A study on the effect of vocal music stimuli on emotional valence of emergency service personnel with post-traumatic stress disorder.

By

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Part 1 - Project Proposal

1.1. Project Title.

A study on the effect of vocal music stimuli on emotional valence of emergency service personnel with post-traumatic stress disorder.

1.2. The Context.

Music plays an important role in the promotion of emotional well-being (Pond and Leavens, 2023) by reducing negative and enhancing positive emotions (Juslin *et al.,* 2011) and may aid emotion regulation for individuals with post-traumatic stress disorder (PTSD) (Bensimon *et al*., 2008). However, exposure to music stimuli and active participation in music may result in either beneficial or detrimental outcomes (Sakka and Juslin, 2018b). For example, singing may positively aid in processing intense thoughts and feelings (Bibb *et al.,* 2018) but depending upon the repertoire, may potentially reinforce or exacerbate negative mental health states (Garrido and Schubert, 2015). With a predisposition to hypervigilance (Chetty *et al.,* 2014) and reduced capacity for stimuli discrimination, exposure to acoustic startle stimuli and unpleasant music may result in individuals with PTSD re-experiencing trauma symptoms (van der Kolk, 2000). Therefore it is imperative that repertoire selection in singing for well-being programs for individuals with PTSD is mindfully curated to maximise psychological benefits and minimise reinforcement of existing pathology.

1.3. The Justification.

Whilst the psychological benefits of singing are both complex and emerging, active participation has been found to improve mental health outcomes (Williams *et al.,* 2018), reduce depression (Petchkovsky *et al.,* 2013), improve functioning and mood (Shakespeare and Whieldon, 2018) and release stress (de Witte *et al.,* 2022). However, singing for mental health studies rarely disclose the repertoire used nor the rationale behind its selection. Given the changes to threat-sensitivity pathways contributing to hypervigilance and hyperarousal symptoms in PTSD (Lanius *et al.,* 2015), a robust rationale is required for repertoire selection in singing for mental health programs and research. A review of music and emotion literature (O'Keefe, 2024) highlights a paucity of research into the effect of *vocal* music on emotional valence in individuals with PTSD and found no validated catalogue of vocal music stimuli from which to draw. As a starting point, this study seeks to gain an understanding of the effect of vocal music stimuli on emotion responses and induction mechanisms in individuals with PTSD.

1.4. The Intended Impact.

The overarching aim of this study is to gain an understanding of the impact of vocal music stimuli on emotional valence and induction mechanisms in individuals with PTSD and to understand the influence of voice and lyrics on emotion responses. This insight will aid in our appreciation of vocal music stimuli and its effect on positive and negative valence and will expand our knowledge with regard to what vocal music may be deemed 'safe' for individuals with PTSD in singing for well-being programs and research.

1.5. The Outlined Intention.

A narrative literature review will be undertaken with a focus on music and emotion research and the role of voice and lyrics. This study aligns with the pragmatic paradigm as the research problem remains central (Creswell, 2009). A mixed methods approach will be employed through an online questionnaire using a non-experimental descriptive design (Mathers *et al.,* 2007). The questionnaire is approximately 30 minutes duration and covers three themes: demographics; vocal music excerpts; music preferences. Participants will be provided a Participant Information Sheet with support service information included and will be required to complete a Consent Form. Participants will be sought through purposive and snowball sampling (Creswell, 2009) via advertising on social media and through closed groups that house the target population. The results from the questionnaire will be statistically analysed and form the subject of student empirical reports.

1.6. The Ethics and Insider Research.

This study has been approved by the Wales Academy of Professional Practice and Research (WAPPAR) at the University of Wales Trinity Saint David (UWTSD) (see Appendix 1). The research is carried out in accordance with the UWTSD Research Ethics and Integrity Code of Practice and the National Statement on Ethical Conduct in Human Research (NHMRC, 2023) in Australia. A Participant Information Sheet (see Appendix 3) will explain the conduct of the study and provide contacts for support services. Individuals with PTSD are advised to discuss participation with their medical team and participants are regularly reminded that they may withdraw their participation at any time. With regard to positionality and neutrality, I may be considered an insider researcher to the extent that I am a member of the population that I seek to study and share a common identity with the participants (Chammas, 2020; Asselin, 2003). As a mitigation strategy, participants were engaged anonymously, completing the questionnaire at a time and location of their choosing and in the absence of direct instruction or interference from the researcher.

1.7. The Expected Learning Outcomes.

The overarching learning outcomes are:

1. To successfully engage with the research process.
2. To successfully engage with quantitative statistical analysis methods.
3. To gain knowledge, insight and understanding regarding the impact of vocal music stimuli on emotional valence in emergency service personnel with PTSD.

1.8. Timeline.

Table 1.1. Timeline for Completion of Project Activities.

ACTIVITIES	**JAN 16-31 2024**	**FEB 1-15 2024**	**MAR 16-31 2024**	**APR 1-15 2024**	**MAY 16-31 2024**	**JUN 1-15 2024**
Define Project Proposal						
Create and Refine Research Tools						
Submit Research Tools for Approval						
Conduct Literature Review						
Data Collection						
Data Analysis						
Submit Draft and Final Report						
Presentation						

Part 2 - Project Report

2.1. Introduction.

The process by which music influences and regulates human affect is complex (Brattico et al., 2013) and yet, it remains the most commonly reported means of regulating and inducing emotion (Schafer *et al.,* 2013). Music may influence feelings (Pike, 1972), expressions (Witvliet and Vrana, 2007), brain activation (Brown *et al.,* 2004), psychophysiological reactions (Krumhansl, 1997), and behaviour (Fried and Berkowitx, 1979). Recent decades have seen increased interest in identifying the neural substrates of emotion regulation (Davidson *et al*., 2000; Ochsner and Gross, 2005; Scherer and Zentner, 2001) with a focus on the emotion-related neural processes evoked by music stimuli (Blood and Zatorre, 2001; Koelsch *et al*., 2006; Koelsch, 2010, 2014). Music listening, deemed a complex task embracing sensory, physiological, behavioural and cognitive processing (Reybrouck *et al.,* 2020) is routinely used in research and in practice to support or change the current state of experienced emotions (Carvalho, 2022). This effect on emotion regulatory processes has implications for a variety of clinical psychological disorders (Hou *et al*., 2017). Therefore, this study will consider the use of vocal music stimuli and measure its effect on emotional valence and induction mechanisms in emergency service personnel with post-traumatic stress disorder (PTSD).

2.2. Literature Review.

This narrative review will briefly consider; the impact of PTSD on emotion regulation; emotion theory and its influence on music and emotion research; the influence of voice and lyrics in musical emotion processing and; how music induced emotions may be measured.

2.2.1. Post-traumatic Stress Disorder.

Post-traumatic Stress Disorder is a consequence of severe emotional trauma arising from prolonged, systematic and repeated exposure to traumatic events, often associated with military veterans and emergency service personnel (police, fire, ambulance) (Pezzin *et al*., 2018; APA, 2013). PTSD is often part of a complex clinical profile with comorbid depressions (Yehuda *et al*., 2015), panic disorder (Pietrzak *et al*., 2012) and sleep disturbances (Hegg-Deloye *et al*., 2014). Symptoms may include intrusive memories (Landis-Shack *et al*., 2017), negative changes in mood or cognitive function (Pant *et al*., 2022), avoidance of trauma related stimuli (Pant *et al*., 2022), sudden outbursts of anger, concentration difficulties and hyperarousal (Ophir *et al*., 2020).

A significant challenge presented to individuals with PTSD is emotion regulation (Wu *et al*., 2022) defined as the process by which an individual maintains, enhances or inhibits emotional arousal through monitoring, evaluating and modifying emotional reactions (Thompson, 1994). Reduced capacity to regulate emotion is due to deficits in information processing caused by increased demand on cognitive and attentional control networks (Shin *et al*., 2001) coupled with hypervigilance to salient and threat stimuli (Buckley *et al*., 2000). Furthermore, impairment to neurological networks and morphological changes to brain regions associated with PTSD cause individuals to cycle between states of emotional under-modulation (hyperarousal and diminished control) (Yehuda et al, 2015) and over-modulation (dissociation and lack of interoceptive awareness) (Hopper *et al.,* 2007). Thus, the impact of music stimuli on emotional valence in individuals with PTSD requires further examination, to determine how we may use music in a helpful way in support of emotion regulation strategies (Lanius *et al.,* 2015).

2.2.2. Music and Emotion.

Music and emotion research tend to align with the Discrete Emotion Theory (DET) or the Circumplex Emotion Theory (CET) (Eerola and Vuoskoski, 2013). DET posits that "neural, affective and cognitive processes differ across specific emotions and that each emotion has a particular motivational and regulatory function" (Izard *et al.,* 2011, p. 44). There are two main types of discrete emotions: basic emotions and emotion schemas (emotions of everyday life) which have either positive or negative valence (Izard *et al.,* 2011; Eerola and Vuoskoski, 2013). Basic emotions have significance for survival and well-being and are activated through interactions among emotion circuits of the brain stem (Izard *et al.,* 2011). Stimuli that elicit basic negative emotions are sensed as extremely challenging, threatening or dangerous (Izard *et al.,* 2011) and are activated rapidly and automatically (Sakka and Juslin, 2018a), whereas the activation of emotion schemas may involve higher order cognition and appraisal processes, through concepts, thoughts and memories (Izard *et al.,* 2011).

According to the CET, valence and arousal are core dimensions for distinguishing emotions (Eerola and Vuoskoski, 2013). The valence of a particular stimulus determines whether it is likely to elicit a positive or negative response (Kreutz and Lotze, 2007) whereas arousal pertains to the state of excitement or energy expenditure linked to an emotion (APA, 2018). For example, startle reflex increases with negative valence and decreases with positive valence (Bradley and Vrana, 1993). Researchers also distinguish between perception and induction of emotions. Primarily based upon acoustic features (Juslin *et al.,* 2022), emotion *perception* arises when a listener recognises emotions expressed in music without necessarily feeling that emotion (Juslin

and Västfjäll, 2008). Conversely, emotion *induction* is driven by brain mechanisms rather than acoustic features (Juslin *et al.,* 2022). Juslin and Laukka (2004) argue that this distinction is critical, as measuring *induced* emotion is more challenging than measuring *perceived* emotion which bears implications for this research project as it seeks to measure *induced* emotions.

The processing of emotion induced by music stimuli may be moderated by age (Loui, 2013), gender (Nater *et al.,* 2006), emotion regulation style (Johnstone *et al.,* 2007; Heller *et al.,* 2009) and personality traits (Alluri *et al.,* 2022). Sakka and Juslin (2018a) demonstrated that a diagnosis of depression may also influence emotional processing of music. Depressed individuals were found to be negatively biassed in their analysis of ambiguous stimuli (Matthews and Macleod, 2005) and experienced greater negative response to surprising events including fear potentiated startle (Kan *et al.,* 2004). A sophisticated and nuanced understanding of how individuals with psychological disorders experience musically induced emotions is required to ensure that the benefits of music listening and active participation are maximised and adverse stimuli is used with caution in both practice and research.

2.2.3. Music Stimuli.

Stimuli used in music and emotion studies are generally selected from either: the Normative Music Database of Emotionally Expressive Music Samples developed by Eerola and Vuoskoski (2011); the four factors and their respective genres in the Short Test of Music Preferences (STOMP) (Rentfrow and Gosling, 2003) or; they are customised to the study being undertaken (Fernandez-Sotos, 2016) or to elicit specific emotions (Ali and Peynircioğly, 2006). Instrumental Western classical music is the dominant genre used (48%) (Eerola and Vuskoski, 2013), a dominance which highlights the superiority of classical music to induce emotions (Kreutz *et al.,* 2008). A further 27% of studies used a mixture of genres including classical, pop and film, only 3% used pop/rock and 11% choosing custom-made music stimuli (Eerola and Vuskoski, 2013). The fact that there are inherent differences in music elements across genres that may influence emotional reactions (Zentner *et al.,* 2008) poses a challenge for researchers and indeed this current research project.

The most frequently studied music cues are tempo, mode, dynamics, timbre and phrasing (Gabrielsson and Lindstrom, 2010). Tempo and mode are considered the primary determinants of ‘happy-sad’ judgements (Fernandez-Sotos, 2016). Music with slow tempo, composed in minor mode is frequently associated with serenity and sadness, whilst music with fast tempo, composed in major mode induces emotions of happiness and anger (Juslin and Laukka, 2003; Trochidis and Bigand, 2013; Fernandez-Sotos, 2016). Where replication of the human voice is

required, a cello or violin are routinely used to mimic the emotional sentiment of the human voice (Bedoya *et al.,* 2021) highlighting the paucity of research encompassing a broad range of genres, especially those more commonly listened to (Cook *et al.,* 2019) and indeed music that incorporates the human voice and lyrics.

2.2.4. Voice and Lyrics.

A precise rationale for excluding the human voice and lyrics in music and emotion studies remains unclear (Fiveash and Luck, 2016). One explanation is that individuals process music, featuring emotionally expressive instruments such as the violin or cello, similarly to how one processes the human voice (Juslin *et al.,* 2022). Furthermore, these instruments utilise the same acoustic features for emotional expression as the human voice (Curtis and Bharucha, 2010; Illie and Thompson, 2006). According to the super-expressive voice theory, the benefit of using violin or cello is that, whilst they sound like the human voice in expressiveness, they can go beyond the voice in terms of intensity, speed and timbre (Juslin and Västfjäll, 2008). However, studies that exclude the human voice and lyrics may be characterised by low ecological validity, as the vast majority of music listening and participation in everyday life, includes music with voice and lyrics.

Music and emotion research contrasts positive with negative valence, whilst voice research contrasts emotional with neutral stimuli, presenting a challenge in synthesis (Escoffier *et al.,* 2013). Using fMRI, Escoffier et al. (2013) explored brain representations of vocal and musical acoustic information, contrasting emotional and neutral vocalisation. Vocal emotional expressions were found to activate the bilateral superior temporal sulcus and surrounding gyri more strongly than neutral vocalisations (Bach *et al.,* 2008; Fecteau *et al.,* 2007) suggesting that these regions support voice sensitive processing mechanisms (Escoffier *et al.,* 2013). Critically, research suggests that temporal lobe representations of the voice *differ* even from the representation of its acoustic approximation, music (Tervaniemi *et al.,* 2006). Weiss et al. (2016) investigated the effect of timbre, including voice, on memory and music preference, demonstrating that melodies with voice were better recognised than all other instrumental melodies. This suggests that the presence of the human voice enhances memory and activates a greater depth of processing (Weiss *et al.,* 2012; Loui, 2013). Vocal melodies heighten engagement, have higher subjective arousal ratings and faster classification than non-vocal sounds (Agus *et al.,* 2012) or instrumental music (Loui, 2013) highlighting the importance of incorporating voice into music and emotion research.

A lack of consensus exists with regard to whether lyrics or melody have a greater influence on emotion (Pond and Leavens, 2023). One theory suggests that incorporating the semantic elements of lyrics implicates language processing (Fiveash and Luck, 2016; Koelsch *et al.,* 2002) which then influences the emotional valence of the music. The effect of lyrics on memory was examined by Serafin et al. (1982) who found that melody recognition was reduced where original words were excluded, suggesting that music and speech are encoded together as a single entity (Loui, 2013). Pond and Leavens (2023) found that lyrics have a significantly greater influence on mood relative to melody and vocal expression. These findings support previous research demonstrating that lyrics in general have a significant influence on mood (Pieschl and Fergers, 2016; Stratton and Zalanowski, 1994; Vastfjäll, 2001). In contrast, Ali and Peynircloğlu (2006) found melody was dominant in eliciting an emotional response demonstrating a greater modulating effect on emotion whilst lyrics increased perceptions of angry and sad music but decreased perceptions of happy and calm music (Cook *et al.,* 2019). Given these contrasting findings, this research study will consider the influence of voice, music and lyrics on emotional valence of participants across all vocal music stimuli.

2.2.5. Measuring Emotion Responses to Music.

While researchers agree that music can evoke discrete emotions, consensus regarding the mechanisms underpinning this effect remains a topic of debate (Pond and Leavens, 2023). Juslin (2013b) considered the underlying psychological processes that mediate between musical events and felt emotions (Juslin and Vastfjäll, 2008) resulting in the design of the BRECVEMA Framework, a validated experimental paradigm (Juslin *et al.,* 2022) that purports to measure subjective impressions that are reflective of the induction mechanisms (Juslin *et al.,* 2014). The associate measure is referred to as the MecScale (see Appendix 7) And consists of eight mechanisms designed to induce musical emotion:

1. **Brain Stem Reflex** - an innate response to a simple acoustic feature such as extreme or increasing loudness or speed (Sakka and Juslin, 2018b).
2. **Rhythmic Entrainment** - a gradual adjustment of an internal body rhythm, such as heart rate, toward an external rhythm in the music (Juslin *et al.,* 2022).
3. **Evaluative Conditioning** - the repeated pairing of a piece of music with other positive or negative stimuli, resulting in a conditioned association (Juslin *et al.,* 2022).
4. **Contagion** - an internal “mimicry” of the perceived voice-like emotional expression of the music, which induces a matching emotion in the listener (Juslin *et al.,* 2022).

5. **Visual Imagery** - inner images of an emotional character conjured up by the listener through a metaphorical mapping of the musical structure (Juslin *et al.,* 2022)
6. **Episodic Memory** - a conscious recollection of a particular event from the listeners past which is triggered by the musical pattern (Juslin *et al.,* 2022).
7. **Musical Expectancy** - a response to the gradual unfolding of the syntactic structure of the music and its expected or unexpected continuation (Juslin *et al.,* 2022)
8. **Aesthetic Judgement** - a subjective evaluation of the aesthetic value of the music based on an individual set of weighted criteria (Juslin *et al.,* 2022).

