# MUSEBAQ: A Modular Tool for Music Research to Assess Musicianship, Musical Capacity, Music Preferences, and Motivations for Music Use

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**Music engagement is complex and is influenced** by music training, capacity, preferences, and motivations. A multi-modular self-report instrument (the Music Use and Background Questionnaire, or MUSEBAQ) was developed to measure a diverse set of music engagement constructs. Based on earlier work, a hybrid approach of exploratory and confirmatory analyses was conducted across a series of three independent studies to establish reliability and validity of the modular tool. Module 1 (Musicianship) provides a brief assessment of formal and informal music knowledge and practice. Module 2 (Musical capacity) measures emotional sensitivity to music, listening sophistication, music memory and imagery, and personal commitment to music. Module 3 (Music preferences) captures preferences from six broad genres and utilizes adaptive reasoning to selectively expand subgenres when administered online. Module 4 (Motivations for music use) assesses musical transcendence, emotion regulation, social, and musical identity and expression. The MUSEBAQ offers researchers and practitioners a comprehensive, modular instrument that can be used in whole, or by module as required to capture an individual's level of engagement with music and to serve as a background questionnaire to measure and interpret the effects of dispositional differences in emotional reactions to music.

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**The impact of music on cognitive and** emotional functioning is increasingly of interest to researchers and practitioners (MacDonald, Kreutz, & Mitchell, 2012; Rickard & McFerran, 2012). It is widely accepted that the effects of music are moderated by an individual's musical background and their level of engagement with music. For instance, researchers often distinguish between musicians and nonmusicians in their samples, and music therapists are likely to tailor their therapies based on a patient's music background. However, this distinction has often been limited to a gross measure of musicianship—such as years of formal music training—which fails to capture the myriad ways by which individuals engage actively with music. Several questionnaires have been developed that are designed to assess specific aspects of music engagement—such as music preferences (Rentfrow & Gosling, 2003), music sophistication (Müllensiefen, Gingras, Musil, & Stewart, 2014), or use of music for mood regulation (Saarikallio, 2008). A comprehensive and psychometrically validated instrument to assess the multidimensional nature of music engagement would, however, be helpful to fully acknowledge this construct in future research and practice in this field. Thus, in their Routes Model of the determinants of music reactions, Scherer and Coutinho (2013) suggested investigation of, at the minimum, *musical expertise*, *stable dispositions*, and *current motivational/mood state* as factors relating to the listener.

In the current paper, we report on the development and psychometric validation of a more extensive modular tool for measuring multiple dimensions of engaging with music. Via a series of three studies, we describe the MUSEBAQ questionnaire, which combines elements of several previous music questionnaires but combines them into a single modular instrument. The aim of developing this instrument is to help researchers and practitioners obtain a robust profile of music background and capacity, music preferences, and motivations for using music from a relatively brief and well validated survey.

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### MUSICIANSHIP AND MUSIC CAPACITY

In its simplest form, musicianship is defined by categorizing individuals as musicians or nonmusicians. This dichotomy is useful in research that needs to broadly control for differences in music skill level or the associated neurological differences (e.g., Merrett & Wilson, 2012). Musicianship is, however, a complex construct (see Rickard & Chin, 2016). Musicians are often further differentiated, for instance, by the frequency and duration (e.g., years) of their music training. Musicians can also be self-taught, or acquire musical skill informally, as evidenced by the many prolific and highly skilled musicians who did not receive any formal training (e.g., Frank Zappa, David Bowie, Django Reinhardt). Nonmusicians can also share many of the advanced skills of the trained musician, becoming highly adept at listening and interpreting music features (Bigand & Poulin-Charronnat, 2006; Lerdahl & Jackendoff, 1983). In this way, nonmusicians can be considered "musical" compared to everyday listeners if they have sufficient knowledge and analytical music listening history to evaluate music (Hargreaves, Hargreaves, & North, 2012). A nonperforming listener of music can also be proficient with formal or informal music theory, despite a lack of capacity for music practice.

Even without any music theory or practice skills, the majority of music listeners report emotional engagement with music, although this clearly varies across individuals. A recent study found that openness to aesthetics predicted musical sophistication in both musicians and nonmusicians (Greenberg, Müllensiefen, Lamb, & Rentfrow, 2015). Empathetic individuals tend to respond emotionally to music, while individuals with a more systematizing personality tend to respond to more intellectually complex music (Greenberg, Baron-Cohen, Stillwell, Kosinski, & Rentfrow, 2015). Musicians are also more likely to respond analytically to music than affectively (e.g., Hargreaves & Colman, 1981). Music receivers can therefore also be distinguished by their listening sophistication capacity, and their capacity to engage emotionally with music. Furthermore, a large-scale online study of musical sophistication in UK found that active engagement with music through activities such as focused music listening and attending music events had a positive impact on beat perception tasks, particularly for individuals with low levels of formal music training (Müllensiefen et al., 2014). Musicianship can perhaps therefore be better conceptualized as incorporating orthogonal dimensions of production and reception, with each dimension reflected on a continuum rather than a dichotomy (Chin & Rickard, 2012a).

Traditionally, music *capacity* is measured using a variety of auditory discrimination tasks (tones, chords/harmonic intervals, pitch, timbre, musical phrasing, rhythm, etc.). There are also several behavioral batteries that measure a combination of music-related skills (Seashore Measures of Musical Talent, 1919, 1956; Kwalwasser-Dykema Music Test, 1930; The Wing Standardized Tests of Musical Intelligence, 1948). More recently, these perceptual musical skills are considered and conceptualized as individuals' musical competence and can be assessed using the Profile of Music Perception Skills (PROMS; Law & Zentner, 2012). Deficits in processing musical components such as contour, interval, rhythm, metric, scale, and music memory can be assessed using the Montreal Battery of Evaluation of Amusia (MBEA; Peretz, Champod, & Hyde, 2003). These tests primarily assess auditory perception, discrimination, and processing skills. However, the capacity to respond and understand music extends beyond such skills, and depends on an individual's capacity to listen critically, to comprehend global music structures, and to appreciate both intellectual and affective intentions conveyed in music pieces. Reduced capacity for either cognitive or affective processing of auditory stimuli—as occurs in certain patients with localized neurological lesions—significantly impairs appreciation of music (Gosselin, Peretz, Johnsen, & Adolphs, 2007; Peretz & Gagnon, 1999).

In the absence of a valid self-report measure of music capacity, however, it is challenging to study the impact of individuals' sensitivity and capacity for listening, perceiving, and understanding emotions conveyed in music. Despite their limitations, self-reports can capture an individual's perception of how they perceive and respond to various types of emotion in music (for example, physiological responses such as getting chills or gooseflesh, feelings of awe or amazement, experiencing strong emotions in response to particular types of music). The Music Empathizing and Music Systemizing scales (Kreutz, Schubert, & Mitchell, 2008), for example, capture the inclination towards empathizing (understanding and responding to affective states of others) or systemizing (understanding characteristics of events and objects). These scales differentiate the tendency to attend to different aspects of music and are helpful for studying differences in cognitive styles of musical processing. Another self-report instrument that captures skilled musical behaviors such as singing and perceptual abilities well, as well as active engagement with music in various forms, is the Goldsmiths Musical Sophistication Index (Gold-MSI; Müllensiefen et al., 2014). Scores on the various subscales of the Gold-MSI were positively

associated with performance on actual listening tasks, making it an ideal alternative for when the use of actual perceptual testing of musical skills is not viable. Higher levels of musical sophistication show engagement in a greater variety of music activities than less sophisticated individuals, and may be able to utilize music more effectively to achieve their goals (Müllensiefen et al., 2014). While extremely useful in assessing specific constructs related to music processing and skilled musical behaviors, one aspect of musical sensitivity not captured in either instrument is the capacity to differentiate perceived levels of emotional sensitivity to music, which is crucial for studying the ability to recognize and understand emotions in music. A self-report measure that recognizes an individual's capacity for music listening and emotional sensitivity to music, in addition to their formal and informal musicianship, practical, and theoretical music knowledge, would therefore significantly improve measurement of musicianship.

### MUSIC PREFERENCES

Music preferences influence how individuals engage with music and overlap with musical identities and music listening habits (MacDonald, 2013; MacDonald, Kreutz, & Mitchell, 2012). They remain important moderators to explore in research on the health outcomes of music, for instance, with the use of certain music preferences previously associated (not necessarily causally) with substance use, behavioral problems, and mood regulation difficulties (Garrido & Schubert, 2013; Greenberg et al., 2015; McFerran, Garrido, O'Grady, Grocke, & Sawyer, 2015; Miranda & Claes, 2009; North & Hargreaves, 2008; Stack, Gundlack, & Reeves, 1994).

Music preferences are, however, challenging to measure. First, there is little agreement on what the basic genres should be, and it is recognized that these evolve over time (Rentfrow & Gosling, 2003). Second, broad classifications fail to recognize that passions can be quite finely localized to a subgenre, so limiting respondents' choices to the broad level lacks validity. Conversely, surveys that might aim to include an exhaustive list of subgenres to date would very likely be unwieldy and impractical. Third, instructions may fail to distinguish a listener's true preference for a type of music from their habitual behavior—for instance, by asking how frequently an individual listens to each genre. For example, while an individual may frequently report listening to pop music, this may be due to involuntary exposure in public places or from their peers' selections, rather than reflective of any preference for this music genre. An accurate measure of music preference should ensure the user's *choice* is captured, but should also ideally distinguish between self-reported preferences that may be biased by experimenter demand or social identity desirability from those that are actually demonstrated by behavioral choices.

One method of overcoming the challenges of labeling and selecting music genres in a self-report survey is to obtain direct behavioral measures of people's listening choices. A novel method of obtaining these data is via smartphone technology, whereby apps can automatically record listeners' playlists as they occur in everyday life (see Randall & Rickard, 2013). This technology is still emerging however, so self-report measures therefore continue to be an important means of obtaining insight into a listener's subjective preferences.

