Pop psych: the impact of music and lyrics on emotion

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Abstract

While the effects of music on emotion have been heavily researched, the added influence of lyrics is notoriously difficult to measure. Generally, negative music has been linked with decreased wellbeing and increased aggressive behaviour, but the specific contribution of lyrics remains largely unexplored. To further understand this interaction, original pop songs were written and produced to test the effect of lyrics while controlling for the effect of music. Using a 3 x 2 within-subject design, participants ($N = 61$) listened to songs in three categories – vitality, unease and sublimity – building on research by Zentner et al. (2008). Each category had two versions with either positive or negative lyrics. 172 words (86 positive, 86 negative) were selected from Warriner et al.'s (2013) database and incorporated into the three song pairs. The track order was counterbalanced between participants. After each song, perceived emotions were reported using the three-dimensional model (Schimmack & Grob, 2000). Participants also responded with felt levels of prosocial (or antisocial) sentiment induced by the stimuli. Intended music emotions were accurately perceived by participants. Importantly, songs with negative lyrics led to lower feelings of prosociality than songs with positive lyrics. This is the first empirical demonstration that lyrics have an effect on felt emotion above and beyond music category. By using such stimuli in future research, along with the use of more subconscious measures, the effects of music and lyrics could be harnessed to facilitate emotions associated with wellbeing and prosocial behaviour.

Keywords: music, lyrics, pop, emotion, valence, stimuli, prosocial

Declaration

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Nathan Leigh Jones

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Pop psych: the impact of music and lyrics on emotion

Music is inescapable. Whether it is heard from a café, a gym or a supermarket, up to a third of our waking hours are set to a soundtrack (Juslin, Liljeström, Västfjäll, Barradas, & Silva, 2008). Now, with personal devices and streaming platforms experiencing monumental growth, we are consuming music like never before (Yang et al., 2008). Through its activation of the human brain, particularly the 'reward circuitry' involved in emotional regulation (Zentner, Grandjean and Scherer, 2008) it is clear that our relationship with music is incredibly unique. Still, there is much to be understood about the psychological effects of mainstream music, particularly its lyrical component.

Do lyrics matter?

The overwhelming majority research on music and emotion focuses on score (i.e. the musical composition independent of lyrics), and stimuli typically consist of Western classical music (Stratton & Zalanowski, 1994). However, far more indicative of real-world listening habits is popular music (or simply 'pop'), a broad genre with a staggeringly large global audience (Ballard, Dodson & Bazzini, 1999). Added to this, pop songs almost always contain lyrical content (Brattico et al., 2011). Given the pervasiveness of pop in everyday life and the lower levels of wellbeing associated with its listeners (Clark & Giacomantonio, 2013), it is remarkable how little attention has been given to the effect of lyrics (Kreyer & Mukherjee, 2009). Clearly, this genre of music has been embraced by the masses, yet its popularity in psychological research is sorely lacking.

Pop is an umbrella term encompassing many musical flavours, but is perhaps best defined as "music of the people" (Dvorak, 2016, p. 191). Emerging in the mid-1950s throughout the US and UK, this broad style of music is identified by its 'verse-chorus' structure and infectious

hooks (Frith, Straw & Street, 2001). Lyrics in pop music are as diverse as the genre itself. While they no doubt have the ability to foster meaningful relationships and bring about positive social change (Belcher & Haridakis, 2013), they have become far more aggressive and antisocial over time (DeWall, Pond, Campbell & Twenge, 2011). Specifically, modern lyrics are using fewer words that describe prosocial companionship (e.g., 'us', 'ours'), while words associated with antisocial behaviour (e.g., 'hate', 'kill') are appearing in higher frequency (Interiano et al., 2018). Pop lyrics also tend to address themes such as sex, drugs, violence and misogyny, yet somehow manage to slip under the radar of public scrutiny (Ballard et al., 1999). When coupled with an irresistible score, listeners are often more likely to accept the legitimacy of an otherwise controversial message (Sellnow & Sellnow, 2001).

Despite the lower frequency of positive lyrics, the most common way that music is used by modern-day listeners is for personal mood regulation (Zentner et al., 2008). Americans spend more money on music consumption each year than they do on medication (Levitin, 2006), suggesting that music is fast becoming our new drug of choice. Indeed, music therapists often use pop music to treat emotional disorders and, specifically, the analysis of lyrics is one of the most common interventions (Dvorak, 2016). With dramatic shifts in the way music is now distributed, we are more equipped in accessing this emotional medicine than ever before. However, the right 'prescription' is often hard to find.

In recent years, popular streaming platform Spotify has sought to address this need by introducing curated mood-based playlists. Unfortunately, in such offerings, lyrics and score do not always seem to be given an equal footing. One such example is an upbeat song called *Out Of My Head* (Xeon et al., 2017) that was recently included in the official Spotify playlist 'Happy Pop'. While the melody itself sounded relatively happy, the lyrics were less than uplifting (*"You*

*got me doin' all this stupid sh*t, you f*ck me up like this"*). When compiling such playlists, it appears that the pleasantness of lyrics is given a lower priority than the pleasantness of score. This observation reflects that fact that lyrics are often regarded as the least important factor in the overall enjoyment of a song, with the beat, vocals and melody ascribed as the most important elements (Ballard et al., 1999).

Of course, it could simply be argued that some people are 'lyrics people' and others are 'music people'. On the surface, this concept appears to hold some merit (Sellnow & Sellnow, 2001), yet lyrics have also been shown to affect behaviour on a deeper level. In a study by Fischer and Greitemeyer (2006), two groups of male participants were exposed to music with either misogynous or neutral lyrics. Afterwards, in another seemingly unrelated study, they were asked to administer hot chili sauce on sandwiches made for both males and females. Participants who had been primed with misogynous lyrics applied more of the uncomfortable hot sauce on sandwiches for women than they did for men. This experiment suggests that antisocial lyrics can have subconscious real-world implications.

Much has been done to regulate antisocial lyrics in music, with mixed success. The US introduced mandatory 'explicit lyrics' labels on album covers in the 1990s but, while it brought awareness to offensive language, it also seemed to indicate which albums were "cool" in the eyes of impressionable young people (Samole, 1996). While the censorship of artistry is a controversial topic, there is still uncertainty as to which aspects of music affect antisocial behaviour. While Zentner et al. (2008) would argue that there is no such thing the music emotion of 'anger', it appears that the addition of objectively aggressive lyrics would no doubt evoke this feeling. Such confusion surrounding this area highlights the need for a greater understanding of

the impact that lyrics have in modern music, and which musical features (if any) contribute to levels of aggressive and antisocial behaviour.

Feeling the music

It is the interplay between both lyrics and score that brings a song to life (Booth, 1976), so in order to understand the effects of lyrics on emotion, research into the effects of score must be given equal importance. The Geneva Emotional Music Scale (GEMS) by Zentner et al. (2008) is a significant contribution to this field that offers extraordinary insight into music perception. Importantly, Zentner et al. argue that music emotions are inherently different to human emotions. For example, one might describe a song as sad or joyful, but would be unlikely to use words such as 'shameful' or 'embarrassing' to explain its musicality (Putman, 1987). While music can portray some emotions, it seems incapable of portraying others (Juslin & Laukka, 2004).

In creating the GEMS, a confirmatory factor analysis was carried out using participants' self-rated emotional responses to various styles of music. Zentner et al. (2008) identified 40 music emotions that fell into nine factors and three broad categories: vitality (power, joyful activation), unease (tension, sadness) and sublimity (wonder, transcendence, tenderness, nostalgia, peacefulness). These categories were later validated by Trost, Ethofer, Zentner and Vuilleumier (2011), using a factor analysis of brain activity recorded via functional MRI (see Figure 1 [A]). While lyrics were not taken into consideration in Zenter et al.'s study – a somewhat surprising fact, considering the genre of pop was explored – these findings offer helpful insights into the three distinct categories of vitality, unease and sublimity in the area of music emotion.

Mode. A far more common way of categorising music emotion is simply by mode – that is, whether a song is in a 'major' key or a 'minor' key. Songs in a major key often feel 'happier',

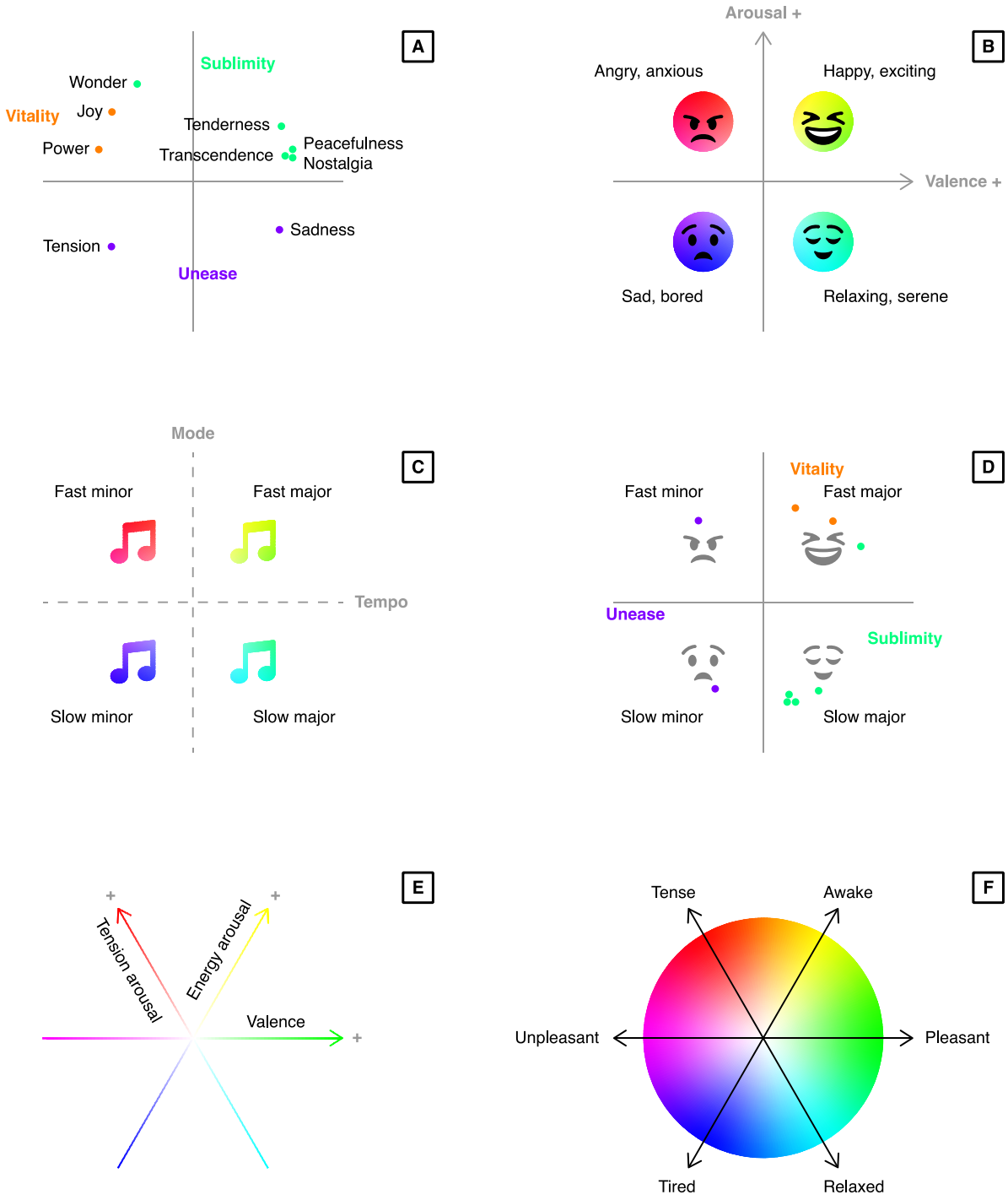

Figure 1. **[A]:** Zentner et al.'s (2008) nine sub-categories of music emotion, arranged as per Trost et al.'s (2011) factor analysis. **[B]:** Thayer's (1978) model of mood with representative emojis. **[C]:** The interaction of tempo and mode. **[D]:** Trost et al.'s factor analysis (shown in [A]) rotated clockwise 90° to align with Thayer's model of emotion (shown in [B]) and tempo and mode (shown in [C]). **[E]:** Schimmack and Grob's (2000) three-dimensional model of emotion. **[F]:** Schimmack and Grob's model with dimension labels and their parallels with the RGB colour wheel.

while songs in a minor key are generally perceived as being ‘sadder’ (Brattico et al., 2011). Early pop music from the 1960s favoured a major key and accounted for 85% of songs on the Billboard charts, but today only 40% of hits are written in a major key (Schellenberg & von Scheve, 2012). While pop forefathers The Beatles released music in both modes, their songs in a minor key had more ‘negative’ lyrics than those in a major key (Whissell & Whissell, 2000). This suggests that the lyrical pleasantness of a pop song has traditionally been consistent with its mode. In the context of Zentner et al.’s (2008) three categories, it would appear that vitality and sublimity typically fall into a major mode, while unease would likely fall into a minor mode (see Figure 1 [B]).