The prevalence of these mechanisms has been explored across a variety of music (Juslin *et al.,* 2022), listeners (Juslin *et al.,* 2011) and situations (Sakka and Juslin, 2018b), however, there are no studies examining the influence of PTSD on emotion responses associated with specific mechanisms (Sakka and Juslin, 2008) nor has vocal music stimuli been used in these studies. In the absence of a standardised set of composed and emotionally provocative vocal music stimuli, a review of studies utilising the BRECVEMA Framework was conducted (O'Keefe, 2024) resulting in a compilation of music elements required to activate each mechanism (see Appendix 9) (Juslin *et al.,* 2022). These parameters were used to inform the selection of vocal music stimuli for this research project.

2.2.6. Conclusion.

Music consistently demonstrates the ability to modulate (Juslin and Laukka, 2004) and regulate (Pond and Leavens, 2023) an individual's emotional state, including those with psychological disorders (Bensimon *et al.,* 2008). However, identifying the optimal arousal zone to cultivate positive adaptive reactions to beneficial stressors and avoid distress triggered by harmful stimuli (Saarikallio and Erkkilä, 2007; Van den Tol *et al.,* 2016; Reybrouck *et al.,* 2020), presents a considerable challenge for both researchers and practitioners (Langdon, 2015). The BRECVEMA Framework provides a validated measure from which to elicit valuable insight into emotional valence and induction mechanisms in PTSD populations. Whilst instrumental music is typically used, this research project will focus on music stimuli that incorporate voice and lyrics, to provide greater ecological validity and provide singing for mental health practitioners and researchers with more accurate information to ensure programs are curated using vocal repertoire that may be deemed helpful rather than harmful.

2.3. Methodology.

2.3.1. Participants.

There were 32 participants in this study (13 female and 19 male). Participants were Australian emergency service personnel, with and without a diagnosis of PTSD. The PTSD participants (n=16) were defined as individuals with a diagnosis of mild, moderate or severe PTSD as indicated through self-report. Non-PTSD participants (n=16) were defined as individuals without a diagnosis of PTSD, also indicated through self-report. Of the PTSD participants, 64.7% reported the impact of PTSD on their life as severe, 17.6% moderate and 17.6% mild. A broad cross section of ages were surveyed: 18-29 years (3.1%); 30-39 years (9.4%); 40-49 years (28.1%); 50-59 years (34.4%); 60-69 years (21.9%) and 70+ years (3.1%). Participants represented police (27), ambulance (2), fire (1), dispatch services (1) and administrative support (1). A self-report mood rating was administered at the beginning of the questionnaire in which participants rated their mood as high (15.6%), moderate (81.3%) and low (3.1%). Inclusion criteria: (1) individuals over the age of 18 years; (2) current or former frontline emergency service personnel and; (3) unobstructed hearing. Exclusion criteria: (1) individuals under 18 years of age; (2) individuals that are not current or former frontline emergency service personnel and; (3) profound hearing impairment. Participants were recruited through advertisements on social media through the Code 9 Foundation (C9F, 2024) and Police Veteran's Victoria (PVA, 2024).

2.3.2. Design and Ethics.

This study adopts a pragmatic, mixed methods approach with PTSD as between-subjects independent variable (two levels; PTSD; non-PTSD) and within-subject dependent variables being emotion ratings (two levels: positive valenced: negative valenced) (Kreutz and Lotze, 2007) and mechanisms (three levels: brain stem reflex, contagion, episodic memory) (Sakka and Juslin, 2018a). Positive emotional responses were defined as: (1) Happiness-Elation; (2) Calm-Contentment; (3) Pride-Confidence; (4) Nostalgia-Longing. Negative emotional responses were defined as: (1) Sadness-Melancholy; (2) Surprise-Astonishment; (3) Anxiety-Nervousness and; (4) Anger-Irritation. The balance of emotion ratings were not included in the statistical analysis due to their subjectivity and concerns with definitions. The study sought to address the overarching research question: what is the impact of vocal music stimuli on emotional valence in emergency service personnel with PTSD? To that end, the following hypotheses were addressed:

H1: Positive emotional valence will be higher in non-PTSD participants compared to PTSD participants, in response to vocal music stimuli.

H2: Negative emotional valence will be higher in PTSD participants compared to non-PTSD participants, in response to vocal music stimuli.

H3: Engagement of brain stem reflex, contagion and episodic memory will be higher in PTSD participants, compared with non-PTSD participants.

This research has been approved by the Wales Academy of Professional Practice and Research (WAPPAR) at the University of Wales Trinity Saint David (UWTSD) (see Appendix 1) and is carried out in accordance with the UWTSD Research Ethics and Integrity Code of Practice and the National Statement on Ethical Conduct in Human Research (Australian Research Council, 2023). Research methods reflect the potential vulnerability of participants with post-traumatic stress disorder (Creswell, 2009) and extend to ethical issues such as privacy during data collection and accurate interpretation of data (Berg, 2001). Participation was anonymous and minimal personal information was collected. Participants were fully informed throughout the recruitment stage and a Participant Information Sheet including detailed support services in case of discomfort. Individuals with PTSD were advised to discuss participation with their medical team.

2.3.4. Vocal Musical Stimuli.

Seven vocal music excerpts were used in this study. Each excerpt was mapped to acoustic elements intended to induce target mechanisms in the BRECVEMA Framework (Juslin, 2013b) (refer Appendix 9). Each vocal music excerpt was 60 seconds long (Frijda *et al.,* 1991; Juslin and Laukka, 2003).

Table 2.1. Vocal Music Excerpts mapped to BRECVEMA Framework.

Induction Mechanism	Acoustic Elements	Vocal Music Excerpt
Brain Stem Reflex (Vocal Music Excerpt 1)	The excerpt includes a sudden, loud chord and vocal treatment with broad	*"Rivedrai le foreste imbalsamate"* from Act 3, Aida, composed by Giuseppi

Induction Mechanism	Acoustic Elements	Vocal Music Excerpt
	spectrum and sharp attack intended to arouse surprise in the listener (Sakka and Juslin, 2018b), increase fear potentiated startle (Ballard *et al.,* 2014; Sakka and Juslin, 2018b) and create sensory dissonance suggestive of danger.	Verdi (Juslin, 2019). Performed by Maria Callas, Orchestra del Teatro alla Scala di Milano, Tito Gobbi and Tullio Serafin.
Rhythmic Entrainment (Vocal Music Excerpt 2)	The excerpt had a tempo of 110 bpm, faster than an individual's heart rate (Juslin, 2013) and was expected to cause a subjective feeling of the urge to dance (Juslin, 2019).	*"Dancing"* written by Kylie Minogue, Steve McEwan and Nathan Chapman. Performed by Kylie Minogue.
Evaluative Conditioning (Vocal Music Excerpt 5)	Due to the iconic Australian band's political stance at the height of their popularity, it is expected that the excerpt will elicit a significantly positive or negative association (Juslin and Västfjäll, 2008; Juslin, 2022). The lyrics centre around civil rights and the melody is strong and effective (LeDoux, 2002).	*"Beds are Burning"* written by Rob Hirst, Jim Moginie, Peter Garrett. Performed by Midnight Oil.
Contagion (Vocal Music Excerpt 7)	This excerpt included slow tempo, minor mode and subtle attacks and has a sad	*"Agnus Dei"*, Op. 11, composed by Samuel Barber. Performed by Edward

Induction Mechanism	Acoustic Elements	Vocal Music Excerpt
	emotional expression (Juslin *et al.,* 2022). Ordinarily, cello or violin would be used to 'mimic' the sad and expressive sound of the voice (Juslin, 1997) but in this piece, a choir is employed to express the emotional content.	Higginbottom and Choir of New College, Oxford.
Visual Imagery (Vocal Music Excerpt 4)	This excerpt conjures mental images associated with the music and listeners may be influenced by the lyrics or by a "story" associated with the music (Juslin, 2019). Predictable melodic, harmonic and rhythmic elements, slow tempo are effective in stimulating vivid imagery (McKinney and Timms, 1995).	*"Steal Away to Jesus"* written by Wallace Willis and performed by Paul Robeson.
Episodic Memory (Vocal Music Excerpt 3)	Considered an anthem to Australian's, this excerpt is emotionally vivid (Juslin *et al.,* 2014) and expected to trigger memories from youth or a time in life, particularly returning home from travelling (Juslin *et al.,* 2022).	*"I Still Call Australia Home"* written and performed by Peter Allen.

Induction Mechanism	Acoustic Elements	Vocal Music Excerpt
Musical Expectancy (Vocal Music Excerpt 6)	This piece includes violations of melodic and harmonic expectations (Juslin *et al.,* 2014) which are expected to induce anxiety due to the uncertainty created by phrases lacking a clear tonal centre (Juslin *et al.,* 2022).	*"Herzgewächse"*, Op. 20, by Arnold Schoenberg. Performed by Christine Schäfer, Ensemble InterContemporain and Pierre Boulez.
Aesthetic Judgement	Subjective evaluation of the aesthetic value of a piece of music based on an individual set of weighted criteria (Juslin, 2013b). Not measured due to subjectivity.	No vocal music excerpt.

2.3.5. Measures.

Three validated measures were used in this study; Emotion Rating Scale (Juslin, 2013b); MecScale (Juslin *et al.,* 2014); Short Test of Music Preferences-Revised (STOMPR) (Rentfrow and Gosling, 2003).

The Emotion Rating Scale (ERS) was used to measure *felt* emotions commonly reported in music and emotion studies on a 12 item scale (Juslin *et al.,* 2014) which covers all four quadrants of the circumplex model of valence and arousal (Russell, 1980; Sakka and Juslin, 2018a). For each vocal music excerpt, participants were asked to indicate the extent to which they *felt* each of the emotions on a scale from 1 (not at all) to 5 (a lot). Participants were also asked to indicate whether voice, music or lyrics had the greatest influence over their emotional response and were offered an opportunity to expand upon their ratings through free narrative.

The MecScale was used to measure subjective induction mechanisms via an eight item questionnaire, each question targeting one of the mechanisms in the BRECVEMA Framework (Sakka and Juslin, 2018a). In response to each vocal music excerpt, participants were asked to answer eight questions with "yes" or "no" answers. In addition, if participants responded "yes" to

the episodic memory or evaluative conditioning item, they were asked to indicate whether the memory or association had “positive”, “negative” or “mixed” valence (Sakka and Juslin, 2018a). Participants were then provided an opportunity to expand upon their responses through free narrative.

The Short Test of Music Preferences - Revised (Rentfrow and Gosling, 2003) was used to measure participants' music preferences. The STOMP-R incorporates 22 music genres and participants are asked to indicate their degree of preference on a scale from 1 (not at all) to 5 (a lot). Participants were also asked to indicate whether voice, music or lyrics had the greatest influence on their preferred music and were provided an opportunity to expand upon their preferences through free narrative.

2.3.6. Procedure.

The research project took place over a two week period. To ensure that participation was anonymous, interested participants completed an Expression of Interest form online. Each participant was allocated a unique access code (Research Randomizer, 2024) and a link to the Vocal Music and Emotion Questionnaire was sent to the email address provided. Participants were advised to complete the online questionnaire at a time and location where they felt comfortable, in the absence of distractions, and that they would require operable headphones or computer audio. Participants were instructed to set the volume to a level that represents their everyday listening. The questionnaire was administered through Google Forms and was expected to take approximately 30 minutes to complete.

2.4. Findings and Discussion.

The findings will primarily explore the between-group comparisons for the Emotion Rating Scale and MecScale. Examination of the STOMPR will not be reported upon due to word count limitations.

2.4.1. Assumption Testing.

To evaluate the effect of the independent variable *diagnosis* (PTSD participants; non-PTSD participants) on the dependent variables, being emotions associated with positive and negative valence, across all vocal music stimuli, a one-way ANOVA was proposed. Missing data was treated using the expected maximum likelihood method (Baker, 2019) and outliers were identified and removed. Assumption testing revealed that the data deviated significantly from

normal distribution across the majority, but not all, of the 12 emotion items. Observations of the quantile-quantile plot confirmed the non-normal distributions. The data was tested for homogeneity of variance using Levene's Test (Field, 2009) which demonstrated issues with skewness and kurtosis. These violations of assumptions required for parametric testing led to the need for non-parametric testing. These assumption violations were also found in a study by Sakka and Juslin (2018a) on depressed individuals using the same measures. Future research may need to consider the limitations of the measures, particularly, the recording of non-normal distribution in small data sets.

2.4.2. Emotion Rating Scale.

To evaluate the effect of *diagnosis* (two categories: yes; no) on positive (*Happiness-Elation; Calm-Contentment; Nostalgia-Longing; Pride-Confidence*) and negative (*Surprise-Astonishment; Sadness-Melancholy; Anxiety-Nervousness; Anger-Irritation*) emotion ratings on the Emotion Rating Scale, an Independent-Samples Kruskal-Wallis Test was used (Field, 2009). The analysis revealed two significant findings and a further two results approaching a significant finding as detailed in Table 2.2.

Table 2.2. Result of Independent-Samples Kruskal-Wallis Test.

Vocal Music Excerpt	**Emotion Rating Scale Item**	**Degrees of Freedom (df)**	**Test Statistic (H)**	**Result (p)**
3	Calm-Contentment	1	3.938	p=0.047
3	Pride-Confidence	1	3.913	p=0.048
4	Calm-Contentment	1	3.262	p=0.071
4	Surprise-Astonishment	1	3.455	p=0.063

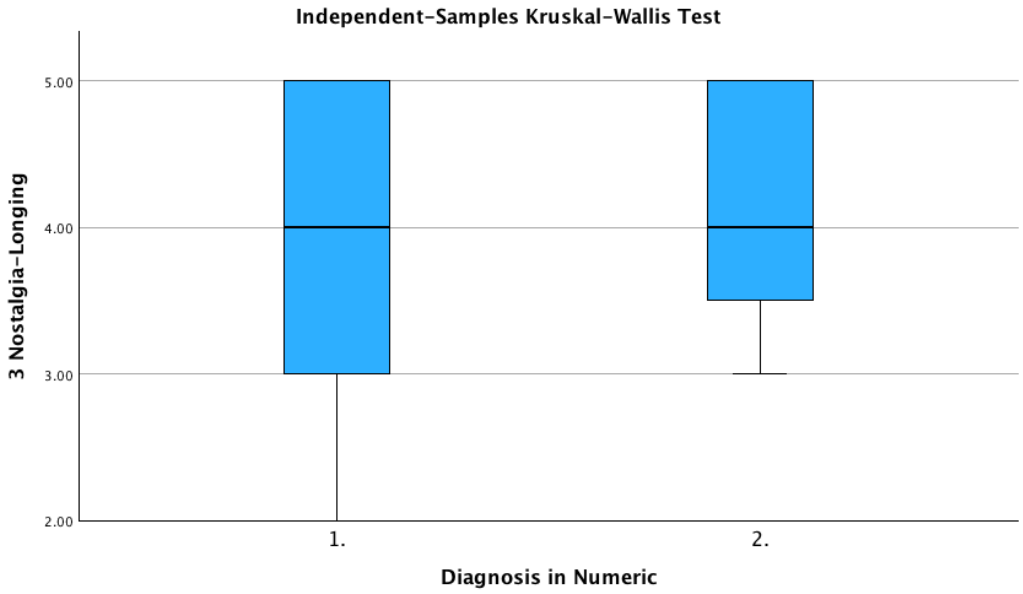
Vocal Music Excerpt 3 Findings.

The results indicated two significant findings relating to Vocal Music Excerpt 3 ("I Still call Australia Home", by Peter Allen). Firstly, the distribution of *Calm-Contentment* differs significantly between groups of the independent variable *diagnosis* ($H(1)=3.938$, $p=0.47$). This suggests that non-PTSD participants reported a higher degree of felt emotion *Calm-Contentment* in response to vocal music excerpt 3 than PTSD participants. Secondly, the

distribution of *Pride-Confidence* differs significantly between groups of the independent variable *diagnosis* ($H(1)=3.913$, $p=0.48$). This suggests that non-PTSD participants reported a higher degree of felt emotion *Pride-Confidence* in response to vocal music excerpt 3 than PTSD participants.

As vocal music excerpt 3 was intended to induce the episodic memory mechanism it was expected that the stimuli would trigger a conscious recollection of an event from the listeners past (Janata *et al.,* 2007; Juslin *et al.,* 2022) and *Nostalgia-Longing* would be rated highly. As can be seen in Figure 2.1, *Nostalgia-Longing* rated highly across both PTSD (M = 3.875, SD = 1.148) and non-PTSD (M = 4.187, SD = .834). The significant difference in valence may be influenced by the quality of the memories evoked by the stimulus. Vocal music stimuli 3 is a very familiar piece of music in Australia and past associations or previous exposure may have influenced a listener's emotional experience (Eerola and Vuoskoski, 2013; Juslin and Västfjäll, 2008).

Figure 2.1. Diagnosis and Nostalgia-Longing for Vocal Music Excerpt 3.



Note: Diagnosis of PTSD, 1 (Yes) (M = 3.875, SD = 1.148), 2 (no) (M = 4.187, SD = .834).

Due to the small sample size, a Fisher-Freeman-Halton Exact Test was used to examine the relationship between independent variable *diagnosis* and dependant variable *memory* to explore whether the quality of the memory (positive, negative, mixed, not applicable) influenced

emotional valence in response to vocal music stimuli 3. Whilst the test result did not suggest a significant association between *diagnosis* and quality of *memory* (p=.074), noteworthy is the fact that not one participant from either group indicated that they experienced negative memories associated with the vocal music stimuli.

Analysis of qualitative data may provide greater insight. Both groups had feelings of *Nostalgia-Longing*, however, the valence between groups varied with PTSD participants experiencing sadness and regret. For example, PTSD participants commented, “Reflective regret work over family” and, “An interesting one! Almost immediately sad.” Whereas, non-PTSD participants reported, ““Nice and calm! Level head,” and “I love this song, I find it very relevant and meaningful for me.” Typically, nostalgic emotions in response to a vivid personal memory (Garrido and Davidson, 2019) evoked by a song, will be positively valenced (Sakka and Saarikallio, 2020; Janata *et al.,* 2007). However, individuals with PTSD may be biassed toward recalling negative memories (Sakka and Saarikallio, 2020) but may equally be in denial of their emotional state which may effect their responses (White, 2016). This may explain the significance of *Calm-Contentment* and *Pride-Confidence*, as participants with PTSD recall negative memories, adversely impacting their ability to experience those emotions in response to the vocal music stimuli.