One of the most frequently used self-report measures of music preferences is the Short Test of Musical Preferences (the STOMP; Rentfrow & Gosling, 2003). Respondents rate their preference for 14 music genres (e.g., alternative, country, jazz, or rock) on a 7-point scale (a revised version of the STOMP comprises 23 genres). Four music preference factors initially emerged from these data, but a five factor model has superseded this, identifying people's preferences for mellow, unpretentious, sophisticated, intense, or contemporary styles of music (MUSIC model; Rentfrow, Goldberg, & Levitin, 2011). These latent factors overcome the difficulties of labeling and limiting the number of music genres from which respondents can choose, but are not meant to replace the STOMP. It is unlikely for instance, that respondents will easily identify with the factor labels *sophisticated* or *unpretentious*. A flexible means of measuring preferences that allows both broad and finer level detail is therefore still needed to more effectively assess music preferences via self-report.

### MUSIC USE MOTIVATIONS

One of the most enabling research findings relating to everyday use of music has been the elaboration of the various ways people use music in their lives. This understanding is shedding light into why both benefits and risk have been associated with music use in previous research. For instance, Chin and Rickard (2013, 2014) found that using music to regulate emotions or thoughts was associated with positive mental health well-being, while using music for social purposes was associated with poorer mental health. Any conceptualization of music engagement must therefore be capable of differentiating the primary motivations people have for using music.

There are numerous self-report questionnaires that tap into different reasons for using music. Several are

quite targeted in their focus, for instance with the Music in Mood Regulation questionnaire (MMR; Saarikallio, 2008) testing various types of affective regulation with music, and the Barcelona Music Reward Questionnaire (BMRQ; Mas-Herrero, Marco-Pallares, Lorenzo-Seva, Zatorre, & Rodriguez-Fornells, 2013) that assesses strongly hedonic or pleasurable experiences with music. Both these questionnaires have demonstrated replicability across studies, but are not intended to capture the broader spectrum of music use reasons.

Broader questionnaires that aim to assess a more comprehensive range of reasons for music use include the Uses of Music Inventory (UMI; Chamorro-Premuzic & Furnham, 2007), the Music USE questionnaire (MUSE; Chin & Rickard, 2012b), the Music Use Inventory (MUI; Lonsdale & North, 2011) and the brief version of the Music Experience Questionnaire (BMEQ; Werner, Swope, & Heide, 2006). Importantly, there is considerable overlap in the factors emerging from each of these instruments—for instance, with affective functions, innovative/engaged production, identity functions, and social functions emerging quite consistently. Nonetheless, each of these questionnaires is limited in the psychometric data available. Importantly, these questionnaires each relied on university student samples (mean ages $= \sim$20 years) for their development and testing. The MUSE was the only questionnaire initially developed from a primarily (88%) non-university student sample (mean age = 37.6 years), but it was then verified using a university student sample. Finally, no reliability or validity psychometrics are reported for the UMI or MUI. Reliability is reported for the MUSE and BMEQ scales, but no validity is reported for any of these questionnaires. There is therefore still a need for a psychometrically validated self-report questionnaire for measuring a broad range of reasons for music use in a normative population.

#### A MULTIDIMENSIONAL MODULAR INSTRUMENT

Most instruments are developed to measure a specific construct, such as music processing, preferences, or experiences, with each serving a different purpose. An overview of key musical constructs and published instruments are presented in Table 1.

It is clear from Table 1 that there is no instrument currently available that captures the key constructs of musical capacity, music training, preferences, and motivations to use music. A structured, multidimensional modular approach has both theoretical and methodological advantages. By examining the influence of a combination of music factors on another non-music outcome, such as cognitive task performance or health indicators, this approach provides a more inclusive and nuanced understanding of how music capacity, preference, and motivations impact non-music related outcomes. Methodologically, this approach facilitates modeling analyses of the complex interactions between music factors and other variables of interest. It is clear that various aspects of general music experiences and uses are captured very well using the currently available instruments. The MUSEBAQ modular instrument was, however, developed to provide a comprehensive musical background profile for music research. It is, however, not intended to supersede, but can be used to supplement other specific measures. For instance, a combination of MUSEBAQ and MUSE will provide researchers with a suite of information on an individual's music training background, capacity towards music, personal preferences of broad music genres, motivations for using music, and also their unique music engagement styles. Similarly, researchers investigating musical processing, abilities or behaviors can use MUSEBAQ to complement their other chosen instrument(s) as the respective tools capture different constructs. The overarching aim of this study, however, was to provide researchers with a single instrument that could be used in full, or in part, to obtain a 360° profile of an individual's music use. For utilitarian purposes, the aim was for the instrument to be as concise as possible while retaining robust psychometric properties.

This research demonstrates that it is crucial to obtain a broader picture of the ways in which individuals use music, and how a constellation of factors, incorporating functions, processes, motivations of music engagement, sensitivity and personal commitment towards music, as well as preferences of music genre, needs to be measured and considered together. The series of studies reported here aims to develop and establish reliability and validity of a modular tool for measuring the contributing aspects of music use, capacity and preferences to provide a comprehensive yet concise music engagement profiling tool for individuals.

## Experiment 1: Questionnaire Development

The aim of Experiment 1 was to generate items to assess the four dimensions of music engagement identified from past research: Musicianship, Musical Capacity, Music Preferences, and Music Use Motivations. These items were scrutinized via peer discussion reviews and were revised in an iterative manner until general satisfaction was reached. The resulting questionnaire was then trialed and revised further subject to feedback.

**TABLE 1.** *Overview of Musical Constructs and the Instruments That Measure Them*

| | Musical processing | Musical skills | Music training/ practice | Musical capacity | Music preferences | Music use/ experience |
|---|---|---|---|---|---|---|
| Perceptual tasks instruments | | | | | | |
| Montreal Battery of Evaluation of Amusia (MBEA; Peretz et al., 2003) | ✓ | | | | | |
| Profile of Music Perception Skills (PROMS; Law & Zentner, 2012) | | ✓ | | | | |
| Self-report measures | | | | | | |
| Short Test of Musical Preferences (STOMP; Rentfrow & Gosling, 2003) | | | | | ✓ | |
| Brief Experiences with Music questionnaire (BMEQ; Werner et al., 2006) | | | | | | ✓ |
| Ollen Musical Sophistication Index (OMSI; Ollen, 2006) | | ✓ | ✓ | | | |
| Uses of Music Inventory (UMI; Chamorro-Premuzic & Furnham, 2007) | | | | | | ✓ |
| Music Empathizing-Systemizing (Kreutz et al., 2008) | ✓ | | | | | |
| Music in Mood Regulation questionnaire (MMR; Saarikallio, 2008) | | | | | | ✓ |
| Music Use Inventory (MUI; Lonsdale & North, 2011) | | | | | | ✓ |
| MUSIC model (Rentfrow et al., 2011) | | | | | ✓ | |
| Music USE questionnaire (MUSE; Chin & Rickard, 2012b) | | | ✓ | | | ✓ |
| Barcelona Music Reward Questionnaire (BMRQ; Mas-Herrero et al., 2013) | | | | | | ✓ |
| Goldsmiths Musical Sophistication Index (Gold-MSI; Müllensiefen et al., 2014) | | ✓ | ✓ | | | |
| Healthy-Unhealthy Music Scale (HUMS; Saarikallio et al., 2015) | | | | | | ✓ |
| Music Engagement Questionnaire (MusEQ; Vanstone et al., 2016) | | | | | | ✓ |

## Method

Five hundred and twenty-four undergraduate Psychology students (75% female); age range 18-57 ($M = 24.4$, $SD = 6.6$) participated in this study. The age distribution of this sample was positively skewed, with a median age of 22 years and 75% of the sample under 24 years of age. The majority (81.3%) identified English as their primary language. The sample had a mean of 3.38 years ($SD = 5.88$) of formal music theory training and 4.36 years ($SD = 6.32$) of formal practical music training.

Initial items were obtained or adapted from the MUSE (Chin & Rickard, 2012b), GEMUBAQ (Coutinho & Scherer, 2014), Goldsmiths Musical Sophistication Index (Müllensiefen et al., 2014), and STOMP-R (Rentfrow & Gosling, 2003) in an attempt to capture a range of music use and capacity constructs. Where constructs were not sufficiently captured in previous questionnaires, new items were generated and refined by the authors in consultation with student groups (Experiment 1 participants) and music researcher peers.

Participants reviewed the items in 16 separate class discussions, assessing the fit of each item to dimensions identified in the literature. That is, items measuring similar behaviors or constructs were grouped together, effectively achieving a socially constructed cluster analysis. These clusters were labeled (e.g., with one set of items relating to *music capacity*, while another related more to *music background*. The items were then refined to ensure clarity for a broad range of potential respondents on the basis of feedback and discussion, and the final questionnaire collated. Individual participants completed a short online survey that asked them to indicate how well the final items captured their own preferences. This questionnaire was then administered in full to this sample. The median completion time was 21.80 min.

## Results and Discussion

### MODULE 1 (MUSICIANSHIP)

Module 1 was created with items designed to measure formal and informal music knowledge and practice. Several items in this module were adapted from the MUSE and GEMUBAQ. To capture both quantity and quality of musicianship, items included years of training, frequency of practice (e.g., "How often did or do you practice or rehearse with an instrument or singing?"), informal practice (e.g., "How often do you engage in music making as a hobby or as an amateur?"), and a subjective assessment of how much "do you know" (e.g., "How much do you know about music structure and theory?"). Items were also included to differentiate past training from current practice and amateur/hobby music making. These questions were then refined by the four authors to avoid repetition and to align better with contemporary conceptualizations of musicianship (e.g., Hargreaves et al., 2012; Rickard & Chin, 2016), yielding a set of six items. Response options varied depending on the question, but included specific fill times (e.g., number of years of training), and 5-point Likert-type scales ranging from 1 (*nothing*) to 5 (*a great deal*) for magnitude questions, or from 1 (*never*) to 5 (*all the time*) for frequency questions.

### MODULE 2 (MUSICAL CAPACITY)

The second module about music capacity generated 31 items assessing both quantity and quality of music listening and general sensitivity to music. The majority of items (20) were generated by the authors and student participants. The four authors drew or adapted seven items from the GEMUBAQ (Coutinho & Scherer, 2014), one from the MUSE (Chin & Rickard, 2012b), and two items were adapted (and one replicated) from the Goldsmiths Musical Sophistication Index (Müllensiefen et al., 2014). Sample items included, "I find it difficult to stop reliving my past when I listen to some music," "I get chills or gooseflesh when listening to moving music," "It's important for me to choose each piece of music I listen to," and "I become so involved in music I'm listening to that I lose track of time or where I am." Responses to item statements were added for the questionnaire using a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

### MODULE 3 (MUSIC PREFERENCES)

Using the STOMP-R and several large online music databases as a starting point, peer discussions were used to generate and refine a broad range of music genres for this module. Participants were asked to describe different types of music, to try to group these into broader music type clusters, and label each cluster. The outcome of each discussion group was compared, and the questionnaire genres were obtained from those for which there was consensus within groups, and some consistency across groups, or by combining groups that were related by less strongly represented across groups.

