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Risk Behavior, Decision Making, and Music Genre in Adolescent Males

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Risk Behavior, Decision Making, and Music Genre in Adolescent Males

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By

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Abstract

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By Joseph E. Hampton

The effects of music on risk behavior and decision-making are still unknown. Previous studies have linked music with risky behaviors such as drinking. Evidence shows that performance and decision-making on certain tasks can be altered by the presence of music. This study seeks to evaluate decision-making while in this “altered” state of mind. It is hypothesized that decisions made listening to rock music will be more risky than those made in other conditions. Participants were assessed using several questionnaires and the Iowa Gambling Task. Participants were randomly assigned to no music, classical music, or rock music. Results indicate several interesting trends in behavior as well as several significant correlations between risky decision-making and reaction time on the Iowa Gambling Task.

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Musical influences can be found everywhere in human culture from New Orleans' jazz funeral processions to the Maasai harmonies of Eastern Africa to the Chinese tea ceremony. Music has emerged spontaneously and in parallel in all known human societies throughout history (D'Errico et al., 2003). Although musicologists usually study music as a purely social construction, some researchers have begun to study music as a biological function (Blackling, 1990; Wallin, Merker, & Brown, 2000). Lomax (1977; 1980) analyzed 4000 musical selections from 148 distinct cultures and geographic regions and found that they could all be broken down into one of only two categories. The basis for the musical stylings of a culture seems to be determined by the basic social structure (matriarchy or patriarchy) in which it is produced. With such a variety of symbols, languages, and cultural activities it is rare to find such spontaneous unity among all peoples on Earth.

All humans, with the exception of a small minority who are tone-deaf (a variation that is expected when observing biological traits that are subject to random mutations) can appreciate and engage in music without formal training from infancy (Peretz, 2006). As for musical processing, most all humans excel at this task (Peretz & Zatorre, 2005). Musicians and non-musicians are equally able to learn songs and detect "bad" notes played in a scale. We seemingly have an innate sense of what sounds appropriate and can easily detect a tone that does not belong. With these intrinsic expectations at hand, this allows for the perception of music and the ability to engage with it by dancing or foot tapping, for example, in real time even upon the first listening of a song. Peretz (2001) and Miller (1989) provide further support for the biological view, citing the condition of amusia caused by brain damage or congenital defects to the inferior frontal gyrus that impair a person's ability to determine expected pitches and detection of harmonic violations, these people cannot tell which notes do not belong on a scale. Twin studies also indicate a genetic factor for musical awareness. In one study, identical twins' results were more similar (*r* = 0.79) than fraternal twins (*r* = 0.49) for irregular pitch identification, indicating that genetic factors may have more influence than the environment (Drayna, Manichaikul, de Lange, Snieder, & Spector, 2001). Human offspring also have an early taste for music. Infants as young as two days old show preference for infant-directed over adult-directed singing and at six months old prefer to hear their mothers sing than simply speaking.

Researchers are also seeking to determine whether the brain has localized or domain-specific areas just for music. It appears that all auditory information is taken in, and only then can the musical parts of the brain begin to pick away at the structure to form expectations and generate scales and rhythmic timings that are appropriate. Musical processing must be separate from other areas of the brain because there are cases in which people have lost their music abilities but retain language and other skills, there are also cases where the person possesses exceptional musical abilities but suffers from severe autism or mental retardation that limits other cognitive functioning one might expect an expert musician to possess (Miller 1989; Peretz, 2001). Because music and language skills can be impaired independently, a specific processing module is likely to exist for at least some musical abilities. However, overall musical processing utilizes neural regions found in both hemispheres of the brain, making isolation of such pathways very difficult (Peretz, 2006).

Of particular interest for the current study is the emotional response to music and its implications for behavior following such events. Research has revealed that children as young as three years old can detect happiness in the music of their culture, and by six years of age they can sense sadness, fear, and anger in music just as easily as an adult (Cunningham & Sterling, 1988; Dolgin & Adelson, 1990; Terwogt & van Grinsven, 1991). This may be caused by prior exposure to such music and identifying each type of music with its intended emotional response. Evidence using functional magnetic-resonance imaging (fMRI) links the emotional response to music to what Blood and Zatorre (2001) call "biologically relevant, survival-related stimuli via their common recruitment of brain circuitry involved in pleasure and reward" (p. 11818). This evidence shows that music can recruit neural pathways in the limbic system as well as the amygdala, generating immediate affective responses akin to reflexes in that music can also produce involuntary physiological and behavioral responses (Gosselin et al., 2005; Peretz, Gagnon, & Bouchard, 1998).