For completeness, an Independent Samples Kruskal-Wallis Test was used to test for variance between the independent variable *diagnosis* and *Likeability*, *Intensity* and *Familiarity* dependent variables, with regard to vocal music excerpt 3. The results demonstrated no significant difference between PTSD and non-PTSD participants suggesting that these variables have not influenced *felt* emotions. Therefore, it suggests that *Likeability, Intensity and Familiarity* did not influence the emotion response of *Calm-Contentment* and *Pride-Confidence* between groups.

Vocal Excerpt 4 Findings.

Whilst not a significant finding, noteworthy are the results for *felt* emotions in response to vocal music excerpt 4 (“Steal Away to Jesus” by Wallace Willis). Again, *Calm-Contentment* is moving toward a significant finding between groups of the independent variable *diagnosis* ($H(1)=3.262$, $p=0.71$). Secondly, the distribution of *Surprise-Astonishment* is moving toward a significant finding between groups of the independent variable *diagnosis* ($H(1)=3.455$, $p=0.63$). This suggests non-PTSD participants report a higher degree of felt emotion *Calm-Contentment* in response to vocal music excerpt 4 than PTSD participants, whilst PTSD participants reported a

higher degree of felt emotion *Surprise-Astonishment* than non-PTSD participants in response to the same stimuli.

Vocal music excerpt 4 was expected to induce the *visual imagery* mechanism. With a slow tempo, low voice tone and vivid lyrics, one may expect a sense of *Calm-Contentment* to be felt in response. Interestingly, the propensity for individuals with PTSD to focus on and reinforce negativity may play a role in this result (Hereld, 2019). PTSD participants indicated that the excerpt "Evoked thoughts of the cruelty of slavery" and was "Bloody boring and painful for listening", which may reflect upon their sense of calm. Their higher degree of *Surprise-Astonishment* may be due to the lyrical content, reinforcing negative associations which has been demonstrated to have a significant impact on mood (Pond and Leavens, 2023). In contrast, non-PTSD participants reported that, "Although it sounded melancholy, the singer's voice had a calmness about him."

All other positive and negatively valenced emotion items showed no significant variances between PTSD and non-PTSD participants. Given that non-PTSD participants demonstrated a greater positive emotional response to vocal music excerpt 3, the null hypothesis is rejected and the alternative hypothesis (H1) that positive emotional valence will be higher in non-PTSD participants compared to PTSD participants in response to vocal music stimuli, is accepted. Given that there is no significant variance between PTSD and non-PTSD participants with regard to negative valence (H2), the null hypothesis is retained.

2.4.3. MecScale.

A Pearson's Chi-square Test (Field, 2009) was conducted to explore the relationship between the independent variable *diagnosis* and target induction mechanisms; *brain stem reflex*, *contagion* and *episodic memory* across all vocal music stimuli. These induction mechanisms were expected to occur more frequently in PTSD participants compared with non-PTSD participants. A significant association between *diagnosis* and whether *brain stem reflex* was induced ($\chi 2$ (1, n=32) = 4.6, p = .033) was found in response to vocal music excerpt 6. Based upon the likelihood ratio (LR = 6.119), induction of *brain stem reflex* is 6.12 times more likely where an individual does <u>not</u> have a diagnosis of PTSD, than if they do have a diagnosis of PTSD. The *brain stem reflex* mechanism is a hard-wired attention response (Davis, 1984) to an auditory event that suggests danger (Juslin *et al.,* 2014) and is believed to induce arousal through the use of extreme loudness or speed (Juslin *et al.,* 2014), sensory dissonance

(Barradas *et al.,* 2021) sharp attack or timbre (Juslin, 2013b) and sudden or extreme sounds that change quickly (Juslin and Västfjäll, 2008). It is often experienced as 'surprise' and referred to as unpleasant by the listener (Cespedes-Guevara and Dibben, 2022).

Table 2.3. Result of Pearson's Chi-square Test.

Vocal Music Excerpt	Induction Mechanism	Test Statistic ($\chi 2$)	Degrees of Freedom (df)	Result (p)	Likelihood Ratio
6	Brains Stem Reflex	4.571	1	p=.033	6.119

Given the hypersensitivity to aural stimuli experienced by individuals with PTSD (van der Kolk, 2000), it was expected that activation of *brain stem reflex* would be more prevalent in PTSD participants. This contrary result may be explained through the effect of emotional over-modulation, dissociation (Lanius *et al*., 2011), emotional numbness (van der Kolk, 2000; Yehuda *et al*., 1997; Lanius *et al*., 2015) depersonalisation and derealisation (Yehuda *et al*., 2015). It may be that individuals with PTSD experience such a high level of hyperarousal at rest that they are unable to summon a stress response to the stimuli (Meyer *et al.,* 2016). Whereas, an individual without PTSD may possess full capacity to experience emotion, individuals with PTSD have diminished capacity for stimuli discrimination. Furthermore, the role of medication prescribed to participants has not been accounted for in this study, which may play a role in inhibiting the depth of emotional experience in individuals with PTSD (Meyer *et al.,* 2016). Given that this result was found in response to vocal music excerpt 6, toward the end of the questionnaire, fatigue may also influence results.

Vocal music excerpt 6 was intended to induce the *musical expectancy* mechanism and violate melodic expectations through atonal and arrhythmic vocalisations, lack of tonal or rhythmic centre and unexpected instrumentation. Qualitative data revealed that non-PTSD participants found the piece, "Gross", whilst PTSD participants had contrasting opinions, "Interesting unusual music composition. Great voice", and perhaps more visually elaborate, "Contempt not for the singer…it felt as she (sic) was caught in a gloomy spiderweb, and was either unaware of impending peril, or felt mild trepidation towards an emotion. Concern. I want to rescue the singer from my perceived danger she is encountering." Again, participants in the PTSD group

demonstrated bias toward negative associations in response to vocal music stimuli without tonal and rhythmic centre.

The alternative hypothesis that induction of *brain stem reflex*, *contagion* and *episodic memory* will be higher in PTSD participants compared with non-PTSD participants, is rejected on the basis of these results, however, it must be noted that the null hypothesis that there is no variance between groups cannot be accepted either. Future hypotheses should consider the directionality of variance in detail.

2.4.4. Voice, Music or Lyrics?

Finally, a Pearson's Chi-Square Test was conducted to determine whether *voice*, *music* or *lyrics* had the greatest influence on *felt* emotion responses across all 7 vocal music stimuli (see Table 2.4.). Whilst there were no significant findings, the results suggest that voice had a greater influence over felt emotion than lyrics and music in vocal music excerpts 1 (M = 1.3226, SD = .54081), 4 (M = 1.5806, SD = .88597), 6 (M = 1.4667, SD = .68145) and 7 (M = 1.5000, SD = .50800). Lyrics were most influential in felt emotion responses to vocal music excerpt 3 (M = 2.6875, SD = .69270) which was the excerpt that afforded significant findings with regard to emotion ratings of *Calm-Contentment* and *Pride-Confidence*. This may suggest that lyrical content has an influence on these felt emotions in non-PTSD participants.

Table 2.4. Influence of voice, music and lyrics on felt emotion across vocal music stimuli.

Statistics	**Vocal Music Excerpt 1** (Brain Stem Reflex)	**Vocal Music Excerpt 2** (Rhythmic Entrainment)	**Vocal Music Excerpt 3** (Episodic Memory)	**Vocal Music Excerpt 4** (Visual Imagery)	**Vocal Music Excerpt 5** (Evaluative Conditioning)	**Vocal Music Excerpt 6** (Musical Expectancy)	**Vocal Music Excerpt 7** (Contagion)
Mean	1.3226	2.1250	2.6875	1.5806	2.3125	1.4667	1.5000
Median	1.0000	2.0000	3.0000	1.0000	2.0000	1.0000	1.5000
Std Dev	.54081	.79312	.69270	.88597	.59229	.68145	.50800

2.4.5. Limitations.

There were a number of limitations in this study. Whilst the sample size (n=32) was deemed acceptable to ensure validity (Field, 2009), it caused challenges for assumption testing and statistical analysis. These challenges may also be a reflection on the measures and their

suitability for use with small sample sizes. The study focused on a minimal number of vocal music stimuli that were mapped to acoustic elements aligned with the BRECVEMA Framework (O'Keefe, 2024) however, a less restrictive approach whereby vocal music excerpts from a broad range of genres are considered, may provide greater understanding of emotional experiences of individuals with PTSD. The participants in this study were primarily current and former police personnel, with only a few from other services including fire, ambulance and support services. Ideally, further studies would focus on gaining greater participation from a cross section of emergency service organisations (police, fire, ambulance).

Whilst intentional, having participants complete the online questionnaire in their own time and location presented inherent limitations. Equipment and sound quality, decibel range and duration of listening could not be controlled, which may have influenced participant responses. Equally, the time of day, quality of mood and medications may have impacted the results of this study. Furthermore, it is acknowledged that terminology on the Emotion Rating Scale may require definitions and participants' understanding or interpretation of such terminology may differ. Future studies should consider administering a validated measure for PTSD such as the Davidson Trauma Scale (DTS) (Davidson et al., 1997), rather than relying upon self-report. Noteworthy, is the fact that 55 Expressions of Interest were received, with 32 participants completing the questionnaire. Due to limitations with research tools, it was not possible to determine how many of the 55 individuals attempted the questionnaire but did not complete it.

2.5. Conclusion.

The aim of this research was to investigate the effect of vocal music stimuli on emotional valence of emergency service personnel with post-traumatic stress disorder. The findings reveal that in response to vocal music stimuli intended to induce episodic memory, positive valence and feelings of nostalgia, individuals without a diagnosis of PTSD were able to experience greater sense of calm, contentment, pride and confidence than those with PTSD. This may be due to the quality of memories evoked by the stimulus and the bias of individuals with PTSD toward negative associations. In addition, contrary to expectations, individuals without PTSD are significantly more likely to experience emotions induced by brain stem reflex, in response to vocal music stimuli, than individuals with PTSD. Whilst this finding may be explained by considering cognitive and emotion regulation challenges experienced by individuals with PTSD, this finding warrants further examination in future research. In practical terms, this research highlights the potential for individuals with PTSD to be negatively biassed in their assessment of

vocal music stimuli that triggers a memory of the past or has lyrical content that may evoke a negative memory or image. Vocal music stimuli that are generally associated with feelings of calm, contentment, pride and confidence, may not induce those feelings in individuals with PTSD to a significant degree. Finally, it may be deduced that voice does influence felt emotions in response to music. Understanding how individuals with PTSD experience musical emotion is critical for both research and professional practice, particularly as it relates to singing for mental health research and well-being programs so as to enhance positive affect. Future research should consider broadening the scope of vocal music stimuli to encompass a range of genres, the use of biological and psychological measures to strengthen research findings and ensure consistency in participant's listening experience.

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APPENDIX 1. WAPPAR Ethical Approval.

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

PG2 / E1 FORM

APPLICATION FOR ETHICAL APPROVAL

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

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

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

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

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

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

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

SECTION A: About You (Principal Researcher)

1	Full Name:		Dannielle O'Keefe			
2	Tick all boxes which apply:		Member of staff:	☐	Honorary research fellow:	☐
3	Undergraduate Student	☐	Taught Postgraduate Student	☒	Postgraduate Research Student	☐

4	Institute/Academic Discipline/Centre:	WAPPAR
5	Campus:	Carmarthen
6	E-mail address:	dannielleokeefe@optusnet.com.au
7	Contact Telephone Number:	+61 412089160
	For students:	
8	Student Number:	2219673
9	Programme of Study:	MA in Professional Practice (Voice Pedagogy)
10	Director of Studies/ Supervisor:	Julie Crossman/ Debbie Winter

SECTION B: Approval for Research Activity

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

SECTION C: Internal and External Ethical Guidance Materials

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

SECTION D: External Collaborative Research Activity

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

8	Is your research externally funded		YES	☐	NO	☐
9	Are you specifically employed to	Voluntary	YES	☐	NO	☐

10	undertake this research in either a paid or voluntary capacity?	Employed	YES	☐	NO	☐
11	Is the research being undertaken within an existing UWTSD Athrofa Professional Learning Partnership (APLP)	If YES then the permission question below does not need to be answered.	YES	☐	NO	☐
12	Permission to undertake the research has been provided by the partner organisation	(If YES attach copy) If NO the application cannot continue	YES	☐	NO	☐

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

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

SECTION E: Details of Research Activity

1	Indicative title:	Safe singing repertoire to elicit positive mental health outcomes and assist in emotion regulation for emergency service personnel with post-traumatic stress disorder.		
2	Proposed start date:	13/09/2023	Proposed end date:	02/01/2024
3	**Introduction to the Research (maximum 300 words)** **Ensure that you write for a <u>Non-Specialist Audience</u> when outlining your response to the three points below:** • *Purpose of Research Activity* • *Proposed Research Question* • *Aims of Research Activity* • *Objectives of Research Activity* Demonstrate, briefly, how **<u>Existing Research</u>** has informed the proposed activity and explain • *What the research activity will add to the body of knowledge* • *How it addresses an area of importance.*			

4	**Purpose** Existing research provides little clarity as to the types of vocal exercises and singing repertoire used in singing for mental health studies. This raises two issues: potential compromise in replication of singing for mental health research; a lack of clarity as to what constitutes safe singing repertoire for individuals with mental health challenges, such that it does not adversely impact mental health states due to a hypersensitivity to aural stimuli. Therefore, this research project will seek to identify safe and appropriate vocal exercises and singing repertoire that elicit positive mental health outcomes and assist in emotion regulation for emergency service personnel with post-traumatic stress disorder.

5	**Research Question** What vocal exercises and singing repertoire elicit positive mental health outcomes for emotion regulation in emergency service personnel with post-traumatic stress disorder?
6	**Aims** The aim of this research project is to investigate the relationship between singing repertoire and its effect on emotion regulation in emergency service personnel with post-traumatic stress disorder.
7	**Objectives** 1. To examine current practice with respect to the curation of vocal exercises and singing repertoire used in group singing for mental health research. 2. To analyse the impact of music and vocal stimuli on emotion regulation in emergency service personnel with post-traumatic stress disorder.
8	**Proposed methods (maximum 600 words)** Provide a brief summary of all the methods that **may** be used in the research activity, making it clear what specific techniques may be used. If methods other than those listed in this section are deemed appropriate later, additional ethical approval for those methods will be needed.

9	The research proposed will adopt a pragmatic, mixed methods approach. This research does not constitute a replication or expansion of previous research. Triangulation will be employed, whereby the research will be completed in three phases. **Phase 1 - Literature Review** A literature review will be conducted to examine singing for mental health research within the scope of anxiety, depression and post-traumatic stress disorder. This examination will pay particular attention to design and methods, specifically, repertoire selection and emotion regulation measures. This literature review will inform the development of interview and questionnaire questions for Phase 2. **Phase 2 - Interview and Questionnaire** Out of the literature review, five relevant studies will be selected. The primary researcher in these studies will be approached via email and invited to participate in a semi-structured interview either online or in person. The purpose of these interviews will be to ascertain the rationale used in the curation of vocal exercises and singing repertoire employed in group programs in singing for mental health research. Detail regarding this element of design is routinely absent in research journals. Where primary researchers are unavailable, secondary researchers will be approached. Where participation in semi-structured interview is not preferred or possible, a semi-structured questionnaire will be provided for completion. Analysis of results will be primarily qualitative. Analysis of the exercises and repertoire currently in practice, will inform the development of Phase 3. **Phase 3 - Questionnaire** A three part questionnaire will be designed as an online survey for participants within the emergency service personnel population. The questionnaire will be both structured and semi-structured and will require both quantitative and qualitative analysis. • Part 1 of the questionnaire will address quantitative information regarding PTSD diagnosis and relevant demographic information. • Part 2 will use a validated emotion scale to measure emotion responses to aural stimuli. • Part 3 will use semi-structured questions to elicit information regarding music preferences, relationship to singing, adverse aural stimuli and barriers to participation in group singing programs. Using purposive sampling, participants will be sought through Police Veterans Victoria and Code 9 Foundation. These organisations provide support for current and retired emergency service personnel, in particular, those with post-traumatic stress disorder. A link to the online survey will be provided to both organisations for inclusion in their newsletters and their social media accounts. In addition, the link will be provided directly, via email, to individuals known by the researcher to be part of the population being studied. **Option for Phase 4 - Focus Group** A focus group comprising of between 5-10 experts within the fields of singing for health research, music therapy and psychology will be stood up to discuss the results of the research and aid in the development and ultimately endorsement of a model for safe singing repertoire for emergency service personnel with post-traumatic stress disorder. Using a semi-structured design, the focus group will also address the potential barriers to participation in group singing programs.

