Dynamic music elements: tempo and key signature effects
on mood, alertness and calmness.

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Abstract

The aim of this study was to examine the relationship between mood, alertness and calmness and particular musical elements; tempo and key signature. A sample of 44 participants was used and each participant was presented a song to listen to. A measure of mood was also noted before and after the song was presented and the MDMQ (Multi-Dimensional Mood State Questionnaire) was used to obtain measures of mood, alertness and calmness after the song. Song familiarity, preference in genre and levels of musical/classical training were also taken into account. Results found there was an increase in mood when presented with a song in a minor key and a fast tempo and also that there was a gender difference in mood change from before and after the song was presented. This has some implications for music psychology and musical therapy that are discussed and some limitations surrounding the sample size and methodology were also stated. Possible future directions in research were presented in order to forward the current study’s direction into improving the area of music therapy.
Introduction

Music is everywhere. Not a day goes by when people don't hear music in some shape or form from somewhere; from their iPods or phones, to their radios in their cars, to on the television during shows and advertisements, to playing while they shop. It is so embedded in our lives that even the word itself, 'music', is derived from the Greek word "mousa", which refers to the goddess of culture; Muse (Dial, 1996). Music is so intrinsically linked with human culture, yet it seems most people don't even realise the effects it can have. Rentfrow (2012) puts forward that recent research into music and its relationship with psychology is confined to two schools of research: the media effects model and the uses and gratification model (Arnett, 1995; Katz, Blumler & Gurevitch, 1973). The media effects model takes the approach that examines how musical styles impact on various psychological and social factors, the research on which looks primarily at the priming effects of the genres and themes of the music. The uses and gratification model takes the approach of regarding the individual's preferences into consideration and suggests that individuals use media in order to fulfil their own needs. The main difference in these approaches is the media effects model considers the music to be the variable that creates the change whereas the uses and gratification model considers the individuals needs and preferences as what dictates what music they choose to listen to. This study will attempt to look at the interactions from both approaches, in that the effects that the music have on the individual will be examined but their preferences in the genre of music will also be recorded and the relationships between the two considered.
Uses and Gratification Model

The uses and gratification model, as presented by Arnett (1995), is very observable in adolescents, where it can be seen in how much attention they pay to magazines (Evans, Rutberg, Sather & Turner, 1991) and music (Brake, 1985), to name but a few of the media sources teenagers can be seen inseparable from. Arnett (1995) presents five dominant uses that media is used for. Entertainment, which is a rather obvious one but is quite clearly one of the main uses for most forms of media, is the first one suggested and can be supported by Ban's (1986) study which found that adolescents cite music as one of the top things that make them happy. Identity formation was another used suggested, in that they take ideals around their roles in society partly from the media, which have been known to present particular ideals of gender roles and physical appearance (Greenberg, Siemicki & Dorfman, 1986). The next suggested use for media is for gaining a high sensation, in so far as individuals search for a level of stimulation from forms of media, for example young men and adolescent boys seeking a high level of stimulation from action movies (Arnett, 1994). Coping is also considered a major use of media, where individuals use different forms of media in order to relieve and dispel negative emotions (Kurdek, 1987). Larson (1990) supports this by suggesting that adolescents often listen to music as part of the process of self-regulation. The last suggested use for media is youth culture identification. Individuals have reported gaining a sense of being connected to a larger peer network through the use of media (Roe, 1985). There is a common theme through these five suggested media uses: socialisation. The search for both identity formation and youth culture identification are interlinked with the search for entertainment and stimulation, in that individual's gain their sense of identity through the media of music, TV or movies but also gain the entertainment and sensations that are desired through the same media (Arnett, 1995). This suggests that the five uses are not explicitly separate but are working simultaneously towards the ultimate goal of socialisation. This is to
be taken into consideration in the current study to examine whether particular music genres are used to gain particular mood states.

**Media Effects Model**

The main assumption of the media effects model is that being exposed to music automatically primes individuals to think and feel in ways that are consistent with the message of the music. These may be negative effects, such as those presented by Fischer & Greitemeyer (2006) that found that males who were exposed to misogynistic music behaved more aggressively when in the company of a female than in the company of a male confederate, or positive effects, like those found by Rodríguez-Bailon, Ruiz, and Moya (2009) which found that participant's attitudes towards Gypsies displayed less prejudice after attending to Flamenco music. These studies suggest that music is very much capable of affecting individual's feelings, emotions and behaviour to a large extent. However, the media effects model has some serious limitations. A key assumption of this model is that individuals are passive recipients of music, idly listening to the music they encounter. However, over two-thirds of the music that is listened to daily in self-selected (Juslin, Liljeström, Västfjäll, Barradas & Silva, 2008). Therefore, there is the possibility that the individual's choice of music could be the source of the effects of songs, as suggested by the uses and gratification model above (Arnett, 1995).

