The Impact of Frequency of Repetition during Processing of Public Service Announcements

Thesis

Presented in Partial Fulfillment of the Requirements for the Degree Master of Arts in Communication in the Graduate School of The Ohio State University

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The Ohio State University

2012

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Abstract

This study aims to specify if and how particular musical features in persuasive messages impact processing of the messages. Specifically, based upon the theoretical frameworks of the musical expectancy theory (Meyer, 1956), and the modern interpretation of expectancy the ITPRA (Huron, 2006), and the Limited Capacity Model of Motivated Mediated Message Processing (Lang, 2006), this study specifies experiential and physiological correlates to typical music elements including changes in style, mode, melody, dynamics and tempo, used in televised public service announcements (PSAs).

Initial coding was performed to determine the most prominent musical element(s) within a 30 PSA. Repetition of the melodic pattern was a commonly occurring element throughout the PSAs and was chosen as the manipulation for the main experiment. The main experiment measured subject’s heart rate as they viewed PSAs with high, medium and low repetition of the melody in two genres: theme and hip hop music. Individual difference measures were also collected to determine if there is an impact on processing. Results show an interaction between genre, repetition and sensation seeking. Music is often used to provide emotional support to mediated messages, and often persuasive mediated messages. Determining how the music works with the narrative can help practitioners create more effective persuasive messages.
Dedication

Dedicated to Thomas Barker
Vita

May 1999…………………………………………Miami Trace High School

2003…………………………….B.A. Communications, Otterbein University

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Field of Study

Major Field: Communication
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Review of Literature

Music is often viewed as abstract and mysterious to most people, including communication scholars. Music an important message production element but communication scholars have yet to develop theories of music as a communicative act. Within mediated messages specifically, music is used in a variety of ways including manipulation of emotion, to capture attention, and to provide information about the story setting. Some consider music within mediated messages to be a heuristic which allows the emotional tone to drive the viewer to distraction (Zander, 1997; Nelson, Duncan, Frontczak, 1985). Once distracted, the viewer doesn’t think too carefully about the actual product or service, but instead primarily the feeling they receive from the commercial. This unconscious attention and transfer of emotion is implied in the research, but how and why? This study aims to specify how particular musical features in persuasive messages impact processing of the messages. Based upon the theoretical frameworks of the musical expectancy theory (Meyer, 1956), its modern interpretation The ITPRA Theory of Expectation (Huron, 2006), and the Limited Capacity Model of Mediated Message Processing (Lang, 2000) this study aims to specify experiential and physiological correlates to typical music elements including changes in style, melody, mode, dynamics and tempo, used in televised public service announcements (PSAs).

Music and Advertising

The first widely discussed attempt to tie music into advertising and purchase
decisions was by Gerald Gorn (1982). He theorized a classical conditioning effect occurs when a product is displayed while pleasant music is playing. The positive association with the unconditioned stimulus (background music) is then transferred by association to the conditioned stimulus (product) in order to create a conditioned response (Gorn, 1982). This finding was rarely replicated and never to the same degree of impact as Gorn’s original experiments (Kellaris & Cox, 1989).

While classical conditioning seems like a possibility, it doesn’t fully make sense in the context of advertising and purchasing behaviors. If we were properly conditioned consumers we would feel the urge to run out and purchase a new BMW every time we heard the song in the BMW commercial play. The effects of classical conditioning are also thought to wear off over time when the objects of association are no longer presented together, whereas it is common to hear a jingle and associate with the brand much later than the last airplay. A more fitting answer may perhaps lie in evaluative conditioning. Evaluative conditioning is the act of pairing a conditioned stimulus (CS) with an unconditioned stimulus (US). The affective quality of the US will be transferred to the CS. While this sounds very similar to classical condition there are marked differences. Unlike classical conditioning the CS does not need to be present going forward to have the desired response to the US. The effects can happen after just one conditioning exposure and continue to remain for a long period of time (Jones, Olson & Fazio, 2010).

A more recent discussion has been centered around musical fit. Fit is simply if the melody, lyrics and timing fit the tone of the product or situation. What is an appropriate fit is a learned and culturally shaped idea. Musical fit has been explored in many areas including fit with brands in advertising. In the three main experiments advertisements for
Chevrolet and Cadillac were shown on a split screen while people from varying walks of life and prior brand interaction were asked to judge if the music fit better with Chevy or Cadillac brands. GMC, the parent company of both brands, identifies Chevrolet as All-American and more blue collar while Cadillac is identified as luxurious and dramatic. Participants across cultures and role consistently recognized distinct brand characteristics within the music playing during the advertisements. The individual intended brand concepts of Chevrolet and Cadillac were distinct and easily identified with proper musical fit (Broadsky, 2011).

There have been many ideas for why music works within advertising, even including neural network models (North, Hargreaves and McKendrick, 1999) but no consensus has been reached within the academic community. Perhaps to truly understand how music works in advertising we need to first focus on the basics of music and processing.

