp. 369-382.
- Launey, Jacques, et al. "Dysrhythmia: a specific congenital rhythm perception deficit." *Frontiers in Psychology*, vol. 5, no. 18, 2014.
- Li, Fang, et al. *Intonation processing in congenital amusia: discrimination, identification, and imitation*, vol. 133, 2010, pp. 1682-1693.
- Liegeois-Chauvel, Catherine, et al. "Contribution of different areas in the temporal lobes to music processing." *Brain*, vol. 121, no. 10, 1998, pp. 1853-1867.
- Loui, Psyche, et al. "Neurological and developmental approaches to poor pitch perception and production." *Annals of New York Academy of Sciences*, vol. 1337, no. 1, 2015, pp. 263-271.
- Moss, Heidi Erickson. *Motor Theory of Articulation: Optimising Efficiency in Diction and Language*. 2022.
- Müllensiefen, Daniel, et al. "The Musicality of Non-Musicians: An Index for Assessing Musical Sophistication in the General Population." *Plos One*, vol. 9, no. 2, 2014.

- Peretz, Isabelle. "Musical Disorders. From Behaviour to Genes." *Association for Psychological Science*, vol. 17, no. 5, 2008, pp. 329-333.
- Peretz, Isabelle, et al. "The amusic brain: in tune, out of key, and unaware." *Brain. A Journal of Neurology*, vol. 132, 2009, pp. 1277-1286.
- Peretz, Isabelle, et al. "The Genetics of Congenital Amusia (Tone-Deafness): A Family Aggregation Study." *The American Journal of Human Genetics*, vol. 81, 2007, pp. 582-588.
- Peretz, Isabelle, et al. "On-line Identification of Congenital Amusia." *Music Perception*, vol. 25, no. 4, 2008, pp. 331-343.
- Peretz, Isabelle, et al. "Varieties of Musical Disorders: The Montreal Battery of Evaluation of Amusia." *New York Academy of Sciences*, no. 999, 2003, pp. 58-75.
- Peretz, Isabelle, and Dominique T. Vuvar. "Prevalence of Congenital Amusia." *European Journal of Human Genetics*, no. 25, 2017, pp. 625-630.
- Pfeifer, Jasmin, and Silke Hamann. "The Nature and Nurture of Congenital Amusia." *Frontiers in Behavioural Neuroscience*, vol. 12, no. 120, 2018.
- Pfeifer, Jasmin, and Silke Hamann. "Revising the diagnosis of congenital amusia with the Montreal Battery of Evaluation of Amusia." *Frontiers in Human Neuroscience*, vol. 9, no. 161, 2015.
- Pfordresher, Peter Q., and Steven Brown. "Poor-pitch Singing in the Absence of "Tone-deafness."" *Music Perception*, vol. 25, no. 2, 2007, pp. 95-115.
- Phillips-Silver, Jessica, et al. "Born to dance but beat deaf: A new form of congenital amusia." *Neuropsychologia*, vol. 49, 2011, pp. 961-969.
- Sloboda, John A., et al. "Quantifying Tone Deafness in the General Population." *Annals of the New York Academy of Sciences*, vol. 1060, 2005, pp. 255-261.
- Stewart, Lauren. "Fractionating the Musical Mind." *Current Opinion in Neurobiology*, vol. 18, 2008, pp. 127-130.

- Whiteford, Kelly L., and Andrew J. Oxenham. "Learning for Pitch and Melody Discrimination in Congenital Amusia." *Cortex*, vol. 103, 2018, pp. 164-178.
- Williamson, Jane Victoria, and Lauren Stewart. "Memory for pitch in congenital amusia: Beyond a fine-grained pitch discrimination problem." *Memory*, vol. 18, no. 6, 2010, pp. 657-669.
- Wise, Karen J., and John A. Sloboda. "Establishing an empirical profile of self-defined "tone-deafness": Perception, singing performance and self-assessment." *Musicae Scientiae*, vol. 12, no. 1, 2008, pp. 3-26.
- Zentner, Marcel R., and Jerome Kagan. "Perception of music by infants." *Nature*, vol. 383, 1996, p. 29.