**The effects of music**

As is already known, music can have wide-ranging effects, from an organisation setting in how ambient music in a shop can affect the perceived passing of time (Areni & Grantham, 2009), to social functions as a topic of conversation or at parties and social events (Delsing, Ter Bogt, Engels & Meeus, 2008). More relevant to psychology, however, is its effects on people’s feelings, mood and behaviour. For example, Greitemeye (2009)
conducted studies where he looked at how songs with prosocial lyrics, as opposed to neutral 
lyrics, actually caused an increase in helping behaviours in the individuals it was presented 
to. Scherer & Zentner (2001) also put forward that the effects that music has on emotion can 
be explained neurologically, implying the central nervous system in emotion generation and 
direct effects on the peripheral nervous systems causing proprioceptive feedback to central 
areas which processes the emotion communicated through the music itself. This is further 
supported by Juslin & Laukka's (2003) literary review of 104 studies on vocal expression 
and 41 studies on music performance which highlighted the accuracy with which discrete 
emotions are communicated to an audience and, also, that there are emotion-specific patterns 
of acoustic queues used to express and communicate these emotions. From these past studies, 
it has become quite clear that music can have very effective and profound effects on 
behaviour and emotions.

**Mood**

On a separate note, mood is something that is constantly changing. Happy moods can 
be induced from sources like conversation with a loved one, to hearing a joke, to simply 
waking up in a good mood (Mayer, Salovey & Caruso, 2004). Conversely, bad moods are 
just as easy to slip into with just as many sources, from arguments, bad weather, even reading 
a sad book or story in a newspaper. Mood changes many, many times each day and there are 
countless sources that affect it. The majority of effects, however, seem to be positive mood 
effects (Heye & Lamont, 2010; North, Hargreaves & Hargreaves, 2004; Juslin et al., 2008). 
Possibly as a result of the positive effects music has, there has been a number of music 
therapies developed in recent years.
Music therapy

Music therapy is based on the associative and cognitive powers of the mind and is one of the expressive therapies which are interpreted as a complementary or integrative medicine in recent times (Sharma & Jagdev, 2012). Music is considered effective as a therapeutic medium because music contains many different levels of structure, yet provides the variability and flexibility needed to counteract the more rigid characteristics of the pathology (Wigram & Gold, 2006). Typical techniques generally include free and structured improvisation, singing familiar songs or improvised songs, listening to music and verbal reflection of the musical processes in relation to the client’s problems (Wigram, Pedersen & Bonde, 2002). Some important factors in music therapy, as far as the technique is concerned are: Improvisation, which was found to be helpful in exploring and expressing 'unspeakable' feelings (Etkin, 1999); Listening to music, described as a receptive technique, was found to enable valuable insights (Lefebvre, 1991); Verbal discussion of the symbolic meanings and themes of were often found to be essential in the therapeutic method (Henderson, 1991; Lefebvre, 1991; Etkin, 1999); Play activities, not normally involving musical material, were introduced and incorporated into the therapy to help explore and experiment with expressing individuals feelings (Hibben, 1991; Henderson, 1991). A good majority of these aspects of the practice of musical therapy involve an interaction with the client/participant, which encourages them to express themselves through the medium of music. There are a number of case studies of successful musical therapy with individuals suffering from autism (Wigram & Gold, 2006); PTSD in comparison to CBT (Carr, d'Ardenne, Sloboda, Scott, Wang & Priebe, 2012), chronic mental illness (Stewart, 1997) and self-esteem and self-concept issues (Kivland, 1986) which suggests that music therapy has a strong foothold as a psychodynamic treatment.
Music and mood