Tempo. Another factor that can alter the musical emotion of a song is its pace. This is generally referred to as tempo, calculated by the number of beats per minute (BPM). Songs with a lower BPM tend to be considered ‘sadder’, while a higher BPM is typically associated with a happier song (Brattico et al., 2011). This relationship between mode and tempo can be seen in Figure 1 [C]. Songs in the category of vitality – that is, happier sounding music, generally at a faster tempo – tend to rely more on their beat rather than their lyrics, while slower, sadder songs seem to be intensified by their lyrical component (Gordon, Schön, Magne, Astésano & Besson, 2010).

Mixed cues. On the whole, charting pop songs are getting slower in tempo over time, and the effect is more pronounced for songs in a major key (Schellenberg & von Scheve, 2012). This trend indicates that mixed emotional cues are becoming ever popular in pop music – that is, there is an abundance of ‘fast minor’ and ‘slow major’ songs that can be perceived as both happy and sad at the same time (Ladinig & Schellenberg, 2012). These mixed emotional cues become even more complicated when lyrics are introduced (Eerola & Vuoskoski, 2011). For example, a song

that is perceived as ‘positive’ due to its major key and upbeat tempo can have another conflicting layer of emotion when negative lyrics are added. It seems that modern listeners enjoy these interesting effects. While somewhat enigmatic, Schellenberg and von Scheve explain that such mixed cues are perhaps enjoyed in the same way that one might appreciate the Edvard Munch painting ‘The Scream’. Simply put, emotions identified in a stimulus are not always the same emotions that are then felt.

Models of emotion

Research on music and emotion is made even more complicated by the lack of understanding about what an emotion actually is (Scherer, 2004). With so many unanswered questions, it is extremely difficult to extend the principles of emotion into the domain of music (Kim et al., 2010). Traditionally, emotions explored in neuroscience have operated on a black-and-white dichotomy of ‘happy’ and ‘sad’, but this simple approach does not capture the vast range of emotion found in music (Trost et al., 2011). Due to these unique properties, music has become the most popular stimulus used in research on emotions (Kim et al., 2010). It appears that this multi-layered complexity of music is more of a blessing than a curse, and can act as a gateway into a deeper understanding of human emotion.

Discrete model. Unfortunately, the self-reporting of musically-induced emotional responses is “deceptively simple” (Juslin & Laukka, 2004, p. 222), and tools in which participants simply report whether or not they experience a given emotion can be somewhat limited (Trohidis, Tsoumakas, Kalliris & Vlahavas, 2011). One such approach often used in research is the ‘discrete model’. Heavily investigated by Ekman (1992) and popularised in the animated movie *Inside Out* (Lasseter & Docter, 2015), the discrete model posits that all human emotions are comprised of a handful of basic emotions such as joy, sadness, anger, fear and

disgust. However, this model does not fully capture the complexity of emotion found in music. For example, disgust and surprise are difficult emotions to musically evoke (Mihalcea & Strapparava, 2012), and the discrete model appears to be lacking certain emotions such as 'tenderness' (Eerola & Vuoskoski, 2011).

Two-dimensional model. Another popular approach to research on emotion is the two-dimensional model proposed by Thayer (1978) where 'arousal' exists on one axis and 'valence' – that is, the degree of pleasantness – exists on the other (i.e. Figure 1 [B]). This simple model not only makes conceptual sense, but it aligns with the cross-section of mode and tempo, and even the three music categories of vitality, sublimity and unease (Zentner et al., 2008, Trost et al., 2011). These three models have been combined on Figure 1 [D] to demonstrate this cohesion. Russell (1980) expanded upon this premise with the circumplex model, mapping a number of descriptors around the 'arousal-valence' cross-section (e.g., tired, astonished, calm, etc.). While Russell's findings add depth to the two-dimensional model, this reliance on semantics can become impractical and somewhat subjective in emotion research.

Three-dimensional model. Instead, many researchers of music and emotion favour the 'three-dimensional model', as it maintains the simplicity of the two-dimensional model while adding extra clarity to the scale of 'arousal'. Originally proposed by Wilhelm Wundt, these dimensions were later validated by Schimmack and Grob (2000) as 'pleasant–unpleasant' (valence), 'awake–tired' (energy) and 'tense–relaxed' (tension), as outlined in Figure 1 [E] and [F]. Not dismissing previous models of emotion, the three-dimensional model is relatively consistent with other major theories (i.e. Figure 1 [A]-[D]). Importantly, Eerola and Vuoskoski (2011) found that this three-scale approach of the dimensional model has higher overall reliability compared to a discrete model when assessing emotions induced by music. In the same

way that red, green and blue light has the capacity to generate an endless array of colours, the variance of 'emotional colour' (i.e. valence, energy and tension) can give rise to an infinite spectrum of emotions.

Challenges in research

The complexities of separating lyrics from score have caused much difficulty for researchers (Mori & Iwanaga, 2014). A melody and the words being sung are almost impossible to unravel (Interiano et al., 2018) and this interplay tends to deter researchers from using lyrics in their stimuli at all (e.g., Hunter, Schellenberg & Schimmack, 2008). Added to this, lyrics can often be vague in nature and somewhat open to interpretation (Ballard et al., 1999). With this area of research being avoided, most studies on the effect of lyrics simply focus on their negative properties and tend to use sweeping generalisations (e.g., the aggressiveness of heavy metal) rather than offer nuanced analysis (Stratton & Zalanowski, 1994).

Duration. In utilising music stimuli for experiments, there is a degree of uncertainty about its recommended duration (Eerola & Vuoskoski, 2011). Many studies have tested participants with tracks that run as briefly as 30 seconds in length (e.g., Hunter et al., 2008), but this is not indicative of the three- to four-minute duration of real-world pop songs (Bannister, 2017). Recent findings reinforce the notion that full-length songs tend to improve the overall quality of data collection (Aljanaki, Yang & Soleymani, 2017). Thus, it is important that materials accurately represent the way in which music is consumed in real-world situations, as stimuli that are too short in duration do not appear to be sufficient in conveying reliable levels of musical emotion.

Familiarity. While access to real-world stimuli is readily available in the form of commercially-released music, this approach can be problematic for two reasons. Firstly, the use

of popular music in research is often limited by copyright restrictions. As stimuli cannot be redistributed freely amongst researchers, the datasets using this copyrighted material are usually not made public (Aljanaki et al., 2017). Secondly, commercial music tracks that are already known by participants can present additional challenges in gauging accurate emotional responses. Functional MRI scans have shown that the familiarly of a song is a key component in how a listener will feel towards it (Pereira et al., 2011). Specifically, prior exposure to a song often elicits greater levels of enjoyment (Ritossa & Rickard, 2004), suggesting that 'mere exposure' effects might contaminate preferences and confound results (i.e. Zajonc, 1968).

Lyrical validity. To avoid familiarity and copyright constraints, some researchers turn to older, more obscure songs. Unfortunately, such pieces of music have not necessarily been designed to elicit the emotions that researchers are seeking to elicit. For example, in an effort to measure the effects of sad lyrics, Stratton and Zalanowski (1994) selected a dramatic song from 1929 titled 'Why Was I Born?'. This seemingly upsetting ballad was intended to act as a negative stimulus, yet it also contained positive words such as 'hope', 'giving' and 'love'. According to Linguistic Inquiry and Word Count (LIWC), an application created by Pennebaker, Booth, Boyd and Francis (2015) to evaluate the emotional properties of text, this song contains only three negative words: 'cry', 'poor' and 'fool'. Furthermore, 'cry' is the only word that the software identifies as having the feeling of sadness. While Stratton and Zalanowski's study was otherwise well-designed, advancements in our understanding of linguistic emotion offer greater opportunities to better measure the emotional effects of lyrics.

Another noteworthy contribution to this burgeoning field of language analysis is a database created by Warriner, Kuperman and Brysbaert (2013) that details the emotional attributes of 13,915 English words. With 'vacation' being the most positive stimulus and

'paedophile' being the most negative, Warriner et al.'s findings offer unprecedented insight into the pleasantness of particular words and the sentiment they elicit. In addition to pleasantness (valence), the intensity of each word was also measured (arousal) along with its of sense of control (dominance). Such resources offer rich potential for selecting more appropriate lyrical stimuli in music research.

Lyrical manipulation. While lyrical validity is important, other potentially confounding musical factors must also be considered. Many studies that have explored the effects of negative lyrics have failed to implement a control condition (i.e. positive lyrics, or no lyrics) to separate the effects of lyrics from the effects of score (Ali & Peynircioğlu, 2006). This limitation can be seen in the 'hot sauce' study previously mentioned (Fischer & Greitemeyer, 2006), where existing songs were arbitrarily deemed 'misogynous' by the researchers. Commercial releases are inherently unique in their artistry, so outcomes cannot be drawn unless an adequate control has been established. Song lyrics should therefore be intentionally manipulated while all other musical variables are kept constant – a difficult task to achieve when using existing music that, by its very nature, has only one lyrical condition.

Perceived and felt emotion. Perhaps the biggest issue surrounding research on music and emotion is the general confusion about what is actually being measured. The difference between emotions heard in the music ('perceived' emotion) and emotions experienced by the listener ('felt' emotion) is a critical distinction to make (Trost et al., 2011). This conceptualisation is somewhat counterintuitive and, as such, very few studies have articulated this difference in music research (Dibben, 2004). While important in theory, this distinction is rather blurred in practice (Gabrielsson, 2002). Due to this ambiguity, most listeners tend to make a fundamental attribution error when reporting on the emotional effects of music, often mistaking

perceived emotion for their own felt emotion (Trohidis et al., 2011). Also, emotional and intellectual responses do not occur simultaneously, so the reporting of both 'felt' and 'perceived' emotion can be a difficult task for participants to undertake (Gabrielsson, 2002). Despite these problems, there is growing recognition surrounding the importance of measuring both 'perceived' and 'felt' responses in research on music and emotion (Kim et al., 2010).

Current study

These challenges are merely a handful of limitations when investigating the impact of lyrics on emotion. Indeed, determining emotional affect through music is an expansive, interdisciplinary task that requires knowledge of musical theory, auditory perception and psychology (Kim et al., 2010). Thus, the current study seeks to use the broad methods of composition, technology and psychology to further understand the effect of lyrics on emotion while controlling for various music conditions. To do this effectively, original songs were created for this study, based on the three all-encompassing categories of music emotion (i.e. Zentner et al., 2008) and using an empirical foundation of lyrical valence (i.e. Warriner et al., 2013). As the resulting materials might be useful in future research projects that seek to investigate the isolated effects of lyrics and score on emotion, an analysis of the effectiveness of these stimuli will be provided. It is expected that music in the category of vitality will be perceived as more pleasant and energetic, more tense in the category of unease, and less energetic in the category of sublimity. It is also expected that the manipulation of positive and negative lyrics will affect levels of perceived emotion in each song. Most importantly, this project will investigate whether individual characteristics (i.e. age, gender, music ability, attitude towards pop music) will predict the degree to which individuals are affected by lyrics, particularly their levels of felt prosocial emotion.

Method

Participants

Sixty-one participants (39 female, 22 male) volunteered to participate in this study. Of these participants, 24 were first-year psychology students who participated for partial course credit. Additionally, 37 participants from the general public offered to participate in exchange for a Snickers bar and the chance to win a one-year subscription to Spotify Premium. The average age was 24 years old (*SD* = 7, range = 18–49). English was the first language spoken by 77% of participants, with self-rated levels of English speaking at 91% (*SD* = 16, range = 18–100).