To assess the neural mechanisms activated when we listen to music, researchers in this field have begun to utilize the benefits of advanced techniques such as functional Magnetic-Resonance-Imaging (fMRI). When music is the focal point of concentration, its effects on the brain have been linked with the same euphoric brain circuitry as food, sex, illicit drugs, and other pleasurable stimuli (Blood & Zatorre, 2001). Of particular interest for the proposed research is the dual role of the orbitofrontal cortex (OFC) in both music perception and decision-making. The OFC has also been associated with numerous behaviors linked to pleasure, reward, punishment, and risk evaluation (Kringelbach & Rolls, 2004; Kringelbach, 2005). Further evidence of the role of the OFC in reward and punishment detection and impulsivity regulation is found in patients with damage to their OFC who have significant difficulty distinguishing between rewards and punishers (Berlin, Rolls, & Kischka, 2004).

The OFC is composed of two neural subdivisions, the mediolateral and the posterior-anterior pathways. Of particular interest in adolescent risk and music perception is the mediolateral pathway. The medial area of the OFC monitors the reward values for any possible reinforcers. The lateral area activity is related to evaluating punishers and may lead to a change in current behavior (Kringelbach & Rolls, 2004). This evidence points to a possible connection between listening to music and making decisions based on risk, reward, pleasure, and punishment. If the same areas of the brain are implicated in both music perception and risk/reward decision-making, it is possible that decisions made while listening to music will differ from those made in the absence of music. For example, it has been shown that decisions made while under the influence of illegal drugs or during sex (all of which have OFC pathways in common) may differ from their respective "sober" counterparts in similar ways as decisions made while listening to music (Bohlin & Erlandsson, 2007; Davis, Hendershot, George, Norris, & Heiman, 2007). This may be due to the common involvement of the OFC and other reward/evaluation pathways in the perception of music, impulsivity control, pleasure seeking, and in the risk-evaluating and decision-making processes (Kringelbach, 2005; Cloutier, Heatherton, Whalen, & Kelley, 2008). Moreover, if different kinds of music play a role in the decision-making process based on the OFC activation, it is expected that distinct genres, such as hard rock and classical music, would influence risk behavior in a significant way. In this work we will assess the role of different kinds of music on the decision making process during a simulated gambling task in college students.

Implications from research in this field of psychology may lead to a better understanding of adolescent and young adult risk-taking behavior and may help explain risky behavior in certain social situations where music and the opportunity for pleasure and risk-behaviors are ever-present, such as driving or dance clubs. Currently, automobile accidents are the top cause of death for those aged 15-19 with over 5,500 deaths per year (National Center for Health

Statistics, 2005). This study seeks to determine whether music genre can affect the risk-behavior and decision-making of adolescent males via the involvement of music-induced involuntary physiological and behavioral responses.

Music's Effects on Perception

Although for the most part music seems quite innocuous, there may be situations, such as driving, where music can have a negative influence on our behavior and decision-making. For years, parents have warned their children about "dangerous" music (Siegel, 2005). One survey of 1780 drivers found that two-thirds of drivers listen to music while operating a vehicle. Also, drivers with over four years without an accident had a higher preference for music-free driving (Dibben & Wiliamson, 2007). Further research by Brodsky (2001) has found more evidence that music can interfere with perception and driving performance. The study looked at the effects of music tempo on driving skills using a driving simulator. The faster the tempo, the more driving errors, such as speeding and missing stop signs, the participants committed. Perception was also altered in the participants, as they progressively failed to estimate their driving speed as music tempo increased. Additional research has shown correlations with gambling task scores and reaction time (Monterosso, Ehrman, Napier, O'Brien, & Childress, 2001). Other research with young adults prone to risk-behavior found that reaction time and false alarm responses increased with participants who scored low on the California Psychological Inventory Sociability Scale that indicates higher levels of disinhibition (Saunders et al., 2008). Assessment of drug-dependent participants has also shown higher levels of impulsivity and quicker decision-making than control groups (Perry & Carroll, 2008). As Blood and Zatorre (2001) found, enjoying music can replicate brain activation in areas associated with illicit drug usage.