So based on this concept that music has a very strong connection with psychological factors, it is reasonable to suggest that music can have a very profound effect on mood (Rentfrow, 2012; Heye & Lamont, 2010; Juslin, Liljestrom, Vastfjall, Baradas & Silva, 2008; Hunter, Schellenberg & Griffith, 2011). However, there is a question on what it is that within the music that causes the effects that it has. Some studies suggest that it is the lyrical content that causes certain psychological changes (Buser, Flannery, Bentley & Gladding, 2005; Greitemeyer, 2009), which is very possible, as the lyrics are the most obvious part of a piece of music and more people will sing out the lyrics of a song as opposed to sound out the instruments that play. There's also suggestions that the genre of the music can contribute to the effects of the music; for example, perceptions of image (Oakes & North, 2013), sexual and ethnic attitudes (LaMarre, Knobloch-Westerwick & Hoplamazian, 2012; Aubrey & Frisby, 2011) and levels of alcohol consumption (Engels, Poelen, Spijkerman & Bogt, 2012), which is just as relevant as lyrical content. However, it is possible that the dynamics of the music also need to be considered, more precisely: tempo and key signature. In a study by Kellaris & Kent (1991), tempo was found to have positive main effects on evaluations of music's arousingness and on behavioural intent. The importance of tempo and modality on emotion was further highlighted in a study by Juslin (2000). Three professional guitarists were asked to perform three short melodies but to communicate different emotions when they played. The three musicians used the tempo, timbre and modality of the music to convey the different emotions. This study makes clear that the dynamics of the song writing is very powerful for conveying the effects of the music.
The current study

The current study will examine the connection between the dynamics music, i.e.: tempo and key signature, and how they affect mood. Considering the relationships found previously between mood and tempo and key, it is expected that there will be a strong link between the mood and these two musical variables. However, as genre and lyrical content may come to be a confounding variable, the individual's preference will be taken into account in the analysis of results. So the individual's preference of genre will be taken into account when being presented with this study. It is expected that a relationship will be found between the tempo of the music (fast and slow) and the participant's mood, and also between the key signature (major or minor) and the participant's mood. The influence of genre preference, level of musical education, and familiarity with the music presented will also be explored. The results of this study will add to what is currently known about psychological effects of music. Illustrating an interaction between mood and musical dynamics will help inform future music-based interventions that aim to reduce negative, or increase positive, mood.
Method

Participants:

Participants were recruited through a convenience sampling method. All participants were between 18 and 65 years of age (Mean = 20.92, SD = 10.96). A total of 44 participants (43.2% female, 56.8% male) were recruited with 10 participants per group.

Design:

A full experimental, between-groups design was used between the four groups. The independent variables manipulated were key signature (major or minor) and tempo (fast or slow). 4 songs were used as audio stimuli, one used per participant; one was in the major key of C major and had a fast tempo of 130 beats per minute (bpm), one was in the major key of C major and had a slow tempo of 66bpm, one was in the minor key of F minor and had a fast tempo of 160 bpm and one was in the minor key of F minor and had a slow tempo of 83 bpm. Participants were assigned to each group randomly. A correlational analysis of classical training/musical education, age, gender, preferred genre and song familiarity was also conducted in the sample. The dependent variables were mood (rated on a numerical 1 to 10 scale) and Good-Bad Mood, Alertness-Tiredness and Calmness-Restlessness scores.

Materials/Apparatus:

Four songs were presented in the experiment, one for each group. The songs presented were Happy by Pharell Williams (2013, track 1; minor key, fast tempo), Boulevard of Broken Dreams by Green Day (2004, track 4; minor key, slow tempo), Losing my Religion by REM (1991, track 2; major key, fast tempo) and Hallelujah by Jeff Buckley (2007, track 6; major key, slow tempo). The Multi-Dimensional Mood State Questionnaire (MDMQ; Steyer, Schwenkmezger, Notz & Eid, 1997), a 30 item questionnaire, was also used
to measure the three subscales of Good-Bad Mood, Alertness-Tiredness and Calmness-Restlessness. Standard demographic questions were also used to assess gender and age. A five point Likert scale was used to record a participants level of Classical Training (1 = None, 2 = Plays music/instrument as a hobby, 3 = Junior Certificate or equivalent, 4 = Leaving Certificate or equivalent, 5 = Full Classical Training). Participant's three favourite genres of music was recorded from a set of 16 choices (Pop, Rock, Blues, Classical, Jazz, Country, Dance, R'n'B, Heavy Metal, Funk, Indie, Punk, Hip-Hop, Rap, Reggae, Other), where it was required to just fill in three boxes with the numbers 1, 2 and 3. It was also recorded if participants had heard the song previously or were familiar with the song through a simple "Yes" or "No" answer.