10	**Location of research activity** Identify all locations where research activity will take place.
11	1. Literature Review will be conducted in Malvern, Victoria, Australia. 2. Interviews will be conducted in person were possible, otherwise via an online platform such as Microsoft Teams or Zoom. 3. Questionnaire will be delivered online to participants primarily domiciled in Victoria, Australia. 4. Focus Group will be conducted in a location to be determined, within Melbourne, Victoria, Australia.
12	**Research activity outside of the UK** If research activity will take place overseas, you are responsible for ensuring that local ethical considerations are complied with and that the relevant permissions are sought. Specify any local guidelines (e.g. from local professional associations/learned societies/ universities) that exist and whether these involve any ethical stipulations beyond those usual in the UK (provide details of any licenses or permissions required). Also specify whether there are any specific ethical issues raised by the local context in which the research activity is taking place, for example, particular cultural and/or legal sensitivities or vulnerabilities of participants.
13	This research will be conducted in Australia. The research is aligned with UK based ethical stipulations through adherence to: • Australian National Association of Teachers of Singing Code of Ethics • Australian Music Therapy Association Code of Ethics • Australian Psychological Society Code of Ethics

14	Use of documentation not in the public domain: Are any documents **NOT** publicly available?	**NO**	☒
		YES	☐
15	*(this box should expand as you type)*		

SECTION F: Scope of Research Activity

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

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

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

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

SECTION G: Intended Participants

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

12	**Participant numbers and source** Provide an estimate of the expected number of participants. How will you identify participants and how will they be recruited?	
13	How many participants are expected?	**Phase 1 - Literature Review** No participants required. **Phase 2 - Interview and Questionnaire** From literature review, 5 relevant studies will be identified and the primary and/or secondary researcher will be contacted to participate in interview or questionnaire. **Phase 3 - Questionnaire** Between 50 and 100 participants are expected to respond out of a sample population of approximately 2000 through Police Veterans Victoria and Code 9 Foundation database and social media reach. Participants known to fall within the target population, but who are not aligned with either organisation, will also be contacted directly via email.
14	Who will the participants be?	**Phase 2** - Singing for mental health researchers. **Phase 3** - Current and former emergency service personnel (police, fire, ambulance) diagnosed with post-traumatic stress disorder.
15	How will you identify the participants?	**Phase 2** - Singing for mental health researchers will be identified through literature review, contacted via email and invited to voluntarily participate in an interview or questionnaire. **Phase 3** - Emergency service personnel will be contacted via email and/or social media via Police Veterans Victoria and Code 9 Foundation and invited to voluntarily participate.

16	**Information for participants:**	YES	NO	N/A
17	Will you describe the main research procedures to participants in advance, so that they are informed about what to expect?	☒	☐	☐
18	Will you tell participants that their participation is voluntary?	☒	☐	☐
19	Will you obtain written consent for participation?	☒	☐	☐
20	Will you explain to participants that refusal to participate in the research will not affect their treatment or education (if relevant)?	☒	☐	☐
21	If the research is observational, will you ask participants for their consent to being observed?	☒	☐	☐
22	Will you tell participants that they may withdraw from the research at any time and for any reason?	☒	☐	☐
23	With questionnaires, will you give participants the option of omitting questions they do not want to answer?	☒	☐	☐
24	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	☒	☐	☐
25	Will you debrief participants at the end of their participation, in a way appropriate to the type of research undertaken?	☒	☐	☐
26	If NO to any of above questions, please give an explanation			
27				

28	**Information for participants:**	YES	NO	N/A
29	Will participants be paid?	☐	☒	☐
30	Is specialist electrical or other equipment to be used with participants?	☒	☐	☐
31	Are there any financial or other interests to the investigator or University arising from this study?	☐	☒	☐
32	Will the research activity involve deliberately misleading participants in any way, or the partial or full concealment of the specific study aims?	☐	☒	☐
33	If YES to any question, please provide full details			
34	Audio/Video equipment may be used to record Focus Group with consent.			

SECTION H: Anticipated Risks

1	**Outline any anticipated risks that may adversely affect any of the participants, the researchers and/or the University, and the steps that will be taken to address them.** If you have completed a full risk assessment (for example as required by a laboratory, or external research collaborator) you may append that to this form.		
2	**Full risk assessment completed and appended?**	**Yes**	☐

		No	☒

3	**Risks to participants** For example: emotional distress, financial disclosure, physical harm, transfer of personal data, sensitive organisational information

4	**Phase 2 Participants** Singing for mental health researchers. *Risk 1.* Sensitivity regarding disclosure of research methodology.	**Phase 2 Participants** Singing for mental health researchers. *Risk 1.* • Ensure that participants understand the purpose of the research being undertaken and how data collected will be analysed and communicated. • Ensure that all data collected is de-identified. • Ensure all data collected is secured in accordance with UWTSD Research Data Management Policy. • Where interviews are in person, ensure location is private.
	Phase 3 Participants Emergency service personnel *Risk 1.* Potential emotional discomfort in response to music stimuli or questions regarding music and emotion. *Risk 2.* Data security breach resulting in personal information being exposed.	**Phase 3 Participants** Emergency service personnel *Risk 1.* • Provide information prior to commencement of the online questionnaire that discloses the exposure to music stimuli and requirement to provide an indication of how that music made them feel which provides opportunity to reject participation. • Include a footer in each page of the questionnaire that advises that the participant may withdraw at any time without consequence. • Provide contact details for relevant support agencies. A link to support services to be available on each page of questionnaire. • Provide information at commencement of online questionnaire that directs the participant to their treating therapist should they require support. • Consider whether it is appropriate and feasible to have a person on research team who can provide support to the participant. *Risk 2.* • Ensure that UWTSD Research Data Management Policy is adhered to. • De-identify data. • Ensure sufficient data management protocols are in place to safeguard collected data. • Ensure only researcher and supervisor have access to data. • Only collect personal information critical to research purpose. • Adhere to Australian Privacy Principles under the Privacy Act 1988. • Install two-factor authentication on all devices that hold collected data. • Ensure hard copy data is filed in a locked receptacle with access only by researcher.

5	If research activity may include sensitive, embarrassing or upsetting topics (e.g. sexual activity, drug use) or issues likely to disclose information requiring further action (e.g. criminal activity), give details of the procedures to deal with these issues, including any support/advice (e.g. helpline numbers) to be offered to participants. Note that where applicable, consent procedures should make it clear that if something potentially or actually illegal is discovered in the course of a project, it may need to be disclosed to the proper authorities	
	This research project does not propose to include sensitive, embarrassing or upsetting topics nor will it likely result in disclosure of information requiring further action. Out of an abundance of caution, participants in Phase 3 will be provided with information that refers them to their treating therapist or to relevant support agencies should they experience discomfort or distress during the completion of the questionnaire. They will also be advised that they may withdraw consent at any time and cease participation in the research.	
6	**Risks to investigator** For example: personal safety, physical harm, emotional distress, risk of accusation of harm/ impropriety, conflict of interest	
	Risk 1. Failure to recruit participants in either Phase 2 or 3. *Risk 2.* Risk of accusation of harm, impropriety or misconduct. *Risk 3.* Breach of data management policy. *Risk 4.* Emotional distress.	*Risk 1.* • Consider expanding the scope of eligible participants for Phase 2 participants. • Consider offering questionnaire rather than interview for Phase 2 participants. • Consider alternative sources for Phase 2. • Consider alternative organisations to attract participants for Phase 3. • Utilise social media and direct email to recruit participants in Phase 3. *Risk 2.* • Adhere to UWTSD Research Ethics and Integrity Code of Practice. • Adhere to Australian National Association of Teachers of Singing Code of Ethics, Australian Music Therapy Association Code of Ethics, Australian Psychological Society Code of Ethics. • Maintain relationship with research supervisor to ensure appropriate instruction. • Maintain meticulous contemporaneous notes. *Risk 3.* • Adhere to UWTSD Research Data Management Policy. • Adhere to Australian Privacy Principles and Privacy Act 1988. • Ensure all devices have two-factor authentication where available. • Ensure all devices and sensitive documents are password protected. • De-identify data to protect personal information where it has been collected. *Risk 4.* • Maintain reflective journal. • Maintain exercise, sleep and mindfulness techniques. • Maintain engagement in psychological support services.

7	**University/institutional risks** For example: adverse publicity, financial loss, data protection	
	Risk 1. Reputational risk to public perception as a result of impropriety, misconduct or breach of data management policy.	*Risk 1.* • Adhere to UWTSD Research Ethics and Integrity Code of Practice. • Adhere to Australian National Association of Teachers of Singing Code of Ethics, Australian Music Therapy Association Code of Ethics, Australian Psychological Society Code of Ethics. • Maintain relationship with research supervisor to ensure appropriate instruction. • Maintain meticulous contemporaneous notes. • Adhere to UWTSD Research Data Management Policy. • Adhere to Australian Privacy Principles and Privacy Act 1988. • Ensure all devices have two-factor authentication where available. • Ensure all devices and sensitive documents are password protected. • De-identify data to protect personal information where it has been collected. • Completion of UWTSD Research Integrity 2.0 module.

8	**Disclosure and Barring Service**			
9	If the research activity involves children or vulnerable adults, a Disclosure and Barring Service (DBS) certificate must be obtained before any contact with such participants.	**YES**	**NO**	**N/A**

10	Does your research require you to hold a current DBS Certificate?	☐	☒	☐

SECTION I: Feedback, Consent and Confidentiality

1	**Feedback** What de-briefing and feedback will be provided to participants, how will this be done and when?
	UWTSD email address will be provided to participants upon completion of the questionnaire or interview through which contact may be made with the primary researcher. *Debrief for Phase 2* A statement will be prepared which broadly outlines the research findings will be provided to participants via email where requested. *Debrief for Phase 3* A statement may be prepared which broadly outlines the research findings. This statement may be provided to Police Veterans Victoria and Code 9 Foundation for inclusion in their newsletter so that participants maintain anonymity but still receive feedback. Feedback will be provided by 30 March 2024. Participants may request a copy of the full report via the UWTSD email provided.
2	**Informed consent** Describe the arrangements to inform potential participants, before providing consent, of what is involved in participating. Describe the arrangements for participants to provide full consent before data collection begins. If gaining consent in this way is inappropriate, explain how consent will be obtained and recorded in accordance with prevailing data protection legislation.
	Phase 2 A plain language statement will be provided to potential participants outlining the research purpose, timeframe and requirements for participation. Potential participants for interview will be provided with an electronic copy of the consent form via email to fill out and return via email. The document will be downloaded, then stored in a secure electronic file. The email containing the document and the downloaded file will be deleted. *Phase 3* A plain language statement will be provided to potential participants outlining the research purpose, timeframe and requirements for participation. This will be in the form of online questionnaire and will be on the first screen. Additional information will be included in this statement regarding the potential for discomfort and will include support agency contacts. It will also highlight that they may withdraw any time without penalty. Once they are satisfied to continue, they will click a button on the questionnaire to indicate they are giving consent. This information will be recorded in the back end of questionnaire in the form of a spreadsheet. Should a focus group take place, a plain language statement will be provided to potential participants outlining the research purpose, timeframe and requirements for participation. Potential participants will be provided with an electronic copy of the consent form via email to fill out and return via email. The document will be downloaded, then stored in a secure electronic file. The email containing the document and the downloaded file will be deleted.
3	**Confidentiality / Anonymity** Set out how anonymity of participants and confidentiality will be ensured in any outputs. If anonymity is not being offered, explain why this is the case.

	Personal information will not be collected unless critical to research purpose. Where personal information is collected, data will be de-identified prior to any output. Where appropriate, participants will be allocated a unique identifyer. Only the principal researcher will have access to this data. *Phase 2* Information collected will be de-identified. Information may include personal information for the purposes of contacting the participant. *Phase 3* Information collected will be used to describe the demographic characteristics of the collective participants. For example, the age and gender of a participant will be collected as it may influence music preferences. Other personal data will not be collected.

SECTION J: Data Protection and Storage

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

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

	Age It is anticipated that age will influence music preferences. Data on age range will be collected. *Gender* It is anticipated that gender will infuence music preferences. Data on gender will be collected. *PTSD Diagnosis* Participants in Phase 3 will be asked to indicate whether they have a diagnosis of PTSD and provide the discipline of their diagnosing practitioner ie. psychologist, psychiatrist. This information is required to confirm that the participant falls within the target population. *Contact Information* Contact information including but not limited to email and phone numbers will be collected for Phase 2. This information is required to facilitate contact with participants for interview or for the delivery of questionnaire for completion. *Consent Forms* Consent forms in Phase 2 will be collected via electronic or manual means. Questionnaires will include a consent form in a digital format whereby participants will indicate their consent by clicking on a button. In this case, no hard copies of the consent form will exist. Consent forms filled out manually will be locked in a secure receptacle and will only be accessible to the primary researcher.		
3	Does it involve special category data (as defined by the GDPR)?	**YES**	**NO**
	"Special category data" *means sensitive personal data consisting of information as to the data subjects' –* *(a) racial or ethnic origin,* *(b) political opinions,* *(c) religious beliefs or other beliefs of a similar nature,* *(d) membership of a trade union (within the meaning of the Trade Union and Labour Relations (Consolidation) Act 1992),* *(e) physical or mental health or condition,* *(f) sexual life,* *(g) genetics,* *(h) biometric data (as used for ID purposes),*	☒	☐
4	If YES, provide a description of the special category data and explain why this data needs to be collected:		
	Indication of PTSD diagnosis required to confirm participant belongs in target population.		

5	Will the research activity involve storing personal data and/or special category data on one of the following:	**YES**	**NO**
6	Manual files (i.e. in paper form)?	☒	☐
7	University computers?	☐	☒
8	Private company computers?	☐	☒
9	Home or other personal computers?	☒	☐
10	Laptop computers/ CDs/ Portable disk-drives/ memory sticks?	☒	☐
11	"Cloud" storage or websites?	☒	☐

12	Other – specify:	☐	☒
13	For all stored data, explain the measures in place to ensure the security of the data collected, data confidentiality, including details of password protection, encryption, anonymisation and pseudonymisation:		
	All data will be kept in password protected cloud storage on the business G-Suite system which will not be shared. Any USB or portable devices used to store or transfer data will be password protected and/or encrypted. Where applicable, participants will be given a unique identifier to ensure confidentiality and this list will be kept securely in the password protected folder. All data recorded on paper will be stored in a secure filing cabinet accessible only by the reseacher. All electronic and manual data collected will be held for a period of time as specified by UWTSD, after which, data stored electronically will be deleted and data recorded on paper will be shredded.		
14	**All Data Storage**		
15	Will the research activity involve any of the following activities:	**YES**	**NO**
16	Electronic transfer of data in any form?	☒	☐
17	Sharing of data with others at the University?	☒	☐
18	Sharing of data with other organisations?	☐	☒

19	Export of data outside the European Union or importing of data from outside the UK?	☒	☐
20	Use of personal addresses, postcodes, faxes, emails or telephone numbers?	☒	☐
21	Publication of data that might allow identification of individuals?	☐	☒
22	Use of data management system?	☐	☒
23	Data archiving?	☐	☒
24	If YES to any question, please provide full details, explaining how this will be conducted in accordance with the GDPR and DPA (and/or any international equivalent):		
	All data will be encrypted and kept in password protected cloud storage on the business G-Suite account which will not be shared. Any USB or portable devices used to store or transfer data will be password protected. All data transfers will be encrypted and password protected. Where applicable, participants will be given a unique identifier to ensure confidentiality and this list will be kept securely in the password protected folder. The data will be stored until the completion of the project and then deleted. In accordance with the DPA2018, participants will have the right to ask to see what data is held relating to them, and this data will be deleted immediately if the participant requests this, in which case the data will not be used in the project.		
25	List all who will have access to the data generated by the research activity:		
	Dannielle O'Keefe (principal researcher) Kerrie Obert (research supervisor)		
26	List who will have control of, and act as custodian(s) for, data generated by the research activity:		
	Dannielle O'Keefe		
27	Give details of data storage arrangements, including security measures in place to protect the data, where data will be stored, how long for, and in what form. Will data be archived – if so how and if not why not.		
	All data will be encrypted and kept in password protected cloud storage on G-Suite system which will not be shared. Any USB or portable devices used to store or transfer data will be password protected, and will be reformatted at the end of the project in order to destroy the data. The data will be stored until the completion of the project and then deleted.		
28	Please indicate if your data will be stored in the UWTSD Research Data Repository (see https://researchdata.uwtsd.ac.uk/). If so please explain. (*Most relevant to academic staff)*		
	N/A		
29	Confirm that you have read the UWTSD guidance on data management (see https://www.uwtsd.ac.uk/library/research-data-management/)	**YES**	☒
		NO	☐
30	Confirm that you are aware that you need to keep all data until after your research has completed or the end of your funding	**YES**	☒
		NO	☐

SECTION K: Declaration

31	The information which I have provided is correct and complete to the best of my knowledge. I have attempted to identify any risks and issues related to the research activity and acknowledge my obligations and the rights of the participants. In submitting this application I hereby confirm that I undertake to ensure that the above named research activity will meet the University's Research Ethics and Integrity Code of Practice which is published on the website: https://www.uwtsd.ac.uk/research/research-ethics/		
	Signature of applicant:	Dannielle O'Keefe	**Date:** 24/07/2023

For STUDENT Submissions:

32	Director of Studies/ Supervisor:	Laura James	**Date:** 7.9.23
33	Signature:	Laura James	

For STAFF Submissions:

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

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

☒	I have read the guidance notes supplied before completing the form.
☒	I have completed **ALL RELEVANT** sections of the form in full.
☒	I confirm that the research activity has received approval in principle
☐	I have attached a copy of final/interim approval from external organisation (**where appropriate**)
☐	I have attached a full risk assessment (and have NOT completed Section H of this form) (where appropriate) *ONLY TICK IF YOU HAVE* ***ATTACHED A FULL RISK ASSESSMENT***
☒	I understand that it is my responsibility to ensure that the above named research activity will meet the University's Research Ethics and Integrity Code of Practice.

☒	I understand that before commencing data collection all documents aimed at respondents (including information sheets, consent forms, questionnaires, interview schedules etc.) must be confirmed by the DoS/Supervisor, module tutor or Academic Director.
☒	I have deleted the guidance notes before submitting the PG2 for consideration

DANNIELLE O'KEEFE

MEZZO SOPRANO

www.dannielleokeefe.com
dannielleokeefe@optusnet.com.au
0412 089 160
ABN: 38 714 202 743

24 July 2023

To: University of Wales Trinity Saint David

Re: A Pilot Study: '*Safe vocal exercises and singing repertoire to elicit positive mental health outcomes and assist in emotion regulation within emergency service personnel population with post-traumatic stress disorder*'.

I confirm that I approve of the research proposed into '*safe vocal exercises and singing repertoire for use in singing for mental health research*' to be carried out by Dannielle O'Keefe, of Dannielle O'Keefe Mezzo Soprano to be carried out between September 2023 and January 2024.