Apparatus

Stimuli were presented through QC35 acoustic noise cancelling headphones (Bose, Massachusetts, USA) in order to exclude unwanted noise and provide a more immersive experience. All tracks were exported as high-quality 44.1 kHz stereo WAV files. Participants were seated in front of an iMac computer, and were able to set the music at their desired volume. Customised software was written in Xojo (Xojo Inc., Texas, USA) to facilitate the presentation of stimuli and the recording of responses.

Stimuli

The stimuli consisted of three original songs designed to convey the music categories of vitality (‘Everything You Are’), unease (‘Look Around’), and sublimity (‘Being Me’[1]), incorporating research by Zentner et al. (2008). The lyrics to these three songs can be seen in Table 1. Each song also had three different lyrical conditions (positive, negative and instrumental), making a total of nine tracks. Lyrics for each song were constructed from the database of 13,915 words by Warriner et al. (2013), with the complete list of words selected shown in Table 2. As the valence of these words ranged from 1 to 9 (1 = negative, 9 = positive),

Table 1.1

Lyrics for the song 'Everything You Are' (vitality)

Section	Positive	Negative
Verse 1	**Valuable**[84] like a **masterpiece**[53] Yes you are, yes you are **Magical**[51] like a **symphony**[76] Yes you are, yes you are	**Hazardous**[84] like a **heart disease**[53] Yes you are, yes you are **Dangerous**[51] like a **guillotine**[76] Yes you are, yes you are
Chorus 1	You're just so **beautiful**[7] I see the **sunshine**[74] in your heart You're just so **wonderful**[86] Now I know everything you are Now I know everything you are Yes you are, yes you are	You're just so **poisonous**[7] I see the **monster**[74] in your heart You're just so **venomous**[86] Now I know everything you are Now I know everything you are Yes you are, yes you are
Verse 2	**Miracle**[55] like a **butterfly**[13] Yes you are, yes you are **Heavenly**[34] like a **lullaby**[50] Yes you are, yes you are	**Sinister**[55] like a **homicide**[13] Yes you are, yes you are **Sickening**[34] like a **paedophile**[50] Yes you are, yes you are
Chorus 2	You're so **adorable**[2] I see the **sweetness**[75] in your heart You're so **phenomenal**[64] Now I know everything you are Now I know everything you are Now I know everything you are Yeah	You're so **unbearable**[2] I see the **bullshit**[75] in your heart You're so **despicable**[64] Now I know everything you are Now I know everything you are Now I know everything you are Yeah
Chorus 3	All your **tranquillity**[79] It's a **vacation**[83] to my heart All your **simplicity**[69] Everything you are Now I know everything you are Yes you are, yes you are	All your **dishonesty**[79] It's a **betrayal**[83] to my heart All your **insanity**[69] Everything you are Now I know everything you are Yes you are, yes you are
Outro	You're like **gingerbread**[24] You're like **lemonade**[43] You're like **paradise**[59] Or a **holiday**[35] You're like **chocolate**[15] You're like **strawberry**[72] Oh, and now I know Everything you are, yeah Yes you are	You're like **polio**[24] You're like **leprosy**[43] You're like **diarrhea**[59] Or a **cavity**[35] You're like **heroin**[15] You're like **cyanide**[72] Oh, and now I know Everything you are, yeah Yes you are

Note. Words in **bold** were chosen from Warriner et al.'s (2013) database and numbered as per Table 2.

Table 1.2

Lyrics for the song 'Look Around' (unease)

Section	Positive	Negative
Verse 1	This world is a **daydream**[17] What a **fantasy**[20] we're in If you come to your senses You can see the **positive**[65]	This world is a **nightmare**[17] What a **tragedy**[20] we're in If you come to your senses You can see the **negative**[65]
Chorus 1	Take a look at all the **brightness**[12] Take a look at all the **greatness**[30] There's nothing but **amazement**[6] to be found See the **meadow**[54] and the **sunrise**[73] See the **ocean**[58] and the **moonlight**[56] Well, all you have to do is look around All you have to do is look around All you have to do	Take a look at all the **sadness**[12] Take a look at all the **madness**[30] There's nothing but **injustice**[6] but to be found See the **sickness**[54] and the **sorrow**[73] See the **cancer**[58] and the **chemo**[56] Well, all you have to do is look around All you have to do is look around All you have to do
Verse 2	This world is **abundant**[1] All it ever does is **give**[25] So, if life has a reason Then the reason is to **live**[45]	This world is **deceitful**[1] All it ever does is **lie**[25] So, if life has a reason Then the reason is to **die**[45]
Chorus 2	Take a look at every **daybreak**[16] Take a look at every **snowflake**[70] There's nothing but **enjoyment**[19] to be found Every **tree**[81] and every **flower**[21] Every **breeze**[11] and every **shower**[68] Well, all you have to do is look around All you have to do is look around All you have to do is look	Take a look at every **torture**[16] Take a look at every **slaughter**[70] There's nothing but **destruction**[19] to be found Every **threat**[81] and every **bombing**[21] Every **war**[11] and every **killing**[68] Well, all you have to do is look around All you have to do is look around All you have to do is look
Bridge	Around and around And around we're spinning Look what **love**[46] has done	Around and around And around we're spinning Look what **hate**[46] has done
Chorus 3	Take a look at all the **goodness**[28] Take a look at all the **kindness**[41] There's nothing but **affection**[4] to be found Every **child**[14] and every **mother**[57] Every **kiss**[42] and every **lover**[48] Well, all you have to do is look around, yeah All you have to do is look around Yeah, yeah All you have to do is look around	Take a look at all the **violence**[28] Take a look at all the **vengeance**[41] There's nothing but **oppression**[4] to be found Every **cult**[14] and every **racist**[57] Every **gang**[42] and every **rapist**[48] Well, all you have to do is look around, yeah All you have to do is look around Yeah, yeah All you have to do is look around

Note. Words in **bold** were chosen from Warriner et al.'s (2013) database and numbered as per Table 2.

Table 1.3

Lyrics for the song 'Being Me' (sublimity)

Section	Positive version	Negative version
Verse 1	Listen to the way I feel inside Listen to the **beauty**[8] of my life Here I stand See how **free**[22] I am	Listen to the way I feel inside Listen to the **trauma**[8] of my life Here I stand See how **weak**[22] I am
Chorus 1	All I ever was All I'll ever be Is **limitless**[44] and **effortless**[18] A life of **honesty**[37] Everyone will know Everyone will see I'm **passionate**[60], **affectionate**[5] I'm being who I am Being me, being me Being me, being me	All I ever was All I'll ever be Is **powerless**[44] and **meaningless**[18] A life of **misery**[37] Everyone will know Everyone will see I'm **nothingness**[60], **incompetent**[5] I'm being who I am Being me, being me Being me, being me
Verse 2	Can you see the **joy**[39] behind my eyes? Can you read the **peace**[61] between the lines? Here I stand See how **proud**[67] I am	Can you see the **fear**[39] behind my eyes? Can you read the **pain**[61] between the lines? Here I stand See how **crushed**[67] I am
Chorus 2	All I ever was All I'll ever be Is **prosperous**[66], **adventurous**[3] A life of **victory**[85] Everyone will know Everyone will see This **happiness**[31], **magnificence**[52] I'm being who I am Being me, being me Being me, being me	All I ever was All I'll ever be Is **terrified**[66], **unsatisfied**[3] A life of **agony**[85] Everyone will know Everyone will see This **loneliness**[31], **unhappiness**[52] I'm being who I am Being me, being me Being me, being me
Ad lib	**Gentle**[23], **soulful**[71] **Golden**[27], **hopeful**[38] **Brave**[10] as I can be **Perfect**[63], **peaceful**[62] **Honest**[36], **truthful**[82] **Glad**[26] as I can be **Happy**[32], **joyful**[40] **Treasured**[80], **thoughtful**[78] **Loved**[47] as I can be **Healthy**[33], **thankful**[77] **Lucky**[49], **grateful**[29] **Blessed**[9] as I can be	**Angry**[23], **helpless**[71] **Battered**[27], **spineless**[38] **Hurt**[10] as I can be **Fearful**[63], **soulless**[62] **Frightened**[36], **hopeless**[82] **Scared**[26] as I can be **Stupid**[32], **worthless**[40] **Ugly**[80], **useless**[78] **Sad**[47] as I can be **Lonely**[33], **loveless**[77] **Broken**[49], **lifeless**[29] **Lost**[9] as I can be
Outro	Being me, being me Listen to the way I feel inside	Being me, being me Listen to the way I feel inside

Note. Words in **bold** were chosen from Warriner et al.'s (2013) database and numbered as per Table 2.

Table 2

Complete list of chosen words from Warriner et al.'s (2013) database with valence, arousal and dominance ratings

		Positive					Negative				
No.	Song	Word	Valence	Arousal	Domin.	ID	Matching word	Valence	Arousal	Domin.	ID
1	U	abundant	7.55	4.21	5.81	42	deceitful	2.60	5.18	4.11	3144
2	V	adorable	7.40	4.66	6.83	167	unbearable	2.10	5.76	3.38	12987
3	S	adventurous	7.37	6.67	5.71	185	unsatisfied	2.81	4.61	3.90	13183
4	U	affection	7.89	5.64	6.60	207	oppression	2.67	4.57	2.94	8450
5	S	affectionate	7.23	4.77	6.90	208	incompetent	2.77	4.50	2.81	6246
6	U	amazement	7.29	6.30	6.43	351	injustice	2.45	6.45	3.27	6398
7	V	beautiful	7.61	5.71	6.17	1010	poisonous	2.52	5.67	4.00	9202
8	S	beauty	7.58	4.89	5.60	1011	trauma	2.89	4.87	2.70	12770
9	S	blessed	7.50	3.55	5.32	1219	lost	2.53	5.11	3.85	7235
10	S	brave	7.38	4.95	6.84	1444	hurt	2.45	4.72	3.73	6018
11	U	breeze	7.61	3.20	4.55	1470	war	2.23	6.27	3.27	13548
12	U	brightness	7.05	4.39	5.79	1492	sadness	2.40	2.81	3.84	10587
13	V	butterfly	7.23	3.20	5.51	1650	homicide	1.50	6.10	2.92	5872
14	U	child	7.20	5.33	5.20	2031	cult	2.77	5.48	3.61	2993
15	V	chocolate	7.63	5.14	5.88	2060	heroin	2.74	4.62	3.67	5761
16	U	daybreak	7.16	3.95	5.30	3101	torture	1.40	5.09	2.76	12661

17	U	daydream	7.15	3.20	6.77	3103	nightmare	1.79	5.83	3.21	8194
18	S	effortless	7.10	3.43	7.00	3960	meaningless	2.95	3.05	3.57	7554
19	U	enjoyment	8.37	5.48	6.56	4122	destruction	2.53	5.62	3.78	3361
20	U	fantasy	7.15	6.18	6.35	4474	tragedy	2.11	6.80	3.02	12710
21	U	flower	7.30	3.67	6.43	4769	bombing	2.10	7.11	3.42	1321
22	S	free	8.25	5.38	6.50	4930	weak	2.95	4.90	5.32	13603
23	S	gentle	7.42	3.17	6.95	5149	angry	2.53	6.20	4.11	423
24	V	gingerbread	7.00	4.18	6.18	5190	polio	2.67	5.00	3.44	9212
25	U	give	7.73	4.57	5.72	5202	lie	2.39	4.81	4.72	7070
26	S	glad	7.55	3.71	7.00	5208	scared	2.80	6.10	4.20	10712
27	S	golden	7.79	4.25	5.67	5270	battered	2.95	3.86	3.22	971
28	U	goodness	7.38	5.20	7.37	5282	violence	2.71	5.95	3.24	13444
29	S	grateful	7.50	4.29	7.00	5359	lifeless	2.24	3.55	2.81	7076
30	U	greatness	7.76	4.43	6.76	5382	madness	2.86	6.25	4.18	7323
31	S	happiness	8.48	6.50	7.05	5595	loneliness	2.35	4.09	3.61	7207
32	S	happy	8.47	6.05	7.21	5596	stupid	2.84	4.34	4.03	11966
33	S	healthy	7.76	4.19	7.00	5679	lonely	2.67	4.37	3.33	7208
34	V	heavenly	7.89	4.95	6.75	5705	sickening	2.53	5.05	3.80	11139
35	V	holiday	7.18	4.93	6.37	5843	cavity	2.60	4.77	4.96	1871
36	S	honest	8.16	4.00	6.70	5881	frightened	2.45	5.61	3.05	4964
37	S	honesty	7.43	3.32	6.81	5882	misery	2.20	4.82	3.80	7767