**Definitions of Music**

Musical terminology is a unique language. Many terms are reserved for music alone but many share meanings with other ideas. In order to clarify discussions going forward it is advantageous to define musical terms often used.
<table>
<thead>
<tr>
<th>Name of Element</th>
<th>Definition</th>
<th>Qualities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (Pitch)</td>
<td>Vibrations per second</td>
<td>Used in a broader definition to include the mental and physical experience. Each note has its own frequency and pitch is in reference to the frequency.</td>
</tr>
<tr>
<td>Intensity(Dynamics)</td>
<td>Getting louder or softer during the course of the song.</td>
<td>Expressed in decibels and used for dramatic effect.</td>
</tr>
<tr>
<td>Duration (Time)</td>
<td>Amount of time each note is held.</td>
<td>Beats per minute is referred to as tempo.</td>
</tr>
<tr>
<td>Wave Form (Timbre)</td>
<td>Forms the tone or quality of the sound.</td>
<td>Overtone structure of the sound that describes any voice, instrument and beauty of tones. Used for expression of emotion or mood.</td>
</tr>
<tr>
<td>Key (Mode)</td>
<td>Scale and its tonal hierarchy</td>
<td>Named for their principal note and scale structure plus chords and chord relations.</td>
</tr>
<tr>
<td>Rhythm</td>
<td>Pattern repeating regularly in time.</td>
<td>Groups of beats are paired together by measure and subdivision.</td>
</tr>
</tbody>
</table>

(Seashore, 1938, Patel, 2008)

Table 1. Definitions and Qualities of Musical Elements

**Music and the Brain**

Musical features are their own language but are these features processed similarly to language or is music processed as the emotions it is thought to evoke? There has been much deliberation regarding the matter but so far there is no clear-cut answer.

It has long been thought our brain processes music and language separately. The left hemisphere is reserved for processing language and sound and the right hemisphere
processes music and emotion. However, recent studies have shown evidence for bilateral processing, especially in pitch (Patel, 2008).

Evidence was compelling for lateral processing. If music is linked as closely to emotion as previously discussed, this version of processing is confounding. It would appear when it comes to processing music has elements of both language and emotion. The right hemisphere of the brain is important to perception and arousal. This area of the brain is believed to aid in the organization of proper emotional behavior. Skin conductance levels, often used to gage degrees of arousal, have been measured as lower in patients with right brain lesions (Scabini & Violani, 1982).

In one study, patients with left brain lesions demonstrated more emotion. Patients with right brain lesions were unemotional themselves and unable to distinguish emotion in speech as well (Heilman, Scholes & Watson, 1970). Another study asked subjects to judge emotional intensity of composites made from the left side of the face, the right side of the face or a normal picture. More subjects judged the left side composite to show the most emotional intensity. This is interesting because in addition to regulating emotional behavior, the right side of the brain is also responsible for left facial responses (Sackheim, Gur & Saucy, 1978). The evidence for emotional processing is robust but what does this mean if we process music bilaterally?

In addition to where music is processed, we must also explore individual differences that influence processing. Sensation seeking is an often discussed psychological construct used to describe those who actively look for things that are new and stimulating (Sargent, Tanski, Stoolmiller & Hanewinkel, 1999). Sensation seekers
have been found to prefer arousing music (McNamara & Ballard, 1999). Arousing music can be highly thrilling, satisfying the need for greater stimulation.

How we process music still remains unclear but there are obvious links to both language and emotion. Music still appears to be its own phenomenon to humans but progressive ideas in music and psychological theory may hold key to answers of how we process musical stimuli.

**Expectancy Theory**

Musical expectancy is the idea that through our learning and culturalization we develop expectations of appropriate use of music (Meyer, 1956; Juslin & Vastfjall, 2008). These expectations shape how we interpret music on an emotional level and how we use, or recognize proper use of music. When the expectations are violated, a sympathetic nervous system reaction occurs. This is followed by a cognitive appraisal of the situation and eventually leads to an emotional response (Juslin & Vastfjall, 2008; Meyer, Palmer & Mazo, 1998). Expectancy shapes many of our ideas regarding music, including how music should be used in a situation, how a melody sounds and develops as well as appropriate dynamics and tempo. The two dimensions influencing how expectancy is developed are well supported in previous literature.

It is difficult to separate the two dimensions, learning and culture, as they are closely intertwined. Meyer proposed humans learn about music as they listen. Since musical styles and preferences can be linked to a culture, learning about music could be happening as we are socialized into our culture. In a study where children were asked to musically convey or evaluate happiness or sadness the more mature, socialized children were likely to employ major and minor keys to differentiate (Adachi & Trehub, 1998).
and modality highly correlated with other variables and demonstrated a positive relationship with the minor mode and sad responses (Kratus, 1993). As it shows in adults and older children, it is possible to theorize mode recognition and use is a learned convention of the Western culture’s musical expectancy.

Stereotypical ideas about musical genres have also grown out of cultural influences. Country music is now seen predominantly as the sound of rural America but it originated in cities. Borrowing from other areas of American culture one of country music’s most identifiable instruments, the steel guitar, originated in Hawaii. Although the origins and instruments were decidedly not middle and southern America, American culture associates the sincerity and stripped down qualities of country music with these simpler, more rural areas (Shusterman, 1999). Hidemi’s essay on Chinese cultural music points out music is specific to each culture and the qualities of meaning in the music are a result of the culture (1987).

Even though we learn from our culture, we also learn universal perceptual cues. Individuals unfamiliar with Indian music were able to identify emotions not because of their cultural familiarity but because they understood universal cues such as tempo and melodic complexity (Balkwell & Thompson, 1999). Even though they were using perceptual cues, these cues were still learned at some point in time and not inherent. Learning, both culturally and perceptually, is the important key to the concept of musical expectancy.