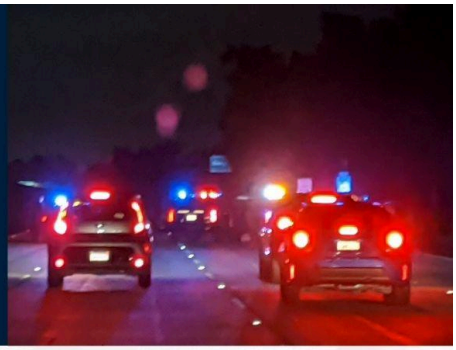
With kind regards,

Dannielle O'Keefe

APPENDIX 2. Vocal Music and Emotion Advertising Flyer.

EMERGENCY SERVICE PERSONNEL

OPPORTUNITY TO PARTICIPATE IN MUSIC RESEARCH



EXPRESSIONS OF INTEREST

Current and former Emergency Service Personnel (police, fire, ambulance) are invited to participate in a research project aimed at investigating the relationship between vocal music and its effect on emotion in individuals with and without post-traumatic stress disorder (PTSD). As evidence suggests that individuals with PTSD experience hypersensitivity to sound, this research seeks to explore the emotional impact of vocal music on such individuals.

We are seeking participants with and without PTSD.

This research is being conducted by Dannielle O'Keefe in conjunction with The University of Wales Trinity Saint David and The Voice Study Centre (UK) in support of a Masters of Professional Practice (Vocal Pedagogy). This research is independently funded. No financial incentive is offered.

WHAT TO EXPECT

Participants will be requested to complete an online questionnaire covering 3 main focus areas:

- In Part 1 participants will be asked questions about their demographics, including mental health status.
- In Part 2 participants will listen to 7 short vocal music excerpts and answer questions about their emotional response to the music.
- In Part 3 participants will be asked about their music preferences.

The questionnaire will take approximately 30 minutes and may be completed at a time and location of the participants choosing, in the absence of external distractions. Participants will require access to a computer with operational audio or a set of headphones through which to listen to music excerpts.

Participation in this questionnaire is anonymous.

Individuals with PTSD are advised to seek advice from their medical practitioner prior to participation.

Expressions of interest may be withdrawn at any time by contacting the principal researcher via email.

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

200
1822 - 2022

VOICE STUDY CENTRE

ELIGIBILITY

Participants must:

- be over 18 years.
- be a current or former frontline serving member of an emergency service organisation.
- have unobstructed hearing.

There is no requirement for participants to have music experience.

NEXT STEPS

To express your interest in participating, please click the red button below and enter your basic contact details. You will be sent an email on or around the 25th of March, 2024 which will include a link to the online questionnaire. **Data collection will take place between the 26th of March and the 15th April, 2024.** Thank you for your interest.

I'M INTERESTED

Principal Researcher

Dannielle O'Keefe
B.Com, B.Mus

Research Supervisor

Dr Michael Bonshor
BA Hons, MA, PhD, PGCertTLHE, FHEA, FISM

For enquiries please contact the principal researcher:

Email: 2219673@student.uwtsd.ac.uk

Note: All information received is managed in accordance with Australian Privacy Principals and UWTSD Research Data Management Policy. Research data collated will be de-identified. Ethics approval granted by Wales Academy of Professional Practice and Research (UWTSD).

APPENDIX 3. Expression of Interest Form.

Expression of Interest to Participate in Research Project.

Thank you for your interest.

Participation in this questionnaire is anonymous.

Current and former Emergency Service Personnel (police, fire, ambulance) are invited to participate in this research project aimed at investigating the effect of vocal music on emotion responses in individuals with and without post-traumatic stress disorder (PTSD).

Individuals **with and without** PTSD are encouraged to participate.

Participants will be asked to complete an online questionnaire consisting of 3 focus areas:

- In **Part 1** participants will be asked questions about their demographics, including mental health status.
- In **Part 2** participants will listen to 7 short vocal music excerpts and answer questions about their emotional response to the music.
- In **Part 3** participants will be asked about their music preferences.

The questionnaire will take approximately 30 minutes and may be completed at a time and location of the participants choosing, in the absence of external distractions. Participants will require access to a computer with operational audio or a set of headphones through which to listen to music excerpts.

Individuals with PTSD are advised to seek advice from their medical practitioner prior to participation. Expressions of interest may be withdrawn at any time, for any reason by contacting the principal researcher via email. Please ensure that you read the following document which explains this research project:

PARTICIPANT INFORMATION SHEET

This research project is being conducted by Dannielle O'Keefe, under the supervision of Dr Michael Bonshor, in conjunction with The University of Wales Trinity Saint David and The Voice Study Centre in support of a Masters of Professional Practice (Vocal Pedagogy).

If you require further information, please contact the principal researcher:

Dannielle O'Keefe
Email: 2219673@student.uwtsd.ac.uk

Please provide your contact details below.

* Indicates required question

1. I have read and understood the Participant Information Sheet? *

Check all that apply.

- [ ] Yes
- [ ] No

2. Please provide your email address. *

Thank you for your interest in this research project.
You will receive an email with a link to the questionnaire on or after the 25th of March, 2024.

Please check your junk mailbox.

If you have any issues with the questionnaire or have not received an email with a link to the questionnaire by the 12th of April, 2024, please email the principal researcher on 2219673@student.uwtsd.ac.uk.

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Google Forms

APPENDIX 4. Participant Information Sheet.

VOCAL MUSIC AND EMOTION

Participant Information Sheet

Introduction

Thank you for your interest in the Vocal Music and Emotion research project. The following pages aim to provide you with further information, so that you can decide if you would like to take part in this research. Please take the time to read the information carefully. You may ask questions about any aspect you may not understand or want to know more about. You may also wish to discuss the research project with a relative, friend or medical practitioner, please feel free to do so.

What is this research project about?

This research project aims to study the effect of vocal music (music with voice and lyrics) on emotion responses in emergency service personnel with and without post-traumatic stress disorder. The research is conducted by Dannielle O'Keefe, under the supervision of Dr Michael Bonshor, in conjunction with the University of Wales Trinity Saint David and The Voice Study Centre, in support of the Master of Professional Practice (Vocal Pedagogy). You are invited to participate in this research project due to your professional background, given that there is a higher prevalence of PTSD in emergency service personnel and this group remains understudied.

What will I be asked to do?

Participation in this research project will involve a time commitment of approximately 30 minutes. You will be asked to complete an online questionnaire covering 3 main focus areas. You may complete the online questionnaire at a time and location of your choosing, in the absence of distractions. You will require a computer with operational audio or headphones for listening to vocal music excerpts.

In **Part 1**, you will be asked demographic questions such as: What is your age range?; Are you a current or former emergency service worker?; Have you been diagnosed with PTSD? In **Part 2**, you will be asked to listen to 7 vocal music excerpts of 60 seconds duration, then you will be asked to indicate your emotional response to the music and to answer questions regarding your experience of the music. In **Part 3**, you will be asked about your music preferences.

What are the possible benefits?

This research project aims to expand upon the knowledge, insight and understanding regarding the effect of vocal music on emotional responses of emergency service personnel, with and without PTSD. This acquired knowledge may then be applied in professional practice within individual and group singing programs for wellbeing. It may also enhance the knowledge, skills and expertise of individual researchers, practitioners and institutions.

What are the possible risks?

This research project has been designed to minimise the risk of harm or discomfort to participants. Whilst the risk of negative experience or discomfort is considered low, it is acknowledged that individuals with PTSD may experience discomfort when listening to music and answering questions regarding emotion. To address this, a list of 24/7 support services is provided below. Individuals are also reminded to seek assistance from their existing medical support team. Should you experience discomfort or distress, you are free to withdraw from the research project.

Lifeline: 13 11 14
https://www.lifeline.org.au

Beyond Blue: 1300 22 4636
https://www.beyondblue.org.au

Police Welfare Services Unit: 1300 090 995
https://www.police.vic.gov.au/get-support

Fire Rescue Victoria Employee Support Services: 1800 161 415
https://ufuvic.asn.au/membership/support-services

CFA Member Wellbeing Support Services: 1800 959 232
https://ufuvic.asn.au/membership/support-services

Ambulance Victoria: 1800 626 377
https://www.ambulance.vic.gov.au/about-us/our-services/family-safe/accessing-support-services

What will happen to information about me?

To safeguard your privacy, we will only request the minimum personally-identifiable information possible. Any personal information you provide will be stored separately and anonymised to ensure that you cannot be identified. This information will be retained for no longer than is necessary for the purposes of the research. If you withdraw from the research project, you may request that any data held about you be deleted. Every effort will be made to comply with this request. Please note, that it will not be possible to delete individual data once the collective data has been analysed.

All data collected will be stored securely on a cloud based storage platform on a password protected device, accessible only to the principal researcher. Any portable devices used to store or transfer data will be password protected and encrypted. At the completion of the research project, data collected will be held for a minimum of 10 years after the research results are published. Once records are of no further value, they will be destroyed.

Anonymised results from this research project may be published in the form of student empirical reports and potentially, in the research and conference literature. Data collected from this research project may be useful for research projects in the future. In this case, anonymised data collected from this research project may be reanalysed.

Who is funding this project?

This research project is independently funded by the principal researcher in fulfillment of requirements for the Master of Professional Practice (Vocal Pedagogy).

Will I hear about the results of this project?

Upon completion, the results of this research project may be made available to you in the form of student empirical reports. In order to obtain a copy of the results, please indicate when prompted at the end of the research questionnaire, or contact the principal researcher, Dannielle O'Keefe via email at 2219673@student.uwtsd.ac.uk.

Do I have to take part?

No, participation is entirely voluntary. You are not obliged to participate. You may decline to answer any of the questions and you may withdraw your participation completely, prior to the data being analysed. If you decide to withdraw from the research project after you have submitted your responses, please notify the principal researcher via email at 2219673@student.uwtsd.ac.uk.

Who do I contact if I have concerns about the project?

If you have a concern or complaint about any aspect of the research project, the way it is being conducted or any questions regarding your rights as a research participant, then you may contact:

Dannielle O'Keefe - Principal Researcher
2219673@student.uwtsd.ac.uk

Dr Michael Bonshor - Supervisor (Voice Study Centre)
michael@voicestudycentre.com

Tracy Theobold - Assistant Director (Voice Study Centre)
tracy@voicestudycentre.com

This research project is carried out in accordance with the University of Wales Trinity Saint David Research Ethics and Integrity Code of Practice and the National Statement on Ethical Conduct in Human Research 2023, published by the National Health and Medical Research Council in conjunction with the Australian Research Council and Universities Australia. This research project has ethical approval from the Wales Academy of Professional Practice and Research (WAPPAR) at the University of Wales Trinity Saint David.

Will I be reimbursed for any expenses?

There are no anticipated expenses for participants and therefore no reimbursement will be offered.

Where can I get further information?

If you require further information, wish to withdraw your participation or you have any issues regarding this research project, you may contact:

Dannielle O'Keefe
Principal Researcher
Email: 2219673@student.uwtsd.ac.uk

APPENDIX 5. Vocal Music and Emotion Questionnaire.

Vocal Music and Emotion Questionnaire

Thank you for your interest in this research project.

Participation is anonymous.

The purpose of this research project is to study the effect of vocal music (music with voice and lyrics) on emotion responses in individuals with and without post-traumatic stress disorder (PTSD).

Individuals **with and without** PTSD are encouraged to participate.

The following questionnaire consists of 3 focus areas:

- Part 1 will request demographic information including mental health status.
- Part 2 will expose participants to 7 short vocal music excerpts and request disclosure of felt emotion in response to the music.
- Part 3 will request information regarding music preferences.

The questionnaire will take approximately 30 minutes to complete and may be completed at a time and location of the participants choosing, in the absence of external distractions. Participants will require access to a computer with operational audio or a set of headphones through which to listen to music excerpts.

Individuals with PTSD are advised to seek advice from their medical practitioner prior to participation.

Participation in any research project is voluntary. If you do not wish to participate, you are not obliged to do so. If you decide to take part and later change your mind, you are free to withdraw at any stage. Please ensure that you read the following **Participant Information Sheet** and **Consent Form** prior to providing your consent to participate.

This research project is being conducted by Dannielle O'Keefe, under the supervision of Dr Michael Bonshor, in conjunction with The University of Wales Trinity Saint David and The Voice Study Centre in support of a Masters of Professional Practice (Vocal Pedagogy).

Should you have any questions, please contact the principal researcher, Dannielle O'Keefe via email at 2219673@student.uwtsd.ac.uk

Thank you for your participation.

* Indicates required question

Participant Information Sheet

Please ensure you read the Participant Information Sheet by clicking on this link:

Participant Information Sheet

1. **Acknowledgement of Participant Information Sheet.** *

Check all that apply.

☐ I have read and understood the Participant Information Sheet.

2. **Consent Form.** *

Please ensure you read and complete this Consent Form. Every box must be checked prior to continuing.

Check all that apply.

☐ I voluntarily agree to participate in this research project.

☐ I understand that even if I agree to participate now, I can withdraw at any time.

☐ I understand that I can refuse to answer any question asked of me during the research process without any consequences of any kind.

☐ I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.

☐ I understand that participation involves the completion of an online questionnaire of approximately 30 minutes duration.

☐ I understand that I will not benefit directly from participating in this research.

☐ I understand that all information I provide in this research project will be treated confidentially.

☐ I understand that in any report on the results of this research, my identity will remain anonymous.

☐ I understand that if I inform the researcher that myself or someone else is at risk of harm, they may be required to report this information to the relevant authorities with or without my permission.

☐ I understand that research data will be held in accordance with the University of Wales Trinity Saint David Research Data Management Policy and will be retained until 31st December, 2024.

☐ I understand that under freedom of information legislation I am entitled to access the information I have provided at any time while it is being stored.

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

7. **Q.3. Are you a current or former emergency services employee?**

Please tick all applicable.

Check all that apply.

- [ ] Current
- [ ] Former
- [ ] Police
- [ ] Fire
- [ ] Ambulance
- [ ] Other: _____

8. **Q.4. Have you been diagnosed with post-traumatic stress disorder?**

Mark only one oval.

- ( ) Yes.
- ( ) No.

9. **Q.5. If yes, who diagnosed you with post-traumatic stress disorder?**

Check all that apply.

- [ ] Psychologist.
- [ ] Psychiatrist.
- [ ] Not applicable.
- [ ] Other: _____

10. **Q.6. If you have post-traumatic stress disorder, would you classify the impact of PTSD on your work and home life as:**

Mark only one oval.

- ( ) Mild.
- ( ) Moderate.
- ( ) Severe.
- ( ) Not Applicable.

11. **Q.7. How would you describe your mood today?**

Mark only one oval.

- Low.
- Moderate.
- High.

Section 2. Vocal Music Listening.

In this section you will be asked to listen to 7 vocal music excerpts. Each excerpt will be of 60 seconds duration. Please ensure that you listen to the entire excerpt without interruption. You will require the audio on your computer to be operable or you may use a set of operable headphones. Please set the volume to a comfortable level as you would in your usual daily listening.

The vocal music excerpt may or may not start at the beginning of the piece.

You will then be asked to rate your experience of 12 emotions in response to each vocal music excerpt. Each emotion is accompanied by a rating scale from 'Not at all' to, 'A lot'. Please indicate the degree to which you experienced each emotion in response to the music.

You will then be asked a series of general questions regarding your experience of the vocal music excerpt.

Once you have completed this process for all 7 vocal music excerpts, please move to the next section.

Should you require support services, please refer to the **Participant Information Sheet** for referrals or contact your exisiting medical team.

Vocal Music Excerpt Number 1.

Please click on the following link to listen.

Vocal Music Excerpt Number 1.

12. **Q.1. Describe how you *felt* when you heard vocal music excerpt number 1.**

1 = Not at all. 5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
Happiness - Elation					
Sadness - Melancholy					
Surprise - Astonishment					
Calm - Contentment					
Interest - Expectancy					
Nostalgia - Longing					
Anxiety - Nervousness					
Pride - Confidence					
Anger - Irritation					
Love - Tenderness					
Disgust - Contempt					
Admiration - Awe					

13. **Q.2. If you would like to provide more detail about how this music impacted you, please do so here.**

14. **Q.3. Please indicate your response to each question in relation to the vocal music excerpt number 1.**

1 = Not at all.
5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
How intense was your emotional experience as a whole?					
How much did you like the music?					
How familiar were you with the music?					

15. **Q.4. Please provide an answer to the following questions regarding vocal music excerpt number 1.**

Mark only one oval per row.

	Yes	No
Did the music feature an event that startled you?		
Did the music have a strong and captivating pulse/rhythm?		
Did the music evoke a memory of an event from your life?		
Did the music evoke more general associations?		
Did the music evoke images while you were listening?		
Were you touched by the emotional expression of the music?		
Was it difficult to guess how the music (eg.melody) would continue over time?		

Did you find the music aesthetically valuable?	◯	◯

16. **Q.5. Please answer the following questions relating to vocal music excerpt number 1.**

Mark only one oval per row.

	Negative.	Positive.	Mixed.	Not Applicable.
If the music evoked a memory, the memory was:	◯	◯	◯	◯
If the music evoked an association, the association was:	◯	◯	◯	◯

17. **Q.6. What impacted you more?**

Mark only one oval.

- ◯ Music.
- ◯ Lyrics.
- ◯ Voice.

18. **Q.7. If you would like to provide more detail about how this music impacted you, please do so here.**

Vocal Music Excerpt Number 2.

Please click on the following link to listen.

Vocal Music Excerpt Number 2.

19. **Q.1. Describe how you *felt* when you heard vocal music excerpt number 2.**

1 = Not at all. 5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
Happiness - Elation					
Sadness - Melancholy					
Surprise - Astonishment					
Calm - Contentment					
Interest - Expectancy					
Nostalgia - Longing					
Anxiety - Nervousness					
Pride - Confidence					
Anger - Irritation					
Love - Tenderness					
Disgust - Contempt					
Admiration - Awe					

20. **Q.2. If you would like to provide more detail about how this music impacted you, please do so here.**

21. **Q.3. Please indicate our response to each question in relation to the vocal music excerpt number 2.**

1 = Not at all.
5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
How intense was your emotional experience as a whole?					
How much did you like the music?					
How familiar were you with the music?					