There are other situations in which perception and decision-making have been altered while listening to music. A European study of consumer habits found that a wine was more likely to be purchased if the country of origin matched the music playing in the store (North, 1999). For example, when stereotypically French music was playing, French wine outsold German wine. However, when the music was switched to German, the wine sales tipped to the German side. Surveys afterwards showed the consumers were unaware of the musical influence on their wine purchasing. Further research with alcoholic beverages and music has discovered that increasing the volume of the music at a bar can seemingly influence the patrons to drink more alcohol overall in a shorter period of time. One study observed 40 randomly selected beer drinkers in a bar in France. When the music was at a normal 72 decibels, patrons drank 2.6 beers and finished them in 14.5 minutes each. When the researchers asked the bar owner to turn up the music to 88 decibels, drinking increased to 3.4 beers and consumption time dropped to 11.5 minutes (Gueguen, Jacob, Le Guellec, Morineau, & Lourel, 2008).

Risk Behavior

Adolescent risk behavior is the subject of much research. However, few studies incorporate music and its possible effects on teens. American adolescents on average spend a large amount of time, 1.5 to 2.5 hours per day, listening to music (Martino et al., 2006). For such a pervasive activity that consumes almost 10 percent of their lives, the full musical effects on adolescent human behavior are still widely undiscovered. Previous research with music and teens has found that adolescents who spend more time listening to music are more prone to risky behaviors such as smoking, underage drinking, and intense pleasure seeking activities (Arnett, 1991; Bohlin & Erlandsson, 2007; Chen, Miller, Grube, & Waiters, 2006). Research has shown that American adolescents over estimate the risk behaviors that their peers are taking part in.

Perception of risk has also been found to correlate with future involvement of risk behaviors, thus if teens believe that everyone is participating in a certain activity, they are more likely to engage in the activity themselves (Gibbons, Helweg-Larsen, & Gerrard, 1995).

Studies have also shown a positive correlation between adolescent emotional response to music and engagement risk-taking behaviors (Roberts, Dimsdale, East, & Friedman, 1998; Weisskirch & Murphy, 2004). Interestingly, both negative and positive emotional responses were linked directly to increasing risk-behaviors. This would indicate that teens who feel emotionally connected to their music are at a higher risk and are more likely to engage in risky behaviors than teens who lack a strong emotional connection to music. An emotional response may alter the decision-making process including reaction time. Pedersen and McCarthy (2008) also implicate increased levels of risk behavior with higher levels of impulsivity. Reaction times may be an indicator of any possible effect from music genre on impulsivity or the decision-making process.

The Iowa Gambling Task (IGT) is used in the clinical setting to assess risk-taking and decision-making and has also demonstrated differences between patients with damage to the OFC among other brain areas perform poorly on these types of tasks, as they do not seem to understand that some of the decks are bad and keep selecting from them (Levine, Mills, Estrada, Clanton, & Denton, 2003). Tests using galvanic skin responses reveal that OFC-damaged participants showed no reaction when hovering over the bad decks while those with normal OFC functioning quickly showed an aversion to the bad decks.

To see how music genre affects decision-making, reaction times and total trials until bad deck avoidance will also be assessed. The IGT records the total time spent as well as time between trials or how long it takes the participant to select another card. Previous research has shown correlations with gambling task scores and reaction time (Monterosso, Ehrman, Napier, O'Brien, & Childress, 2001). Other research with young adults prone to risk-behavior found that reaction time and false alarm responses increased with participants who scored low on the California Psychological Inventory Sociability Scale, which indicates higher levels of disinhibition (Saunders et al., 2008). Assessment of drug-dependent participants has also shown higher levels of impulsivity and quicker decision-making than control groups (Perry & Carroll, 2008). As Blood and Zatorre (2001) found, enjoying music can replicate brain activation in areas associated with drugs of abuse. Although decision-making under the influence of music was not assessed, it is hypothesized that similar brain activation will lead to similar impulsive and risky decision-making patterns.

Reaction Time

Reaction time can reveal differences in decision-making, impulsivity, and risk behavior. Niwa and Ditterich (2008) describe the decision-making process as having to reach a specific threshold in order to act on the decision, especially one involving more than one choice. If the decision-making threshold is lowered, as during increased levels of impulsivity, faster reaction times are exhibited. Some conditions such as Attention-Deficit Disorder and drug addiction produce similar symptoms in response times.