APPENDIX A– DIAGNOSTIC TESTS FOR CA:

(i) The Montreal Battery of Evaluation of Amusia (MBEA) is a comprehensive behavioural test requiring approximately two hours to complete (Peretz et al., 2008) and comprising six subtests that break down theoretical processing components of music perception and memory, within a model of music recognition (Peretz et al., 2007; Sloboda et al. , 2005). These components are: discrimination of pitch contour; pitch intervals; key; rhythmic grouping; meter, and memory of novel but conventional music (Hyde and Peretz, 2003). Three tests assess the ability to discriminate pitch changes in melodies and three tests assess the ability to discriminate rhythmic changes, metre, and memory (Peretz et al., 2009).

Congenital amusia is affirmed if the test subject performs 2 standard deviations (SD) below the mean MBEA score of musically intact (Peretz et al., 2008) control participants (Peretz et al., 2007). Presently, the MBEA is the primary tool used for distinguishing CA cases across laboratories (Cuddy et al., 2005; Sloboda et al., 2005)

The test is best explained in its original wording, in the below inserts (Peretz et al., 2003):

The Model

In our model of music perception and memory, musical input must be processed along the *melodic dimension* (defined by sequential variations in pitch) and the *temporal dimension* (defined by sequential variations in duration) and then mapped onto a stored long-term representation if there is one that matches the input. This model, represented in FIGURE 1, only considers monophonic music, that is, music that contains a single voice. This may correspond to the tune component of a song. The lyrics component of a song is assumed to be processed in parallel in a different system, the language processing system sketched at the right of the figure. Some aspect, yet to be defined, in the auditory stream is supposed to trigger the intervention of the music or the language processing system. The musical input is then analyzed by two parallel and largely independent subsystems whose functions are to specify, respectively, the melodic content (i.e., representing the melodic contour and the tonal functions of the successive pitches) and the temporal content (representing the metric organization as well as the rhythmic structure of the successive durations). To simplify, the melodic route represents *what* and the temporal route represents *when* events occur in the auditory musical input. Both routes, defining the musical analysis

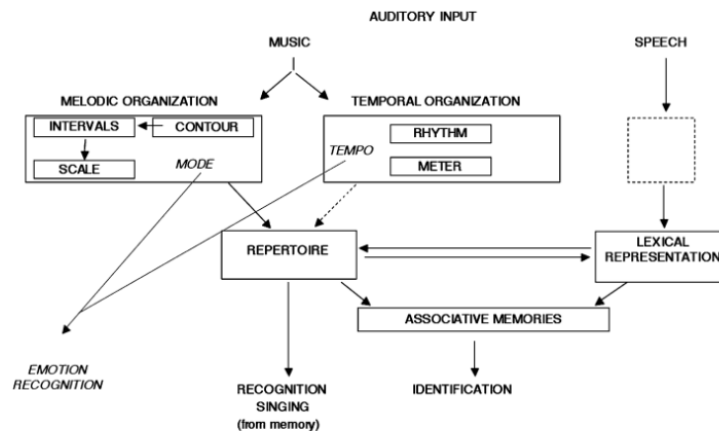


FIGURE 1. Schema of the processing components involved in music recognition. The processing components involved in emotion recognition are represented in *italics*.

components, send their respective outputs—or perhaps a combination of the two—to the *repertoire*. The *repertoire* is conceived of as a perceptual representation system, available to all listeners, that contains all the representations of the specific musical phrases to which one has been exposed during one's lifetime. In turn, the repertoire output can activate stored representations in other systems, such as the lexical representations for the retrieval of the accompanying lyrics, if any, or the associative memories for retrieving and pronouncing the title (leading to identification) of the musical excerpt and for retrieving all sorts of nonmusical information (such as an episode related to the first hearing of the music concerned). Naming a musical excerpt via associative memories, however, is not necessary for recognition. Successful activation (or selection) of one particular musical candidate in the *repertoire* will evoke a sense of familiarity and hence lead to recognition.

The model is supposed to apply to the recognition of both familiar and unfamiliar musical input. The main processing difference is that unfamiliar sequences do not yet have a mental representation stored in the *repertoire* when first presented. How-

While failing to assess harmony and emotion—centrally associated with regular cognition (Sloboda et al., 2005)—and at discerning certain amusic subtypes, it offers a sturdy screening tool for identifying “true” amusics; in confirming an absence of CA, post-diagnostics can be used to encourage one’s further musical activity. (Cuddy et al., 2005; Sloboda et al., 2005).