22. **Q.4. Please provide an answer to the following questions regarding vocal music excerpt number 2.**

Mark only one oval per row.

	Yes	No
Did the music feature an event that startled you?	◯	◯
Did the music have a strong and captivating pulse/rhythm?	◯	◯
Did the music evoke a memory of an event from your life?	◯	◯
Did the music evoke more general associations?	◯	◯
Did the music evoke images while you were listening?	◯	◯
Were you touched by the emotional expression of the music?	◯	◯
Was it difficult to guess how the music (eg.melody) would continue over time?	◯	◯

Did you find the music aesthetically valuable?	◯	◯

23. **Q.5. Please answer the following questions relating to vocal music excerpt number 2.**

Mark only one oval per row.

	Negative.	Positive.	Mixed.	Not Applicable.
If the music evoked a memory, the memory was:	◯	◯	◯	◯
If the music evoked an association, the association was:	◯	◯	◯	◯

24. **Q.6. What impacted you more?**

Mark only one oval.

- ◯ Music.
- ◯ Lyrics.
- ◯ Voice.

25. **Q.7. If you would like to provide more detail about how this music impacted you, please do so here.**

Vocal Music Excerpt Number 3.

Please click on the following link to listen.

Vocal Music Excerpt Number 3.

26. **Q.1. Describe how you *felt* when you heard vocal music excerpt number 3.**

1 = Not at all. 5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
Happiness - Elation					
Sadness - Melancholy					
Surprise - Astonishment					
Calm - Contentment					
Interest - Expectancy					
Nostalgia - Longing					
Anxiety - Nervousness					
Pride - Confidence					
Anger - Irritation					
Love - Tenderness					
Disgust - Contempt					
Admiration - Awe					

27. **Q.2. If you would like to provide more detail about how this music impacted you, please do so here.**

28. **Q.3. Please indicate our response to each question in relation to the vocal music excerpt number 3.**

1 = Not at all.
5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
How intense was your emotional experience as a whole?					
How much did you like the music?					
How familiar were you with the music?					

29. **Q.4. Please provide an answer to the following questions regarding vocal music excerpt number 3.**

Mark only one oval per row.

	Yes	No
Did the music feature an event that startled you?	◯	◯
Did the music have a strong and captivating pulse/rhythm?	◯	◯
Did the music evoke a memory of an event from your life?	◯	◯
Did the music evoke more general associations?	◯	◯
Did the music evoke images while you were listening?	◯	◯
Were you touched by the emotional expression of the music?	◯	◯
Was it difficult to guess how the music (eg.melody) would continue over time?	◯	◯

27. **Q.2. If you would like to provide more detail about how this music impacted you, please do so here.**

28. **Q.3. Please indicate our response to each question in relation to the vocal music excerpt number 3.**

1 = Not at all.
5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
How intense was your emotional experience as a whole?					
How much did you like the music?					
How familiar were you with the music?					

Did you find the music aesthetically valuable?		

30. **Q.5. Please answer the following questions relating to vocal music excerpt number 3.**

Mark only one oval per row.

	Negative.	Positive.	Mixed.	Not Applicable.
If the music evoked a memory, the memory was:				
If the music evoked an association, the association was:				

31. **Q.6. What impacted you more?**

Mark only one oval.

- Music.
- Lyrics.
- Voice.

32. **Q.7. If you would like to provide more detail about how this music impacted you, please do so here.**

Vocal Music Excerpt Number 4.

Please click on the following link to listen.

Vocal Music Excerpt Number 4.

33. **Q.1. Describe how you *felt* when you heard vocal music excerpt number 4.**

1 = Not at all. 5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
Happiness - Elation					
Sadness - Melancholy					
Surprise - Astonishment					
Calm - Contentment					
Interest - Expectancy					
Nostalgia - Longing					
Anxiety - Nervousness					
Pride - Confidence					
Anger - Irritation					
Love - Tenderness					
Disgust - Contempt					
Admiration - Awe					

34. **Q.2. If you would like to provide more detail about how this music impacted you, please do so here.**

35. **Q.3. Please indicate our response to each question in relation to the vocal music excerpt number 4.**

1 = Not at all.
5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
How intense was your emotional experience as a whole?					
How much did you like the music?					
How familiar were you with the music?					

36. **Q.4. Please provide an answer to the following questions regarding vocal music excerpt number 4.**

Mark only one oval per row.

	Yes	No
Did the music feature an event that startled you?		
Did the music have a strong and captivating pulse/rhythm?		
Did the music evoke a memory of an event from your life?		
Did the music evoke more general associations?		
Did the music evoke images while you were listening?		
Were you touched by the emotional expression of the music?		
Was it difficult to guess how the music (eg.melody) would continue over time?		

Did you find the music aesthetically valuable?	◯	◯

37. **Q.5. Please answer the following questions relating to vocal music excerpt number 4.**

Mark only one oval per row.

	Negative.	Positive.	Mixed.	Not Applicable.
If the music evoked a memory, the memory was:	◯	◯	◯	◯
If the music evoked an association, the association was:	◯	◯	◯	◯

38. **Q.6. What impacted you more?**

Mark only one oval.

- ◯ Music.
- ◯ Lyrics.
- ◯ Voice.

39. **Q.7. If you would like to provide more detail about how this music impacted you, please do so here.**

Vocal Music Excerpt Number 5.

Please click on the following link to listen.

Vocal Music Excerpt Number 5.

40. **Q.1. Describe how you *felt* when you heard vocal music excerpt number 5.**

1 = Not at all. 5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
Happiness - Elation					
Sadness - Melancholy					
Surprise - Astonishment					
Calm - Contentment					
Interest - Expectancy					
Nostalgia - Longing					
Anxiety - Nervousness					
Pride - Confidence					
Anger - Irritation					
Love - Tenderness					
Disgust - Contempt					
Admiration - Awe					

41. **Q.2. If you would like to provide more detail about how this music impacted you, please do so here.**

42. **Q.3. Please indicate our response to each question in relation to the vocal music excerpt number 5.**

1 = Not at all.
5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
How intense was your emotional experience as a whole?					
How much did you like the music?					
How familiar were you with the music?					

40. **Q.1. Describe how you *felt* when you heard vocal music excerpt number 5.**

1 = Not at all. 5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
Happiness - Elation					
Sadness - Melancholy					
Surprise - Astonishment					
Calm - Contentment					
Interest - Expectancy					
Nostalgia - Longing					
Anxiety - Nervousness					
Pride - Confidence					
Anger - Irritation					
Love - Tenderness					
Disgust - Contempt					
Admiration - Awe					

41. **Q.2. If you would like to provide more detail about how this music impacted you, please do so here.**

42. **Q.3. Please indicate our response to each question in relation to the vocal music excerpt number 5.**

1 = Not at all.
5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
How intense was your emotional experience as a whole?					
How much did you like the music?					
How familiar were you with the music?					

43. **Q.4. Please provide an answer to the following questions regarding vocal music excerpt number 5.**

Mark only one oval per row.

	Yes	No
Did the music feature an event that startled you?		
Did the music have a strong and captivating pulse/rhythm?		
Did the music evoke a memory of an event from your life?		
Did the music evoke more general associations?		
Did the music evoke images while you were listening?		
Were you touched by the emotional expression of the music?		
Was it difficult to guess how the music (eg.melody) would continue over time?		

Did you find the music aesthetically valuable?	◯	◯

44. **Q.5. Please answer the following questions relating to vocal music excerpt number 5.**

Mark only one oval per row.

	Negative.	Positive.	Mixed.	Not Applicable.
If the music evoked a memory, the memory was:	◯	◯	◯	◯
If the music evoked an association, the association was:	◯	◯	◯	◯

45. **Q.6. What impacted you more?**

Mark only one oval.

- ◯ Music.
- ◯ Lyrics.
- ◯ Voice.

46. **Q.7. If you would like to provide more detail about how this music impacted you, please do so here.**

Vocal Music Excerpt Number 6.

Please click on following link to listen.

Vocal Music Excerpt Number 6.

47. **Q.1. Describe how you *felt* when you heard vocal music excerpt number 6.**

1 = Not at all. 5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
Happiness - Elation					
Sadness - Melancholy					
Surprise - Astonishment					
Calm - Contentment					
Interest - Expectancy					
Nostalgia - Longing					
Anxiety - Nervousness					
Pride - Confidence					
Anger - Irritation					
Love - Tenderness					
Disgust - Contempt					
Admiration - Awe					

48. **Q.2. If you would like to provide more detail about how this music impacted you, please do so here.**

49. **Q.3. Please indicate our response to each question in relation to the vocal music excerpt number 6.**

1 = Not at all.
5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
How intense was your emotional experience as a whole?					
How much did you like the music?					
How familiar were you with the music?					

50. **Q.4. Please provide an answer to the following questions regarding vocal music excerpt number 6.**

Mark only one oval per row.

	Yes	No
Did the music feature an event that startled you?	◯	◯
Did the music have a strong and captivating pulse/rhythm?	◯	◯
Did the music evoke a memory of an event from your life?	◯	◯
Did the music evoke more general associations?	◯	◯
Did the music evoke images while you were listening?	◯	◯
Were you touched by the emotional expression of the music?	◯	◯
Was it difficult to guess how the music (eg.melody) would continue over time?	◯	◯

Did you find the music aesthetically valuable?	◯	◯

51. **Q.5. Please answer the following questions relating to vocal music excerpt number 6.**

Mark only one oval per row.

	Negative.	Positive.	Mixed.	Not Applicable.
If the music evoked a memory, the memory was:	◯	◯	◯	◯
If the music evoked an association, the association was:	◯	◯	◯	◯

52. **Q.6. What impacted you more?**

Mark only one oval.

- ◯ Music.
- ◯ Lyrics.
- ◯ Voice.

53. **Q.7. If you would like to provide more detail about how this music impacted you, please do so here.**

Vocal Music Excerpt Number 7.

Please click on the following link to listen.

Vocal Music Excerpt Number 7.

54. **Q.1. Describe how you *felt* when you heard vocal music excerpt number 7.**

1 = Not at all. 5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
Happiness - Elation					
Sadness - Melancholy					
Surprise - Astonishment					
Calm - Contentment					
Interest - Expectancy					
Nostalgia - Longing					
Anxiety - Nervousness					
Pride - Confidence					
Anger - Irritation					
Love - Tenderness					
Disgust - Contempt					
Admiration - Awe					

55. **Q.2. If you would like to provide more detail about how this music impacted you, please do so here.**

56. **Q.3. Please indicate our response to each question in relation to the vocal music excerpt number 7.**

1 = Not at all.
5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
How intense was your emotional experience as a whole?					
How much did you like the music?					
How familiar were you with the music?					

57. **Q.4. Please provide an answer to the following questions regarding vocal music excerpt number 7.**

Mark only one oval per row.

	Yes	No
Did the music feature an event that startled you?		
Did the music have a strong and captivating pulse/rhythm?		
Did the music evoke a memory of an event from your life?		
Did the music evoke more general associations?		
Did the music evoke images while you were listening?		
Were you touched by the emotional expression of the music?		
Was it difficult to guess how the music (eg.melody) would continue over time?		

Did you find the music aesthetically valuable?	◯	◯

58. **Q.5. Please answer the following questions relating to vocal music excerpt number 7.**

Mark only one oval per row.

	Negative.	Positive.	Mixed.	Not Applicable.
If the music evoked a memory, the memory was:	◯	◯	◯	◯
If the music evoked an association, the association was:	◯	◯	◯	◯

59. **Q.6. What impacted you more?**

Mark only one oval.

- ◯ Music.
- ◯ Lyrics.
- ◯ Voice.

60. **Q.7. If you would like to provide more detail about how this music impacted you, please do so here.**

Section 3. Music Preferences.

For the following items, please indicate your basic preference level for the music genres listed using the scale provided.

1 = Strongly Dislike.
3 = Neither Like or Dislike.
5 = Strongly Like.

Should you require support services, please refer to the **Participant Information Sheet** for referrals or contact your exisiting medical team.

61. **Please indicate your music preferences.**

Mark only one oval per row.

	1. Strongly Dislike.	2.	3. Neither Like or Dislike.	4.	5. Strongly Like.
Alternative					
Bluegrass					
Blues					
Classical					
Dance/Electronica					
Folk					
Funk					
Gospel					
Heavy Metal					
World					
Jazz					
New Age					
Oldies					
Opera					
Pop					
Punk					
Rap/hip-hop					
Reggae					
Religious					
Rock					

Soul/R&B Soul/R&B					
Soundtracks/theme Soundtracks/theme songs songs					

62. **Please answer the following questions regarding your preferred music.**

1 = Not at all.
5 = A lot.

Mark only one oval per row.

	1.	2.	3.	4.	5.
How influential are lyrics to your emotional experience of your preferred music?					
How influential is voice to your emotional experience of your preferred music?					
How influential is instrumentation to your emotional experience of your preferred music?					

63. **Is there anything else you'd like to tell us about your preferred music?**

Thank you for your participation in this research project.

Should you require support services, please refer to the **Participant Information Sheet** for referrals or contact your exisiting medical team.

64. I would like to:

Mark only one oval.

- Be informed of the outcome of this research project.
- Be contacted to participate in future research projects related to this topic.
- Be contacted to participate in group singing programs for wellbeing.

65. If you checked any of the options above, please provide your email address. This information will be removed before data analysis takes place.

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APPENDIX 6. Emotion Rating Scale (Jusin, 2013).

Section 1. Emotion Items.

Describe how you *felt* when you heard the music.

		Not at all	***A lot***
1	happiness – elation	0 1 2 3 4	
2	sadness – melancholy	0 1 2 3 4	
3	surprise – astonishment	0 1 2 3 4	
4	calm – contentment	0 1 2 3 4	
5	interest – expectancy	0 1 2 3 4	
6	nostalgia – longing	0 1 2 3 4	
7	anxiety – nervousness	0 1 2 3 4	
8	pride – confidence	0 1 2 3 4	
9	anger – irritation	0 1 2 3 4	
10	love – tenderness	0 1 2 3 4	
11	disgust – contempt	0 1 2 3 4	
12	admiration – awe	0 1 2 3 4	
13	How intense (strong) was your emotional experience as a whole?	0 1 2 3 4	
14	How much did you like the music?	0 1 2 3 4	
15	How familiar were you with the music?	0 1 2 3 4	

APPENDIX 7. MecScale (Juslin, 2013).

Section 2. Mechanism Items (MecScale)

1	Did the music feature an event that startled you? Yes □ No □
2	Did the music have a strong and captivating pulse/rhythm? Yes □ No □
3	Did the music evoke a memory of an event from your life? Yes □ No □ If *yes*, the memory was: Negative □ Positive □ Mixed □
4	Did the music evoke more general associations? Yes □ No □ If *yes*, the association was: Negative □ Positive □ Mixed □
5	Did the music evoke images while you were listening? Yes □ No □
6	Were you touched by the emotional expression of the music? Yes □ No □
7	Was it difficult to guess how the music (e.g., melody) would continue over time? Yes □ No □
8	Did you find the music aesthetically valuable? Yes □ No □
9	What impacted you more? Music □ Lyrics □

APPENDIX 8. Qualitative Responses to Brain Stem Reflex, Contagion and Episodic Memory.

Vocal Music Excerpt	BRECVEMA / Emotion	PTSD Group Responses	Non-PTSD Group Responses
"Rivedrai le foreste imbalsamate" from Act 3, Aida, composed by Giuseppi Verdi (Juslin, 2019). Performed by Maria Callas, Orchestra del Teatro alla Scala di Milano, Tito Gobbi and Tullio Serafin.	Brain Stem Reflex - Surprise - Astonishment	❖ "I'm not into opera. I found it quite boring and I was disinterested." ❖ "That type of music, although not in my playlist, does somewhat intrigue me." ❖ "I felt the loudness of the male voice startled me at first, I felt it through my whole body." ❖ "motivational. Vocally well presented." (sic) ❖ "Anxious." ❖ "The first half was too busy for me and made me feel anxiety and didn't really enjoy it the ending was more calming however." (sic) ❖ "Thought it initial felt aggressive in nature before calming down." (sic) ❖ "I had to fast forward when both voices were interacting too intense"	❖ "Too loud and too much going on." ❖ "The music is bery dramatic, heightens your senses more towards the anxiety and awarenes side." (sic) ❖ "Not something I would listen to but the increase in volume and the crescendo caused my heart rate to increase." ❖ "Was super irritating." ❖ "Male vocal - Strength, Passion Female vocal - sadness." ❖ "The impact of the male to female voice was significant - it was overpowering but I wanted to hear more." ❖ "Was a little intense in parts. I turned the volume down during." the playing as I found it a bit loud. That might be

Vocal Music Excerpt	BRECVEMA / Emotion	PTSD Group Responses	Non-PTSD Group Responses
			because the time of the day I participated in this research. ❖ Moments were melancholy but primarily the piece was jarring and put my nerves on end."
"Agnus Dei", Op. 11, composed by Samuel Barber. Performed by Edward Higginbottom and Choir of New College, Oxford.	Contagion Sadness-Melancholy	❖ "I felt like I was in the presence of our lord and saviour Jesus Christ." ❖ "This one to me is a song that when I am in a good place mentally, I would sit down in a meditation position and tune right into it. Love this." ❖ "I feel like it was from a sad part of a movie. Apocalypse Now perhaps?" ❖ "Reminded me of church services when I was a child." ❖ "I know the placement of this music in a critical and highly emotive scene in a war movie - and it made me sad to hear it again." ❖ "Again this reminded me of many Concerts that I went to when younger of My Mum singing in a	❖ "Something I'd listen to whilst getting a massage." ❖ "Excellent." ❖ "Instantly calming and comforting. engulfing, relaxing." ❖ "I didn't want this piece to stop. It was easy to immerse in and it felt good."