Procedure:

Participants were first required read a cover sheet of a questionnaire booklet presented to them and were given information here to ensure they understood the aim and method of the study, that the study was completely anonymous, that they were fully within their rights to withdraw from the study at any time and that by filling in the questionnaire booklet they were giving their own informed consent to take part in the study. Contact details were also offered for any participant who desired to make any enquiries after the completion of the study. Afterwards, they proceeded to give demographic information of their gender and age in a written format and were also required to give information on if they had any level of musical or classical training. Next, participants were requested to give a measure of their current mood on a numerical scale of 1 to 10, with 1 being the worst mood they can imagine and 10 being the best mood they could imagine. After filling in this data, participants were asked to listen to a song, from a pool of 4 songs, as mentioned above, through a set of headphones. The song with which they were presented with was the defining group variable in this study. Participants were to listen to the entirety of the song and were instructed to continue with
filling in the questionnaire, in their own time, once the song had ended. After an example of how informing the participant in how to fill in the succeeding questionnaire, they were required to give another reading of their mood in the 1 to 10 numerical fashion. The Multi-Dimensional Mood State Questionnaire (MDMQ; Steyer, Schwenkmezger, Notz & Eid, 1997) followed on the next two pages of the booklet and all the 30 items were scored in a 5 point Likert scale. The last two instructions the participant was given was to fill in their 3 favourite genres of music from a list of 15 possible selections and, if a genre wasn't there that they desired to put down, there was an "other" option, where they were required to state the unavailable genre, and to state whether they were familiar with or had previously heard the song that they have been presented with during the study. Participants were then informed of when the results of the study would be available, debriefed on the in-depth nature of the study, if they wished, and thanked for their participation in the study.
Results

Descriptive Statistics:

Descriptive results were found for the variables analysed through the course of this study. A breakdown of age and gender descriptive were given above. The mean Pre-song Mood was 6.91 (SD = 1.179) and ranged from a minimum of 3 to a maximum of 9. Post-song Mood’s mean was slightly higher, at 7.02 (SD = 1.517), and shared exactly the same range of scores recorded as Pre-song Mood. Most participants had no level of Classical Training (65.9%), 8 played instruments as a hobby (18.2%), 3 studied music to Junior Certificate level (6.8%), none to Leaving Certificate Level and 4 participants had a Full Classical Training in music, i.e.: studied it in college/learned how to read, write and understand musical theory (9.1%). A massive majority of participants reported having heard the song presented to them before (90.9%), with a meagre 4 participants (9.1%) not recognising the song presented to them. The table (Table 1) below shows the distribution of the genre participants reported as their 3 favourite musical genres. As can be seen, rock music was the most favoured genre, with pop only a little less, Dance and Indie music were the most selected 2nd favourite and Pop was the most selected 3rd favourite selected.

Totals and descriptive statistics were also found for the three subscales from the MDMQ. The mean of the Good-Bad Mood subscale was found to be 43.16 (SD = 8.132), with a range of 42, minimum of 18 and maximum of 60. The Alertness-Tiredness subscale was found to have a mean of 35.02 (SD = 9.204), a range of 41, minimum of 14 and a maximum of 55 reported scores. The same data was also recorded for the Calmness-Restlessness subscale, which had a mean of 40.41 (SD = 9.069), range of 39, minimum of 17 and a maximum of 56.
Table 1 *Frequency of Favourite Genre Selection*