(ii) The Sung Performance Battery (SPB) includes tasks requiring participants to repeat isolated pitches, intervals, and short novel melodies; participants are also requested to sing iconic melodies, first at an organic tempo and then at slow tempo, as dictated by a metronome (Bella and Berkowska, 2009).

(iii) The Goldsmith Musical Sophistication Index (GoldSMI, Müllensiefen et al., 2014) was documented being used for the first time in a case study on pair of dizygotic twins—the intention was to finely isolate differences between an amusic and non-amusic participant (Pfeifer and Hamann, 2018).

Its components: a self-report questionnaire (Müllensiefen et al., 2014); a genre-sorting task (Gold-Genre); a melody memory task (Gold-Melody), and; a beat-alignment perception task (Gold-BAT). The Gold-Genre task comprises 16 musical excerpts without lyrics or vocals, from 4 different genres—participants have to group them into 4 provided categories without help; the Gold-Melody task requires comparison of 13 melody pairs, with the second melody of each pair transposed to a different key and sometimes altered; The Gold-BAT scrutinises beat-based processing, using 12 melodies from 3 unlike genres—the subject’s task is to determine if a beat track is correctly superimposed on the beat of each melody (Pfeifer and Hamann, 2018).

(iv) The Distorted Tune Test (DTT) has been carried out on over 600 participants in the UK. About 4% of this sample performed as poorly as 20 adults who self-reported or were identified by others as amusic. What this implies is that 4% of the population could suffer from a genetically determined defect in musical pitch perception. The DTT is criticised for having low validity because it relies on one single measurement of musical pitch ability—further, it lacks control conditions (Peretz and Vuvan, 2017).

(vi) The Online Test

From a practical and educational perspective, the online test offers fairly accurate option for identifying amusic individuals, and gauges the prevalence of amusia in a large population effectively—it provides lay society with a more accessible way of detecting ‘false amusics’ (Cuddy et al., 2005; Sloboda et al., 2005) as well as disproving those who think of themselves as unmusical but in fact do not suffer a music-related disorder (Peretz et al., 2008).

This was revealed based on the 19 percent of the initial study’s participants who self-reported themselves as unmusical. Theoretically, the online test also supports earlier studies finding that CA is expressed by a pitch-processing deficiency rather than a time-processing one (Peretz et al., 2007). The inserts below (Peretz et al., 2008) break down the detailed test rubrics.

1. The On-line Test

The on-line auditory test includes 72 melodies derived from 12 stimuli taken from the MBEA (Peretz, Champod, & Hyde, 2003). The melodies are all constructed in a major mode according to Western tonal-harmonic conventions. They contain 9.6 successive tones, on average, and are computer generated at a tempo of 120 beats/min. The 12 melodies were modified so that the same critical tone was altered either in terms of pitch or time (see Figure 1). The tone to be changed always fell on the first downbeat in the third bar of the four-bar melody (hence, was metrically stressed) and was 500 ms long. The time change (Figure 1B) consisted of introducing a silence of 5/7 of the beat duration (i.e., 357 ms) prior to the critical tone, thereby locally disrupting the meter or introducing an off-beat tone, without changing anything else. In the pitch conditions, the change consisted of using either a tone that was mistuned by half a semitone, hence introducing a “sour” note, or a tone that was outside the key of the melody, hence introducing a “foreign” or “wrong” pitch in the musical context (Figure 1C and D). The melodies were presented with 10 different timbres (e.g., piano, saxophone, clarinet, recorder, harp, strings, guitar) to make the auditory test more interesting.

The stimuli and experimental set-up were presented using standard Web browser technologies (i.e., HTML, PHP, and Flash). The melodies were converted from

files in WAV format to MP3 in order to guarantee optimal sound quality on different computer platforms and at different data transmission rates while keeping file sizes low. The stimuli and experimental set-up were generated using the open source LAME MP3 encoding package. The responses were automatically recorded and tabulated for further analysis using Microsoft Excel and DataFinder (Digimed Systems Inc., 2006).