Vocal Music Excerpt	BRECVEMA / Emotion	PTSD Group Responses	Non-PTSD Group Responses
		choir.” ❖ “Initially liken to religious music but as progressed felt more around integrige like backing music in a space explore film clip.” (sic) ❖ “This music evoked an immediate memory / emotional response.”	
“I Still Call Australia Home” written and performed by Peter Allen.	Episodic Memory Nostalgia-Longing	❖ “Reminds me of flying back home after overseas travel.” ❖ “I remember this sone from when i was younger, being drunk and singing it at a nightclub. That was a fun time.” (sic) ❖ “I have loved this song for a long long time.” ❖ “Love this song. Evokes a mixture of happiness and sadness.” ❖ “Pleasant nostalgic feeling.” ❖ “This is quite a calming but image envoking piece for me of places Ive seen and great achievements made.” (sic) ❖ “Brings back childhood	❖ “Nice and calm! Level head.” ❖ “I love this song, I find it very relevant and meaningful for me.” ❖ “Main emotion of pride tempered with nostalgia and melancholy for things past and gone.” ❖ “Has sentiment as Australia is my home.” (sic)

Vocal Music Excerpt	BRECVEMA / Emotion	PTSD Group Responses	Non-PTSD Group Responses
		memories.” ❖ “Reflective regret work over family.” ❖ “joined in singing this one.” (sic) ❖ “An interesting one! Almost immediately sad.”	

APPENDIX 9. The BRECVEMA Framework and Associated Music Elements.

BRECVEMA FRAMEWORK - Musical Elements for Incorporation into Vocal Music Stimuli		
Mechanism	**Corresponding Music Elements**	**Music Stimuli Previously Used**
Brain Stem Reflex	● Loud chord with broad spectrum and sharp attack (Juslin and Laukka, 2004). ● 75 dBa peak sound level (Juslin and Laukka, 2004). ● Stimulus length, 37 seconds (Juslin and Laukka, 2004). ● Extreme or increasing loudness or tempo (Juslin *et al.,* 2014). ● Sudden sounds (Juslin *et al.,* 2014). ● Dissonant (Juslin *et al.,* 2014). ● Feature a fast or rapidly increasing temporal pattern (Juslin *et al.,* 2014). ● Loudness, speed, timbre (Juslin *et al.,* 2022). ● Extreme loudness or speed (Juslin and Laukka, 2004). ● Extreme features, high sound level, quick attack and sharp timbre that cannot be predicted from the syntactic structure of music (Juslin, 2013). ● Arouses surprise in the listener (Juslin, 2019). ● Increased fear-potentiated startle (Juslin and Laukka, 2004). ● Extreme or increasing loudness or speed (Juslin *et al.,* 2014). ● Sudden, loud, dissonant or feature a fast or rapidly increasing temporal pattern (Juslin *et al.,* 2014). ● Auditory event that suggests 'danger' (Juslin *et al.,* 2014). ● Fast, loud, noisy, very low or high frequency (Juslin and Västfjäll, 2008).	● Digital version of Prayer by Ernest Bloch (Jewish Life, No.1) (Sakka and Juslin, 2018a). ● Joseph Haydn's Symphony No. 94 ('Suprise') (Juslin *et al.,* 2014). ● Gustav Mahler's Symphony No. 10 'Finale' (Juslin *et al.,* 2014). ● *Infernal Dance of all Kashchei's Subjects* from *The Firebird*, a ballet and orchestral concert work composed by Igor Stravinsky in 1910 (performed by the Berlin Radio Symphony Orchestra, conducted by Lorin Maazel) (Barradas *et al.,* 2021).

	● Sound qualities indicative of change such as sudden or extreme sounds, sounds that change quickly or sounds that are the result of strong force or large size (Juslin and Västfjäll, 2008). ● Sensory dissonance is suggestive of danger in the environment (Ploog, 1992). ● Startle or suprise by the loud beginning of a piece of music (Arjmand *et al.,* 2017). ● Loud drum and brass chord at beginning (Barradas *et al.,* 2021).	
Rhythmic Entrainment	● Faster rhythm than heart rate (Juslin, 2002). ● Gradual adjustment of an internal body rhythm toward an external rhythm in the music (Sakka and Juslin, 2018a).	-

Episodic Memory	● Popular radio program song associated with happy memories of holidays, relaxation, summer and fun. (Juslin *et al.,* 2022). ● Stimulus length 39 sec (Sakka and Juslin, 2018a). ● Well known soundtrack (Juslin *et al.,* 2014). ● Music representing adolescence or young adulthood of participants (Juslin *et al.,* 2014). ● Emotionally vivid (Juslin *et al.,* 2014). ● Past is triggered by the music (Juslin *et al.,* 2022). ● Nostalgia when song evokes a vivid personal memory from a time in life (Juslin *et al.,* 2022). ● Songs assumed to be associated with happy memories of fun, holidays and summer for most people (Juslin *et al.,* 2022). ● Stronger emotional responses to music popular during their youth than to music popular later in life (Juslin, 2013).	● Sommar, Sommar, Sommar written by Sten Carlberg and Erik Sandström performed by Åke Jelvings Orchestra (Juslin *et al.,* 2022). ● Star Wars Theme (Juslin *et al.,* 2014). ● *Wedding March in C major,* from Suite of Incidental Music (Op. 61) to William Shake-speare's play A Midsummer Night's Dream, written by Felix Mendelssohn-Bartholdy in 1842 (performed by Mar-gareta Lindgren on a church pipe organ) (Barradas *et al.,* 2021).
Evaluative Conditioning	● Positive or negative association (Juslin *et al.,* 2022) ● Festive songs (Juslin *et al.,* 2022). ● Emotion induced by a piece of music due to stimulus paired repeatedly with other positive or negative stimuli (Juslin and Västfjäll, 2008). ● Responses are highly personal and syncratic - difficult to study (Juslin and Västfjäll 2008).	-

Visual Imagery	• Metaphorical mapping of musical structure (Juslin *et al.,* 2022) • Mental images of landscape suggested by a piece of 'new age' music whilst at home (Juslin *et al.,* 2022). • Repetitions, predictability in melodic, harmonic and rhythmic elements, slow tempo are especially effective in stimulating vivid imagery (McKinney and Tims, 1995). • Shaped by the unfolding structure of the music (Juslin *et al.,* 2022).	
Emotional Contagion	• Cello and/or violin as they are closest sounding instruments to the human voice (Juslin *et al.,* 2022) • Slow tempo, minor mode, subtle dynamics (Juslin and Laukka, 2003) • Slow tone attacks (Juslin and Laukka, 2003) • Stimulus length 122 sec (Sakka and Juslin, 2018b) • Expressive voice-like cello timbre (Juslin *et al.,* 2014) • Sad emotional expression (Juslin *et al.,* 2014) • Mimicry of perceived voice-like emotional expression of the music (Juslin *et al.,* 2022) • Sadness at slow, quiet, low-pitched performance on cello that features much vibrato and rubato (Juslin *et al.,* 2022) • Music features expressive human voices or instruments that are highly reminiscent of a human voice (Juslin *et al.,* 2022). • Expressive acoustic patterns similar to those that occur in speech (Juslin and Laukka, 2003).	• *Concerto for Two Violins in A minor*, Op. 3, No.8, II. Larghetto e Spiritoso, Antonio Vivaldi performed by Accademia Ziliniana. (Sakka and Juslin, 2018a). • *Prayer* from Jewish Life No. 1, written by Ernest Bloch in 1924 (performed by Jay Bacal, using the Vienna Symphonic Library) (Barradas *et al.,* 2021).

	• Andante moderato, slow tempo, low pitch, legato articulation and minor mode (Barradas *et al.,* 2021).	
Musical Expectancy	• Violations of melody/harmonic expectations (Juslin *et al.,* 2014). • Delays or confirms a listeners schematic expectations (Juslin *et al.,* 2014). • Unexpected melodic, harmonic or rhythmic sequence (Juslin *et al.,* 2014). • Response to the gradual unfolding of the syntactical structure of the music and its expected continuation (Juslin *et al.,* 2022). • Anxiety due to uncertainty created by phrases without a clear tonal centre in an “avant-garde” piece (Juslin *et al.,* 2022). • Emotional reactions to music are induced when the listeners musical expectations are disrupted by new or unprepared harmony (Juslin, 2013). • Culturally relevant i.e. dissonance chords. • Slow dance where tempo and rhythm relate to movement and emotions, waltz or marching rhythm (Juslin, 2013).	• Ernest Bloch (1880–1959) titled Prayer, from Jewish Life No.1, composed for cello and piano, with expression marked as andante moderato (circa 80 bpm) (Juslin *et al.,* 2014). • *Lyric Suite, Three Pieces for String Orchestra*, Part III: Adagio Appassionato, written by Alban Berg in 1926 (performed by Wiener Philharmoniker, conducted by Claudio Abbado) (Barradas *et al.,* 2021).
Aesthetic Judgement	• Subjective evaluation of the aesthetic value of music based on an individual set of weighted criteria (Juslin, 2013). • Exceptional skill of a great performer (Juslin *et al.,* 2022). • Evoking pleasure with a beautiful sonata (Barradas *et al.,* 2021	

APPENDIX 10. SPSS Outputs from Statistical Analysis.

Please note that raw data from questionnaire has not been provided due to ethical considerations and on advice from Dr Michael Bonshor. Only material related to content within findings is included. Full SPSS analysis available. Should further examination be required, please contact the author via email 2219763@student.uwtsd.ac.uk.

Independent-Samples Kruskal-Wallis Test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of 1 Happiness-Elation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.472	Retain the null hypothesis.
2	The distribution of 1 Sadness - Melancholy is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.452	Retain the null hypothesis.
3	The distribution of 1 Surprise - Astonishment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.301	Retain the null hypothesis.
4	The distribution of 1 Calm - Contentment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.123	Retain the null hypothesis.
5	The distribution of 1 Nostaligia - Longing is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.219	Retain the null hypothesis.
6	The distribution of 1 Anxiety - Nervousness is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.922	Retain the null hypothesis.
7	The distribution of 1 Pride - Confidence is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.831	Retain the null hypothesis.
8	The distribution of 1 Anger - Irritation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.399	Retain the null hypothesis.

9	The distribution of 2 Happiness-Elation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.174	Retain the null hypothesis.
10	The distribution of 2 Sadness-Melancholy is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.384	Retain the null hypothesis.
11	The distribution of 2 Surprise-Astonishment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.890	Retain the null hypothesis.
12	The distribution of 2 Calm-Contentment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.680	Retain the null hypothesis.
13	The distribution of 2 Nostalgia-Longing is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.571	Retain the null hypothesis.
14	The distribution of 2 Anxiety-Nervousness is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.[c]	Unable to compute.
15	The distribution of 2 Pride-Confidence is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.584	Retain the null hypothesis.
16	The distribution of 2 Anger-Irritation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.[c]	Unable to compute.
17	The distribution of 3 Happiness-Elation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.186	Retain the null hypothesis.
18	The distribution of 3 Sadness-Melancholy is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.877	Retain the null hypothesis.
19	The distribution of 3 Suprise-Astonishment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.[c]	Unable to compute.
20	The distribution of 3 Calm-Contentment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.047	Reject the null hypothesis.
21	The distribution of 3 Nostalgia-Longing is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.511	Retain the null hypothesis.
22	The distribution of 3 Anxiety-Nervousness is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.[c]	Unable to compute.
23	The distribution of 3 Pride-Confidence is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.048	Reject the null hypothesis.
24	The distribution of 3 Anger-Irritation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.[c]	Unable to compute.

25	The distribution of 4 Happiness-Elation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.696	Retain the null hypothesis.
26	The distribution of 4 Sadness-Melancholy is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.614	Retain the null hypothesis.
27	The distribution of 4 Suprise-Astonishment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.063	Retain the null hypothesis.
28	The distribution of 4 Calm-Contentment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.071	Retain the null hypothesis.
29	The distribution of 4 Nostalgia-Longing is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.312	Retain the null hypothesis.
30	The distribution of 4 Anxiety-Nervousness is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.519	Retain the null hypothesis.
31	The distribution of 4 Pride-Confidence is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.980	Retain the null hypothesis.
32	The distribution of 4 Anger-Irritation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.190	Retain the null hypothesis.
33	The distribution of 5 Happiness-Elation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.780	Retain the null hypothesis.
34	The distribution of 5 Sadness-Melancholy is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.163	Retain the null hypothesis.
35	The distribution of 5 Suprise-Astonishment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.562	Retain the null hypothesis.
36	The distribution of 5 Calm-Contentment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.936	Retain the null hypothesis.
37	The distribution of 5 Nostalgia-Longing is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.784	Retain the null hypothesis.
38	The distribution of 5 Anxiety-Nervousness is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.[c]	Unable to compute.
39	The distribution of 5 Pride-Confidence is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.847	Retain the null hypothesis.
40	The distribution of 5 Anger-Irritation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.754	Retain the null hypothesis.

41	The distribution of 6 Happiness-Elation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.[c]	Unable to compute.
42	The distribution of 6 Sadness-Melancholy is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.770	Retain the null hypothesis.
43	The distribution of 6 Suprise-Astonishment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.872	Retain the null hypothesis.
44	The distribution of 6 Calm-Contentment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.422	Retain the null hypothesis.
45	The distribution of 6 Nostalgia-Longing is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.896	Retain the null hypothesis.
46	The distribution of 6 Anxiety-Nervousness is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.842	Retain the null hypothesis.
47	The distribution of 6 Pride-Confidence is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.800	Retain the null hypothesis.
48	The distribution of 6 Anger-Irritation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.[c]	Unable to compute.
49	The distribution of 7 Happiness-Elation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.491	Retain the null hypothesis.
50	The distribution of 7 Sadness-Melancholy is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.439	Retain the null hypothesis.
51	The distribution of 7 Suprise-Astonishment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.688	Retain the null hypothesis.
52	The distribution of 7 Calm-Contentment is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.086	Retain the null hypothesis.
53	The distribution of 7 Nostalgia-Longing is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.969	Retain the null hypothesis.
54	The distribution of 7 Anxiety-Nervousness is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.[c]	Unable to compute.
55	The distribution of 7 Pride-Confidence is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.317	Retain the null hypothesis.
56	The distribution of 7 Anger-Irritation is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.676	Retain the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

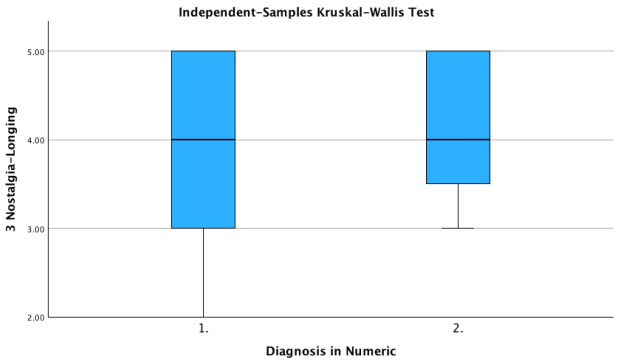
c. There is only one group with valid data.

Descriptive Statistics for Vocal Music Excerpt 3 and 4.

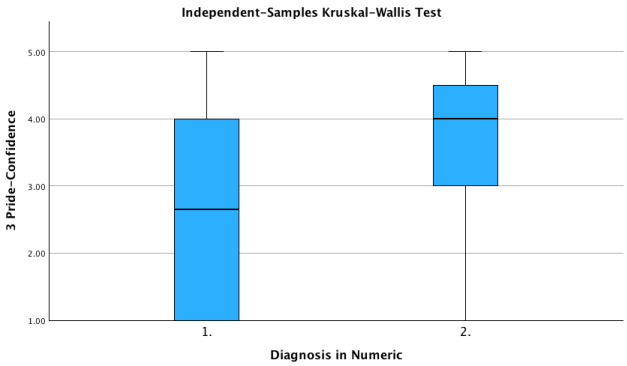
Statistics

Diagnosis in Numeric			3 Calm-Contentment	3 Pride-Confidence	4 Calm-Contentment	4 Suprise-Astonishment
0	N	Valid	16	16	16	16
		Missing	0	0	0	0
	Mean		3.7500	3.6250	3.0000	1.1875
	Median		4.0000	4.0000	2.5000	1.0000
	Std. Deviation		.93095	1.31022	1.15470	.54391
	Skewness		.000	-1.023	.594	3.030
	Std. Error of Skewness		.564	.564	.564	.564
	Kurtosis		-.915	.236	-1.243	9.093
	Std. Error of Kurtosis		1.091	1.091	1.091	1.091
	Percentiles	25	3.0000	3.0000	2.0000	1.0000
		50	4.0000	4.0000	2.5000	1.0000
		75	4.7500	4.7500	4.0000	1.0000
1	N	Valid	16	16	16	16
		Missing	0	0	0	0
	Mean		2.9375	2.5821	2.2137	1.5860
	Median		3.0000	2.6565	2.0000	1.0000
	Std. Deviation		1.12361	1.49838	1.16747	.80195
	Skewness		-.185	.296	.949	1.015
	Std. Error of Skewness		.564	.564	.564	.564
	Kurtosis		-.352	-1.371	.714	-.543
	Std. Error of Kurtosis		1.091	1.091	1.091	1.091
	Percentiles	25	2.0000	1.0000	1.0000	1.0000
		50	3.0000	2.6565	2.0000	1.0000
		75	4.0000	4.0000	3.0000	2.0000

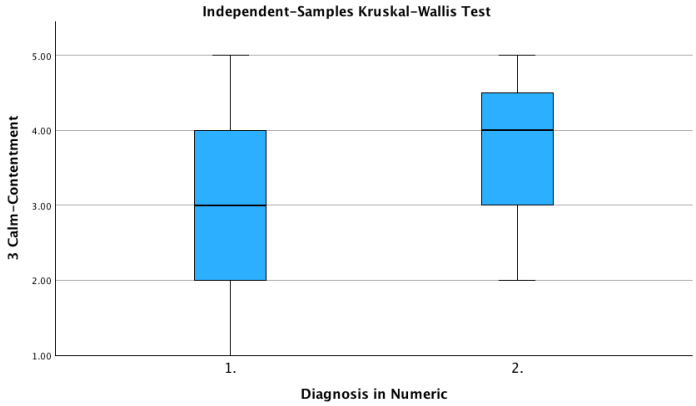
Diagnosis and Nostalgia-Longing for Vocal Music Excerpt 3.