Six broad genres emerged from group discussions: rock or metal; classical; pop or easy listening; jazz, blues, country or folk; rap or hip/hop; dance or electronica. Within each broad category, a range of subgenres was generated across the discussion groups by a similar process (see Supplementary Material 1, Module 3 in online version of this paper for a complete list of subgenres). To minimize time demands on survey participants, the online administration of the survey utilized adaptive release of options to limit the subgenres visible to only those of the six broader categories selected by each respondent.

In a subsequent online survey, participants were each asked to select which of the six main music genres would best fit their own first music preference. Over half the sample's first preference was captured within two broad categories—pop or easy listening and rock or metal—that reflects the relatively young population. They were also asked to indicate whether this classification was a "good" or "poor" fit for their personal music preferences; 84% of the sample confirmed their selection was a good fit for one of the six main categories. Broken down by genre (see Table 2), the best fits were reported for the dance or electronica genre (good: poor fit = 16:1), classical genre (good: poor fit = 10:1), and pop or easy listening genre (good: poor fit = 7:1). The poorer fits were jazz, blues, country, or folk (4:1) and rap or hip/hop (4:1), which may reflect the diverse collection of styles grouped into the former category, and the ongoing evolution of contemporary subgenres evolving in the latter category. Nevertheless, each music preference type was rated as a significantly better fit than chance, providing support for the classifications.

For the questionnaire, the root stem, "How often do you choose to listen to any of the following styles of music?" was added. The wording of this question aimed to target the user's deeper music preferences rather than habitual listening, but also recognized that strong preferences need to be reflected in behavior. Responses to item statements were initially prepared as a 3-point ordinal scale (*never*, *sometimes*, *often*).

### MODULE 4 (MUSIC USE MOTIVATIONS)

To develop a set of items that comprehensively assessed motivations for music use, discussion groups were prompted to generate as many reasons for listening to

**TABLE 2.** *Distribution of Music Preferences (1st Preference) Across Sample and Relative Fit of Genre and Subgenre Labels for Participants' Preferred Music*

| Music preference (broad) | Selected as 1st preference | Good Fit | Not Good Fit | $X^2$ |
|---|---|---|---|---|
| 1. Rock or metal music | $N = 115$ (24%) | 97 (84%) | 18 (16%) | 54.27*** |
| 2. Classical music | $N = 33$ (7%) | 30 (91%) | 3 (9%) | 22.09*** |
| 3. Pop or easy listening music | $N = 136$ (28%) | 118 (87%) | 18 (13%) | 73.53*** |
| 4. Jazz, blues, country or folk music | $N = 78$ (16%) | 61 (78%) | 17 (22%) | 27.84*** |
| 5. Rap or Hip/Hop | $N = 41$ (9%) | 32 (78%) | 9 (22%) | 12.90*** |
| 6. Dance or Electronica | $N = 48$ (10%) | 45 (94%) | 3 (6%) | 36.75*** |
| 7. Other | $N = 28$ (6%) | 20 (71%) | 8 (29%) | 5.14* |
| | $N = 479$ | 403 (84%) | 76 (16%) | |
| *Excluding Other:* | $N = 451$ | 383 (80%) | 68 (14%) | |

*** $p < .001$, * $p < .05$

music as they could. The groups used the MUSE (Chin & Rickard, 2012b) as a starting point but were asked to critically reflect on the suitability and adequacy of these items for their own experience, and to develop items where gaps were perceived. This activity was offered in an undergraduate online class environment over two weeks, allowing an opportunity for participants to brainstorm in the first session and then reflect, discuss with family and peers, and refine their responses in the second session. They were also asked to group the suggestions into broader categories and generate labels for each category.

This process generated a set of 57 items. Sample items include, "I like to use music for the very intense experience it gives me," "I use music to distract me from emotional pain," "Having similar taste in music often helps me relate better to my peers," "My music collection/playlist says a lot about me," "I use background music to create a more pleasant space," and "Certain types of music helps me think or concentrate." In the subsequent online survey, individual participants were asked to indicate whether their primary way of using music was captured in at least one of the questionnaire's items; 97% indicated agreement. Responses to item statements were added for the questionnaire using a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

## Experiment 2: Psychometric Testing of Questionnaire

The aim of Experiment 2 was to obtain a large normative data set for all four modules of the questionnaire generated in Experiment 1, and to explore the factor structure and reliability of Modules 1, 2, and 4. (Due to the adaptive reasoning presentation of Module 3, it was not possible to subject this module to such analyses.)

### Method

Study 2 participants were recruited by university students involved in Study 1, following guidelines encouraging recruitment of an equal proportion of males and females, and representation across a variety of musical experiences, age categories, and socioeconomic strata. Recruitment and online administration procedures in this study complied with the National Statement on Ethical Conduct in Human Research (2007), and were approved by the University Human Ethics Committee. After agreeing to participate in this study, participants were provided with the survey link, where they provided informed consent and completed the online survey. Complete survey responses were obtained from 2964 individuals (40.4% male, 58.9% female, 0.7% unknown; $Age_M = 32.0$, $Age_{SD} = 14.6$, Age range 18 to 87). The age distribution was positively skewed, with a median age 24 years, and 75% of the sample under 42 years of age. Median completion time for the initial set of items was 23.68 minutes.

Data screening and analyses were conducted using IBM SPSS Statistics version 22. Participants' response timings were checked, as per guidelines recommended for web-based surveys, with no issues detected for unusually short or long response times (Reips, 2002). Additional checks were done to ensure that all variables were normally distributed, with $z$-scores in the recommended range of $\pm 3$ (Kline, 2015). The skewness ($-.43$) and kurtosis (.51) values were also in the acceptable range between $-1.0$ and $+1.0$. The tolerance values ranged between .34 and .77, and the VIF values ranged between 1.30 and 2.92, both within recommended ranges of tolerance > .10 and VIF < 10, demonstrating no issues with multicollinearity (Kline, 2015).

A hybrid approach using both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA)

**TABLE 3.** *PCA and EFA Factor Loadings of Items in Module 1*

| Initial item code | Module 1 items | Factor 1 | | Factor 2 | | Reliability if item removed Cronbach's α |
|---|---|---|---|---|---|---|
| | | PCA | EFA | PCA | EFA | |
| MS1 | Formal music training (theory) – years | .917 | .924 | | | .410 |
| MS2 | Music structure and theory knowledge | .847 | .839 | | | .798 |
| MS3 | Formal music training (practice) – years | .883 | .902 | | | .580 |
| MS4 | Professional music making | | | .800 | .785 | .847 |
| MS5 | Practice or rehearsal | | | .893 | .889 | .645 |
| MS6 | Music making as a hobby/amateur | | | .870 | .967 | .702 |

*Note*: Weaker factor loadings have been suppressed in all factor analysis tables for greater clarity. Factor 1: Formal music training; Factor 2: Music making.

was taken in this paper. This approach comprises three stages of analysis (Matsunaga, 2010):

1. Screening and reducing items using principal component analysis (PCA)
2. Determining the number of factors and identifying items that load onto particular factors (EFA)
3. Confirming the factor structure of the data (CFA) (see Experiment 3).

The sample of 2,964 individuals was randomly split into two subsamples to run PCA and EFA separately. The first subsample consisted of 1,494 individuals (40.3% male, 59.1% female, 0.6% unknown) and the second with 1,470 individuals (40.5% male, 58.8% female, 0.7% unknown). As Module 1 consistent of a small number of items, factor analysis was limited to the first two stages only (PCA and EFA).

## Results and Discussion

### MODULE 1: MUSICIANSHIP

Nearly 55% of participants indicated that they had no formal music theory training. The remaining participants had an average of 2.92 years of formal music theory training (range = 1-39 years). Approximately 47% of participants indicated that they had no formal practical music training. The remaining participants had an average of 4.07 years (range = 1-60 year). The music background of participants on the other musicianship items is reported in Table 4. A factor analysis using PCA (promax rotation) of the six items for Module 1 revealed that items loaded on two dimensions of musicianship, accounting for a total of 76.59% of variance. The first factor consisted of the first three items of the module, describing formal music training (accounting for 59.76% variance). The second factor comprised items relating to more specifically to music making (accounting for an additional 16.84% of variance) (see Table 3). These two factors were moderately correlated, $r = .53$, $N = 1457$, $p < .001$, but were orthogonal constructs. This indicates that the distinction between the two factors could still be useful in differentiating two distinct forms of musicianship. Internal reliability of each subscale was assessed and Cronbach's α for the formal music training factor was .73, and for the music making factor was .81. Reliability for the music training factor was increased slightly ($\alpha = .80$) when the question about music structure and knowledge was removed, while reliability for the music making factor was increased slightly ($\alpha = .85$) when the question about professional music making was removed. However, as these two individual items may be useful to distinguish different types of music background in certain research contexts, they were retained in the final questionnaire.

It is important to note that while two factors were identified within this module, it is not advisable to use these factors as subscales when utilizing this module in research or practice. This is because the items do not use the same measurement scales (with four using Likert-type scales and two requiring a response in "years"), so summing or combining responses may yield ambiguous interpretations. It is recommended therefore that the six items be retained as individual items, and interpreted accordingly. Reporting responses to each item will also enable comparison of studies using the MUSEBAQ with previous research that has used the more traditional music training indices, such as "years of music training" or "professional musicianship" in their sample (Table 4).