38	S	hopeful	7.44	4.84	6.58	5906	spineless	2.95	4.57	4.10	11604
39	S	joy	8.21	5.55	7.00	6722	fear	2.93	6.14	3.32	4524
40	S	joyful	8.21	5.53	7.05	6723	worthless	1.89	4.45	2.71	13829
41	U	kindness	7.65	3.96	6.95	6823	vengeance	2.53	5.23	4.04	13364
42	U	kiss	7.78	6.05	6.52	6835	gang	2.71	6.55	5.37	5073
43	V	lemonade	7.05	4.63	6.00	7024	leprosy	2.25	4.38	3.35	7035
44	S	limitless	7.11	5.83	6.05	7113	powerless	2.90	3.95	3.04	9328
45	U	live	7.95	4.71	6.50	7159	die	1.67	6.90	3.28	3443
46	U	love	8.00	5.36	5.92	7246	hate	1.96	6.26	4.47	5635
47	S	loved	7.65	5.59	6.68	7247	sad	2.10	3.49	3.84	10583
48	U	lover	8.05	7.45	6.37	7252	rapist	1.30	6.33	2.21	9863
49	S	lucky	7.32	5.30	5.36	7266	broken	2.75	4.86	3.76	1512
50	V	lullaby	7.57	3.79	6.05	7273	paedophile	1.26	5.05	3.37	8847
51	V	magical	8.23	5.88	5.30	7330	dangerous	2.33	6.81	2.56	3077
52	S	magnificence	7.47	3.95	6.93	7339	unhappiness	1.89	4.41	2.96	13096
53	V	masterpiece	7.14	4.70	6.00	7503	heart disease	2.09	5.80	3.38	5685
54	U	meadow	7.30	2.62	6.15	7547	sickness	2.40	3.95	2.80	11142
55	V	miracle	7.30	5.52	5.26	7750	sinister	2.63	5.10	4.15	11205
56	U	moonlight	7.05	3.61	6.28	7886	chemo	1.50	4.82	3.15	2014
57	U	mother	7.53	4.73	6.11	7922	racist	2.05	4.84	4.37	9795
58	U	ocean	7.39	3.50	5.88	8375	cancer	1.90	5.14	2.90	1723
59	V	paradise	7.00	4.82	7.90	8700	diarrhea	2.10	6.85	2.58	3428

60	S	passionate	7.17	6.33	6.62	8761	nothingness	2.79	3.25	3.20	8263
61	S	peace	7.75	4.65	7.17	8819	pain	2.00	6.27	3.47	8642
62	S	peaceful	8.00	4.38	6.84	8820	soulless	2.71	4.76	3.72	11501
63	S	perfect	7.19	4.71	6.53	8902	fearful	2.66	5.45	3.12	4525
64	V	phenomenal	7.11	5.35	6.04	8980	despicable	2.76	4.86	3.24	3351
65	U	positive	7.57	5.50	7.26	9279	negative	2.52	5.05	4.29	8118
66	S	prosperous	7.16	6.00	6.76	9584	terrified	2.51	6.10	3.29	12440
67	S	proud	7.00	5.55	7.09	9601	crushed	2.87	5.07	4.24	2968
68	U	shower	7.19	4.15	7.47	11105	killing	1.95	5.52	4.47	6813
69	V	simplicity	7.05	3.57	6.18	11188	insanity	2.70	7.79	4.12	6424
70	U	snowflake	7.19	3.55	4.81	11416	slaughter	2.33	5.77	3.57	11279
71	S	soulful	7.10	5.68	6.38	11500	helpless	2.24	4.91	3.00	5737
72	V	strawberry	7.25	4.05	5.54	11905	cyanide	2.70	5.72	4.92	3042
73	U	sunrise	7.35	4.68	5.95	12079	sorrow	2.95	3.55	3.80	11496
74	V	sunshine	8.14	5.32	5.43	12083	monster	2.55	5.55	5.00	7872
75	V	sweetness	7.37	4.37	5.92	12186	bullshit	2.33	7.00	3.00	1590
76	V	symphony	7.15	4.19	5.62	12228	guillotine	1.63	5.64	3.39	5472
77	S	thankful	7.76	4.52	6.55	12465	loveless	2.59	4.46	3.96	7248
78	S	thoughtful	7.26	2.55	6.62	12510	useless	2.80	4.39	4.65	13270
79	V	tranquillity	7.86	3.64	7.61	12729	dishonesty	2.05	5.39	4.32	3574
80	S	treasured	7.14	5.16	7.05	12783	ugly	2.47	4.43	3.86	12956

81	U	tree	7.59	2.67	5.62	12790	threat	2.63	6.57	3.60	12515
82	S	truthful	7.48	3.71	6.75	12867	hopeless	2.20	4.52	2.84	5907
83	V	vacation	8.53	5.22	7.11	13283	betrayal	2.24	5.71	3.12	1091
84	V	valuable	7.17	3.85	6.04	13306	hazardous	2.80	5.25	4.36	5652
85	S	victory	7.59	5.90	6.95	13416	agony	2.46	5.78	4.00	244
86	V	wonderful	7.41	4.57	7.19	13793	venomous	2.90	7.21	4.23	13368

Note. V = vitality, U = unease, S = sublimity. ID = word identifier assigned by Warriner et al. (2013).

86 items with a rating below 3.00 were used to create the 'negative' songs, while 86 items with a rating above 7.00 were substituted in the 'positive' conditions. Mean ratings of the valence, arousal and dominance of chosen words are displayed in Table 3. These words were also verified by LIWC and are shown in Table 4. All other words used in the songs were neutral (i.e. neither high or low in valence).

The songs were composed and recorded by the author in Logic Pro X (Apple Inc., California, USA) using a combination of original MIDI components and royalty-free samples.

Table 3

Mean ratings for chosen words as measured by Warriner et al. (2013)

	Valence	(*SD*)	Arousal	(*SD*)	Dominance	(*SD*)
Vitality (+)	7.45	(0.42)	4.62	(0.71)	6.21	(0.70)
Vitality (-)	2.35	(0.42)	5.70	(0.87)	3.71	(0.70)
Unease (+)	7.51	(0.33)	4.58	(1.15)	6.19	(0.70)
Unease (-)	2.26	(0.44)	5.53	(1.01)	3.63	(0.69)
Sublimity (+)	7.57	(0.40)	4.82	(1.02)	6.63	(0.51)
Sublimity (-)	2.57	(0.31)	4.74	(0.82)	3.57	(0.58)

Note. (+) = positive lyrics, (-) = negative lyrics.

Table 4

Ratings for chosen words as measured by LIWC

	Emotional Tone	Positive Emotion	Negative Emotion	Anger	Sadness	Anxiety
Vitality (+)	99%	39.13%	0%	0%	0%	0%
Vitality (-)	1%	0%	20.83%	8.33%	0%	0%
Unease (+)	99%	39.29%	0%	0%	0%	0%
Unease (-)	1%	1.35%	42.86%	25%	10.71%	3.57%
Sublimity (+)	99%	82.86%	0%	0%	0%	0%
Sublimity (-)	1%	0%	77.14%	8.57%	37.14%	17.14%

Note. (+) = positive lyrics, (-) = negative lyrics.

Vocals for each song were also sung by the author in both positive and negative conditions.[II] As seen in Table 5, each track had a running time of approximately three to four minutes (*M* = 3:45, *SD* = 0:12), reflecting standard durations in mainstream pop music. Vocals were recorded on a M930 condenser microphone (Microtech Gefell GmbH, Germany), with all substituted lyrics recorded in the same session to ensure vocal consistency. Aside from the 172 words (86 positive, 86 negative) that were carefully edited into each track, the three pairs of songs were otherwise identical. Instrumental versions were also created that were identical to their lyrical counterparts, but did not include any vocals, background vocals or vocal effects. The tracks were mixed at Hercules Street recording studio (Sydney, Australia) by a professional music engineer using Pro Tools HD (Avid Technology Inc., Massachusetts, USA) and a MacBook Pro computer (Apple Inc., California, USA). All stimuli are available online for general listening and future research (https://osf.io/wyhzt).[III]

Data Collection Tools

Participants were asked to provide some anonymous and confidential personal information, including age and gender. To avoid any musical biases, participants specified whether or not they played a musical instrument (yes/no) and how they would rate their musical

Table 5

Musical features of stimuli

Category	Song title	Key / mode	Time signature	Beats per minute	Duration
Vitality	Everything You Are	D major	4/4	104	3:28
Unease	Look Around	G minor	4/4	83	3:38
Sublimity	Being Me	C major	4/4	103	4:08

Note. Features remained consistent for each music category, regardless of lyric condition.

abilities (0 = poor, 100 = excellent). Participants were also asked to indicate their attitude towards pop music (-100 = I hate it, +100 = I love it).

Three-dimensional model of emotion. To understand both the perceived and felt emotion of participants after listening to each song, the six extremes of the three-dimensional model were used (Schimmack & Grob, 2000). These were presented in three horizontal scales (tension, valence and energy) and used the same adjectives used by Eerola and Vuoskoski (2011) as seen in Figure 2. Given the complexity of the data (i.e. three ratings per condition, and six conditions of interest), visualising overall differences in emotion can be difficult, especially variances in the way that individuals respond to stimuli. Thus, to facilitate simpler data comprehension, a new way of visualising individual differences in these three ratings is presented. The principles of RGB colour were applied to the dimensional model, where red = *tension*, green = *valence* and blue = *energy* (see Figure 3). That is, the three ratings in each scale were combined into one colour, with each colour representing a different state of mind. Existing links between colour, music and emotions seem to support such parallels. Faster tempos and major keys have been associated with brighter, warmer colours, while slower tempos and minor

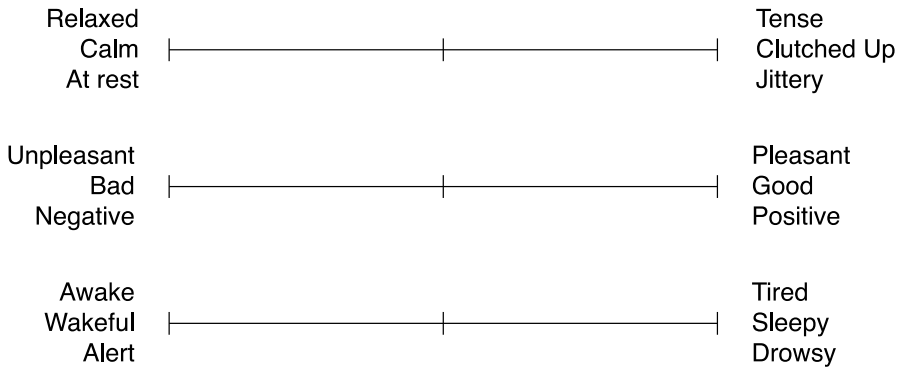

Figure 2: The three-dimensional model adapted from Eerola and Vuoskoski (2011) that was used to measure perceived emotion by participants after hearing each track.

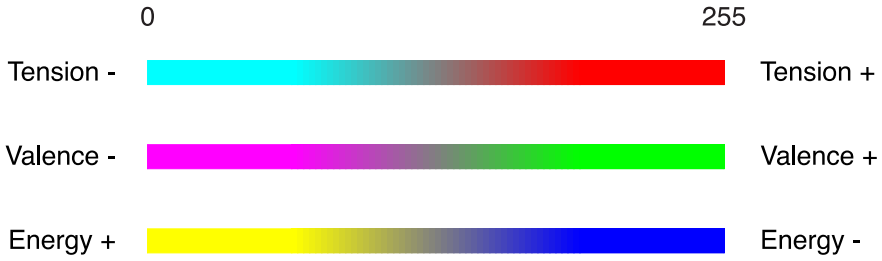

Figure 3: Self-response scales based on the three-dimensional model of emotion and previous research by Eerola and Vuoskoski (2011), combined with RGB colour scales.

keys are linked to darker, cooler colours (Schloss et al., 2008). This concept is expressed in Figure 1 [F], will be briefly explored in the Results section to demonstrate how individual differences in the three dimensions can be visualised in a simplified format.