De Wit, Crean, and Richards (2000) used reaction times to assess behavioral inhibition among subjects who were given d-amphetamine, ethanol, or placebo. Results indicate that drug-altered states can affect reaction times with d-amphetamine decreasing reaction time and ethanol increasing reaction time. Reaction time has also been correlated with decision-making, increased impulsivity, and risk behavior, including performance on the Iowa Gambling Task (Eagle, Bari, Robbins, 2008; Monterosso, Ehrman, Napier, O'Brien, & Childress, 2001; Perry & Carroll, 2008). Faster reaction times have also been found for decisions that require little thought or are part of a firmly held belief (Otter, Allenby, & Van Zandt, 2008). If music genre alters decision making in this regard, reaction times may differ as a result.

For the current study, assessing the reaction time between card selections and total completion times for the Iowa Gambling Task will indicate if music genre has an effect on this possible aspect of decision-making, impulsivity, and increased risk behavior (Levine, Mills, Estrada, Clanton, & Denton, 2003). A "penalty" reaction time will also be calculated for participants who sustain a large reduction of money during the IGT. It is hypothesized that penalty reaction times should differ from normal trial reaction times. The penalty should cause discerning participants to exhibit some caution in order to prevent such another large loss. However, the penalty may not be as alarming to participants who exhibit high levels of impulsivity or quick decision-making, thus they should respond at the same speed no matter the penalty.

Specific Aims and Rationale

The aim of this research is to assess the role of music in influencing the decision-making process of college students during a simulated risky behavior.

This study seeks to answer important questions surrounding the "altered" mindset of the teenaged music listener and the decisions that arise from such brain stimulation. Although much of the previous research is correlational, the proposed study will utilize experimental techniques to limit possible confounding variables and to establish a causal direction for this valuable finding. It is hypothesized that listening to rock music will lead to increased risky behavior on the Iowa Gambling Task.

Method

Participants

The participants were 34 male Marshall University students, ages 18-20, randomly assigned to one of three music conditions1. One participant incurred a computer error and was unable to complete the study, leaving 33 total participants in the study. Participants were all members of the Psychology 201 (General Psychology) human subjects pool. Cognitively impaired individuals, mentally disabled individuals, and non-English speaking individuals unable to provide informed consent are excluded from the study. [1]

Materials

The study took place in a laboratory room at the Department of Psychology utilizing a laptop computer. The study assessed only one participant at a time and consisted of two questionnaires, playing a computer card game, and a final questionnaire. The Risk Behavior Questionnaire (Appendix A) was the first questionnaire (Stoyles, 2002). Participants completed 57 questions regarding their age, family, social, and school lives. Specifically they were asked: if they had positive relationships with their family and teachers; if they have had sexual intercourse; if they and their friends used alcohol or marijuana; if they were engaging in any rebellious or criminal behavior; and overall feelings about their parents and friends as positive or negative influences in their lives. All questions were answered using a 5-point scale that ranges from 1-Strongly Disagree to 5-Strongly Agree. This questionnaire served as a possible indicator of an individual’s tendency toward risk behavior. Participants then completed a second questionnaire (Appendix B), the Positive and Negative Affect Schedule (PANAS), to measure their emotional response to music from the past week. This assessment asked participants to rate

[1] Marshall University IRB # 9338

20 emotions (ten positive and ten negative) on a scale of one (not at all) to five (extremely) with a score range of 0-100. Previous research has found strong correlations between an adolescent's level of emotional response to music, either positive or negative, and risky behavior (Roberts, Dimsdale, East, & Friedman, 1998).

The music for the Rock and Classical conditions consisted from 9 and 11 songs, respectively. Songs from the Rock condition were hard rock instrumentals by mainstream artists such as Steve Vai and Joe Satriani. Songs for the Classical condition were by composers such as Beethoven and Mozart. The mean tempos (in beats per minute) were determined using DeKstasy and BPMer software. The rock condition was 157.22 BPM (N= 27, SD=18.81) and 150.19 BPM (N= 26, SD= 16.53) for the classical condition. The two groups were not significantly different with regard to tempo. The songs were broken down into 27 (Rock) and 26 (Classical) 30-second clips that were continually selected at random by Microsoft Windows Media Player. This was to ensure that all participants, regardless of completion time, would experience a variety of songs.

Headphones (ATH-ANC7 by Audio-Technica: OH, USA) were provided to all subjects and volume controls were set at a low, background level for those in music conditions. The headphones utilized a noise-canceling feature for the non-music condition to limit any outside noise. Participants listened to their music selection or experienced relative silence while performing the Iowa Gambling Task on the computer screen.