These results highlight how Module 1 provides more detailed and useful information about the musicianship of participants than the traditional dichotomous classification of "musician" or the frequently used "years of music training." Traditional categorization of this sample as musicians and nonmusicians would have identified between 12 and 15% of the sample as musicians based

**TABLE 4.** *Module 1 (Musicianship Characteristics) of Experiment 2 Participants*

| Item | Mean | *SD* | | | |
|---|---|---|---|---|---|
| Years music training (theory) | 2.93 | 3.25 | | | |
| Years music training (practice | 4.07 | 5.00 | | | |
| | Nothing | A little | A fair amount | A moderate amount | A great deal |
| Knowledge about music structure and theory | 923 (31.2%) | 1262 (42.7%) | 398 (13.5%) | 250 (8.5%) | 122 (4.1%) |
| | Never | Rarely | Sometimes | Often | All the time |
| Engage in professional music making | 2183 (73.7%) | 333 (11.2%) | 231 (7.8%) | 124 (4.2%) | 93 (3.1%) |
| Frequency of practice or rehearsal with an instrument or singing | 1509 (50.9%) | 564 (19.0%) | 413 (13.9%) | 323 (10.9%) | 155 (5.2%) |
| Engage in music making as a hobby or as an amateur | 1468 (49.5%) | 588 (19.8%) | 436 (14.7%) | 309 (10.4%) | 163 (5.5%) |

on professional status, or having at least a moderate level of music training. This module enables identification of a further 30% of the sample as non-professional music performers. This sample also has higher levels of practical music training ($M = 4.03$ years, $SD = 3.25$) than music theory ($M = 2.93$ years, $SD = 5.00$), $t(2947) = -7.93$, $p < .001$. Moreover, the sample had at least some informal music knowledge (69% know at least "a little") and practice (30% practiced at least "sometimes"), which would likely have been overlooked by classifying these individuals as nonmusicians. Because of this potential utility and diversity of items within the two scales, we recommend its use for contexts in which description of a sample beyond traditional musician versus nonmusician categories would be informative.

#### MODULE 2: MUSIC CAPACITY

For Module 2, PCA was first conducted using the subsample of 1,494 participants in order to reduce the initial set of 31 items. The Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the analysis, KMO = .94, and a significant Bartlett's test of sphericity $\chi^2(465) = 20982.19$, $p < .001$, indicated that correlations between items were sufficiently large for factor analysis (Field, 2009). Promax rotation was used for all factor analyses. Items in each of the five displayed factors for this module were refined based on both theoretical and statistical conditions aimed at increasing reliability and internal consistency of each factor. The following three criteria were set:

1) Modulus item loadings were at least .40
2) Modulus inter-item correlations were between .35 and .70
3) Modulus item-total correlations were at least .40

Using these criteria, 28 items were retained in the final solution (see Table 5 for factor loadings of items).

After screening items using PCA above, EFA was then conducted using the responses from the second subsample of 1,470 participants to determine the number of factors underlying the correlations among and variation in the shortlisted items, identify items that load strongly onto each of the extracted factors, and further reduce items that did not meet the criteria set previously. The KMO measure verified the sampling adequacy for the analysis, KMO = .93, and a significant Bartlett's test of sphericity $\chi^2(378) = 18500.16$, $p < .001$. The tolerance values ranged between .28 and .86, and the VIF values ranged between 1.17 and 3.58, both within recommended ranges of tolerance > .10 and VIF < 10, demonstrating no issues with multicollinearity (Kline, 2015). On the basis of Horn's parallel analysis (Thompson, 2004), the final factor (indifference to music) was not retained. These items are positioned at the end of this module's administration to allow researchers to easily omit them if only the most psychometrically robust factors are to be included. Should this factor be retained, researchers are advised to perform their own factor analysis to test its validity. The model without this factor explained 53.00% of the variance (see Table 6 for variance and sum of squared loading of each factor). The criteria used previously with PCA were also applied to this EFA, with the additional criterion of Cronbach's alpha being greater than .70.

Utilizing both PCA and EFA, the exact same factor structure patterns were obtained across two independent samples, providing strong evidence in support of the obtained four-factor solution. Of this item set, 14 of the module items are original, while 13 were drawn

**TABLE 5.** *PCA and EFA Factor Loadings of Items in Module 2*

| Initial item code | Final item No. | Module 2 items | Factor loadings of items | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Factor 1 | | Factor 2 | | Factor 3 | | Factor 4 | | Factor 5 | |
| | | | PCA | EFA | PCA | EFA | PCA | EFA | PCA | EFA | PCA | EFA |
| MC13 | MC10 | Tears come to my eyes when listening to some pieces of music | .862 | .653 | | | | | | | | |
| MC28 | MC2 | I experience strong emotions when I listen to particular types of music | .766 | .823 | | | | | | | | |
| MC27 | MC23 | I can be greatly moved by music | .765 | .820 | | | | | | | | |
| MC17 | MC13 | Music can produce feelings of wonder and fascination in me | .708 | .718 | | | | | | | | |
| MC12 | MC9 | I get chills or 'gooseflesh' when listening to moving music | .701 | .686 | | | | | | | | |
| MC16 | MC6 | I tend to appreciate music for its beauty or sublimity | .686 | .613 | | | | | | | | |
| MC29 | MC24 | Listening to music fills me with emotion | .670 | .768 | | | | | | | | |
| MC23 | MC19 | I sometimes seem to 'catch' the emotions that I hear in the music | .630 | .673 | | | | | | | | |
| MC22 | MC18 | When I listen to live music, I tend to experience the emotions expressed by the performers. | .484 | .551 | | | | | | | | |
| MC14 | MC15 | I can't help swaying my body or tapping my foot when listening to some music | .469 | .541 | | | | | | | | |
| MC8 | MC12 | It's important for me to choose each piece of music I listen to | | | .831 | .554 | | | | | | |
| MC9 | MC16 | It's important that I give my full attention to music when listening | | | .788 | .579 | | | | | | |
| MC25 | MC21 | Music is like an addiction for me | | | .702 | .836 | | | | | | |
| MC5 | MC4 | I often spend time online or in shops looking for music | | | .631 | .595 | | | | | | |
| MC26 | MC22 | I become so involved in music I'm listening to that I lose track of time or where I am | | | .625 | .733 | | | | | | |
| MC7 | – | I seek out live music listening experiences | | | .539 | < .40 | | | | | | |
| MC1 | MC8 | I couldn't live without music | | | .436 | .594 | | | | | | |
| MC19 | MC3 | I find it difficult to stop reliving my past when I listen to some music | | | | | .832 | .699 | | | | |
| MC20 | MC7 | I often see detailed pictures or movies in my head when I listen to music | | | | | .790 | .801 | | | | |
| MC21 | MC17 | Images appear without any effort when I hear music | | | | | .739 | .721 | | | | |
| MC18 | MC14 | Music often evokes vivid memories from my past | | | | | .713 | .668 | | | | |
| MC2 | MC1 | After hearing a new song a few times, I can usually sing or hum it by myself. | | | | | | | .803 | .646 | | |
| MC3 | MC20 | I have a good ear for music | | | | | | | .779 | .734 | | |
| MC6 | MC5 | I am able to describe a piece of music I've heard to someone else | | | | | | | .688 | .721 | | |
| MC4 | MC11 | I'm intrigued by music I'm not familiar with and want to find out more | | | | | | | .426 | .579 | | |
| MC30 | MC25 | I often feel bored while listening to music | | | | | | | | | -.825 | -.537 |
| MC10 | MC26 | I am quite indifferent to the presence of music | | | | | | | | | -.691 | -.492 |
| MC15 | MC27 | I never feel like dancing to music | | | | | | | | | -.669 | -.532 |

*Note.* Items retained after EFA are in bold font. **Factor 1** label: Emotional music sensitivity; **Factor 2** label: Personal commitment to music; **Factor 3** label: Music memory and imagery; **Factor 4** label: Listening sophistication; **Factor 5** label: Indifference to music

**TABLE 6 .** *Variance, Sum of Squared Loading and Alpha Reliability Coefficients of the Music Capacity Factors*

| Music capacity factors | % of variance before rotation | Rotation Sums of Squared Loadings | Cronbach's Alpha | Number of items retained |
|---|---|---|---|---|
| Emotional music sensitivity | 34.38 | 7.94 | .90 | 10 |
| Listening sophistication | 7.25 | 6.03 | .77 | 4 |
| Personal commitment to music | 6.49 | 6.41 | .81 | 6 |
| Music memory and imagery | 4.89 | 5.19 | .81 | 4 |
| Indifference to music | 3.85 | 2.30 | – | – |

**TABLE 7.** *Module 3 (Music preferences) of Experiment 2 Participants*

| Genre | Never | Sometimes | Often | Don't Know | Most popular subgenres | (% often listen to) |
|---|---|---|---|---|---|---|
| Rock or Metal | 764 | 943 | 23 | 23 | Alternative | 27.9 |
| | (25.8%) | (41.6%) | (31.8%) | (0.8%) | Classic | 27.9 |
| | | | | | Soft | 27.3 |
| | | | | | Indie | 26.0 |
| | | | | | Rock and Roll | 26.0 |
| Classical | 895 | 1461 | 581 | 27 | Instrumental | 22.4 |
| | (30.2%) | (49.3%) | (19.6%) | (0.9%) | Orchestral | 17.3 |
| | | | | | Classical | 19.3 |
| | | | | | 20$^{th}$ Century | 14.8 |
| Pop or Easy listening | 176 | 889 | 1878 | 21 | Chart (top 40) | 45.9 |
| | (5.9%) | (30.0%) | (63.4%) | (0.7%) | Mainstream | 45.5 |
| | | | | | Oldies | 32.9 |
| | | | | | Easy listening | 31.4 |
| Jazz, blues, country, folk | 709 | 1330 | 887 | 38 | R&B | 20.2 |
| | (23.9%) | (44.9%) | (29.9%) | (1.3%) | Acoustic | 18.9 |
| | | | | | Blues | 15.3 |
| | | | | | Indie/ contemporary folk | 15.3 |
| Rap or Hip/Hop | 973 | 1149 | 802 | 40 | Hip/Hop | 23.3 |
| | (32.8%) | (38.8%) | (27.1%) | (1.3%) | Contemporary R&B | 19.3 |
| | | | | | Rap | 17.5 |
| | | | | | Urban | 10.9 |
| Dance or Electronica | 885 | 1188 | 841 | 50 | House | 18.3 |
| | (29.9%) | (40.1%) | (28.4%) | (1.7%) | Disco | 10.4 |
| | | | | | Electronic ambient | 10.3 |
| | | | | | Techno | 10.2 |
| Other | 491 | 1046 | 796 | 631 | Musicals/ soundtracks | 17.7 |
| | (16.6%) | (35.3%) | (26.9%) | (21.3%) | World | 10.7 |
| | | | | | Religious | 7.5 |
| | | | | | Comedy | 6.1 |

*Note*: Nomination of genres and subgenres not exclusive, so individuals can nominate more than one category.

or adapted from previous questionnaires (GEMUBAQ and MSI).