In 1935 Hevner set out to find elements of music that conveyed emotion to listeners. She played compositions of varying modes, tempos, rhythms, etc. to participants and asked them to circle adjectives that described the piece. Of all of the
elements studied, modality was more stable in response than any other. Major key compositions were consistently associated with happiness and playfulness and minor key compositions were associated with sadness and sentimental yearning. Throughout the years this musical phenomenon has remained strong. When asked to pair the colors with Western music, Japanese participants consistently paired major key melodies with warm colors and minor key melodies with dark and gloomy colors. The researchers noted there was a very sharp distinction between responses for the two modes (Hoshino, 1996).

Another look at emotion asked composers to compose melodies centered around different emotions. The composers chose rhythmic movement to indicate joy but minor keys to indicate sorrow. Participants were then asked to assign an emotion to each composition to see if the composer’s intended emotion matched with the participant’s idea of each emotion. Of the emotions participants recognized sorrow and the minor key compositions most frequently (Thompson & Robitaille, 1992).

Other musical features have been used to attempt to identify culturally specific or learned emotional qualities in music. Rhythm was found to account for 80% of the variance in both happy-sad and excited-calm measures in one analysis (Kratus, 1993) but later it was discovered rhythm on its own does not convey emotion but rhythm does assist pitch in conveying emotions (Schellenberg, Krysciak & Campbell, 2000).

Although it was hypothesized variations in both tempo and dynamics would have an effect on emotional expressiveness, empirical testing demonstrated only dynamics made any difference (Kamenetsky, Hill & Trehub, 1997).

Rhythm and dynamics both bring about changes and could provide an element of excitement to a musical composition. If rhythm assists pitch and dynamics are a
modulation of the volume in pitch then they must work in tandem. The feelings music arouses in a listener are complex and should be attributed to the piece and experience as a whole (Robinson, 1994) but it may be possible both could perhaps contribute more than others to the element of arousal based upon the empirical evidence. Each of these features are not biologically wired into us, but the appropriate affective and physiological responses to these features were learned through listening.

While some individual differences in music preferences can be due to neurological needs such as sensation seeking, sometimes they appear to be a result of musical expectations. Music preferences are seen as an extension of our personalities and what we wish for the public to see (Chamorro-Premuzic, Fagan & Furnham, 2010; Rentfrow & Gosling, 2003). Our personalities are constructed from socialization and our physical environment and include attributes such as age, gender and cognitive processing preferences. These construct our musical inclinations and our uses of music, for example those assessed to be extroverted prefer cheerful music with vocals (Rentfrow & Gosling, 2003). Our learned knowledge of cultural influences shaping musical expectancy is a robust phenomenon which may help to explain some of our mysteries surrounding the processing and uses of music.

**ITPRA**

Recently, the musical expectancy theory was updated into a general psychological theory, The ITPRA Theory of Expectation which stands for the types of responses we have to a given stimuli, including music: imagination, tension, prediction, reaction, and appraisal (Huron, 2006).
• Imagination response allows us to think and in a lesser form feel potential outcomes before they occur. We are able to think about what might happen and while thinking about that outcome, feel some of the emotions we would feel if that outcome were to come true. This response is a mechanism for behavioral motivations.

• Tension response also occurs before the outcome. This response prepares our arousal and attention for an impending event. By preparing our bodies are able to react quickly and appropriately to the anticipated event. This response will be prolonged when the timing of the event is uncertain. When the nature of the outcome is uncertain the intensity of the tension response may be inadequate or overblown.

• Prediction response occurs again prior to the outcome. With prediction, if the stimulus is expected the emotional reaction is positive and negative when the stimulus is unexpected. Often this response is referred to as “primary affect”. Accurate predictions are considered valuable within this response.

• Reaction response determines the valence of the outcome after the event has occurred. Three features characterize a reaction response: first is a quick onset, secondly the response is not conscious and last, the response is defensive or protective.

• Appraisal response allows for a conscious evaluation of the situation after the event has occurred. Either positive or negative evaluations (or
potentially mixed) may be the result of this response depending on the result of the complex evaluation process.

ITPRA proposes that we learn through experience and culture about our expectations of music as well as which is the appropriate cognitive and physiological response to the stimuli. Given the cultural expectations for Western music, it is possible to predict the appropriate responses or combination of responses from the theoretical categories for particular musical features. The ITPRA could be applied not only to features, but the way we react to uses of music and musical fit. Both Huron and Meyer agree learning happens while listening, it is possible the situation surrounding how and where the music is heard could be integrated into the learning experience. By integrating the context of how music is used, choosing the appropriate response should take situational cues into consideration.