Prosocial scale. To measure any prosocial (or antisocial) associations with the musical stimuli, a fourth scale was added to the three horizonal scales of tension, valence and energy. In keeping with the labelling format used by Eerola and Vuoskoski (2011), the three words *aggressive*, *destructive* and *hostile* were chosen to represent antisocial emotion. Inversely, the

words *caring*, *constructive* and *helpful* were selected to represent prosocial emotion (Figure 4). The scale ranged from -100 (antisocial) to +100 (prosocial).

Discrete model of emotion. Seven discrete emotion scales were also used in order to measure any other emotional responses not recorded by the three-dimensional model of emotion or the prosocial scale, including anger, happiness, fear, disgust, sadness and surprise (Ekman,

Figure 4: The prosocial scale used to measure levels of felt emotion after hearing each track.

1992). In line with previous studies on music and emotion (Eerola & Vuoskoski, 2011), the emotion of tenderness was also added. However, as not all discrete emotions seem to be adequately captured by music, some of the ratings lacked variance and, as such, were not analysed here. Instead, the analyses presented in the Results section focus on the well-validated three-dimensional model of music emotions and felt prosocial ratings.

Procedure

Participants were individually tested in a quiet room at the University of Adelaide. Softer ambience was created using two dim lamps with 25W globes. While two people could undertake the task simultaneously, testing areas were partitioned to minimise any distractions. To begin, participants entered their demographic details. They were then shown a brief animated video explaining that three different songs would be played in three different conditions – once with singing, once without singing, then once again with singing – making a total of nine tracks. Any allusion to lyrics, particularly word substitutions, were avoided. The instruction video has been archived online (https://osf.io/gy6fz).

The track order was counterbalanced between participants, with several restrictions on each sequence: 1) no two songs (i.e. vitality, unease or sublimity) could be played back-to-back, 2) no two tracks with the same lyrical valence (i.e. positive or negative) could be played back-to-back, and 3) the three middle tracks were to be instrumental versions only. These restrictions allowed for 60 unique listening combinations. The video also explained to participants that they were being asked to report on two sets of emotions: 1) the emotions they heard in the music, and 2) the personal emotions they felt at that given moment. As this distinction is often hard for participants to grasp (Gabrielsson, 2002), it was heavily emphasised in the instructional video. This difference was also reinforced in the user interface, with a dark grey background accompanying response fields about emotions perceived in the music, and a light grey background for personal responses of felt emotion.

After each song finished, participants were presented with a dark grey screen that asked, "How would you describe this song?" Emotions perceived in the music were given using sliding scales of the three-dimensional model and the prosocial scale. Following this, participants repeated the procedure on a light grey screen that asked, "How do you feel right now?", with the three-dimensional model and prosocial scale used to indicate felt emotion. Once participants had entered and submitted their responses, the next track began. Responses were given following each of the nine tracks, including the instrumental versions of each music category. As these instrumental tracks are not indicative of the way pop music is generally consumed (i.e. with lyrics), they were not analysed in the study. Nevertheless, they served as a helpful 'palette cleanser' for participants between positive and negative lyric conditions – that is, their purpose was to minimise the amount of interference between the first and second type of lyrics experienced for each music category.

Once all nine tracks were played and responses were given, participants rated their level of enjoyment for each of the three songs, labelled ‘Everything You Are’, ‘Look Around’ and ‘Being Me’. Scales were coded from 0–100, with an option to play the instrumental version of each song to assist in correct recall. Finally, participants were asked whether they guessed the purpose of the study and were offered a text field to respond with their thoughts.

Results

All songs were generally liked by participants, with a 68.7% average enjoyment rating across all tracks combined. However, there was considerable variation between the three music types, with each style indicating a range of responses from 0 to 100. Unease was the most popular music style ($M = 70$, $SD = 26$), but vitality ($M = 68$, $SD = 27$) and sublimity ($M = 68$, $SD = 25$) were also reasonably enjoyed, suggesting that participants were adequately engaged in the task.

Through the analysis of short answers, 73% of participants guessed that lyrics were a major focus of this study. This figure was calculated by examining the short responses given in the final question, “Did you guess the purpose of this study?” At no time were participants informed that words or lyrics were being explored in this experiment, but that it was simply “a study about music and our emotions”. Thus, any response that contained the word *lyric* (i.e. lyrics, lyrical) or *word* (i.e. words, wording) was considered a successful guess. These answers also offered an insight into the way that participants experienced the stimuli.

In each song, only the responses to positive and negative lyric versions were analysed. Results of instrumental tracks are presented in the figures for completeness and, as seen in Figures 5 and 6, were generally given intermediate ratings between positive and negative lyrics.

Participants also gave both perceived and felt ratings for each emotion, but for the purposes of stimuli validation, only *perceived* emotions were analysed. However, in order to determine the subsequent effect of lyrics on prosociality, ratings of *felt* emotion were considered to better reflect the internal emotional state of participants.

Three-dimensional ratings

Tracks from each music category aimed to induce a different pattern of emotions. It was expected that vitality would elicit higher energy ratings, unease would elicit higher tension ratings, and sublimity would elicit lower energy ratings. Additionally, versions with negative lyrics were expected to elicit lower valence ratings compared to their counterparts with positive

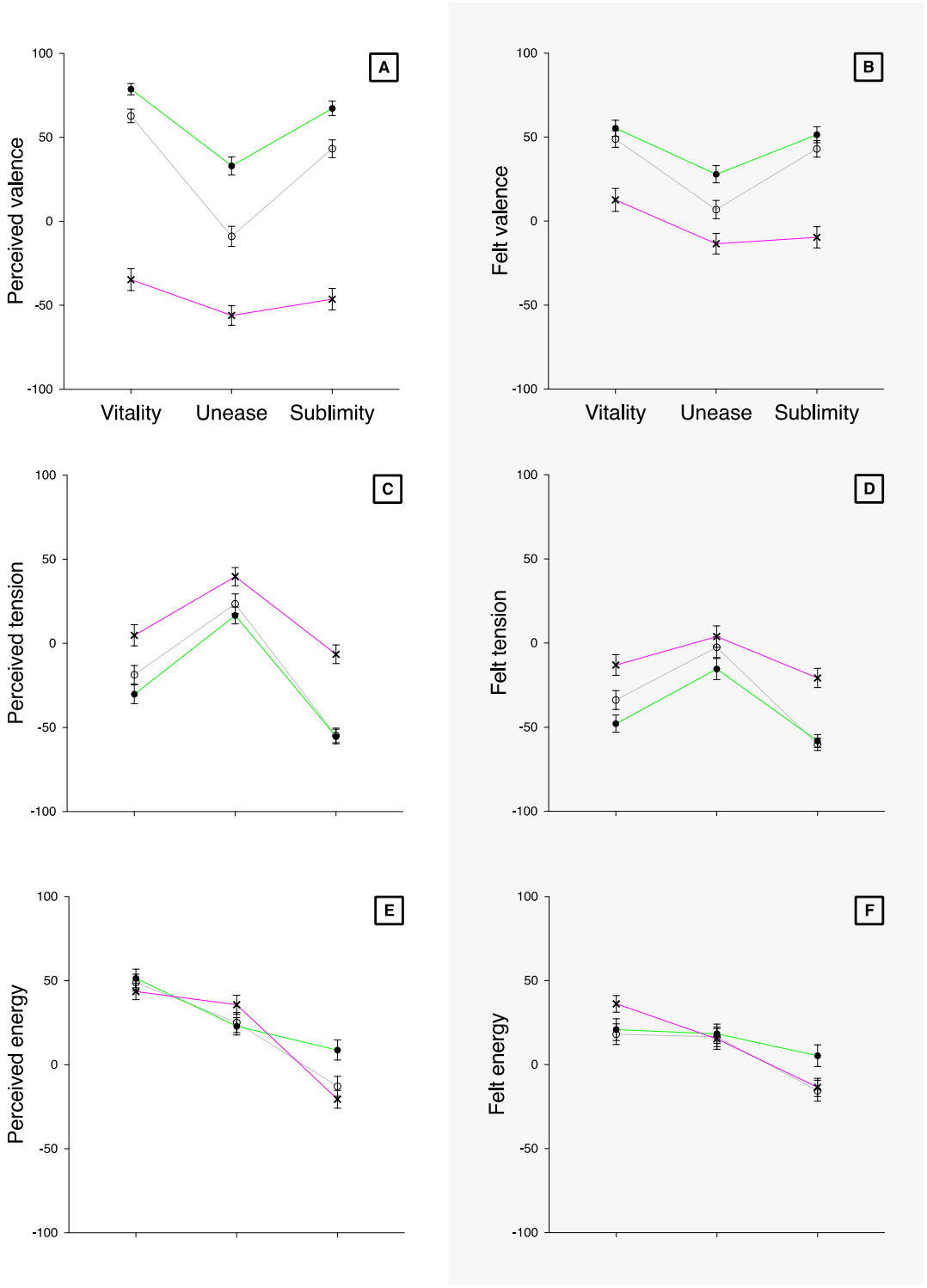

Figure 5. **Left column [A, C, E]:** Levels of pleasantness, tension and energy perceived by participants in the music. **Right column [B, D, F]:** Levels of pleasantness, tension and energy felt by participants after hearing each song.

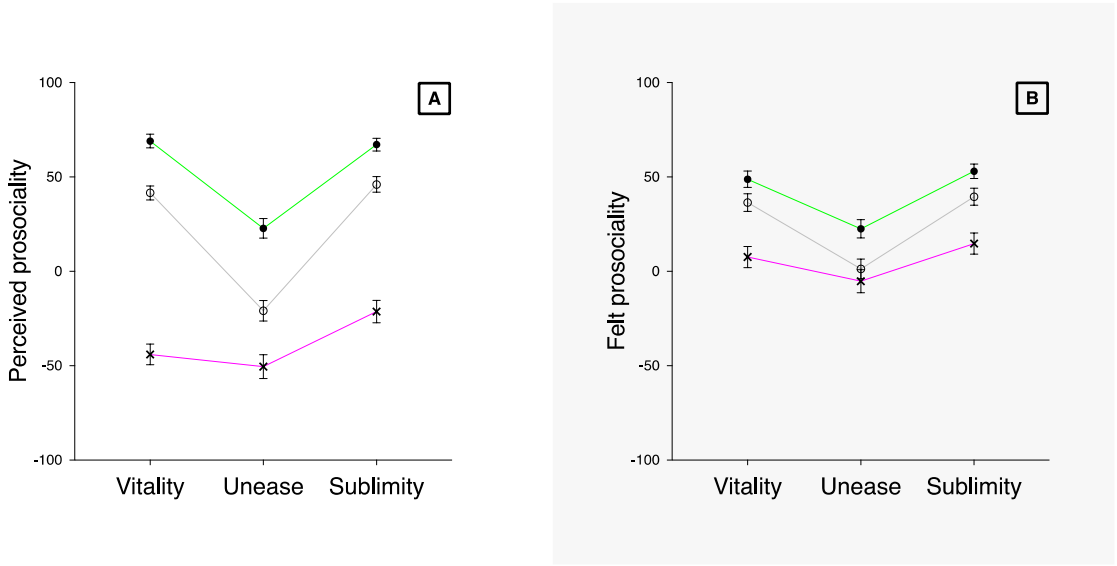

Figure 6. **[A]:** Levels of prosocial emotion perceived by participants in the music. **[B]:** Levels of prosocial emotion felt by participants after hearing each song.

lyrics. To confirm that intended emotions were accurately perceived, participant ratings from the three-dimensional model of emotion were analysed (see Figure 5). As expected, the intended emotion of each song aligned with the rating patterns perceived by participants.

A 3(music category) x 2(type of lyrics) repeated measures analysis of variance was conducted on each on the three ratings of valence, tension and energy. In each instance, the Pillai statistic was reported. It is worth noting that effect sizes were much smaller in levels of felt emotion reported by participants. To demonstrate this finding, the overall effects of music and lyrics in felt levels of valence, tension and energy can be seen in Figure 5 (right column). However, as discussed, felt ratings were not analysed as perceived emotions were deemed more indicative of emotion heard in the music.