#### MODULE 3: MUSIC PREFERENCES

In this sample, the majority of participants (63.4%) reported often choosing to listen to pop/easy listening music. Preferences were fairly evenly distributed across other music genres. Preferences for subgenres were complex and many cells contained low frequencies. Nevertheless, this module demonstrated the most popular subgenres within each broader category (see Table 7).

Intercorrelations between music preference categories were also explored (see Table 8). A preference for classical music was moderately correlated with a preference for jazz/blues/country/folk music, and a preference for rap or hip/hop music was moderately correlated with a preference for dance/electronica (Cohen, 1992).

In this trial of the questionnaire, several subgenres were endorsed by very small numbers of respondents. To maintain as concise a questionnaire as possible, subgenres receiving less than 10% of the responses (e.g., breakbeat dance, zydeco, teen pop, mediaeval classical

**TABLE 8.** *Intercorrelations between Broad Music Preference Categories (N = 2,964).*

| | Classical music | Pop or easy listening music | Jazz, blues, country or folk music | Rap or Hip/Hop | Dance or Electronica | Other |
|---|---|---|---|---|---|---|
| Rock or metal music | .055** | −.078** | .130** | .016 | .003 | .040* |
| Classical music | | .020 | .346** | −.098** | −.044* | .075** |
| Pop or easy listening music | | | .104** | .168** | .139** | .092** |
| Jazz, blues, country or folk music | | | | .049** | .011 | .110** |
| Rap or Hip/Hop | | | | | .498** | .153** |
| Dance or Electronica | | | | | | .218** |

*$p < .05$; **$p < .01$

music, gothic rock, Christmas music) were removed from the final questionnaire. Feedback from respondents was also obtained and used to revise the final questionnaire. Anecdotal feedback from participants indicated that the 3-point response items were not fine grained enough to allow them to provide the differentiation between genre preferences required. While this feedback was informal, the authors agreed that greater differentiation was important, and also consistent with the 5-point ratings in other modules. Responses were therefore revised to a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*).

A factor analysis of the broad music genres identified three factors: rap or hip/hop, dance or electronica and pop loaded strongly on the first factor (accounting for 27% of the variance); jazz, blues, country or folk and classical loaded strongly on the second factor (accounting for an additional 23% of the variance); while rock or metal loaded on a third, with pop loading inversely on this factor (accounting for an additional 17% of the variance). These three factors are consistent with factors identified by Rentfrow et al., 2011) as "Urban," "Sophisticated," and "Intense" music preferences, respectively. While these factors may be of use to some researchers, the primary aim of the MUSEBAQ was to generate the most concise and usable questionnaire format for music researchers or practitioners. For this purpose, it is recommended that broad music genres might generally be of more use to describe individual music preferences, as they reflect the terms used in everyday life to describe types of music and are likely to be more easily interpreted by participants and more relevant for researchers.

### MODULE 4: MUSIC USE MOTIVATIONS

Similar to Module 2, a hybrid approach using PCA and EFA was taken for Module 4. The analyses were conducted using the same two subsamples as per Module 2. PCA was first conducted using the subsample of 1,494 participants in order to reduce the initial set of 57 items. The Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the analysis, KMO = .98, and a significant Bartlett's test of sphericity $\chi^2(1596) = 55335.18$, $p < .001$, indicated that correlations between items were sufficiently large for factor analysis (Field, 2009). The same set of criteria used previously for Module 2 was also applied for Module 4. Based on the criteria, 41 items were retained after the initial PCA analysis (see Table 9 for factor loadings of items).

After screening items using PCA above, EFA was then conducted using the responses from the second subsample of 1,470 participants to determine the number of factors underlying the correlations among and variation in the shortlisted items, identify items that load strongly onto each of the extracted factors, and further reduce items that do not meet the criteria set previously. The KMO measure verified the sampling adequacy for the analysis, KMO = .97, and a significant Bartlett's test of sphericity $\chi^2(820) = 36576.06$, $p < .001$. Multicollinearity was also checked, with no observed correlations above .70 among items. According to Horn's parallel analysis (Thompson, 2004), four factors (with 30 items) should be retained, which in combination explained 59.70% of the variance (see Table 10 for variance and sum of squared loading of each factor). Nonetheless, the fifth factor (with a further three items) "cognitive regulation" was validated by PCA and EFA and therefore may be retained by researchers, although factor analysis on their own data is recommended to confirm their validity. The items from this subscale are situated together at the end of this module's administration to allow researchers the ability to easily omit them if only the most psychometrically robust factors are to be included. The criteria used previously with PCA were also applied to this EFA, with the additional criterion of Cronbach's alpha being greater than .70. Of the final item set, 23 of the module items are original, while 10 were drawn or adapted from the MUSE.

**TABLE 9.** *PCA and EFA Factor Loadings of Items in Module 4*

| Initial item code | Final item No. | Module 4 items | Factor loadings of items | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Factor 1 | | Factor 2 | | Factor 3 | | Factor 4 | | Factor 5 | | Factor 6 | |
| | | | PCA | EFA | PCA | EFA | PCA | EFA | PCA | EFA | PCA | EFA | PCA | EFA |
| **MM16** | **MM12** | **I like to use music for the very intense experience it gives me** | **.852** | **.827** | | | | | | | | | | |
| **MM47** | **MM7** | **Music raises me to another state of mind** | **.741** | **.735** | | | | | | | | | | |
| **MM34** | **MM16** | **Music exposes me to emotions I don't often feel** | **.722** | **.585** | | | | | | | | | | |
| **MM35** | **MM25** | **Music helps me discover who I want to be** | **.704** | **.727** | | | | | | | | | | |
| **MM2** | **MM1** | **I seek deep experiences through music** | **.695** | **.780** | | | | | | | | | | |
| **MM22** | **MM18** | **Music inspires new ideas and thoughts in me** | **.671** | **.728** | | | | | | | | | | |
| **MM31** | **MM23** | **Music listening sparks my creativity** | **.603** | **.586** | | | | | | | | | | |
| **MM40** | **MM19** | **Music helps me understand who I am** | **.596** | **.511** | | | | | | | | | | |
| **MM42** | **MM28** | **Music is like a comforting friend to me** | **.519** | **.656** | | | | | | | | | | |
| NA | **MM9** | **I feel that music communicates what language can't** | **.447** | **.653** | | | | | | | | | | |
| **MM20** | **MM24** | **I use music to distract me from emotional pain** | | | **.826** | **.849** | | | | | | | | |
| **MM26** | **MM20** | **I use music to help me work through my emotional problems** | | | **.760** | **.733** | | | | | | | | |
| **MM23** | **MM27** | **I use music to get through difficult times** | | | **.747** | **.727** | | | | | | | | |
| **MM30** | **MM22** | **I use music to explore and understand my own feelings** | | | **.696** | **.725** | | | | | | | | |
| **MM17** | **MM13** | **I listen or play music when I'm upset or feeling down** | | | **.684** | **.730** | | | | | | | | |
| **MM6** | **MM4** | **I like to use music to distract me from my worries** | | | **.679** | **.737** | | | | | | | | |
| **MM48** | **MM30** | **Playing music is an outlet for my anger or frustrations** | | | **.614** | **.580** | | | | | | | | |
| **MM19** | **MM15** | **I use music to calm myself when I'm stressed or feeling anxious** | | | **.592** | **.544** | | | | | | | | |
| NA | – | I use music to help me reminisce or because it reminds me of the past | | | .497 | < .4 | | | | | | | | |
| NA | – | I use particular pieces of music to improve my mood | | | .468 | < .4 | | | | | | | | |

*(continued)*

**TABLE 9. (continued)**

| Initial item code | Final item No. | Module 4 items | Factor loadings of items | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Factor 1 | | Factor 2 | | Factor 3 | | Factor 4 | | Factor 5 | | Factor 6 | |
| | | | PCA | EFA | PCA | EFA | PCA | EFA | PCA | EFA | PCA | EFA | PCA | EFA |
| NA | – | **I use music to distract me from physical aches** | | | **.412** | **.491** | | | | | | | | |
| **MM14** | **MM10** | **I like to listen to music that my friends like** | | | | | **.899** | **.709** | | | | | | |
| **MM45** | **MM29** | **Music is more powerful when I experience it with others** | | | | | **.596** | **.605** | | | | | | |
| **MM5** | **MM3** | **Having similar taste in music often helps me relate better to my peers** | | | | | **.587** | **.497** | | | | | | |
| **MM3** | **MM2** | **Concerts often make me feel part of a community** | | | | | **.568** | **.550** | | | | | | |
| **MM18** | **MM14** | **I often use music to feel a closer bond with other people** | | | | | **.520** | **.553** | | | | | | |
| **MM15** | **MM11** | **Music is important for informing and maintaining relationships** | | | | | **.433** | **.448** | | | | | | |
| **MM37** | **MM26** | **Music helps me feel comfortable around other people** | | | | | **.414** | **.431** | | | | | | |
| **MM7** | **MM5** | **I consider myself a music 'fan' or music buff of certain types of music** | | | | | | | **.774** | **.625** | | | | |
| **MM21** | **MM17** | **My music collection/playlist says a lot about me** | | | | | | | **.753** | **.612** | | | | |
| **MM8** | **MM21** | **I dance, sing or play music to express my feelings** | | | | | | | **.520** | **.631** | | | | |
| **MM11** | **MM8** | **I feel safe expressing my feelings through music** | | | | | | | **.457** | **.614** | | | | |
| NA | – | I imagine myself being like the performer or character in the music | | | | | | | .423 | < .4 | | | | |
| NA | MC31 | Certain types of music help me think or concentrate | | | | | | | | | .791 | .473 | | |
| NA | MC32 | I use music to block out noise | | | | | | | | | .722 | .466 | | |
| NA | MC33 | Music helps me to keep going on another task for a longer period of time | | | | | | | | | .647 | .568 | | |
| NA | – | I use music to improve the atmosphere when I'm alone | | | | | | | | | .472 | < .4 | | |
| NA | – | I use music to help me sleep | | | | | | | | | .456 | < .4 | | |
| NA | – | I use background music to create a more pleasant space | | | | | | | | | .442 | < .4 | | |
| NA | – | I exercise better with music | | | | | | | | | | | .684 | < .4 |
| NA | – | I feel physically energized by music | | | | | | | | | | | .599 | < .4 |