**Expectancy and Advertising.**

In advertising music is paired with a product or message. If the music played meets our expectancy, including fit and the proper situation, no argumentation is made and the evaluative conditioning can occur. If expectancy is not met, there is a negative response causing the listener to refute the message and a conditioning effect will not occur. While looking at responses to Russian laments, researchers discovered those unfamiliar with the traditional gasps used were disrupted in their listening while those familiar with these laments were not disrupted and considered them part of the song (Meyer, Palmer & Mazo, 1998). Expectancy for the unfamiliar listeners was violated, essentially taking the listener out of any absorption and connection they were experiencing with the music.
According to the Limited Capacity Model for Motivated Mediated Message Processing (LC4MP; Lang, 2000, 2006) mediated information is encoded into memory then stored linking to associated items and later retrieved when needed. This processing serves a biological function to cognitively assist in choosing the proper response to the stimuli. The LC4MP framework compliments both expectancy and the ITPRA as all three are discussing appropriate processing and learned responses to a stimuli. By combining these ideas we could hypothesize when music is heard, the relative information regarding that music is activated or retrieved. This includes prior knowledge, experience and stored appropriate responses. Each musical feature should then be fairly consistent on the activation of the stored knowledge, experience and response of that particular feature. If appropriate responses are consistent there should be a way to detect and measure these responses in relation to the musical feature.

The purpose of this study will be to identify a prominent musical feature used in public service announcements and empirically test the appropriate corresponding response. Prior to designing the main experiment, coding was necessary to identify the most appropriate feature.

Coding

Thirty-two anti-smoking public service announcements (PSAs) were coded for specific musical features. Initial coding identified presence of music, musical mode and if the music was primarily used for background, scene or to deliver the message. Each PSA was then coded for presence or changes in musical features. Features included dynamic change (soft or loud), tempo change (slow or fast), repetition in melodic pattern, melody
pick-up, style change, dissonance, resolution of dissonance as well as onset and ending of music.

Two coders with professional music training performed the coding individually, then worked together to reach agreement on any non-matching codes. From the codes two patterns emerged: melody pick-up in PSAs determined positive in an un-related pre-test and varying degrees of repetition in melody across types and valence. It is possible that the 30 second format of the PSAs was not suitable for other major patterns to emerge. Just as narrative takes time to develop, music needs time to establish itself before noticeable changes can be made.

Melody pick-up is a difficult concept to accurately explain and manipulate, therefore it was eliminated from the main experiment. Frequency of repetition in melody was chosen not only for the ability to manipulate for the main experiment, but also due to the interesting and unique potential of this feature.

According to the ITPRA, repetition is associated with the prediction response (Huron, 2006). Often this response is thought of as affective, but an important aspect of prediction is the accuracy of the prediction appraisals. The individual should exert greater attentional effort to encoding the overall message to ensure their prediction is correct and to quickly adjust the subsequent response if incorrect. Since we learn by listening, after the first few repetitions the listener will know what to expect and have the ability to devote more cognitive resources to the encoding. By devoting more resources to encoding the overall message, the listener should have a greater ability to create the valuable accurate prediction.
Frequency of repetition could potentially be very arousing, making the music attractive to individuals high in sensation seeking. Sensation seeking individuals are often the target of public service announcements, as their desire for arousal can lead to pursuing risky behaviors (Sargent, et al., 1999; Palmgreen, et al., 2001). Frequency of repetition in the melody could potentially obtain the attention of high sensation seekers and facilitate their encoding of the important message.

**H1**- High frequency of repetition in melodic pattern will elicit a prediction response, increasing encoding for the message to ensure accuracy of the prediction. This response will be measured by a decrease in the heart rate as indicated by heart rate change during the message to indicate effortful attention and cognitive processing.

**H2**- Individuals who are high in sensation seeking will exert greater attentional effort as indicated by heart rate change with videos featuring high repetition than individuals who score medium and low in sensation seeking. The increased effort to process is due to the increased desire for stimulation and arousing content.
Methods

Design and Stimuli

This experiment employed a 3 (Repetition Frequency: high, medium, low) × 2 (Music Type: Hip Hop, Soundtrack/Theme) repeated measures factorial design. Six anti-smoking public service announcements (PSAs) were chosen for this experiment from the pool of 32 coded PSAs. PSAs were chosen based upon their ability to fit with one of two chosen musical genres, hip hop and themes. Three videos were chosen specifically to be matched with hip hop music and three videos were chosen specifically to be matched to theme music. Three conditions were created (see Table 2). Participants from each condition viewed the same videos and heard the same music, but the background music was shown under different videos for each repetition. Each video was only shown once to each participant and heard each frequency of repetition once for each genre.

Once the final videos were chosen, the audio was stripped and re-recorded by the same voices to prevent liking for the voice where possible. The exceptions to the voice similarity were videos depicting children and one video where the audio did not need to be removed to change the music. Hip hop songs were chosen from free online hip hop podcasts. The audio was manipulated and mixed for each of the three chosen songs to achieve the desired amount of repetition within 30 seconds to fit seamlessly under each video. The videos for the second type of music were originally set to very melodramatic
music beds. To keep the same type of music for the manipulation, an older musical theater accompaniment soundtrack was used. One song provided three distinct sections that were manipulated into high, medium and low repetition within the melody. One section of the melody did not repeat itself. This was considered low repetition. Medium repetition was a 15-second selection of the song that was played twice under the 30-second PSA. Another section of the song was taken and repeated 27 times to create the high repetition. As with the hip hop music, each was edited to 30 seconds and was seamlessly integrated into the video. All editing was performed using the Avid Pinnacle software.