<table>
<thead>
<tr>
<th>Genre</th>
<th>1st Favourite Selected</th>
<th>2nd Favourite Selected</th>
<th>3rd Favourite Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pop</td>
<td>10 (22.7%)</td>
<td>3 (6.8%)</td>
<td>9 (20.5%)</td>
</tr>
<tr>
<td>Rock</td>
<td>11 (25%)</td>
<td>4 (9.1%)</td>
<td>1 (2.3%)</td>
</tr>
<tr>
<td>Blues</td>
<td>4 (9.1%)</td>
<td>2 (4.5%)</td>
<td>3 (6.8%)</td>
</tr>
<tr>
<td>Classical</td>
<td>1 (2.3%)</td>
<td>6 (13.6%)</td>
<td>4 (9.1%)</td>
</tr>
<tr>
<td>Jazz</td>
<td>1 (2.3%)</td>
<td>1 (2.3%)</td>
<td>4 (9.1%)</td>
</tr>
<tr>
<td>Country</td>
<td>1 (2.3%)</td>
<td>1 (2.3%)</td>
<td>2 (4.5%)</td>
</tr>
<tr>
<td>Dance</td>
<td>3 (6.8%)</td>
<td>7 (15.9%)</td>
<td>4 (9.1%)</td>
</tr>
<tr>
<td>R’n’B</td>
<td>2 (4.5%)</td>
<td>6 (13.6%)</td>
<td>3 (6.8%)</td>
</tr>
<tr>
<td>Heavy Metal</td>
<td>1 (2.3%)</td>
<td>2 (4.5%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Funk</td>
<td>1 (2.3%)</td>
<td>0 (0%)</td>
<td>2 (4.5%)</td>
</tr>
<tr>
<td>Indie</td>
<td>3 (6.8%)</td>
<td>7 (15.9%)</td>
<td>3 (6.8%)</td>
</tr>
<tr>
<td>Punk</td>
<td>0 (0%)</td>
<td>2 (4.5%)</td>
<td>1 (2.3%)</td>
</tr>
<tr>
<td>Hip-Hop</td>
<td>1 (2.3%)</td>
<td>2 (4.5%)</td>
<td>3 (6.8%)</td>
</tr>
<tr>
<td>Rap</td>
<td>1 (2.3%)</td>
<td>0 (0%)</td>
<td>2 (4.5%)</td>
</tr>
<tr>
<td>Reggae</td>
<td>0 (0%)</td>
<td>1 (2.3%)</td>
<td>1 (2.3%)</td>
</tr>
<tr>
<td>Other</td>
<td>4 (9.1%)</td>
<td>0 (0%)</td>
<td>2 (4.5%)</td>
</tr>
</tbody>
</table>
Inferential Statistics:

A 2 X 2 X 2 Mixed Factorial ANOVA was ran between the variables of Tempo (1 = fast, 2 = slow), Key (1 = major, 2 = minor) and Mood Change (pre-song mood and post-song mood) and found a significant within-subjects effect in the interaction between Mood Change, Tempo and Mood (F (1) = 5.542, p = .024). A further analysis of this interaction was conducted by a 2 X 2 Repeated Measures ANOVA between Mood Change and Tempo after the data was split by Key and found and found no significant results in the Major Key half of the data. However, a significant within-subjects interaction was discovered between Mood Change and Tempo in the Minor Key half of the data (F (1) = 5.581, p = .028). Analyses continued with a 2 X 2 Repeated Measures ANOVA being run between Mood Change and Key after splitting the data by Tempo and found an approaching significance within-subjects interaction between Mood Change and Key in the Slow Tempo half of the data (F(1) = 3.106, p = .093) and also a significant within-subjects effect in Mood Change in the Fast Tempo half of the data (F(1) = 5.833, p = .025) but no significant result in the interaction between Mood Change and Key. One last analysis was conducted on the data, after splitting the file by both Key and Tempo, through the means of a Paired Samples T-Test of Pre-song Mood and Post-song Mood. No significant result was found in the Fast Tempo and Major Key group, the Slow Tempo and Major Key group or the Slow Tempo and Minor Key group. The only effect found was in the group with Fast Tempo and Minor Key (t (10) = -2.631, p = .025) where the mean mood score increased significantly from 7 (SD = 1342) to 7.55 (SD = 1.572).

A 2 X 2 X 2 Mixed Factorial ANOVA was also ran between Mood Change and Gender where a significant between-subjects result was found (F(1) = 4.326, p = .044). A set of independent samples T-Tests were ran between Gender and both Pre-song Mood and Post-song Mood and two nearing significant results were found. There was a near significant difference (t (30.373) = 1.812, p = .08) in Pre-song Mood, in that males had a higher mean...
mood (mean = 7.2, SD = .975) than females (mean = 6.53, SD = 1.389). The near significant
difference (t (42) = 1.953, p .058) in Post-song Mood shared the same trend, where males had
a higher mean mood (mean = 7.4, SD = .957) than females (mean = 6.35, SD = 1.954)

A MANOVA was also ran between Group (1 = Minor + Fast, 2 = Minor + Slow, 3 =
Major + Fast, 4 = Major + Slow) and the MDMQ subscales (Good-Bad Mood, Alertness-
Tiredness, Calmness-Restlessness) which found no significant result in any of the subscales.
No significant correlation, as ran by Pearson's, was discovered between Age and Mood
Change or Age and the MDMQ subscales, nor any significant result found in the 2 X 2
Repeated Measures ANOVA between Song Familiarity (1= Yes, 2 = No) and Mood Change.
However, when three One-Way ANOVAs were conducted separately to analyse the three
MDMQ subscales individually against Gender and a significant result was found in one of the
subscales, namely the Calmness-Restlessness subscale (F(1) = 4.178, p = 0.047). An
independent samples T-Test was ran between the Calmness-Restlessness subscale and
Gender which found a significant difference in the means, where males (mean = 42.76, SD =
7.79) had a higher score on the subscale than females (mean = 37.32, SD = 9.889).