*Note.* Items retained after EFA are in bold font. **Factor 1:** Musical transcendence; **Factor 2**: Emotional regulation; **Factor 3**: Social; **Factor 4**: Music identity and expression; **Factor 5:** Cognitive regulation; **Factor 6**: Physical

**TABLE 10.** *Variance, Sum of Squared Loading and Alpha Reliability Coefficients of the Music Use Motivation Factors*

| Music motivation factors | % of variance before rotation | Rotation Sums of Squared Loadings | Cronbach's Alpha | Number of items retained |
|---|---|---|---|---|
| Musical transcendence | 42.28 | 13.93 | .92 | 10 |
| Emotional regulation | 5.31 | 13.91 | .93 | 9 |
| Social | 4.07 | 8.97 | .86 | 7 |
| Music identity and expression | 3.52 | 9.94 | .79 | 4 |
| Cognitive regulation | 2.77 | 10.58 | – | – |

## Experiment 3: Questionnaire Validation

A set of 67 items—grouped into four independent modules describing the various ways individuals engage with music—emerged from Experiments 2 and 3. As two existing questionnaires—the MUSE (Chin & Rickard, 2012b) and the GEMUBAQ (Coutinho & Scherer, 2014)—contributed substantially to its creation, this multidimensional instrument was named the MUSEBAQ (or the Music USE and Background Questionnaire). This final study was designed to test the psychometric properties of the final MUSEBAQ on an independent community sample derived from Amazon Turk (a marketplace for recruiting user defined survey respondents). The aim of this study was to perform CFA on the multifactor Modules 2 and 4, and test these subscales for concurrent validity using similar scales from existing questionnaires.

### Method

#### PARTICIPANTS

In Experiment 3, a separate sample of 304 participants (51% male, 49% female) between the ages of 21 and 69 ($Age_M = 35.13$, $Age_{SD} = 9.62$) was recruited via Amazon Mechanical Turk. The age distribution was again positively skewed, with a median of 32 years and 75% of the sample under 38 years. Slightly over a third (35%) of participants indicated that they had not had any formal music theory training. The remaining participants had an average of 3.56 years of formal music theory training (range = 1-26 years). As for formal music training (practice), 31% of participants reported that they had not had any training. The remaining majority of participants had 3.99 years of music training (range = 1-31 years). A summary of the distribution of music background experience of these participants is reported in Table 11.

**TABLE 11.** *Demographics of Experiment 3 Survey Participants*

| | | Experiment 2 ($N = 2{,}964$) | | Experiment 3 ($N = 304$) | |
|---|---|---|---|---|---|
| Age | Mean (*SD*) | 32.03 | (14.58) | 35.13 | (9.62) |
| Knowledge about music structure and theory | | | | | |
| | Nothing | 923 | (31.2%) | 52 | (17.1%) |
| | A little | 1262 | (42.7%) | 129 | (42.4%) |
| | A fair amount | 398 | (13.5%) | 71 | (23.4%) |
| | A moderate amount | 250 | (8.5%) | 36 | (11.8%) |
| | A great deal | 122 | (4.1%) | 16 | (5.3%) |
| Engage in professional music making | | | | | |
| | Never | 2183 | (73.7%) | 105 | (34.5%) |
| | Rarely | 333 | (11.2%) | 75 | (24.7%) |
| | Sometimes | 231 | (7.8%) | 81 | (26.6%) |
| | Often | 124 | (4.2%) | 27 | (8.9%) |
| | All the time | 93 | (3.1%) | 16 | (5.3%) |
| Frequency of practice or rehearsal with an instrument or singing | | | | | |
| | Never | 1509 | (50.9%) | 75 | (24.7%) |
| | Rarely | 564 | (19.0%) | 68 | (22.4%) |
| | Sometimes | 413 | (13.9%) | 77 | (25.3%) |
| | Often | 323 | (10.9%) | 69 | (22.7%) |
| | All the time | 155 | (5.2%) | 15 | (4.9%) |
| Engage in music making as a hobby or as an amateur | | | | | |
| | Never | 1468 | (49.5%) | 75 | (24.7%) |
| | Rarely | 588 | (19.8%) | 69 | (22.7%) |
| | Sometimes | 436 | (14.7%) | 91 | (29.9%) |
| | Often | 309 | (10.4%) | 52 | (17.1%) |
| | All the time | 163 | (5.5%) | 17 | (5.6%) |

#### MATERIALS

*Formal and informal music knowledge and practice.* As with Experiment 1, the first module about music knowledge practice included six items designed to capture the formal music training and general music practice reported by the individual.

*Musical capacity.* The second module about music capacity comprised 24 shortlisted items from Experiment 2; these items assessed both quantity and quality of music listening and general engagement with music. Responses to item statements were made on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

*Music preferences.* As with Experiment 1, the third module about music preferences included six broad

genres with each broad category (rock or metal; classical; pop or easy listening; jazz, blues, country or folk; rap or hip/hop; dance or electronica) filtered further down to subgenres (see Appendix for a complete list of subgenres). Responses to item statements were made on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*).

*Music use motivations.* The fourth module consists of 30 shortlisted items from Experiment 2 about why individuals use music. As per Experiment 1, responses to item statements were made on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

*Battery of music scales for validity checks.* The following three scales were included to assess the validity of the modular MUSEBAQ measurement tool. The Uses of Music Inventory (UMI; Chamorro-Premuzic & Furnham, 2007) is a 15-item scale that measures three aspects of music use: emotional, cognitive, and background. Responses to item statements were made on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), and reported Cronbach's $\alpha$ range from .76 (background subscale) to .85 (cognitive subscale).

The Brief Music in Mood Regulation (B-MMR; Saarikallio, 2012) scale is a 21-item scale that measures mood regulation through music. Responses to item statements were made on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), and reported Cronbach's $\alpha$ range from .73 (diversion subscale) to .85 (solace subscale).

The Barcelona Music Reward Questionnaire (BMRQ; Mas-Herrero et al., 2013) is a 20-item, five-factor scale that measures facets of how individuals experience reward associated with music. Responses to item statements were made on a 5-point Likert scale ranging from 1 (*completely disagree*) to 5 (*completely agree*), and reported Cronbach's $\alpha$ range from .78 (social reward subscale) to .93 (sensory motor subscale).

The Music Use Inventory (Lonsdale & North, 2011) is a 31-item questionnaire asking participants to share how important music is in their lives, and then to rate 30 items on how well they described why they listen to music. In this study, two items only from the identity subscale ("I listen to music to create an image for myself" and "I listen to music to portray a particular image to others") were used to test the Identity subscale from Module 4, and to avoid repetition with other items from other questionnaires administered. Responses to these 6 items were made on an 11-point Likert scale ranging from 1 (*not at all important*) to 10 (*extremely important*), and the Cronbach's $\alpha$ for these two items from the current data was .71.

### PROCEDURE

All recruitment and online administration procedures in this study complied with the National Statement on Ethical Conduct in Human Research (2007) and were approved by the University Human Ethics Committee. After agreeing to participate in this study, participants were provided with the survey link, where they provided informed consent and completed the online survey. Once seven outliers (who completed the questionnaire over more than 24 hours) were removed, the median time to complete the MUSEBAQ, Uses of Music Inventory, BMRQ, B-MMR, and MUI was 12.55. The MUSEBAQ on its own (which is less than two thirds of the total battery) is estimated to take on average less than 10 min.

Data screening was conducted using IBM SPSS Statistics version 22 and CFA analyses were conducted with Mplus version 7.3 (Muthén & Muthén, 1998-2011). Model fit was evaluated primarily using the root mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMR). Both are population-based indices that are not affected by sample size (Hu & Bentler, 1999). In addition, both the Tucker-Lewis Index (TLI) and the Comparative Fit Index (CFI) are reported as additional metrics of model fit as recommended by Jackson and colleagues (2009). TLI and CFI relate to the total variance accounted for by a model, where values greater than .95 and .90 respectively are considered to indicate excellent and adequate fit to the data respectively (Hu & Bentler, 1999; Marsh, Hau, & Wen, 2004). RMSEA and SRMR relate to the residual variance, where values smaller than .06 or .08 respectively indicate excellent and adequate model fit (Hu & Bentler, 1999; Kline, 2005).

## Results and Discussion

To validate the four-factor structure obtained for Module 2 from the PCA and EFA in Experiment 2, CFA was conducted on a separate independent sample. Figure 1 shows the four-factor model for Module 2 *Music Capacity*. Standardized estimates and errors are reported in the model.

Model fit for a four-factor structure for Module 2 *Music Capacity* was reasonably adequate, RMSEA = .07, SRMR = .06, TLI = .88, CFI = .90, as ascertained using Hu and Bentler's (1999) benchmarks of RMSEA $\leq$ .06, SRMR $\leq$ .08, TLI $\geq$ .95, and CFI $\geq$ .95.