<table>
<thead>
<tr>
<th>PSA Video</th>
<th>Music Repetition in Condition 1</th>
<th>Music Repetition in Condition 2</th>
<th>Music Repetition in Condition 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip Hop 1</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Theme 2</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Hip Hop 2</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Theme 2</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Hip Hop 3</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Theme 3</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
</tbody>
</table>

Table 2. PSA Stimuli
Self-Report Measures

Participants in this study were also asked to complete two scales: the Short Test of Musical Preferences (STOMP) and the Music Empathizer, Music Systemizer Scale (ME-MS). The STOMP is a 19-item scale assessing individual differences in music choices relating to personality (Rentfrow & Gosling, 2003). Participants are presented with 14 types of music and were asked to rate their liking for each from 1 (strongly dislike) to 7 (strongly like). For this analysis, items 6 (Rap/hip hop) and 14 (Soundtracks/theme songs) were chosen to represent the two types of music played under the PSAs as they most accurately represent the genres. These two items were treated as continuous variables in the statistical analysis.

Within this study, the intended use for this scale is to test for interaction effects of self-reported liking for the types of music played in the PSAs on both the processing of repetition in the music and style of processing.

The Music Empathizer-Music Systemizer (ME-MS) scale (Kreutz, Schubert, Mitchell, 2008) is a measure created to account for individual differences in the processing of music. The ME-MS scale was made by adapting the previous Empathizer-Systemizer inventory scale to fit music processing. This particular scale represents two different strategies for processing and emotional rewards from music. Empathizing is a cognitive trait thought to represent longer distant neural networks and is associated with emotional processing. This trait is generally attributed to, but not exclusive to, females. Systemizing is a cognitive trait thought to be represented in the brain by greater local connectivity and is associated with greater interest in technology. This is generally
attributed, but not exclusive to, males. This scale is intended to provide some insight into how different features may be processed alternatively by different types of people.

The scale is presented as a series of 18 feeling statements answered yes (1) or no (2) by participants. Both sub-scales were recoded for analysis as yes=1, no=0 and questions 6-9 on the empathizing and systemizer sub-scales were reverse coded. Scores for each were calculated by taking the mean of coded and reverse coded ratings. The two sub-scales have extremely different reliability ME (Chronbach’s $\alpha = .543$) and for MS (Chronbach’s $\alpha = .818$), but reliability for the overall Music Empathizer Music Systemizer scale is adequate (Chronbach’s $\alpha = .773$).

The smoking attitude scale (Krosnick et al., 2006) comprised of 17 feeling ratings in regards to smoking behaviors and situations on a scale of 1 (strongly disagree) to 7 (strongly agree)(Appendix D.). Questions included statements such as: *People should have the right to smoke where and when they want* and *People have a basic right to breathe smoke-free air*. Answers to statements 1, 3, 4, 12, 13, 14, 15 and 17 were reverse coded prior to analysis.

A possible relation to smoking behaviors is the individual’s propensity for sensation seeking. To measure this the Brief Sensation Seeking Scale (BSSS-8; Hoyle et al., 2002; Stephenson et al., 2007) was administered (see Appendix C.). The BSSS-8 consisted of 8 questions measuring four dimensions: experience seeking, boredom susceptibility, thrill and adventure seeking, disinhibition. Answers were averaged for a total sensation seeking score. Both the Smoking Attitudes Scale and Brief Survey of Sensation Seeking were reliable, with Chronbach’s $\alpha$ as .825 and .821, respectively.
Dependent Variable

The psychophysiological measure collected was chosen for its ability to reveal potential attentional reactions. Heart rate measures were collected for their ability to indicate how a person is cognitively processing the message.

Heart rate can demonstrate activation of the parasympathetic nervous system (PNS) which could indicate cognitive processing. A slowing of the heart beats per minute indicates the PNS has the primary control of the bodily systems including the vagal nerve of the brain. This activation indicates a period of rest, or the body paying attention to the stimulus. Inversely, an increase in heart rate indicates the activation of the sympathetic nervous system (SNS) where cognitive resources are diverted from processing and instead are focused on preparing the body for response to new or threatening stimuli (Berntson, Norman, Lozano & Gillman, 2010; Potter & Bolls, 2011). Heart rate measure for this experiment was collected using the BioNex system and BioLab software (Mindware Technologies, 2010). Heart rate is measured in analysis as the duration between R peaks and was sampled at 1,000 samples per second and computed prior to analysis as beats per minute.

The advantage of psychophysiology is to view actual measurements in a dynamic situation. We can take what is known about these physical responses and make inferences about their meaning. While psychophysiology allows inferences to be made, reliance on self-report can help solidify the validity of these inferences. In addition to the HR and self-report measures, demographics were collected. (Appendix D).
Participants and Experimental Procedure

Thirty six undergraduate students from a large Midwestern university participated in this experiment for extra course credit or monetary compensation. They were between 18-28 years old ($M = 20.89, SD =1.753$) and 52.8% were female. Participants in this sample were 52.8% white, 13.9% black, 5.6% Hispanic, and 27.8 Asian or Pacific Islander. Six subject’s data was excluded from the final analysis due to technical problems or excessive movement. Each participant took between 45 minutes to 1 hour to individually complete the experiment. Upon arrival, the participant was greeted and informed of the experiment procedures before giving consent. The experimenter attached the electrodes discussed above to the participant along with a 7-mm Ag/AgCl electrode for grounding along the bottom right rib. As the electrodes were attached, the experimenter explained what each electrode was used for and talked to the participant about how data collection would work to relax the participant. The participant was then led into the viewing room and seated in front of a television with a 21 inch screen. Participants were given a keyboard to answer questions. They were asked to relax and watch the videos as they would normally do. When the screen prompted them to answer questions, they were instructed to use their dominant hand to answer as it was not attached to any electrodes. Physiological data were collected during PSA viewing. After viewing, the electrodes were removed from the participant. The participant was led to a lab computer where she/he completed the smoking attitude, sensation seeking and music individual difference scales, along with demographics.
Results

A 3 (Repetition Frequency) × 2 (Music Genre) repeated ANCOVA was performed. Covariates were gender, preference for hip hop or theme songs/soundtracks, ME, MS, and sensation seeking.