Participants were invited to visit a nonpublic computer to log on to the on-line test. First, they had to give an access code, test their computer (download the Flash program if missing), and adjust the volume of the audio system to a comfortable level. Thus, there is no control or requirement regarding the appropriate loudness level or speakers quality. Next, the participant entered the web page containing the actual test and filled in a consent form.

Participants then were first tested with the “off-beat” condition followed by the “mistuned” condition and finally the “out-of-key” condition. In each condition, participants were presented with 24 melodies (12 containing no incongruity and 12 containing an incongruity) one at a time, in a random but fixed order. The task was to detect whether an incongruity occurred in each melody, by way of clicking a “yes” button whenever there was an anomaly, and a “no” button when there was none. Participants received 2 examples before each condition and were provided with feedback after these two trials only. The auditory test lasted 15 minutes. After the test, the participants completed



FIGURE 1. Example of melody with no incongruity (A), with a time incongruity (B: || refers to the silence of 5/7 of the beat duration), with a mistuned pitch incongruity (C: the circled note refers to the mistuned pitch), and with an out-of-key pitch incongruity (D).

101 questions about their personal history and musical background. At the end of the session, the participants obtained their test scores (see www.brams.umontreal.ca/amusia-demo for test examples and the full questionnaire). The whole procedure could be completed in 25 minutes.

Inserts for (vi)

APPENDIX B–ESTABLISHED WESTERN MUSICAL KEYS

The concept of key is one fundamental to the system of **tonality**–the organisation of notes, sound colours, and note groups around a centrally important tone).

Music key refers to a system of functionally related pitches and note groupings that revolve around a central note, called the **tonic** (DeVoto). In tonal Western music, a 7 note grouping known as a **scale** commonly manifests with distinct sounds that differentiate the scale as **major** or **minor**. When a piece tends to use a main group of pitches that form the harmonic foundation of that piece of music, they tend to belong a major or minor **scale**; the piece is then established to be in that respective major or minor **key** (Chase, 2021).

APPENDIX C– FINE GRAINED DISCRIMINATION OF PITCH IN MUSIC

In Western music, melodies are typically composed of notes differentiated by intervals of 12th and 6th divisions within an octave (Ayotte et al., 2002)– that is to say 1/12th and 1/6th apart ‘steps’, known as semitones (chromatics) and tones respectively.

In contrast to these melodic intervals, intonation in everyday speech typically employs leaps of over half an octave in Western music–6/12 ‘steps’.

APPENDIX D–SUBTYPES OF AMUSIA

The data attests that at least 3 forms of CA exist, as demonstrated by participants who performed below the determined cut-off score–they were sorted into subgroups (i) only exhibiting pitch deficits (18.6% of amusics); (ii) only exhibiting rhythmic deficits (31.4%); and (iii) exhibiting both pitch and rhythm deficits (50%) (Pfeifer and Hamann, 2015).

Further, reports of subtypes with pitch deficits or pitch and rhythm deficits are more prevalent than cases with solely rhythmic problems((Launey et al., 2014; (Phillips-Silver et al., 2011)—corroborating the claim that pitch-based musical deficiency is the most common manifestation of CA (Peretz et al., 2007)—but this could also arise due to less rhythm-related subtesting with the MBEA (Pfeifer and Hamann, 2015).

One study conducted three separate tests on participants: the Scale test, requiring the detection of an anomalous pitch across 30 pairs of compared melodies, of which half the pairs contained a stray pitch; subsequently using these same melodies, the Off-key test, requiring the identification of an off-key note; and the Off-beat test, requiring recognition of an out-of-time note (Peretz and Vuvan, 2017). Although serving as a control condition, the Off-beat test's inclusion is notable because it acknowledges the existence of amusia specific to the time dimension, offering leads on 'beat-deafness', a form of CA that is time-based rather than pitch-based (Phillips-Silver et al., 2011).

Neuropsychological evidence indicates a dissociation between two kinds of temporal organisation mechanisms—'rhythm', or grouping events according to temporal proximity without regard to greater periodicity; and 'metre', involving the underlying temporal regularity or beat pulse. Both selective disruption of rhythmic structure with spared metric organisation (Liegeois-Chauvel et al., 1998) *and* spared rhythmic structure occurring with inability to locate the beat (Fries and Swihart, 1990) have been reported.