The Iowa Gambling Task (IGT) is a computer-based card game established by Bechara, Damasio, Damasio, and Anderson (1994) to simulate real life decision making with uncertainties, rewards, and punishments (Appendix D). The IGT displays four decks of cards on a computer screen, two of which are net positive (selecting these decks will result in a gain in total money) and two that are net negative (the player will continually lose money on these decks). The player was given instructions and $2000 to start the game. The player was instructed to draw a card by selecting the deck by pressing the corresponding number on the keyboard. Each card had a monetary reward and/or a penalty that varied from $50-1150. After each card was drawn, the participant was shown the reward and/or penalty for the current turn as well as their total overall amount. Each participant completed 100 IGT trials. The IGT score at the end of 100 trials serves as a dependent variable. The IGT software was also used to record reaction times for each trial.

The final questionnaire (Appendix C) assessed the participants' familiarity and enjoyment with the music (if applicable) and ascertains their favorite genre of music.

Testing Procedure

Participants were recruited from the university's subject pool and arrived at a scheduled time to the room where the study took place. The participants were seated at the desk and given the informed consent form to review. After informed consent was obtained, the participants were randomly assigned to one of three music conditions (Rock, Classical, or Silent). They were then provided with the Risk Behavior Questionnaire and the Positive and Negative Affect Schedule and notified to alert the researcher when completed. The participants were then provided with headphones and a laptop computer along with verbal and written (on screen) instructions for the Iowa Gambling Task. Additionally, participants were notified that a final score of $3000 or more would be rewarded with an extra hour of research credit. The researcher then left the participant alone to complete the IGT. After the 100 trials were completed, the IGT informed the participants to notify the researcher. The final score was then displayed. The participants filled out the final questionnaire (Appendix C) and were debriefed. Total time for completion was 10-15 minutes.

Statistical Design

ANCOVA designs were used to test the hypothesis that the three levels of music (rock, classical, and none) affected IGT scores and reaction time. Individual tendencies towards risk behavior, as assessed by the Risk Behavior Questionnaire, and level of emotional response, measured by the Positive and Negative Affect Schedule, served as covariates. Additional ANOVAs were run to assess the effects of music condition on IGT strategies and performance.

Several variables were extracted from the IGT based on reaction times, deck selections, and gain/loss ratios. To assess how a large penalty would affect reaction time on the next trial, a penalty reaction time was calculated by identifying reaction time the IGT trial immediately following a large penalty. These times were averaged for each participant. To assess changes in strategy, a gain/loss ratio was calculated for each participant's first 50 trials and last 50 trials of the IGT by dividing their rewards by their penalties for each block of trials. Performance was also assessed by the number of good and bad decks each participant selected during the first and last 50 trials.

Results

The study was performed to assess the role of music genre in a risky, decision-making task. Participants were randomly assigned to one of three music conditions (Rock, Classical, and Silent) and were all given the same assessments. To ensure that scores were representative of the music condition and not pre-existing behavioral patterns, the participants were scored on their propensity towards risky behavior as well as their emotional response to music to allow for statistical control in the later analyses.

Assumptions

Assumptions for the ANOVA and ANCOVA models were tested for violations. The quantitative variables (IGT score, reaction time, penalty reaction time, gain/loss ratios, good and bad deck selections, levels of enjoyment and familiarity, Risk Behavior Questionnaire, and PANAS) were tested using the Kolmogorov-Smirnov test. The covariates were found to be normally distributed. For Risk Behavior Questionnaire scores (Z = 0.72, p = 0.68) and for PANAS (Z = 0.68, p = 0.75). The Q-Q plots for the covariates are available for the covariates in Figures 1 and 2. Table 1 provides the results from the Kolmogorov-Smirnov tests that did not require transformation.