Prior to the statistical analysis, change scores were computed for the heart rate data and the conditions were changed to within subjects. A change score is desired to evaluate if there are any differences in heart rate between the baseline period and the viewing of the PSA. The baseline heart rate was calculated by taking the first 5000 milliseconds (5 seconds) of heart beats and dividing by 60000 milliseconds to obtain a heart rate measured in beats per minute for the five seconds prior to viewing each PSA. The same procedure was followed for the 30000 milliseconds following to obtain the average heart rate for the duration of PSA viewing. Heart rate change was calculated by subtracting the baseline heart rate from the PSA viewing heart rate. The three conditions were changed to within subjects by taking the change scores from the high, medium and low repetitions for each music genre and collapsing them together. This created High Hip Hop, High Theme, Medium Hip Hop, Medium Theme, Low Hip Hop, Low Theme scores.

Hypothesis 1 predicted high frequency of repetition would elicit a prediction response, increasing attention as indicated by a larger decrease in heart rate change to ensure accuracy of the prediction. This hypothesis was partially supported.
Hypothesis 2 predicted high frequency of repetition would decrease heart rate change indicating attentional effort from those high in sensation seeking. These individuals will be seeking greater levels of arousal and the frequent repetition in melody will be enticing to this group. Again, this hypothesis was partially supported.

While all conditions experienced some decrease in heart rate, some had greater instances of decreased heart rate than others. A three-way interaction was discovered between repetition, music type and sensation seeking, $F(2, 28) = 3.515, p < .05$. The two-way interaction between repetition and music type was not significant, and instead, sensation seeking moderated their effects. Sensation seeking was measured as a continuous variable; thus, to illustrate the Repetition x Music Genre x Sensation Seeking interaction, the participants were categorized into three groups of sensation seeking seekers (high, medium, and low) based upon a 33% split. The interaction effect is illustrated in Figure 1. The top panel shows the interaction pattern when the music was theme, and the bottom panel shows the pattern when the music was hip hop. As shown in the top panel, when the music was theme, participants with all three levels of sensation seeking trait showed similar patterns to the repetition manipulation: slowest heart rate in response to moderate amount of repetition and increased heart rate when the repetition was low or high. High sensation seekers showed the largest effect size, manifesting a very little change in heart rate when repetition was in low and high compared to when it was moderate. The bottom panel shows a quite different response pattern when the PSAs had hip hop music. When repetition increased, high sensation seekers showed greater attentional effort as indicated by heart rate change when repetition is high in frequency, supporting hypotheses one and three. Taken together, they show type of music plays a
significant role in how sensation seekers are influenced by frequency of repetition in the music.

Figure 1. Repetition x Music Genre x Sensation Seeking Interaction Effect on HR response.
Discussion

The results for this study indicate frequency of repetition of the melody and music genre have a relationship that is mediated by the participant’s level of sensation seeking. For PSAs with theme music, the medium amount of repetition was the most successful at garnering attention across all levels of sensation seekers as indicated by decrease in heart rate change. For PSAs featuring hip hop music, high sensation seekers exerted more attentional effort during PSAs with high repetition of melodic pattern as indicated by the low levels of heart rate change. The heart rate change increased, indicating decrease in attention, as the frequency of repetition decreased. Results for PSAs with hip hop music lend support to both hypotheses 1 and 2, but results for theme music does not.

High sensation seekers, the likely target audience for an anti-smoking PSA, appeared to be more effortful in their processing when the repetition was moderate for the melodramatic theme music, but high for the hip hop music. While the outcome for hip hop music is as predicted, why was high repetition in theme music so ineffective in garnering attentional effort? This may be a matter of improper musical fit. High sensation seekers may be watching and experiencing the increased arousal from the frequent repetition in the theme PSAs. This increased arousal is in preparation for something to come, but by the end of the PSA this increased arousal remains unresolved. According to the ITPRA, heightened arousal that is unresolved will lead to a tension response. This tension response may be building during the PSA, drawing the heart rate up (or not...
leaving the cognitive resources to decrease) while viewing. Although the timbre of the music may sound fitting and the tone is fitting to the visual style, there can still be a violation of expectancy through fit.

Expectations for the genre and situation may have also been an important factor. Theme music is typically used to enhance drama or set the stage for things to come in the narrative. The high frequency of repetition may be signaling the body to prepare for something to come. This signal is not fitting with the simple black and white testimonial style featured in two of the three theme PSAs. The viewer may be waiting in anticipation for something that never comes. This may be especially true for high sensation seekers as they are looking for experiences to increase their arousal. Within the hip hop genre repetitive beats are commonplace. The hip hop videos employed multiple cuts and scene changes that may be a better situational fit with high frequency of repetition as there is more action and things to come.