APPENDIX E—

STATEMENT-QUESTION PITCH DISCRIMINATION

VS FINE PITCH DISCRIMINATION IN MUSIC

It is the dominant view that the pitch deficits of amusia are specific to the music domain (Ayotte et al., 2002; Peretz, 2008) but whether amusia has implications for speech perception and intonation is still unresolved. A particular study found that amusics demonstrated a statement-question discrimination deficit when exposed to small pitch direction contrasts at the end of a sentence; compared with study controls, the amusics also exhibited impaired process on discerning between statements, questions, and

imitating their intonation. These findings make the case for CA not being a music-specific disorder—if pitch in music and language processing did indeed share common mechanisms, this would have broader implications for CA *not* being a music-specific disorder (Li et al., 2010)

APPENDIX P–POOR SINGING IMPAIRMENTS

Studies conducted on occasional singers drew various impairment reports:

- (i) systematic pitch transposing when imitating a melody—with tempo correctly imitated;
- (ii) performing at a varied tempo without transposing pitch;
- (iii) poor singers appear less competent on absolute measures of pitch and time accuracy, transposing either or both when instructed to imitate a melody, than on relative measures, such as producing incorrect pitch intervals or note durations differing from the musical notation (Bella and Berkowska, 2009).

APPENDIX N–THE NATURE VS NURTURE DEBATE

In amusic families, 39% of first-degree relatives suffer the same disorder, while only 3% are afflicted in the control families (Peretz et al., 2007).

While empirical evidence suggests that amusia is less penetrant when the musical environment is reinforced, one cannot wholly blame their failure to cultivate musical awareness on a lack of musical input during their formative years (Anderson et al., 2012: 8).

One case study on a fraternal twin pair further examined the role of genetics—familial incidence could arguably come from a shared family environment. Findings however, attest that CA cannot be attributed to insufficient music exposure or differential musical education during childhood—the twins’ musical background was closely matched and yet, one twin was diagnostically assessed as amusic while the other had typical pitch and rhythm perception (Pfeifer and Hamann, 2018).

APPENDIX R– Research Participants and Method

Test subjects include students from my private studio practice as well as private assignees from two music schools I used to teach at; they range in age from 14 to over 60 years of age and will be identified as **Al; Siew; Jeremy**; Sub; Rach; Phil; Kat; **Gio**; Sandy; **KJ**; Jo; Win; Zoph; Vanny; Ryan; Anne; Isabelle; Nat; and Bel. With all listed students, it was stark from the initial lesson if an individual was relatively pitch-proficient—Sub, Phil, Sandy, Jo, Win, Zoph, Vanny, Ryan, Anne, Isabelle, Nat, and Bel—or not—Al, Siew, Jeremy, Gio, and KJ. The first group easily demonstrated their pitch awareness and proficiency right at the outset, struggling only when venturing out of their comfortable vocal register. The second identified group consistently faced difficulty with matching and manipulating to given pitches, also struggling to follow simple 3-5 note melodic shapes, even at reduced tempo or atempo. Currently, Al and Siew are still singing with me.

It is this group of who will make ideal profiles for my anticipated 8 week ‘pitch starter-kit’ trial—I foresee Al resuming his earlier role as a test control against the other 4 students, whom I perceive to lie farther right on the spectrum of pitch-poor.

Categories of pitch-aid tactics for trial testing:

(i) *Facial and articulator adjustments*— enacting smiling versus not smiling; raising brows, opening eyes wide and lifting cheeks into the ‘opera face’ to explore a more head dominant sound; and playing with different vowel shapes i.e. “uh” and “eh” to facilitate relaxing the jaw and brightening sound respectively

(ii) *Visuospatial imagery*—visualise directing sound to a particular spot in physical space, with the intention of denting a surface, drilling a hole through it, or knocking a standing object over by envisioning the force of consistently produced sound, or simply targeting a pitch on the imagined vertical axis; funnelling the exhale airflow so as to irrigate face cavities thoroughly; picturing gently descending from above onto the intended note(s) as

opposed to push up through the ground to reach it (them), as this results in unsustainably and harmfully fighting to force sound out through the throat;

(iii) *Body mapping*—similar to visuospatial imagery, except that imaging is specific to the singer's projection of what is materialising inwardly, and based on their anatomical understanding, as they attempt to produce and craft a deliberate vocal sound.