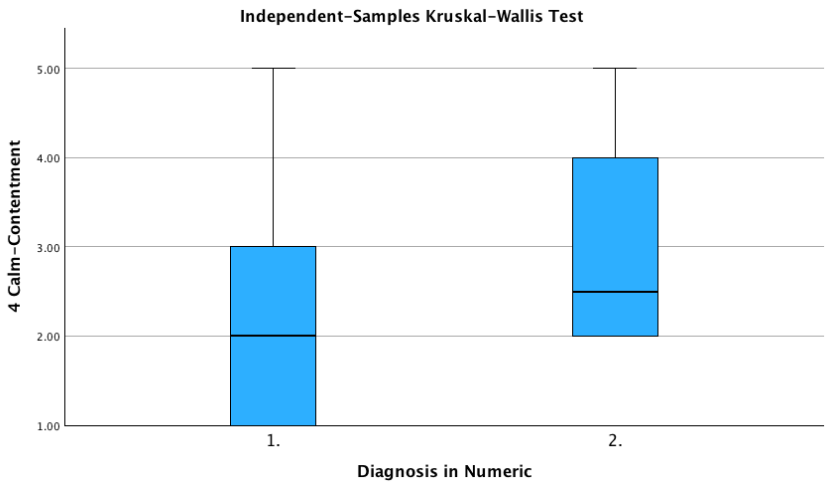
Diagnosis and Pride-Confidence for Vocal Music Excerpt 3.



Diagnosis and Calm-Contentment for Vocal Music Excerpt 3.



Diagnosis and Calm-Contentment for Vocal Music Excerpt 4.



Independent Samples Kruskal-Wallis Test - Diagnosis and Likeability, Intensity and Familiarity.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of Intensity3.1Log is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.286	Retain the null hypothesis.
2	The distribution of Intensity4.1Log is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.391	Retain the null hypothesis.
3	The distribution of Likeability3.2.1Log is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.921	Retain the null hypothesis.
4	The distribution of Likeability4.2.1Log is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.063	Retain the null hypothesis.
5	The distribution of Familiarity3.3Log is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.565	Retain the null hypothesis.
6	The distribution of Familiarity4.3Log is the same across categories of Diagnosis in Numeric.	Independent-Samples Kruskal-Wallis Test	.504	Retain the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

Pearson's Chi-Square Test Vocal Music Excerpt 6 - Brain Stem Reflex.

Diagnosis in Numeric * 6 Brain Stem Reflex

Crosstab

			6 Brain Stem Reflex 1.00	6 Brain Stem Reflex 2.00	Total
Diagnosis in Numeric	0	Count	4	12	16
		Expected Count	2.0	14.0	16.0
	1	Count	0	16	16
		Expected Count	2.0	14.0	16.0
Total		Count	4	28	32
		Expected Count	4.0	28.0	32.0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.571[a]	1	.033		
Continuity Correction[b]	2.571	1	.109		
Likelihood Ratio	6.119	1	.013		
Fisher's Exact Test				.101	.051
Linear-by-Linear Association	4.429	1	.035		
N of Valid Cases	32				

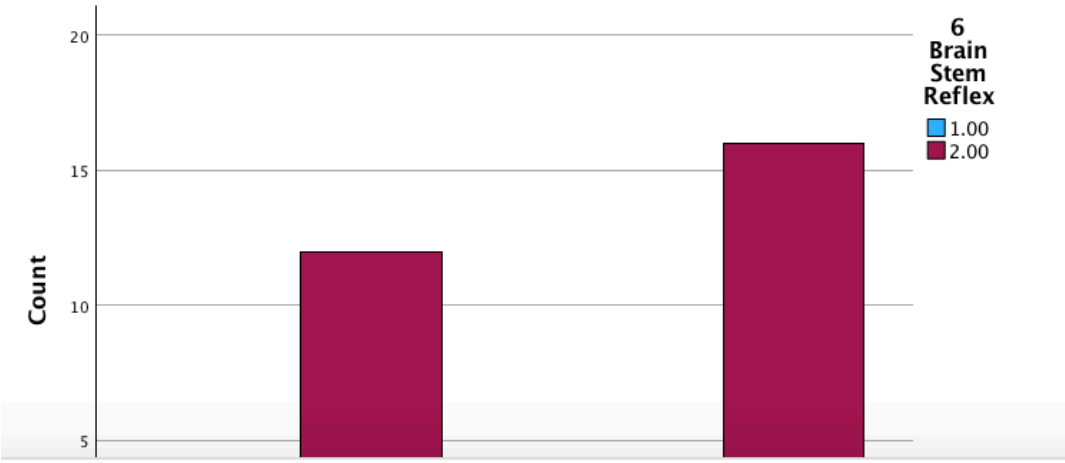
a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.00.

b. Computed only for a 2x2 table

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.378	.033
	Cramer's V	.378	.033
N of Valid Cases		32	

Bar Chart



Pearson's Chi-Square Tests - Voice, Music, Lyrics for each Vocal Music Excerpt.

Diagnosis in Numeric * VME1VML2

Crosstab

		VME1VML2										
		1.00			2.00			3.00			Total	
		N	%	Standardized Residual	N	%	Standardized Residual	N	%	Standardized Residual	N	%
Diagnosis in Numeric	0	10	45.5%	-.2	4	50.0%	.1	1	100.0%	.7	15	48.4%
	1	12	54.5%	.2	4	50.0%	-.1	0	0.0%	-.7	16	51.6%
Total		22	100.0%		8	100.0%		1	100.0%		31	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	1.151[a]	2	.562	.836		
Likelihood Ratio	1.536	2	.464	.836		
Fisher-Freeman-Halton Exact Test	1.149			.836		
Linear-by-Linear Association	.596[b]	1	.440	.524	.333	.197
N of Valid Cases	31					

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .48.

b. The standardized statistic is -.772.

Directional Measures

			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance	Exact Significance
Nominal by Nominal	Lambda	Symmetric	.042	.122	.334	.738	
		Diagnosis in Numeric Dependent	.067	.193	.334	.738	
		VME1VML2 Dependent	.000	.000	.[c]	.[c]	
	Goodman and Kruskal tau	Diagnosis in Numeric Dependent	.037	.019		.573[d]	.836
		VME1VML2 Dependent	.007	.020		.816[d]	.836

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Cannot be computed because the asymptotic standard error equals zero.

d. Based on chi-square approximation

Symmetric Measures

		Value	Approximate Significance	Exact Significance
Nominal by Nominal	Phi	.193	.562	.836
	Cramer's V	.193	.562	.836
	Contingency Coefficient	.189	.562	.836
N of Valid Cases		31		

Diagnosis in Numeric * VME2VML2

Crosstab

		VME2VML2										
		1.00			2.00			3.00			Total	
		N	%	Standardized Residual	N	%	Standardized Residual	N	%	Standardized Residual	N	%
Diagnosis in Numeric	0	4	50.0%	.0	6	50.0%	.0	6	50.0%	.0	16	50.0%
	1	4	50.0%	.0	6	50.0%	.0	6	50.0%	.0	16	50.0%
Total		8	100.0%		12	100.0%		12	100.0%		32	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.000[a]	2	1.000	1.000		
Likelihood Ratio	.000	2	1.000	1.000		
Fisher-Freeman-Halton Exact Test	.130			1.000		
Linear-by-Linear Association	.000[b]	1	1.000	1.000	.588	.176
N of Valid Cases	32					

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 4.00.

b. The standardized statistic is .000.

Directional Measures

			Value	Asymptotic Standard Error[a]	Approximate T	Approximate Significance	Exact Significance
Nominal by Nominal	Lambda	Symmetric	.000	.000	.[b]	.[b]	
		Diagnosis in Numeric Dependent	.000	.000	.[b]	.[b]	
		VME2VML2 Dependent	.000	.000	.[b]	.[b]	
	Goodman and Kruskal tau	Diagnosis in Numeric Dependent	.000	.000		1.000[c]	1.000
		VME2VML2 Dependent	.000	.000		1.000[c]	1.000

a. Not assuming the null hypothesis.

b. Cannot be computed because the asymptotic standard error equals zero.

c. Based on chi-square approximation

Symmetric Measures

		Value	Approximate Significance	Exact Significance
Nominal by Nominal	Phi	.000	1.000	1.000
	Cramer's V	.000	1.000	1.000
	Contingency Coefficient	.000	1.000	1.000
N of Valid Cases		32		

Diagnosis in Numeric * VME3VML2

Crosstab

		VME3VML2										
		1.00			2.00			3.00			Total	
		N	%	Standardized Residual	N	%	Standardized Residual	N	%	Standardized Residual	N	%
Diagnosis in Numeric	0	3	75.0%	.7	1	50.0%	.0	12	46.2%	-.3	16	50.0%
	1	1	25.0%	-.7	1	50.0%	.0	14	53.8%	.3	16	50.0%
Total		4	100.0%		2	100.0%		26	100.0%		32	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	1.154[a]	2	.562	.792		
Likelihood Ratio	1.200	2	.549	.792		
Fisher-Freeman-Halton Exact Test	1.328			.792		
Linear-by-Linear Association	1.042[b]	1	.307	.461	.231	.129
N of Valid Cases	32					

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is 1.00.

b. The standardized statistic is 1.021.

Directional Measures

			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance	Exact Significance
Nominal by Nominal	Lambda	Symmetric	.091	.221	.393	.694	
		Diagnosis in Numeric Dependent	.125	.298	.393	.694	
		VME3VML2 Dependent	.000	.000	.[c]	.[c]	
	Goodman and Kruskal tau	Diagnosis in Numeric Dependent	.036	.059		.572[d]	.792
		VME3VML2 Dependent	.024	.045		.469[d]	.792

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Cannot be computed because the asymptotic standard error equals zero.

d. Based on chi-square approximation

Symmetric Measures

		Value	Approximate Significance	Exact Significance
Nominal by Nominal	Phi	.190	.562	.792
	Cramer's V	.190	.562	.792
	Contingency Coefficient	.187	.562	.792
N of Valid Cases		32		

Diagnosis in Numeric * VME4VML2

Crosstab

		VME4VML2										
		1.00			2.00			3.00			Total	
		N	%	Standardized Residual	N	%	Standardized Residual	N	%	Standardized Residual	N	%
Diagnosis in Numeric	0	11	52.4%	.3	0	0.0%	-1.0	4	50.0%	.1	15	48.4%
	1	10	47.6%	-.3	2	100.0%	1.0	4	50.0%	-.1	16	51.6%
Total		21	100.0%		2	100.0%		8	100.0%		31	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	2.017[a]	2	.365	.595		
Likelihood Ratio	2.788	2	.248	.540		
Fisher-Freeman-Halton Exact Test	1.714			.595		
Linear-by-Linear Association	.083[b]	1	.773	.836	.464	.148
N of Valid Cases	31					

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .97.

b. The standardized statistic is .288.

Directional Measures

			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance	Exact Significance
Nominal by Nominal	Lambda	Symmetric	.040	.211	.186	.853	
		Diagnosis in Numeric Dependent	.067	.347	.186	.853	
		VME4VML2 Dependent	.000	.000	.[c]	.[c]	
	Goodman and Kruskal tau	Diagnosis in Numeric Dependent	.065	.024		.377[d]	.595
		VME4VML2 Dependent	.015	.023		.644[d]	.704

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Cannot be computed because the asymptotic standard error equals zero.

d. Based on chi-square approximation

Symmetric Measures

		Value	Approximate Significance	Exact Significance
Nominal by Nominal	Phi	.255	.365	.595
	Cramer's V	.255	.365	.595
	Contingency Coefficient	.247	.365	.595
N of Valid Cases		31		

Diagnosis in Numeric * VME5VML2

Crosstab

		VME5VML2										
		1.00			2.00			3.00			Total	
		N	%	Standardized Residual	N	%	Standardized Residual	N	%	Standardized Residual	N	%
Diagnosis in Numeric	0	1	50.0%	.0	10	55.6%	.3	5	41.7%	-.4	16	50.0%
	1	1	50.0%	.0	8	44.4%	-.3	7	58.3%	.4	16	50.0%
Total		2	100.0%		18	100.0%		12	100.0%		32	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.556[a]	2	.757	.851		
Likelihood Ratio	.558	2	.757	.851		
Fisher-Freeman-Halton Exact Test	.814			.851		
Linear-by-Linear Association	.356[b]	1	.551	.767	.383	.198
N of Valid Cases	32					

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 1.00.

b. The standardized statistic is .597.

Directional Measures

			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance	Exact Significance
Nominal by Nominal	Lambda	Symmetric	.067	.111	.580	.562	
		Diagnosis in Numeric Dependent	.125	.203	.580	.562	
		VME5VML2 Dependent	.000	.000	.[c]	.[c]	
	Goodman and Kruskal tau	Diagnosis in Numeric Dependent	.017	.046		.764[d]	.851
		VME5VML2 Dependent	.014	.039		.638[d]	.851

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Cannot be computed because the asymptotic standard error equals zero.

d. Based on chi-square approximation

Symmetric Measures

		Value	Approximate Significance	Exact Significance
Nominal by Nominal	Phi	.132	.757	.851
	Cramer's V	.132	.757	.851
	Contingency Coefficient	.131	.757	.851
N of Valid Cases		32		

Diagnosis in Numeric * VME6VML2

Crosstab

		VME6VML2										
		1.00			2.00			3.00			Total	
		N	%	Standardized Residual	N	%	Standardized Residual	N	%	Standardized Residual	N	%
Diagnosis in Numeric	0	7	36.8%	-.8	6	75.0%	1.0	2	66.7%	.4	15	50.0%
	1	12	63.2%	.8	2	25.0%	-1.0	1	33.3%	-.4	15	50.0%
Total		19	100.0%		8	100.0%		3	100.0%		30	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	3.649[a]	2	.161	.169		
Likelihood Ratio	3.764	2	.152	.304		
Fisher-Freeman-Halton Exact Test	3.578			.169		
Linear-by-Linear Association	2.584[b]	1	.108	.180	.090	.062
N of Valid Cases	30					

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is 1.50.

b. The standardized statistic is -1.608.

Directional Measures

			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance	Exact Significance
Nominal by Nominal	Lambda	Symmetric	.192	.152	1.173	.241	
		Diagnosis in Numeric Dependent	.333	.237	1.173	.241	
		VME6VML2 Dependent	.000	.000	.[c]	.[c]	
	Goodman and Kruskal tau	Diagnosis in Numeric Dependent	.122	.116		.171[d]	.169
		VME6VML2 Dependent	.090	.087		.073[d]	.100

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Cannot be computed because the asymptotic standard error equals zero.

d. Based on chi-square approximation

Symmetric Measures

		Value	Approximate Significance	Exact Significance
Nominal by Nominal	Phi	.349	.161	.169
	Cramer's V	.349	.161	.169
	Contingency Coefficient	.329	.161	.169
N of Valid Cases		30		

Descriptive Statistics for Voice, Music and Lyrics.

Statistics

		VME1VML2	VME2VML2	VME3VML2	VME4VML2	VME5VML2	VME6VML2	VME7VML2
N	Valid	31	32	32	31	32	30	32
	Missing	2	1	1	2	1	3	1
Mean		1.3226	2.1250	2.6875	1.5806	2.3125	1.4667	1.5000
Median		1.0000	2.0000	3.0000	1.0000	2.0000	1.0000	1.5000
Std. Deviation		.54081	.79312	.69270	.88597	.59229	.68145	.50800
Variance		.292	.629	.480	.785	.351	.464	.258

GLOSSARY

Affect	An umbrella term that covers all positively or negatively valenced states such as emotion, mood and preferences (Juslin and Västfjäll, 2008).
Arousal	Activation of the autonomic nervous system (ANS). Physiological arousal is one of the components of an emotional response but can occur in the absence of emotions (Juslin and Västfjäll, 2008).
Emotions	Relatively intense affective responses that usually involve a number of sub-components - subjective feeling, physiological arousal, expression, action tendency and regulation which are more or less synchronised. Emotions focus on specific objects and last minutes to hours (Juslin and Västfjäll, 2008).
Emotion Induction	All instances where music evokes an emotion in a listener, regardless of the nature of the process that evoked the emotion (Juslin and Västfjäll, 2008).
Emotion Perception	All instances where a listener perceives or recognises expressed emotions in music without necessarily feeling an emotion (Juslin and Västfjäll, 2008).
Emotion Regulation	The process of shaping which emotions one has, when one has them, and how one experiences or expresses these emotions (Gross, 2015, p.6).
Feeling	The subjective experience of emotion (or mood). This component is commonly measured via self-report and reflects any or all of the other emotion components (Juslin and Västfjäll, 2008).
Mood	Affective states that feature a lower felt intensity than emotions, that do not have a clear object, and that last much longer than emotions - several hours to days (Juslin and Västfjäll, 2008).
Musical Emotions	A short term for emotions that are induced by music (Juslin and Västfjäll, 2008).
Music Stimuli	Sound organised across time (Levitin *et al.,* 2018, p.52).
Preferences	Long-term evaluations of objects or persons with a low intensity ie. liking a particular music style (Juslin and Västfjäll, 2008).

Valence	The subjective value of an event, object, person, or the other entity in the life space of the individual. An entity that attracts the individual has positive valence whereas one that repels the individual has negative valence (APA, 2018).
Vocal Music Stimuli	Sound organised across time incorporating non-verbal vocalisations including humming, cries, laughter, moans and screams (Pisanski *et al.,* 2022) and verbal vocalisations including singing and speech (Welsh, 2005).