Perceived valence. As seen in Figure 5 [A], a simple main effect analysis showed that negative lyrics led to a decrease in perceived pleasantness, $F(1, 60) = 250.4$, $p < .001$, $\eta^2 = .807$.

There was also a main effect of type of music category, with the unease track being perceived as more unpleasant $F(2, 59) = 25.1$, $p < .001$., $\eta^2 = .460$. Additionally, a significant interaction was found between the effects of music and lyrics on perceived valence, $F(2, 59) = 6.5$, $p = .003$., $\eta^2 = .182$. Paired sample t-tests showed that lyrics had a negative effect on all tracks, minimum $t(60) = 11.0$, $p < .001$, CI^{95} [72.89 105.37]. Interestingly, this effect was least pronounced in the unease music type.

Perceived tension. Negative lyrics led to an increase in perceived tension, $F(1, 60) = 61.4$, $p < .001$, $\eta^2 = .506$ (see Figure 5 [C]). A main effect of type of music category was also found, with the unease track being perceived as more tense $F(2, 59) = 67.3$, $p < .001$., $\eta^2 = .695$. The effects of music and lyrics on perceived tension produced a significant interaction, $F(2, 59) = 6.2$, $p = .003$., $\eta^2 = .174$. Paired sample t-tests confirmed that lyrics had a negative effect on all tracks, minimum $t(60) = 4.0$, $p < .001$, CI^{95} [11.55, 34.63], although once again, this effect was least pronounced in the unease music category.

Perceived energy. The main effect of lyrics was significant, with positive lyrics leading to a small increase in perceived energy, $F(1, 60) = 4.3$, $p = .043$, $\eta^2 = .066$ (see Figure 5 [E]). Also, there was a main effect of music category, with the category of vitality being perceived as more energetic and sublimity being perceived as least energetic, $F(2, 59) = 36.2$, $p < .001$., $\eta^2 = .550$. As with perceived valence and tension, a significant interaction was found between the effects of music and lyrics on perceived energy, $F(2, 59) = 13.2$, $p < .001$., $\eta^2 = .310$. Paired sample t-tests showed that negative lyrics in the unease music category resulted in slightly higher levels of perceived energy, $t(60) = 2.6$, $p = .013$, 95% CI [2.78, 22.91], while negative lyrics in the sublimity music category resulted in lower levels of perceived energy, $t(60) = 4.4$, $p < .001$,

CI^{95} [16.05 42.58]. However, perceived energy levels in the vitality music category were not affected by positive or negative lyrics, $t(60) = 4.0$, $p = .238$, CI^{95} [11.55, 34.63].

Visualising individual differences in RGB dimensions. As explained in the Method section, a new way of visualising the data of perceived valence, tension, and energy ratings using RGB dimensions is explored. In the RGB colour model, the three domains of red, green and blue are added together in various combinations to produce virtually any colour. Typically, these colour values are determined by three scales each ranging from 0–255. For this purpose, participant ratings were scaled to a 0–255 range, and responses of each individual in every condition are shown in Figure 7. Each row in Figure 7 represents data from one participant, demonstrating the variance in participants' reported emotions in a clear and novel way (e.g., greener shades represent more positive emotions, redder shades represent more negative feelings, bluer shades represent more calm, serene, feelings). In particular, the decrement from perceived to felt emotions is visible as a decrement in the intensity of the colours. This simple way of identifying and representing complex, multi-faceted emotions could have a variety of applications in research settings and beyond.

Prosocial ratings

This was the main variable of interest, particularly the felt prosocial ratings. Following the trend of the three-dimensional emotions, levels of perceived prosociality were greater than felt levels of prosociality and are shown in Figure 6 [A]. Again, the levels of perceived prosociality were not analysed, but are displayed to offer an overall picture of rating patterns. It is worth noting, however, that levels of antisocial emotion were perceived in the music (as demonstrated by negative ratings in Figure 6 [A]) but were not necessarily felt by participants, who generally indicated felt ratings above zero (see Figure 6 [B]).

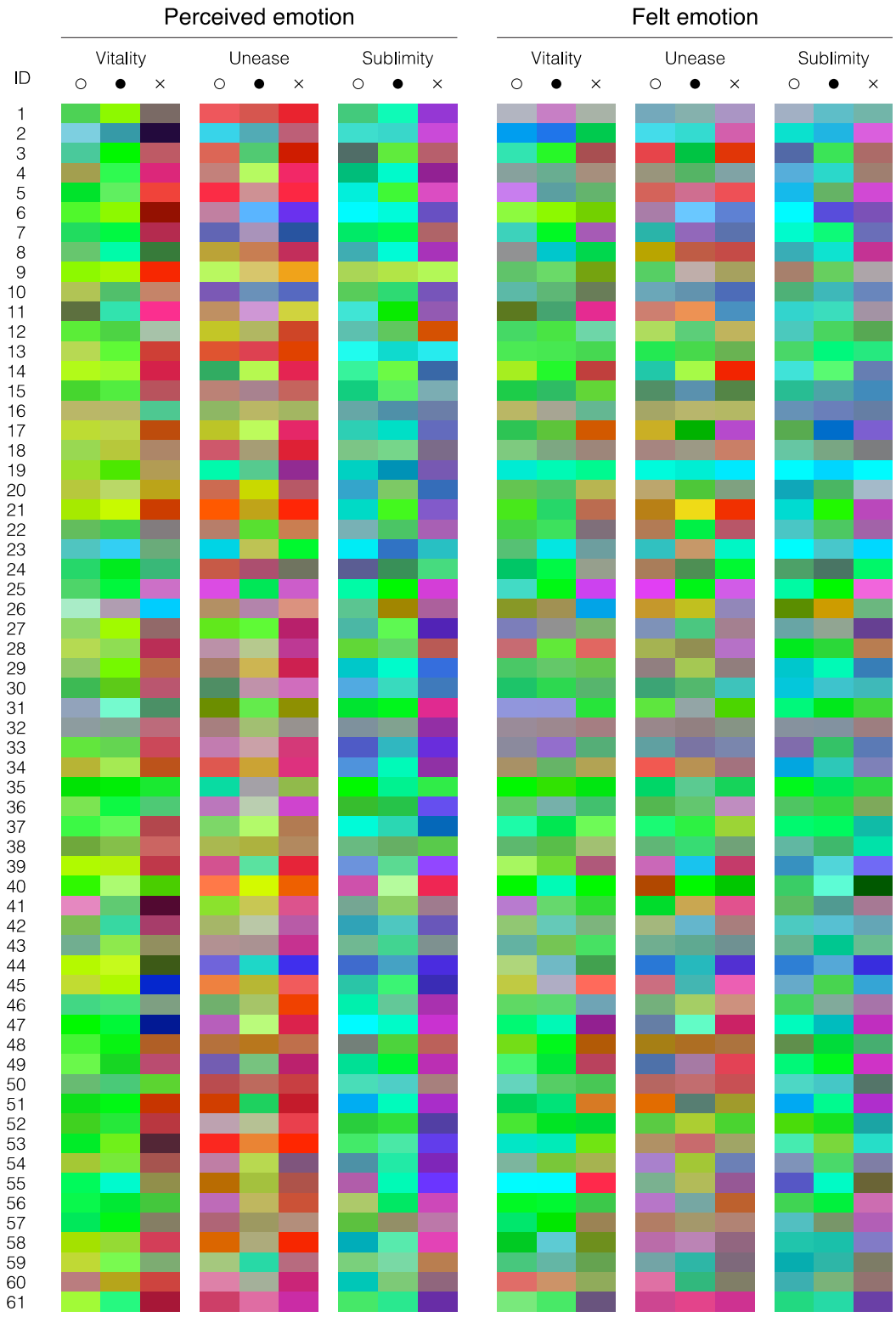

Figure 7. Responses made by each participant via the three-dimensional model of emotion, with data visualized by colour (as per Figure 3). **Left columns:** Emotions perceived in the music for each

category, in instrumental (○), positive lyric (●) and negative lyric (×) conditions. **Right columns:** Emotions felt by participants after listening to each category in the same three conditions.

Felt prosociality. Levels of prosocial emotion felt by participants are shown in Figure 6 [B]. Negative lyrics prompted participants to give more antisocial ratings compared to positive lyrics, $F(1, 60) = 42.7$, $p < .001$, $\eta^2 = .416$. There was also a main effect of music category, with the unease track being associated with the most antisocial ratings, $F(2, 59) = 22.6$, $p < .001$, $\eta^2 = .433$. No significant interaction was found between music category and lyrics, $F(2, 59) = 1.72$, $p = .188$, $\eta^2 = .055$.

To ensure that these effects were not confounded by the order in which the tracks with positive and negative lyrics were presented, three 2(type of lyric: positive or negative) x 2(order: positive or negative lyrics first) analyses of variance were conducted on the felt prosocial ratings for each music category. There was no interaction between lyric type and order for any music category (minimum $p = .183$), suggesting that the order in which lyrics were presented did not influence prosocial ratings.

Relationship between felt prosocial ratings, music abilities, and attitude towards pop music. In order to quantify the effect of lyrics on each participant, a 'prosocial lyric score' was introduced. This was calculated by subtracting the average felt prosocial ratings for the three tracks with negative lyrics from the average felt prosocial ratings for the three tracks with positive lyrics. The average prosocial score was +36 ($SD = 43$; range = -72–+144). The music ability of participants was around the midpoint at 49% ($SD = 29$; range = 0–100), while attitudes towards pop music were more positive than negative at +38 ($SD = 41$; range = -69–+100). Music abilities were not correlated with prosocial lyric scores ($r = .14$, $p = .272$), but attitude towards pop music was ($r = .33$, $p = .010$) and can be seen in Figure 8. Thus, a more positive attitude towards this genre was associated with a larger effect of lyrics.

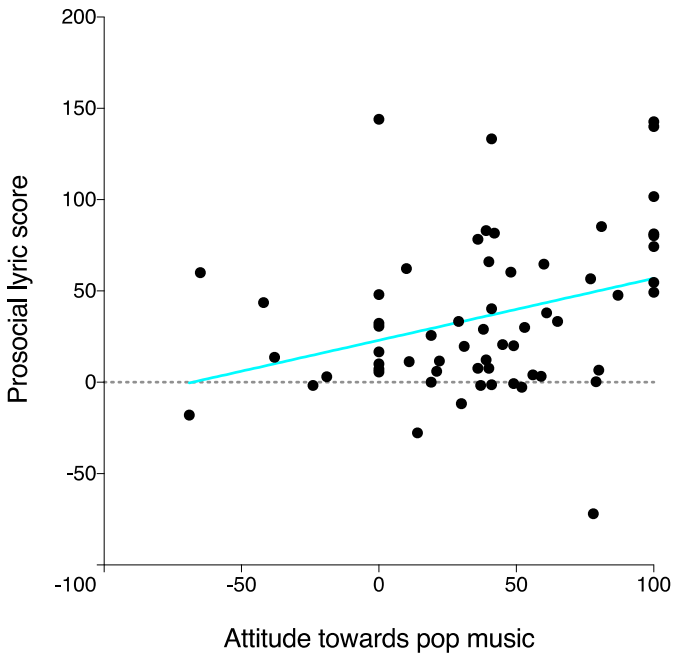

Figure 8. Scatter plot showing the correlation between prosocial lyrics score (i.e. the difference between prosocial responses to positive and negative lyrics) and attitude towards pop music.

Finally, a linear regression model was carried out to ensure that these effects were not confounded by age and gender (e.g., that attitude towards pop music might covary with younger age). Prosocial lyrics scores were regressed on age, gender, music abilities and attitude towards pop music. All predictors were entered into the regression model simultaneously. The only significant predictor identified was attitude towards pop music ($\beta = .285$, $SE = .140$, $p = .047$), while none of the other predictors were significant (minimum $p = .304$). Therefore, attitude towards pop music predicted the effect of lyrics above and beyond age, gender or music abilities.

Discussion

Felt prosocial emotion

These striking findings show that songs with negative lyrics induce lower feelings of prosociality than songs with positive lyrics. Such feelings were clearly reported by participants in

all three categories of vitality, unease and sublimity, demonstrating that lyrics have an effect on felt emotion above and beyond music category. Notably, the lyrics in this study were manipulated while keeping all music elements constant, avoiding one of the significant drawbacks of previous research in which lyrics and score are often confounded.