In the case of the Level of Classical Training (1 = None, 2 = Plays Instrument/Music
as a Hobby, 3 = Junior Certificate Level or equivalent, 4 = Leaving Certificate Level or
equivalent, 5 = Full Classical Training) there was no significant result found when examined
with the MDMQ subscales, as well as no significant results found when analysed with Mood
Change.
A One Way ANOVA was run to examine if there was a relationship between the genres selected and the MDMQ subscales, however, no significant result was found. A Repeated Measures ANOVA was also run between the genres and mood change which found a near significant interaction (F (6) = 6.198, p = .081) between 2nd Favourite Genre and Mood Change. This concluded the statistical analysis.
Discussion

The statistical results above show that there was an increase in mood when participants were presented with songs with a fast tempo and in a minor key signature. This suggests that there is a positive effect associated with this combination of song writing. This is consistent with the original hypothesis on this, albeit only found on particular combination of tempo and key signature. However, because the song presented was in the key of F Minor, it is possible that the mood increase is due to that particular key and not generalizable to all minor keys. This same argument could be extended to the tempo also. A fast tempo was defined here as faster than 120 bpm and due to the song presented having a tempo of 160 bpm, it could be that that particular tempo range, for example between 150 bpm to 170 bpm produces particular effects. This could be an interesting avenue for future research.

The gender differences were unexpected results and are interesting, in that the mood changes for female were non-existent. Females mean score on mood did not change, which may suggest an interesting direction for future research into if women are less affected by music than men. The other gender difference, in the Calmness-Restlessness subscale, suggests that males are more calmed by music than females. This result combined with the lack of change females expressed in the mood change further suggests that females are less affected by musical variables than males. Individual's genre preference and level of classical training showed no significant effects, nor did familiarity with the song presented but this may be as a result of there only being 4 participants in the sample who did not recognise the presented song.
The fact that particular a key and tempo caused an increase in mood supports the media effects model (Rentfrow, 2010), where it is the music having the effect on the mood and behaviour of the individual. This is also consistent with the studies presented above by Fischer & Greitemeyer (2006) and Rodriguez-Bailon, Ruiz and Moya (2009). Even when genre preference was taken into consideration, there was only near significant differences, which suggests that the effects of individual's preferred music doesn't have as strong of an effect as was thought. This was seen as a major limitation of the media effects model but if this preference isn't affective as is currently assumed this limitation becomes considerably less of a limitation. Due to the size of the sample in this study, it may be possible that music preferences do not actually have any significant effects on mood but this would have to be researched using a much bigger sample to accurately discover if there is any effect.

The tempo and key signature did not have any effects on the variables recorded by the MDMQ, so it can be extrapolated that these parts of song writing do not have any effect outside of the mood changes. This is an unusual finding, considering there has been an effect on mood. It would have been expected for there to be a consistency across the results that, if there was an effect on mood, there would be on the subscales, if not all then certainly the Good-Bad Mood subscale. This raises the question that perhaps music raises individual's mood immediately and only during the song and very briefly afterwards as the participant was required to report their mood numerically immediately after the song ended but there may have been a temporal effect, in that by the time they finished the MDMQ, the increase on their mood had faded. This in itself requires much more in-depth research to verify, ideally with a latency task as part of the experiment.
The fact that there was no effect of the level of classical training suggests that there is an
effect of tempo and key, fast and minor respectively, regardless of any understanding of the
theory of music or song writing. There are changes in mood that are strong enough that being
aware of the possibility of these variables having a personal effect makes no difference and a
change in mood happens regardless.

As was stated in the opening of this study, music is everywhere and has been
consistently present for centuries. Due to this fact, the lack of any effects from age is hardly
surprising. There is no age restriction on listening to music, nor does music lose its value due
to age, therefore, an age difference would be a surprising, but also very interesting, result. No
significant effect, in this same regard supports that music does not lose its power and
capability to move through time.