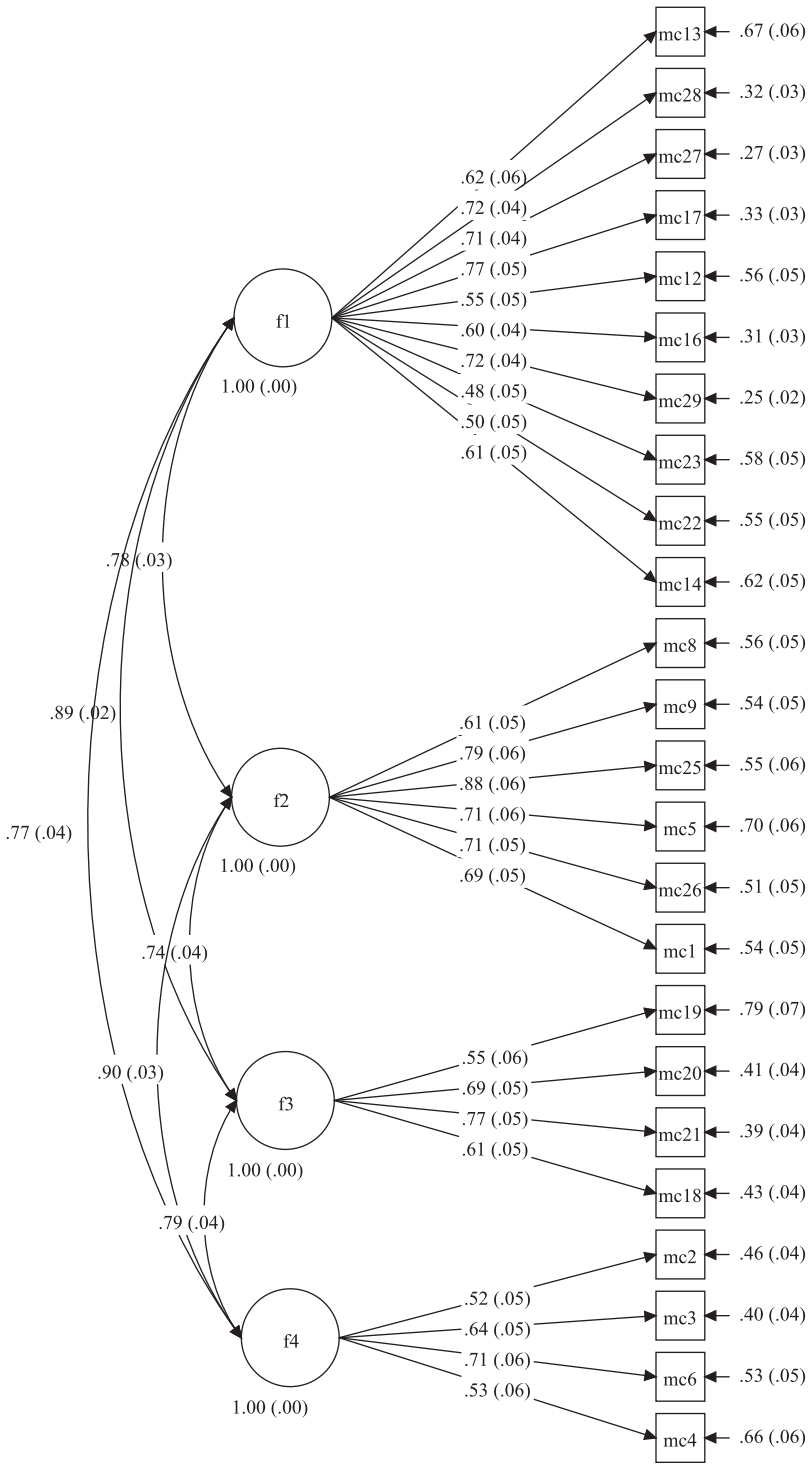


**FIGURE 1.** Four-factor model for Module 2 Music Capacity. f1: Emotional music sensitivity; f2: Personal commitment to music; f3: Music memory and imagery; f4: Listening sophistication. Individual item codes are listed alongside module items in Table 3.

To validate the four-factor structure obtained for Module 4 from the PCA and EFA in Experiment 2, CFA was conducted on a separate independent sample. Figure 2 shows the four-factor model for Module 4 *Music Use Motivations*. Standardized estimates and errors are reported in the model.

Model fit for a four-factor structure for Module 4 *Music Use Motivations* was reasonably adequate, RMSEA = .07, SRMR = .05, TLI = .91, CFI = .91, as ascertained using Hu and Bentler's (1999) benchmarks of RMSEA $\leq$ .06, SRMR $\leq$ .08, TLI $\geq$ .95, and CFI $\geq$ .95.

Concurrent validity was tested via correlations between the MUSEBAQ Module 2 and four subscales, with subscales from previous questionnaires testing similar constructs. Specifically, it was anticipated that for the MUSEBAQ Module 2: (a) emotional music sensitivity subscale should correlate positively with the MMR strong sensation and BMR sensory motor subscales; (b) personal commitment to music subscale should correlate with the BMR musical seeking subscale; (c) listening sophistication should correlate with the UMI cognitive subscale; and (d) music memory and imagery should correlate with the MUI identity subscale. Similarly, it was expected that the MUSEBAQ Module 4: (a) music transcendence subscale should correlation positively with the UMI cognition subscale; (b) social subscale should correlate with the MRS social rewards subscale; (c) music identity and expression subscale should correlate with the musical seeking subscale; and (d) emotion regulation subscale should correlate with the MRS mood regulation subscale and all the MMR subscales. These correlations are presented in Table 12, and confirm all expected correlations.

## General Discussion

The aim in this research was to develop an evidence-based flexible questionnaire for assessing the broad range of ways in which individuals engage with music. The primary target audience for this questionnaire was music psychology researchers, although the questionnaire could also be useful for practitioners with an interest in tailoring their interventions on the basis of a client's music engagement, or for more general researchers who are interested in the relationship of music engagement with another variable of interest. Theoretically driven items were generated to assess traditional and less formal musicianship, capacity to engage with music, music genre preferences, and reasons or motivations for using music. Across a series of three independent studies, the items were subjected to a range of methodologies to reduce them to a robust set of factors that replicated across several samples. The resulting questionnaire—the MUSEBAQ—is a comprehensive, modular instrument that can be used in whole, or by module as required. The entire profile provides substantially more information about an individual's musical engagement than has been previously available, and requires an average of less than 10 minutes to complete. The individual modules can be used in isolation if a more targeted assessment is required, for instance of musical capacity.

### MODULES 1 AND 3: MUSICIANSHIP AND PREFERENCES

Module 1 provides an overview of an individual's music background with regard to both formal and informal music knowledge and practice. The two factors identified within this module are consistent with previous research that recognizes musicianship can exist without formal music training (Chin & Rickard, 2012a). These studies also demonstrated, however, that using six questions to detail an individual's music background can be informative, and therefore researchers may choose to use each of these items to detail the musicianship demographics of their sample. Clearly this will provide a more comprehensive assessment of a participant's musicianship than is traditionally achieved by the metric 'years of music training or identification as a professional musician. It may be misleading to suggest that the skills of listening and interpretation of music features are uniform within both categories of musicians and nonmusicians (Bigand & Poulin-Charronnat, 2006, Hargreaves et al., 2012, Lerdahl & Jackendoff, 1983). Therefore, the use of Module 1 information will enable researchers to avoid blunt classifications that lose finer detailed information about an individual's music knowledge or practice, which may be needed to shed light on differences amongst participant responses.

Module 3 provides a flexible means of obtaining detailed information on a sample's music preferences. It achieves greater detail about subgenres than previous questionnaires by using adaptive release reasoning, so that respondents are only required to provide additional responses within only those genres to which they often or always listen. The subgenre labels will inevitably require updating in the future due to the rapid growth and differentiation of contemporary music types. Nevertheless, the use of subgenre breakdown will enable participants to feel their selections are more authentic than when broad categories only are used. This was confirmed in the general agreement that for most genres, participants' own music tastes were adequately captured by the labels provided. Furthermore, findings here

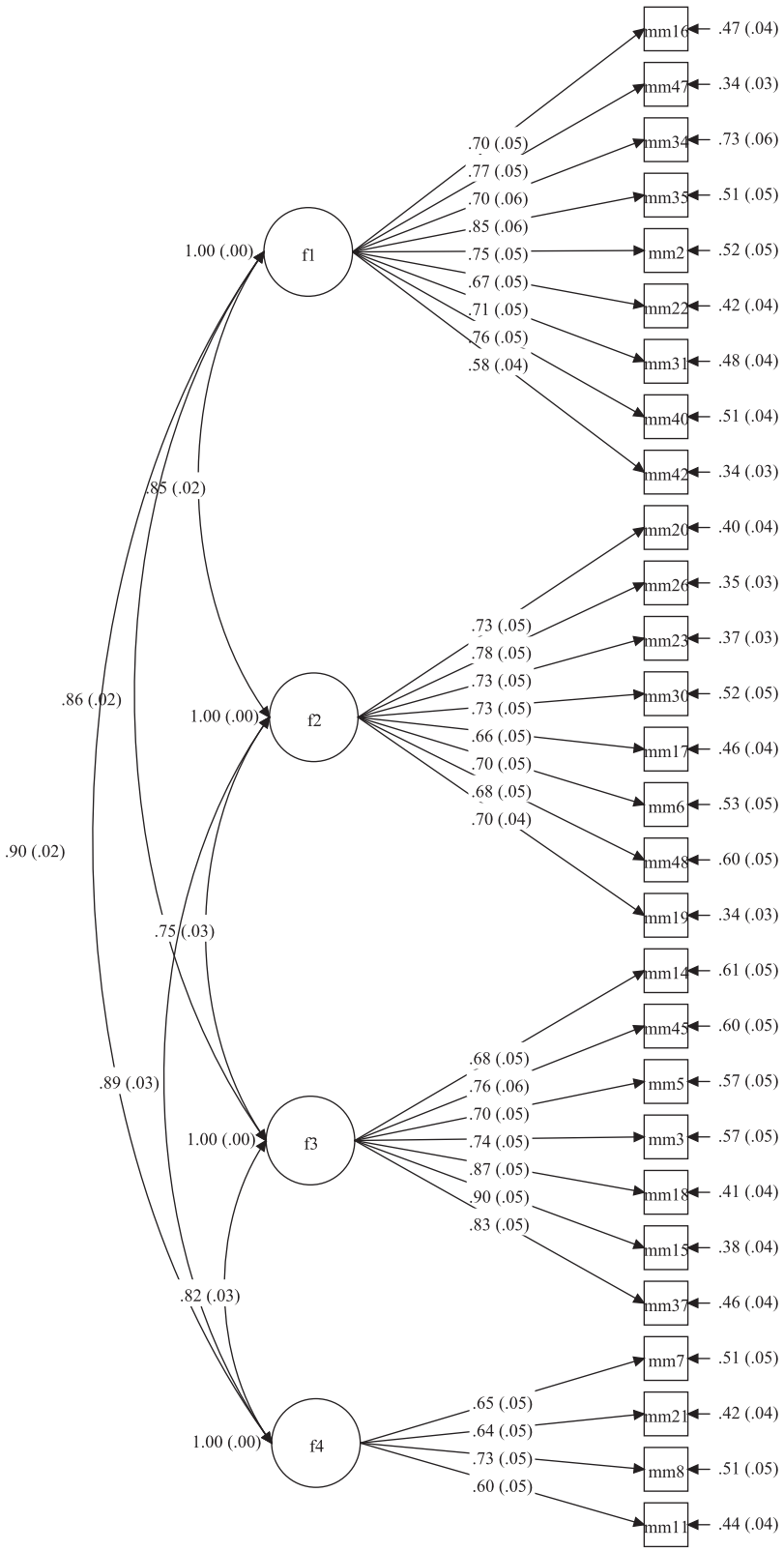


**FIGURE 2.** Four-factor model for Module 4 Music Use Motivations. f1: Music transcendence; f2: Emotion regulation; f3: Social; f4: Music identity and expression. Individual item codes are listed alongside module items in Table 7.