While age, gender and music ability did not predict the degree to which individuals are affected by lyrics, attitude towards pop music did – that is, the more that participants enjoyed pop music, the more that lyrics affected their felt levels of prosocial emotion. In light of the fact that lyrics are often viewed the least important factor in music listening (Ballard et al., 1999), this finding is particularly salient. If people who love pop are more strongly affected by lyrics yet remain uninformed about their capacity to impact felt emotion, more awareness should be raised about the importance of lyrics in mainstream music and their potential to affect prosocial attitudes.

Indeed, previous research has focused on this importance, but it has primarily explored general antisocial themes. Additionally, it has failed to implement comparable conditions featuring positive lyrics. As broad themes are generally harder to quantify, this study opted to create original lyrics constructed around empirically-validated words that had an extreme positive or negative valence (i.e. Warriner et al., 2013). The clear difference in prosocial emotion felt by participants in each lyric type suggests that positive and negative words in general, not merely ‘prosocial’ and ‘antisocial’ themes, can affect prosocial attitudes.

This finding has profound implications for public policy. While the censorship of lyrics has not been a particularly successful endeavor (Samole, 1996), a new perspective on the curation of music should be explored using emerging technologies such as Linguistic Inquiry and Word Count (LIWC). In the same way that the Australian Government has implemented a

'Health Star Rating' system for packaged foods, the music industry might adopt a similar approach where more 'stars' equate to smarter listening choices. This service could impact the radio industry (i.e. monitoring the number of antisocial songs that are broadcast), the music industry (promoting more prosocial songs, or even having a 'positive music chart' based on lyric analysis and sales), retailers (i.e. understanding which songs should be played in store to facilitate positive interactions) and, of course, music therapists (i.e. choosing songs that are most effective). Additionally, this insight into the importance of lyrics could assist songwriters in creating songs that better encourage wellbeing and prosocial attitudes. Tools such as LIWC should be made easily accessible to the creative community to help bring an element of science to their art.

It should be pointed out that text-analysis software is still in its infancy, and artificial intelligence cannot always detect the subtleties often found in lyrics. For example, an antisocial lyric such as "I'm too *good* for you" would be seen as positive, while a prosocial lyric such as "I'll be there in your *pain*" would be seen as negative. Nevertheless, this study showed that LIWC ratings have strong parallels with emotional responses. While song lyrics can often be subjective (Ballard, 1999), these tools offer objective analyses on the overall impact of words. As this technology evolves, it will no doubt shape the way we understand the impact of music and lyrics on emotion. It will also be increasingly useful for carefully choosing lyrics that are most likely to create a positive impact.

Perceived music emotion

Like felt prosocial emotions, perceived music emotions reported with the three-dimensional scale were remarkably consistent amongst participants. As expected, Everything You Are (vitality) was identified as the most pleasant and energetic song, while Being Me

(sublimity) was perceived as the least energetic. This supports the notion that, on the whole, the objective classifications listeners make about music emotion tend to be relatively consistent (i.e. Juslin & Laukka, 2004). Interestingly, Look Around (unease) was perceived as the most tense and unpleasant song, yet it was the most enjoyed song overall. Thus, high levels of perceived tension and low levels of perceived valence do not necessarily predict feelings of overall liking. Furthermore, positive lyrics in this category of unease were perceived as less pleasant than those in vitality and sublimity, despite the fact that all three songs with positive lyric types carried a similar valence (Figure 5 [A]). As one participant commented in the response field provided, "Even with the 'happy' lyrics in Look Around, I still felt an unpleasantness from the instrumental behind it." Another noted that the song "contained some disturbing wavelengths". Still, both users rated Look Around as their favourite song, with enjoyment levels of 98% and 95% respectively.

This finding suggests that, regardless of lyrics, songs in the category of unease inherently carry higher levels of tension and are harder to manipulate with lyrics alone. As Look Around had the slowest BPM and was the only song in a minor key (see Table 5), it seems that mode and tempo can elicit a sense of negativity that goes beyond the effect of lyrics. Perhaps even more notable is that a song can feel 'unpleasant' to a listener, regardless of whether or not it is liked. This not only validates Ritossa and Rickard's (2004) preference of the word 'pleasantness' over 'liking' in research on music and emotion, but also highlights the benefit of making a clear distinction between 'perceived' and 'felt' emotion. Many participants *perceived* the unpleasantness in the song, yet still *felt* fondly towards it.

It is also worth highlighting that perceived energy levels in Look Around were significantly reduced when positive lyrics were added (Figure 5 [E]). This outcome appears to be

an expression of mixed emotional cues, where layers of conflicting emotion (i.e. positive lyrics, tense score) cause an element of confusion in listeners. In contrast, the perceived energy levels of Everything You Are (vitality) were not at all affected by positive or negative lyrics (Figure 2[E]). Lyrics are no doubt important, but these results indicate that positive or negative lyric type does not uniformly affect the overall perception of a song, particularly in the case of vitality and unease. However, in Being Me (sublimity), the sadder lyrics in the negative lyric type consistently led to lower levels of perceived valence and energy, along with higher levels of tension. While the valence of lyrics made no difference to the category of vitality, it clearly made a difference to sublimity. This finding dovetails with that of Brattico et al. (2011) who found that the auditory cortical regions seem 'delighted' by the upbeat nature of happier songs, while the limbic system is engaged by the lyrical sadness of a slower song. Perhaps there is truth in the quote attributed to singer/songwriter Frank Ocean: "When you're happy, you enjoy the music; but when you're sad, you understand the lyrics".

Three-dimensional ratings and RGB colour

These interesting results in perceived energy levels reinforce the importance of a three-dimensional approach to research in music and emotion. If a two-dimensional model of emotion was instead used where the dimensions of 'energy' and 'tension' were combined into the broad measurement of 'arousal' (i.e. Figure 1 [B]), such a discrepancy would not have emerged. This is particularly apparent in the diverging results for energy and tension in Figure 5, plotted in panels [C] and [E]. Similarly, this variation between valence, tension and energy can be observed in the RGB visualisation (Figure 7), along with clear differences in perceived and felt emotion. In conjunction with the three-dimensional model of emotion, the use of colour assisted in concisely reporting 1,098 individual felt and perceived emotional responses at a glance. To the best of the

author's knowledge, this is the first instance in which colour has been used to report such complex responses using this model of emotion. While music is the most popular stimulus used in emotion research (Kim et al. 2010), these results suggest that colour should also be given importance as a multi-sensory research tool. As previously mentioned in the context of Russell's (1980) circumplex model, the nature of language often presents barriers in emotional responding (as demonstrated in the stark difference between the words 'pleasantness' and 'liking'). Yet, in the same way that music taps into a broader spectrum of emotion, so too does colour. Beyond data visualisation, this new combination of three-dimensional emotion and RGB scales could be used to assist participants in making more accurate and implicit emotional responses, or even used as a general tool to assist in emotional awareness (i.e. finding the 'colour' of one's emotions). More research should be carried out on the way in which these colours are mapped on to the three-dimensional model, and whether they do in fact correspond with the way most people see – or even 'hear' – various colours.

New stimuli

The original songs created for this project have addressed numerous factors that have previously been barriers to effective research in this area. Importantly, the new stimuli are grounded in well-validated findings by Zentner et al. (2008) and Warriner et al. (2013) so, coupled with the results of this study, there is a high level of confidence that they indeed elicit the emotions that were intended. This ecological validity suggests that these stimuli reflect 'real world' pop music and correctly represent the three all-encompassing music categories of vitality, unease and sublimity. They are also realistic in both style and duration, and were reasonably enjoyed by participants. As these songs will not be commercially released, it is highly unlikely that participants in future experiments would be affected by any familiarity biases. This work is

also distributed under a Creative Commons Attribution 4.0 International License, so the use of these tracks avoids copyright restrictions often associated with commercial pop music. This means that any datasets collected using these stimuli (including the current one) can be made available to other researchers. In addition to versions with positive and negative lyrics, instrumental tracks of all three songs have also been made accessible. This 'clean' condition could be used in future research to test for the 'mere exposure' effects of lyrics – that is, whether hearing a particular lyric type first could influence attitudes towards musical features, or vice versa. Put simply, this unique collection of stimuli offers manipulated, empirically validated lyric types that control for various music elements.

Future directions

In order to reduce any response bias in participants, an effort was made to maintain a level of secrecy about the nature of this project. However, some may have been aware (through word of mouth or deductive reasoning) that the author who was testing participants was also the singer on the songs being heard. Thus, ratings given on each track may have been influenced by an element of social desirability. There was no doubt an element of anticipation as to what responses were expected from the researcher, as almost three-quarters of participants guessed the purpose of this study upon completion. This is understandable considering the relatively obvious changes in lyrics, but such awareness may have also affected the legitimacy of responses. To eliminate these (and any other) biases, future studies should seek to use additional measures that are more implicit in nature, combining self-reporting with more subconscious measures.

One such method could be through the use of electroencephalography (EEG). It has recently been found that EEG can detect various emotions in the brain, observed in both alpha signals in occipital and frontal regions, and beta signals in temporal and frontal regions (Gawali,

Rao, Abhang, Rokade & Mehrotra, 2012). Also, Lee and Hsieh (2014) have been able to classify various emotional states using EEG-based functional connectivity patterns. While the current study relied on the music ending before self-reporting was carried out, the use of EEG would facilitate data collection that reflects the emotional states of participants in 'real-time' – that is, concurrent with the presentation of musical stimuli. Naturally, with such an approach, participants would be unable to control their brain responses and remain unaware of the main dependent variable. Additionally, other measures such as behavioural games could be used in future studies to assess prosocial behaviour and observe how music and lyrics affect decision-making in social situations (e.g., Eisenegger et al., 2013). In these games, participants are not explicitly asked whether they have prosocial feelings; instead, their tendency towards prosocial behaviour is measured in a more implicit way (e.g., by measuring subtle changes in their tendency to cooperate in a financial decision-making game). These additional measures would be less likely to suffer from the drawbacks of self-reporting.

Another angle of research could be the investigation of the effects of music when participants are in different emotional states. As shown in the high levels of felt valence, energy and prosociality and low levels of felt tension, participants in this study were generally in a good mood. However, the effects of aggression and antisocial behaviour could be explored on a more visceral level. Primarily, this could be done by designing an experiment that induces a sense of aggression in participants to better understand how music is perceived and felt under such circumstances, and to what extent lyrics can help participants return to a more prosocial state.

While attitude towards pop music predicted the effect of lyrics in participants, future studies should explore additional individual differences that predict whether people are more susceptible than others to such effects. For example, as one's level of agreeableness has been

found to affect the way their feel about the message of a song (Galizio & Hendrick, 1972), any associations between the influence of lyrics and the personality trait of agreeableness could be identified using these stimuli. A wide range of other personality differences could also be investigated (i.e. the Big Five), or aspects such as education or social-economic status. This information could be used to predict which individuals are more likely to respond positively (or negatively) to lyrics, which would be useful for predicting the effectiveness of music interventions.

Conclusion

This study is the first demonstration that lyrics have an impact on felt emotion above and beyond music category. Through the use of novel approaches that address aspects of both lyrics and score, more could be understood about the unique elements of music that impact our emotional wellbeing and, in turn, how they can shape a more cohesive and compassionate society. In this new era of music mass-consumption, it appears that lyrics matter more than ever.