Visuals fitting with the music could drive other effects. Further exploration will need to be the next step by coding the visual elements. The hip hop visuals were more colorful and appeared to have more action which may have led to the large decline in heart rate for high sensation seekers. That amount of arousal may have been too much to process for the medium and low sensation seekers, causing cognitive overload. A moderate amount of repetition in theme music appears to be ideal for all levels of sensation seekers. Perhaps this strikes the right balance of not creating tension, but still remaining interesting in an auditory sense.

While these findings provide insight, the study of music in persuasive messages is far from over. This study was limited by the small pool of subjects. Perhaps more can be
revealed about the complex and dynamic nature as the sample size increases. As we increase the sample size, additional measures need to be collected for evaluation. Self-report measures should be analyzed with new and already collected skin conductance data to gain a better understanding of how emotion factors into processing. As was stated previously, coding for visual and narrative elements within the videos will allow us to make better recommendations for pairings of music and visual stimuli. Finally, once these elements have been better identified, this study should extend itself to different types of persuasive messages and different genres of music.

The most exciting finding in this study is that music indeed matters during processing PSAs. The melody is not just a filler or distractor item in the overall message. Repetition in the melody influences the responses to the PSAs. In an analysis by Huron & Ollen (2003), 94% of songs in the sample that were longer than a few seconds, across many genres, had some form of repetition within the melody. This is a common musical feature that cannot be overlooked but could be used to the advantage of message producers. Strategically using melody repetition in message design and production should be taken into consideration in health campaigns that aim to target certain audience groups, such as those with high sensation seeking tendencies.
References


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Appendix A: The Code Book for Music in PSAs (8-6-2011)

The first pass at coding should be used to determine general features and qualities of the background music. Once complete, please view and stop as many times as necessary to determine the structural features of the background music for each PSA.

General Features

1. **PSA ID**

   Please indicate the PSA ID.

2. **Music**

   Please indicate whether there is music played anywhere in the PSA. Sound effects do not count as music, including a ringing phone or bell.

   \[1= \text{music is presented}\]
   \[0= \text{music is not presented}\]

3. **Musical Mode**

   Please make judgment on whether the melody playing in a major or minor mode/key. Major key is traditionally happy and light sounding, minor traditionally sounds sad. Sad music is not all in a minor key, and happy not always major. These are general indicators. The key is dependent on how the notes are arranged and which are featured more prominently as the chord base.
Example: The theme from Mad Men is in a minor key, the theme from Friends is in a major key.

1= major key
0= minor key

4. **Background/ Scene/ Message**

What is the use of the music in the advertisement? There are three possible codes and some may seem to overlap but use the best one for each

- **Background**- this is where the music is used purely to play under the audio or to heighten emotion with the visuals. The musical piece itself does not seem to have any significance to the narrative or the message. An example is a girl talking about her friend’s drug use while a sad sounding instrumental piece is playing.

  1= music is used for background purposes

  0= music is not used for background purposes

- **Scene**- this is where the music is used to set a scene in the narrative. The music is a cue to let the audience know the location or reinforce a situation. An example would be if the PSA were taking place at a high school football game and the marching band was playing.

  1= music is used to set the scene

  0= music is not used to set the scene
- Message- this is where the music delivers the message. In this case the melody and lyrics are used to tell the audience what the PSA is about. An example would be a boy rapping about why he doesn’t do drugs.

- 1= music is used to deliver the message
- 0= music is not used to deliver the message

Specific Features

These features should be coded completely independent of any other influence including narrative*, video production, other audio and any other musical features. If more than one appears in a section, all that apply should be coded separately. Stop at the end of each second in the timecode to code for that second. Go back and review as many times necessary.

*Significant occurrences could be a musical signal to a narrative or visual feature.

MB-Music Begins- to be coded within the first second there is an onset of music. To be used for initial musical beginning and also any subsequent occasions the music has come to a complete stop and started again.

DC-Dynamic Change- Dynamics are the loudness or softness of a musical composition. A change in dynamics would be a change in volume, subtle or drastic. Place a 1 in the box when any noticeable change occurs and continue to code the change until a leveling effect has occurred. Example: A piece crescendos, or gradually gets louder over two seconds and then levels off. Those two seconds would be coded as both a dynamic change and under L. A baseline level should initially be established for dynamics on a scale of 1 (music is very soft)-7 (music is very loud).
DC Baseline

1 = very soft 2 = soft 3 = somewhat soft 4 = moderate 5 = somewhat loud 6 = loud 7 = very loud

L

1 = music gets louder
0 = music does not get louder

S

1 = music gets softer
0 = music does not get softer

TC-Tempo Change - tempo is used to describe the speed of the musical composition. A change in the tempo would involve the notes being played closer together or faster or further apart, which is slower. Do not confuse speed picking up with the melody picking up as described below. Sometimes a fuller sound will make the tempo seem faster but pay close attention to whether it is actually speeding up or if it is the introduction of new percussion or instruments. A baseline level should initially be established for tempo on a scale of 1 (tempo of music is very slow) - 7 (tempo of music is very fast).