Although there is a lot of support for the uses and gratification model (Arnett, 1995),
the current study has seen no results to support it. Genre found only a near significant result
that suggests there may be a small amount of support but nothing concrete. This does not
mean, by any stretch of the imagination, that the uses and gratification model should be
disreputed. There is still plenty of validity in the model, as is shown by the studies support it,
as was discussed earlier, the current study only examined genre and if a song had been heard
previously, which also found no result. However, this may be confounded by the fact that
there was an overwhelming majority of people who had heard the song presented to them
before so this cannot be considered a particularly accurate measure of if enjoying or hearing a
song previously has any outstanding effects. If an accurate examination of the uses and
gratification model is to be conducted, more than just song familiarity and preference in
genre would need to be taken into consideration; possibly by giving individual's the
capability to control what they listen to and then examine any potential psychological effects
after the chosen song.
Limitations and Possible Future Research Directions

As with all studies, there are some limitations that must be noted. Firstly, sample size, and by extension power, were smaller than desired. This was mainly due to the time restraints that had to be met due to the nature of this being an undergraduate thesis. Another reason behind the sample size is the fact that each participant was presented with their audio stimuli individually to eliminate any potential group interactions or effects that may have presented themselves. In addition to this, the current study only used 4 songs, one per group, which may create the issue of the results found being a result of the song, rather than the variables that were being examined in this study. A future study using multiple songs within each group would be hugely suggested to combat that this issue. As was also suggested above, a more in-depth examination of the preferred music could be conducted through the design of allowing the participant the choice of which song they were presented with.

Due to the results found with the minor key and fast tempo, it may be an avenue for future research to attempt to establish if other key signatures have particular effects on mood, or even other psychological variables such as attentional ability or other cognitive abilities. The only keys used in this study were F Minor and C Major, so it could be a possibility that the effects found, and in the case of the major key, not found, were from those particular keys, therefore an examination of key and tempo separately and looking at multiple keys across all 24 major and minor keys and also on more specific tempo intervals, rather than just simply fast and slow.

It would definitely be of future importance to attempt to replicate this study on a wider and larger scale to support the results found. A much larger sample, more ethnic and cultural diversity and possibly even an exploration of differences between children and adults may be good research directions to go into to examine if there is any general, all-
encompassing effects of music that is universal regardless of things like culture, age or gender. Even if it was found that there were cultural and age differences with music, it would still be a good step forward in the applied side of music. Musically therapy would greatly benefit from the knowledge that particular keys and tempos elicit particular effects and for this to be applied in a clinical setting it could make therapy a much easier thing to try work with in regards to the music presented to patients. Even if this was extended to time signature, which may also be something to examine if there are any effects of, when it comes to trying to use song composition in a therapeutic setting, particular beats or patterns of noise could be found to be calming or stimulating. This kind of knowledge would be invaluable in any therapy working with non-verbal patients, such as patients on the autism spectrum.

As was mentioned briefly above, a future study could be suggested to look into other musical dynamics' effects. The current study only took tempo and key signature into consideration but there is still time signature, volume, timbre and even if there are effects of time/key/tempo changing within the song that could be analysed for any outstanding effects. With the nature of this study being an undergraduate thesis, the possibility of conducting tests into these elements were impossible but based upon finding a result from a minor key and a fast tempo, it is very reasonable to suggest that there could be more effects that stem from other song writing elements. This also brings me to my next limitation: the interaction between all of the musical elements. With any song, there will always be a tempo, a key, a time signature, etc. and when they are all present in a song, once that song is played it is incredibly difficult to single out if the effects are coming from an interaction of them all or if the effects are coming solely from one. In this current study, this was catered for by having each song overlap within key and tempo, i.e.: the two songs in the minor key shared the exact same key and only differed in tempo. Therefore this interaction effect was not too much of an issue here; however, if this was done on a larger scale, examining a wide range of musical
elements, this would certainly be an issue. A more recommendable route to go down would be to have individual studies, factoring in only one or two of them at a time while keeping the other musical variables constant. This would obviously cause problems at the choice of song end of things, in so far as there would be an incredibly limited song-pool to choose from if you were attempting to keep, for example, tempo, key and timbre the same and only change time signature. It may even be required to write one's own music and present that so as to prevent this issue with song choice. While this would also be a long and difficult process, and may require the assistance and services of professional musicians, it could certainly be an avenue to go down to keep these kinds of variables in check. Plus, the potential results that could be found would definitely be an achievement in the field of music psychology.