References

Ali, S.O., & Peynircioğlu, Z.F. (2006). Songs and emotions: are lyrics and melodies equal partners? *Psychology of Music, 34*(4), 511-534. doi:10.1177/0305735606067168

Aljanaki, A., Yang, Y., & Soleymani, M. (2017). Developing a benchmark for emotional analysis of music. *PLoS ONE, 12*(3): e0173392. doi:10.1371/journal.pone.0173392

Ballard, M.E., Dodson, A.R., & Bazzini, D.G. (1999). Genre of music and lyrical content: expectation effects. *The Journal of Genetic Psychology, 160*(4), 476-487. doi:10.1080/00221329909595560

Bannister, M. (2017). The Billboard Hot 100: exploring six decades of number one singles. Retrieved from https://github.com/mspbannister/dand-p4-billboard/blob/master/Billboard_analysis__100417_.md

Belcher, J.D., & Haridakis, P. (2013). The role of background characteristics, music-listening motives, and music selection on music discussion. *Communication Quarterly, 61*(4), 375-396. doi:10.1080/01463373.2013.776986

Booth, M.W. (1976). The art of words in songs. *Quarterly Journal of Speech, 62*(3), 242-249. doi:10.1080/00335637609383338

Brattico, E., Vinoo, A., Bogert, B., Jacobsen, T., Vartiainen, N., Nieminen, S., & Tervaniemi, M. (2011). A functional MRI study of happy and sad emotions in music with and without lyrics. *Frontiers in Psychology, 2*:308, 1-16. doi:10.3389/fpsyg.2011.00308

Clark, S.S., & Giacomantonio, S.G. (2013). Music preferences and empathy: toward predicting prosocial behavior. *Psychomusicology: Music, Mind, and Brain, 23*(3), 177-186. doi:10.1037/aOO34882

DeWall, C.N., Pond, R.S., Campbell, W.K., & Twenge, J.M. (2011). Tuning in to psychological change: linguistic markers of psychological traits and emotions over time in popular U.S. song lyrics. *Psychology of Aesthetics, Creativity, and the Arts, 5*(3), 200-207. doi:10.1037/a0023195

Dibben, N. (2004). The role of peripheral feedback in emotional experience with music. *Music Perception: An Interdisciplinary Journal, 22*(1), 79-115. doi:10.1525/mp.2004.22.1.79

Dvorak, A.L. (2016). A conceptual framework for group processing of lyric analysis interventions in music therapy mental health practice. *Music Therapy Perspectives, 35*(2), 190-198. doi:10.1093/mtp/miw018

Eerola, T. & Vuoskoski, J.K. (2011). A comparison of the discrete and dimensional models of emotion in music. *Psychology of Music, 39*(1), 18-49. doi:10.1177/0305735610362821

Eisenegger, C., Pedroni, A., Rieskamp, J., Zehnder, C., Ebstein, R., Fehr, E., & Knoch, D. (2013). DAT1 polymorphism determines L-DOPA effects on learning about others' prosociality. *PLoS ONE, 8*(7): e67820. doi:10.1371/journal.pone.0067820

Ekman, P. (1992). An argument for basic emotions. *Cognition and Emotion, 6*(3-4), 169-200. doi:10.1080/02699939208411068

Fischer, P., & Greitemeyer, T. (2006). Music and aggression: the impact of sexual-aggressive song lyrics on aggression-related thoughts, emotions, and behavior toward the same and the opposite sex. *Personality and Social Psychology Bulletin, 32*(9), 1165-76. doi:10.1177/0146167206288670

Frith, S., Straw, W., & Street, J., eds. (2001). *The Cambridge Companion to Pop and Rock.* Cambridge: Cambridge University Press.

Gabrielsson, A. (2002). Emotion perceived and emotion felt: same or different? *Musicae Scientiae, Spec Issue, 2001-2002*, 123-147. doi:10.1177/10298649020050S105

Galizio, M. & Hendrick, C. (1972). Effect of musical accompaniment on attitude: the guitar as a prop for persuasion. *Journal of Applied Social Psychology, 2*(4), 350-359. doi:10.1111/j.1559-1816.1972.tb01286.x

Gawali, B.W., Rao, S., Abhang, P., Rokade, P. & Mehrotra, S.C. (2012). Classification of EEG signals for different emotional states. *Fourth International Conference on Advances in Recent Technologies in Communication and Computing (ARTCom2012),* 177-181. doi:10.1049/cp.2012.2521

Gordon, R.L., Schön, D., Magne, C., Astésano, C., Besson, M. (2010). Words and melody are intertwined in perception of sung words: EEG and behavioral evidence. *PLoS ONE, 5*(3): e9889. doi:10.1371/journal.pone.0009889

Hunter, P.G., Schellenberg, E.G., & Schimmack, U. (2008). Mixed affective responses to music with conflicting cues. *Cognition and Emotion, 22*(2), 327-352. doi:10.1080/02699930701438145

Interiano, M., Kazemi, K., Wang, L., Yang, J., Yu, Z., Komarova, N.L. (2018). Musical trends and predictability of success in contemporary songs in and out of the top charts. *Royal Society Open Science, 5*: 171274. doi:10.1098/rsos.171274

Juslin, P.N. & Laukka, P. (2004). Expression, perception, and induction of musical emotions: a review and a questionnaire study of everyday listening. *Journal of New Music Research, 33*(3), 217-238. doi:10.1080/0929821042000317813

Juslin, P.N., Liljeström, S., Västfjäll, D., Barradas, G., & Silva, A. (2008). An experience sampling study of emotional reactions to music: listener, music, and situation. *Emotion, 8*(5), 668-683. doi:10.1037/a0013505

Kim, Y.E., Schmidt, E.M., Migneco, R., Morton, B.G., Richardson, P., Scott, J., Speck, J.A., & Turnbull, D. (2010). Music emotion recognition: a state of the art review. *11th International Society for Music Information Retrieval Conference (ISMIR 2010)*, 255-266. Retrieved from http://www.mirlab.org/conference_papers/International_Conference/ISMIR 2010/ISMIR_2010_papers/ismir2010-45.pdf

Kreyer, R., & Mukherjee, J. (2009). The style of pop song lyrics: a corpus-linguistic pilot study. *Anglia - Journal of English Philology, 125*(1), 31-58. doi:10.1515/ANGL.2007.31

Ladinig, O., & Schellenberg, E.G. (2012). Liking unfamiliar music: effects of felt emotion and individual differences. *Psychology of Aesthetics, Creativity, and the Arts, 6*(2), 146-154. doi:10.1037/a0024671

Lasseter, J. (Producer), & Docter, P. (Director). (2015). *Inside Out* [Motion Picture]. United States: Disney/Pixar.

Lee, Y., & Hsieh, S. (2014). Classifying different emotional states by means of EEG-based functional connectivity patterns. *PLoS ONE, 9*(4): e95415. doi:10.1371/journal.pone.0095415

Levitin, D.J. (2006). *This is your brain on music: The science of a human obsession*. New York, NY: Dutton.

Ladinig, O., & Schellenberg, E.G. (2012). Liking unfamiliar music: effects of felt emotion and individual differences. *Psychology of Aesthetics, Creativity, and the Arts, 6*(2), 146-154. doi:10.1037/a0024671

Mihalcea, R., & Strapparava, C. (2012). Lyrics, music and emotions. *Proceedings of the 2012 Joint Conference on Empirical Methods in Natural Language Processing and Computational Natural Language Learning (EMNLP-CoNLL '12)*, 590-599. Retrieved from http://www.aclweb.org/anthology/D12-1054

Mori, K., & Iwanaga, M. (2014). Pleasure generated by sadness: effect of sad lyrics on the emotions induced by happy music. *Psychology of Music, 42*(5), 643-652. doi:10.1177/0305735613483667

Pennebaker, J.W., Booth, R.J., Boyd, R.L., & Francis, M.E. (2015). *Linguistic Inquiry and Word Count: LIWC2015.* Austin, TX: Pennebaker Conglomerates.

Pereira, C.S., Teixeira, J., Figueiredo, P., Xavier, J., Castro, S.L., Brattico, E. (2011). Music and emotions in the brain: familiarity matters. *PLoS ONE, 6*(11): e27241. doi:10.1371/journal.pone.0027241

Putman, D.A. (1987). Why instrumental music has no shame. *British Journal of Aesthetics, 27*(1), 55-61. doi:10.1093/bjaesthetics/27.1.55

Ritossa, D.A., & Rickard, N.S. (2004). The relative utility of 'pleasantness' and 'liking' dimensions in predicting the emotions expressed by music. *Psychology of Music, 32*(1), 5-22. doi:10.1177/0305735604039281

Russell, J.A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology. 39*(6), 1161-1178. doi:10.1037/h0077714

Samole, S. (1996). Rock & roll control: censoring music lyrics in the '90's. *University of Miami Entertainment & Sports Law Review, 13*, 175-194. Retrieved from http://repository.law.miami.edu/umeslr/vol13/iss2/1

Schellenberg, E.G., & von Scheve, C. (2012). Emotional cues in American popular music: five decades of the top 40. *Psychology of Aesthetics, Creativity, and the Arts, 6*(3), 196-203. doi:10.1037/a0028024

Scherer, K.R. (2004) Which emotions can be induced by music? What are the underlying mechanisms? And how can we measure them? *Journal of New Music Research, 33*(3), 239-251. doi:10.1080/0929821042000317822

Schimmack, U. & Grob, A. (2000). Dimensional models of core affect: a quantitative comparison by means of structural equation modeling. *European Journal of Personality, 14*(4), 325-345. http://doi.org/10.1002/1099-0984(200007/08)14:4%3c325::AID-PER380%3e3.0.CO;2-I

Schloss, K.B., Lawler, P., & Palmer, S.E. (2008). The color of music. *Journal of Vision, 8*(6), 580. doi:10.1167/8.6.580

Sellnow, D., & Sellnow, T. (2001). The "illusion of life" rhetorical perspective: an integrated approach to the study of music as communication. *Critical Studies in Media Communication, 18*(4), 395-415. doi:10.1080/07393180128090

Stratton, V.N., & Zalanowski, A.H. (1994). Affective impact of music vs. lyrics. *Empirical Studies of the Arts, 12*(2), 173-184. doi:10.2190/35T0-U4DT-N09Q-LQHW

Thayer, R.E. (1978). Toward a psychological theory of multidimensional activation (arousal). *Motivation and Emotion, 2*(1), 1-34. doi:10.1007/BF00992729

Trohidis, K., Tsoumakas, G., Kalliris, G., & Vlahavas, I. (2011). Multi-label classification of music by emotion. *EURASIP Journal on Audio, Speech, and Music Processing, 2011*:4. doi:10.1186/1687-4722-2011-426793

Trost, W., Ethofer, T., Zentner, M., & Vuilleumier, P. (2011). Mapping aesthetic musical emotions in the brain. *Cerebral Cortex, 22*(12), 2769-2783. doi:10.1093/cercor/bhr353

Warriner, A.B., Kuperman, V., & Brysbaert, M. (2013). Norms of valence, arousal, and dominance for 13,915 English lemmas. *Behavior Research Methods, 45*(4), 1191-1207. doi:10.3758/s13428-012-0314-x

Whissell, R., & Whissell, C. (2000). The emotional importance of key: do Beatles songs written in different keys convey different emotional tones? *Perceptual and Motor Skills, 91*(3), 973-980. doi:10.2466/pms.2000.91.3.973

Xeon, S., Miettinen, A., Nilsson, E.T.E., & Aitchison, C.E. (2017). *Out Of My Head.* Spotify. Retrieved June 9, 2018, from https://open.spotify.com/user/spotify/playlist/37i9dQZF1DX1H4LbvY4OJi

Yang, Y., Lin, Y., Cheng, H., Liao, I., Ho., Y., & Chen., H.H. (2008). Toward multi-modal music emotion classification. *Lecture Notes in Computer Science, 5353*, 70-79. doi:10.1007/978-3-540-89796-5_8

Zajonc, R.B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology Monograph Supplement, 9*(2), 1-27. doi:10.1037/h0025848

Zentner, M., Grandjean, D., & Scherer, K.R. (2008). Emotions evoked by the sound of music: characterization, classification, and measurement. *Emotion, 8*(4), 494-521. doi:10.1037/1528-3542.8.4.494

Footnotes

[I] 'Being Me' was originally titled 'Truly Me'. However, after it was recorded and mixed, it was discovered that the word 'truly' has a high positive valence that inflated the levels of overall positive emotion detected by LIWC. In 'Truly Me', the level of positive emotion in the negative lyric type was 7.14%. Once the word 'truly' was substituted for the more neutral word 'being', the level of positive emotion in the negative lyric type was subsequently reduced to 0%.

[II] The question of whether a male vocalist would skew results to one particular gender was considered. This issue was also raised by Ali and Peynircioğlu (2006) who used both male and female vocalists in a similar study, but no interaction was found between vocalist gender and participant gender. Thus, to assist in holding all variables constant and for general convenience, only one vocalist of the same gender (i.e. that of the author) was used for all tracks.

[III] Music stimuli are available for free download via the Open Science Framework (https://osf.io/wyhzt).