**TABLE 12.** *Concurrent Validity of MUSEBAQ Subscales*

| MUSEBAQ Subscale | Concurrent test subscale | Correlation |
|---|---|---|
| Module 2 Emotional Sensitivity to music | BMR Sensory Motor | .56** |
| | B-MMR Strong Sensation | .71** |
| Module 2 Personal commitment | BMR Musical Seeking | .70** |
| Module 2 Listening sophistication | UMI Cognitive | .42** |
| Module 2 Music memory and imagery | UMI Cognitive | .30** |
| Module 4 Music transcendence | UMI Cognitive | .60** |
| Module 4 Music identity and expression | MUI Identity | .53** |
| Module 4 Social | BMR Social Reward | .81** |
| Module 4 Emotion regulation | BMR Mood Regulation | .74** |
| | B-MMR Entertainment | .62** |
| | B-MMR Revival | .69** |
| | B-MMR Strong Sensation | .69** |
| | B-MMR Diversion | .77** |
| | B-MMR Discharge | .50** |
| | B-MMR Mental Work | .70** |
| | B-MMR Solace | .76** |

**$p < .01$

of the links between preference for rock or metal music and classical, and jazz/blues/county/folk music demonstrate support for past research that music preferences may also be driven by preferences for musical features or attributes, and not just music genre or type (Rentfrow et al., 2011). By using Module 3 in combination with the other modules in this questionnaire, future studies can examine more broadly the relationships between music preferences with socio-psychological processes, environmental and emotional contexts, as well as musical capacity and motivations for engaging with music. An interesting question for future research would also be to investigate whether music engagement can be predicted by pattern of music preferences. While engaged listeners typically listen to self-chosen, preferred music (Greasley & Lamont, 2011; Liljeström, Juslin, & Västfjäll, 2013), breadth and diversity of music preferences or evolution of music preferences over time (Greasley & Lamont, 2016) may also be indicative of high levels of music engagement.

### MODULES 2 AND 4: MUSICAL CAPACITY AND MOTIVATIONS FOR USE

Module 2 enables the individual variation in sensitivity or capacity to respond to music to be identified. This should be valuable in research where individual differences in capacity to respond to music may explain differences in outcome measures of interest (e.g., an emotional response or efficacy of a music medicine intervention). This study is the first to identify four robust factors within this construct: emotional sensitivity; listening sophistication; music memory and imagery; and personal commitment to music. Each of these pathways reflect related but distinct ways in which individuals can become highly attuned to music, and thereby may explain why some individuals respond more strongly than others to music exposure.

Module 4 captures the primary motivations underlying music use. Most notably, this is the first study to find "music transcendence" to be the primary motivation for music listening. Previous research has found that people tend to report using music for quite practical reasons that achieve greater happiness (emotion regulation), connection to others (social, identity), or efficacy (background, physical). These uses were replicated here, with emotion regulation, social and musical identity, and expression confirmed as key motivations for using music. This study, however, is the first to yield a more spiritual or eudaimonic wellbeing factor in motivations for using music. The items contributing to the music transcendence scale tapped into the more intense, inspirational, and otherworldly nature of music experiences. Previous research has included items that also seem to measure this construct (e.g., the in the "strong sensation" subscale of the MMR; Saarikallio, 2008, or several items in the "surveillance" subscale of the MUI; Lonsdale & North, 2011). It may be, however, that insufficient items around this type of engagement with music in these questionnaires have meant that the items are subsumed and identified as part of other factors rather than a factor in its own right. This finding is consistent with qualitative accounts of music engagement that often depict strong experiences with music offering listeners new perspectives or insights into their lives, greater purpose or meaning in life, or a powerful spiritual experience (Gabrielsson, 2011). Inclusion of this factor brings psychometric testing of music engagement into better alignment with one of the most important, but to date omitted, reasons for using music.

The factor structure of Modules 2 and 4 were obtained via the gold standard, hybrid approach to factor analysis using PCA, EFA and CFA (Matsunaga, 2010). This allowed us to first identify the set of latent factors that capture both musical capacity and music use motivation, and subsequently test the underlying

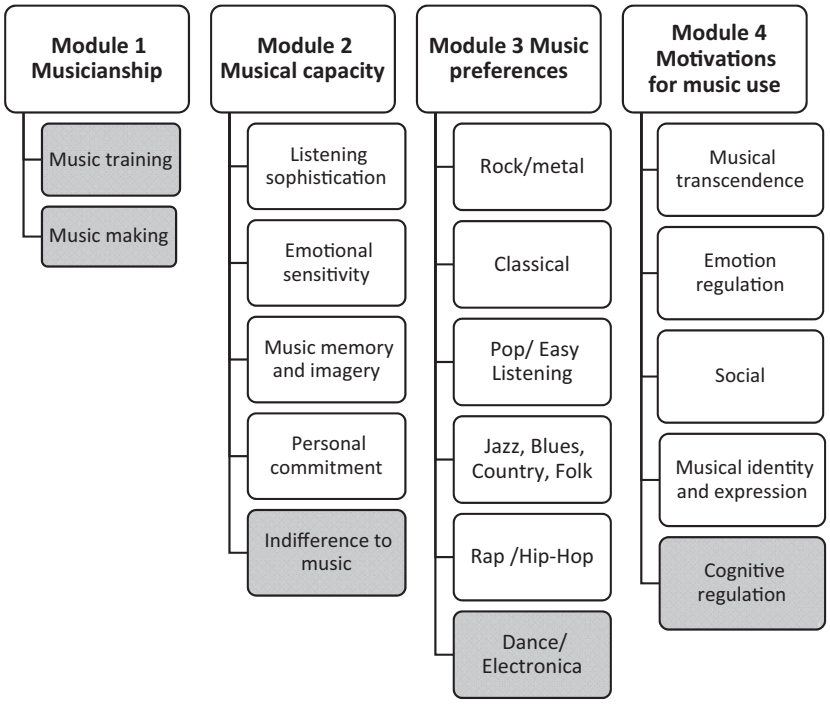


**FIGURE 3.** MUSEBAQ modules and component subscales. (Shaded subscales to be utilized with caution—see text for further detail).

structure of both constructs and investigate if the models fit adequately. Results across the three stages of factor analyses provide strong support for the underlying structure of the two modules. In Experiment 2, a large sample was randomly subdivided into two subsamples. Factor loadings of retained items and factor structure were consistent across both subsamples. Furthermore, shortlisted items from Experiment 2 were used in the CFA in Experiment 3, utilizing another independent sample, with a combination of fit indices reflecting an adequate model fit. The consistency of results across different samples provides additional support for the four-factor structure. This process also uncovered several factors that were not sufficiently robust to be retained. While theoretically supported, "indifference to music" (Module 2), and "physical" and "cognitive regulation" motivations (Module 4) were excluded following CFA, although the validity of the latter factor is supported partially and therefore can be retained with caution.

The psychometric properties of the MUSEBAQ were also strong. Internal reliability (Cronbach's alphas) for all Module 2 and 4 subscales was strong (ranging from .77 to .93), and concurrent validity with previous measures of music engagement and use was demonstrated. While other forms of validity will be tested in future research, Experiment 3 suggested that there may be limitations in the MUSEBAQ's discriminant validity. The majority of subscales and factors tested correlated positively and strongly with each other. While not entirely surprising given that the same individual is likely to exceed or lack a range of related music habits, previous research has indicated that engaging with music in certain ways can be predictive of quite different outcomes (Chin & Rickard, 2013, 2014). Further research (e.g., using cluster analysis) on data from the MUSEBAQ will be important to determine how individuals are differentiated in their music use patterns.

It is noteworthy that the age bias in each of the three studies reported means that findings must be interpreted with some caution. The age distribution was positively skewed such that the factors identified in these samples may reflect music characteristics of individuals better for the under 40 demographic than older demographics. While approximately a quarter of the current sample was above this age, there is nonetheless an age bias in all three studies despite explicit efforts in Experiments 2 and 3 to recruit from older populations. Regardless, Experiment 2 did survey 168 individuals aged 60+ so this age group is still well represented in these data, and may still provide one of the relatively large samples of senior aged participants in published work of this type. Replication of this work is nonetheless recommended, although given the demonstrated

difficulty in attracting older participants to be involved in online research, paper and pen administration may be worthwhile.

## Conclusion

The MUSEBAQ is a relatively brief, flexible, and comprehensive questionnaire that has demonstrated psychometric validity and reliability. Its modular nature allows it to be fit to purpose and reduces demand on participants. Indices can be obtained for a range of subscales enabling insight into the quality of music engagement rather than only the frequency. While further research is required to determine whether a global music engagement index is meaningful, the current MUSEBAQ generates rich data on four distinct aspects of music engagement (see Figure 3). Researchers and practitioners are encouraged to use this instrument to obtain rich data about their participants' music background and uses, and to allow a more consistent comparability of samples across studies. This is particularly important for divergent findings or failure to replicate in cases in which listener samples diverge with respect to musical engagement and background factors that may have affected reactions to different kinds of music. Obviously, the empirical assessment and specification of the probability of such effects constitute an important agenda for research in its own right.

## Author Note

Requests for the MUSEBAQ can be made via https://www.musicengagement.net/musebaq-survey The initial development of the Geneva Music Background Questionnaire (GEMUBAQ), which served as one input to the present work, was supported by the Music and Emotion Focus of the Swiss Center for Affective Sciences. The authors also thank Raymond Macdonald for suggestions regarding musical identity items.

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