Conclusion

The results found, even in light of the potential limitations discussed above, are a positive step forward in the field of music therapy and music psychology. With so many variables, confounding or not, surrounding something that is used so socially and widely as music and songs, there will always be more research that could be conducted to add to school and practice. This study is a step forward in some research routes that could be explored in order to find some very importing findings and could open many doors into different forms of therapy and practice and one would hope that this would be built upon and expanded on to achieve the potential that is there. The applied nature of music therapy is one that is relatively new to the psychodynamic approach and there is still much research to be done before it can be considered a full treatment of psychological problems and illness. So far, there has been a positive step in that it has been seen to help very disabling issues, such as autism, PTSD and some mental illnesses and may someday be a treatment for more.
References


You are invited to participate in a research study titled “Dynamic music elements and their effects on the psyche”. This study is being conducted by Luke O’Halloran from Dublin Business School.

In this study, you will be asked to complete a series of questions before and after attending to an audio stimulus. Your participation in this study is voluntary and you are free to withdraw your participation from this study at any time. The study should take approximately 20 minutes to complete.

There are no risks associated with participating in this study. The study collects no identifying information of any respondent. All of the response in the study will be recorded anonymously.

While you will not experience any direct benefits from participation, information collected in this study may benefit the development in the experimental school of psychology in the future.

If you have any questions regarding the study or this research project in general, please contact Luke O’Halloran at

Please note that by completing and submitting this survey, you are indicating your consent to participate in the study. Your participation and time is appreciated.

Feel free to tear off this page and retain it, if you wish.
• Circle your gender:  Male  Female

• State your age:

• Have you had any education in music or any level of classical training and if so, what level (e.g.: Junior/Leaving Certificate Music, Classical Training in Percussion/Piano/etc.):

_____________________________________________________________________
_____________________________________________________________________

• Rate your current mood on a numerical scale from 1 to 10, with 1 being the worst mood and 10 being the highest mood:

Please do not turn to next page until directed to do so.
Instructions

In the following pages, you will find a list of expressions that characterize different moods. Please take a look at the list, word by word, and mark for each word the answer that represents best the actual intensity of your current mood status.

Example:

Right now I feel...

<table>
<thead>
<tr>
<th>Definitely not</th>
<th>Not really</th>
<th>Very much</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Supposed you feel very good at the moment, you would circle the number 5:

Right now I feel...

<table>
<thead>
<tr>
<th>Definitely not</th>
<th>Not really</th>
<th>Very much</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Please pay attention to the following facts:

- Within the list there are some attributes that possibly describe the same or similar moods. Please do not get irritated due to this fact, and judge each attribute irrespective of your answer to another attribute.

- Please judge only how you feel at this moment, and not how you normally or sometimes feel.

- If you have some difficulties in finding an answer, please mark those answer that fits best.

Please judge each word and do not leave out a word.

Rate your current mood on a numerical scale from 1 to 10, with 1 being the worst mood and 10 being the highest mood:

Continue to next page.
Right now I feel...

<table>
<thead>
<tr>
<th></th>
<th>Definitely Not</th>
<th>Not Really</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Content</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>• Rested</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>• Restless</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>• Bad</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>• Worn-out</td>
<td>1</td>
<td>2</td>
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<tr>
<td>• Composed</td>
<td>1</td>
<td>2</td>
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<tr>
<td>• Tired</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>• Great</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>• Uneasy</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>• Energetic</td>
<td>1</td>
<td>2</td>
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<tr>
<td>• Uncomfortable</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>• Relaxed</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>• Highly Activated</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>• Superb</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Emotion</td>
<td>1</td>
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<td>Absolutely Calm</td>
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<td>Sleepy</td>
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<td>Good</td>
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<td>At Ease</td>
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<td>Unhappy</td>
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<td>Alert</td>
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<td>Discontent</td>
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<td>Tense</td>
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<td>Fresh</td>
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<td>Happy</td>
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<td>Nervous</td>
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<tr>
<td>Exhausted</td>
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<td>Calm</td>
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<td>Wide Awake</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Wonderful</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Deeply Relaxed  1  2  3  4  5  6

• Number the following boxes with 1 to 3 to indicate your preferences in genres of music, with 1 being your favourite, 2 being your next favourite, and 3 being your next favourite (only number 3 of the boxes):

- Pop
- Rock
- Blues
- Classical
- Jazz
- Country
- Dance
- R’n’B
- Heavy Metal
- Funk
- Indie
- Punk
- Hip-Hop
- Rap
- Reggae

Other (please state): ______________________

• Had you heard the song presented to you in the past/was it familiar to you? (circle your answer)

Yes  No

Thank you for your participation in this study. The results of this study will be made available to you, if you wish to know, after March 21st. Please make contact through e-mail or phone, if you wish to receive the results of this study.