TC Baseline

1 = very slow 2 = slow 3 = somewhat slow 4 = moderate 5 = somewhat fast 6 = fast 7 = very fast

F

1 = music gets faster
0 = music does not get faster

S
1= music gets slower
0= music does not get slower

SC-Style Change- although all Western music is formed from the same notes, the way the notes are arranged creates the melody and each melody can be played with different instruments, syncopations (rhythm) or tempo to create a style. When the style changes the music will sound completely different from what has been played before, even if it is the same notes. Examples would be if the music were played in a jazz style and was then switched to country or an upbeat Top 40 style song was shifted into a dark and gloomy tone. A style change can be a complete song change but does not need to be as every song could be arranged in many styles.

1= style changes
0= style does not change

PU- Melody Picks Up- This occurs when the music becomes more prominent. May include addition of instruments to make the sound fuller or a greater definition of the percussion (beat). Often will occur with tempo and/or dynamic change but not necessarily. Code separately from any of these changes.

1= melody picks up
0= melody does not pick up

ME-Music Ends- Music comes to a complete stop. To be coded in the first second the music is not present.

1= music ends
0= music is playing
MR-Melody Repeat- an occurrence where the melodic pattern repeats itself. Coded at the inception of the repeated pattern.

1= melody repeats
0= melody does not repeat

D-Dissonance- melodic dissonance – This occurs when the notes in the chords don’t seem to “go” together. The sound is tense or restless and creates a need for resolution.

1= dissonance occurs
0= dissonance does not occur

DR-Dissonance Resolved
Resolution of the dissonance, sound is back to a normal melody pattern or chord

1= dissonance has occurred and is resolved/ resolving
0= no dissonance has occurred or dissonance is still occurring

SO-Significant Occurrence
A musical event out of the norm that has been previously established. This is the only code that could be referencing a musical signal or cue to the narrative. An example of this would be a prominent musical tone followed by the character making their vital point.
Example: In the Law and Order television shows there are two tones to signify a new place and time in the narrative.

1= presence of significant occurrence
0= no significant occurrence present
Appendix B: Music Empathizing-Systemizing Scale

Music Empathizing-Systemizing Scale

ME1. I think that I can easily sense how performers feel while playing music.
ME2. Music is important to me mainly because it expresses something personal and touching.
ME3. When listening to music, I have thoughts about the emotional state of the writer/composer at the time.
ME4. I feel when listening to music I can understand the emotions the writer/performer is trying to express.
ME5. I often experience physical sensations such as tears, shivers, etc. when listening to certain pieces of music.
ME6. I never guess the emotions of the performer(s).
ME7. I never find the lyrics of a song to be meaningful to me.
ME8. I do not feel I am able to identify with the singers/writers of my favorite music.
ME9. I do not care about the lives of my favorite artists at the times they produced a certain song/album.
MS1. I often wonder how the mechanics of musical instruments work.
MS2. I like hearing the different layers of instruments and voices in a song/piece of music.
MS3. I especially like the organized way music is laid out.
MS4. At concerts, I like to see the roles of the different band/orchestra members.
MS5. I like to keep my music collection clearly ordered, e.g., alphabetically or by genre.
MS6. I am not interested in understanding the structure of a piece of music.
MS7. I am not intrigued about the physics and acoustics of musical instruments.
MS8. I do not find it interesting how music is created from different parts.
MS9. I am not at all interested in the production side of music and the technologies involved.
Appendix C: The Brief Sensation Seeking Scale (BSSS-8)

BSSS-8 Scale Scoring
Use the mean of the eight 5-point scales.

The BSSS-8

Experience seeking
1. I would like to explore strange places.
5. I would like to take off on a trip with no pre-planned routes or timetables.

Boredom susceptibility
2. I get restless when I spend too much time at home.
6. I prefer friends who are excitingly unpredictable.

Thrill and adventure seeking
3. I like to do frightening things.
7. I would like to try bungee jumping.

Disinhibition
4. I like wild parties.
8. I would love to have new and exciting experiences, even if they are illegal.
Appendix D: Smoking Attitude Scale

This is a 17-item scale assessing individuals’ attitude toward smoking. Its internal consistency and construct validity have been established (Shore, Taschian, & Adams, 2000).

Reference:

Instructions: Please indicate your agreement with the following statements on a scale from 1 (strongly disagree) to 7 (strongly agree):

1. I would not date a person who smokes.
2. I would marry a person who smokes.
3. I would object to living with a smoker.
4. I prefer not to spend a lot of time with people who smoke.
5. I would be willing to form a close friendship with a smoker.
6. There is no good reason to ban smoking on airplane flights.
7. Restricting smoking in public places is unfair to smokers.
8. Laws restricting smoking in the workplace are unfair to smokers.
9. People should have the right to smoke where and when they want.
10. Smoking should not be restricted by law in any way.
11. Nonsmokers should learn to be more tolerant of smokers.
12. People have a basic right to breathe smoke-free air.
13. Secondhand smoke is a legitimate health risk.
14. Employers should be required to provide a smoke-free work environment for their employees.
15. All forms of cigarette advertising should be illegal.
16. Cigarette companies should be permitted to advertise their products in any way they wish.
17. The sale of cigarettes should be outlawed altogether.
Appendix E: Demographic Questions

Are you male or female?  Male___ Female____
Age: _______
Race  (check all that apply):
  □  white, non-Hispanic
  □  black, non-Hispanic
  □  Hispanic
  □  Asian or Pacific Islander
  □  American Indian or Alaskan Native
  □  Other: _______________
What is your primary language in daily life? ___________________