(iv) *Vocalising* for sound placement—wailing like an ambulance siren; dramatic yawning; exaggerated sighing; humming a single note for a given number of counts followed by humming a simple series of notes in a given sequence *while* trying to produce the same note *with* different tonal quality

(v) *Body movement*—placement and movement of hands along the vertical space axis, shaping the air to represent melodic contour; sitting versus standing, actively rising or stooping to different heights to correspond to pitch height along the vertical space axis;

(vi) *Visually representing given pitches and or melodies*— drawing where pitches are perceived to be and how melodies are construed to look like, in comparison with where they actually are

APPENDIX T–8 week 'Pitch-starter' kit Trial

The approximate trial schedule would go as follows:

Week 1–

MBEA proxy test; establishing individual singer's proficiency entry point, week 4 and week 8 goals; determining suitable repertoire and choosing 1-2 appropriate songs; introduction to voice science and breath support basics, chosen pitch-aid device tactics;

Week 2–

Continue with pitch-aid device drills, applying to increased singing assignments including 2 melodic shapes extracted from selected song repertoire;

Week 3–

Continue with applying pitch-aid device drills, revising week 2 melodic shape extracts and then *exploring permuting note sequence*; with these same extracts, explore melodic shape *sequences*;

Week 4– Continue with week 3's work; workshop repertoire choice 1, singing along to melody with accompaniment, and attempt singing melody while gradually reducing melodic guidance

Week 5–

Halfway MBEA proxy; continue employing pitch-aid (recall) drills for melodic sequences up to 12 notes long; continue practising repertoire choice 1, working especially on pitching transitioning between song sections

Week 6–

Still applying pitch-aid tactics, polish repertoire choice 1, practise singing melody independently over accompaniment; begin to workshop repertoire choice 2

Week 7–

Continue polishing repertoire choices 1 and 2, focussing on song section transitions and struggle areas; internal evaluation of progress based on targets outlined week 1;

Week 8–

Final MBEA proxy; feedback filing; performing repertoire choice 1 and or 2 with accompaniment but no melody supplied; debrief and next steps discussion;

APPENDIX U–LITERATURE

9 literature articles that used CA and TD interchangeably, out of 36

(note: total number of sources is more than this):

- 1) Launey, Jacques, et al. "Dysrhythmia: a specific congenital rhythm perception deficit." *Frontiers in Psychology*, vol. 5, no. 18, 2014.
- 2) Phillips-Silver, Jessica, et al. "Born to dance but beat deaf: A new form of congenital amusia." *Neuropsychologia*, vol. 49, 2011, pp. 961-969.
- 3) Pfeifer, Jasmin, and Silke Hamann. "Revising the diagnosis of congenital amusia with the Montreal Battery of Evaluation of Amusia." *Frontiers in Human Neuroscience*, vol. 9, no. 161, 2015.
- 4) Whiteford, Kelly L., and Andrew J. Oxenham. "Learning for Pitch and Melody Discrimination in Congenital Amusia." *Cortex*, vol. 103, 2018, pp. 164-178.
- 5) Ayotte, Julie, et al. "Congenital Amusia. A group study of adults afflicted with a music-specific disorder." *Brain*, vol. 2002, no. 125, pp. 238-251.
- 6) Peretz, Isabelle, and Dominique T. Vuvan. "Prevalence of Congenital Amusia." *European Journal of Human Genetics*, no. 25, 2017, pp. 625-630.
- 7) Peretz, Isabelle, et al. "The amusic brain: in tune, out of key, and unaware." *Brain. A Journal of Neurology*, vol. 132, 2009, pp. 1277-1286.
- 8) Peretz, Isabelle, et al. "The Genetics of Congenital Amusia (Tone-Deafness): A Family Aggregation Study." *The American Journal of Human Genetics*, vol. 81, 2007, pp. 582-588.
- 9) Peretz, Isabelle. "Musical Disorders. From Behaviour to Genes." *Association for Psychological Science*, vol. 17, no. 5, 2008, pp. 329-333.

APPENDIX W–CRITICAL REFLECTION

Terry Borton's model (1970) in stages:

1. What?–Observe and describe the situation
2. So What?–Conduct scrutiny
3. Now What?–Reflect on development

David A. Kolb's cyclical model (1975):