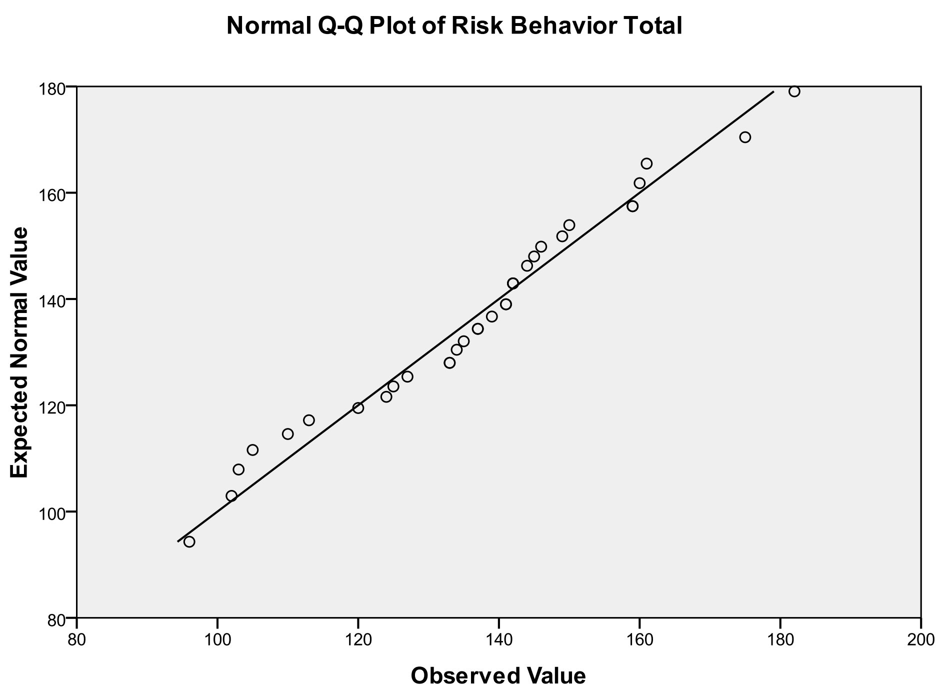

Figure 1. The Q-Q plots for the covariate Risk Behavior Questionnaire.

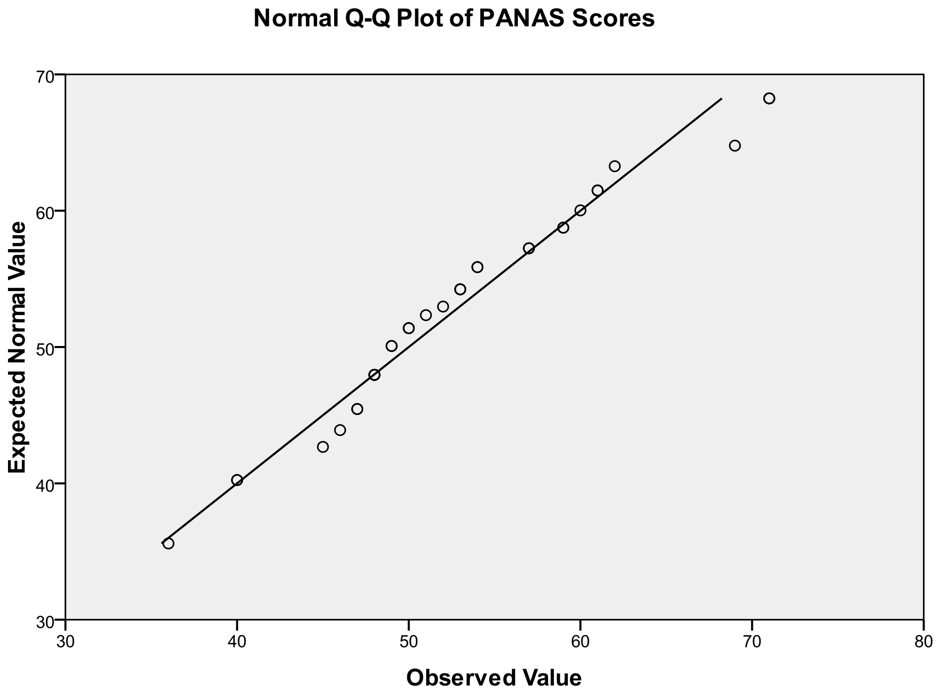

Figure 2. The Q-Q plots for the covariate Positive and Negative Affect Schedule (PANAS).

		Pre-trial 50 Bad Deck Selections	Pre-trial 50 Good Deck Selections	PANAS	Risk Behavior Total	Avg. Penalty Reaction Time	Level Of Enjoyment
N		33	33	33	33	33	22
Normal Parameters	Mean	22.7273	27.9697	52.97	136.6970	1908.6035	3.32
	Std. Deviation	7.12071	7.99408	8.357	20.38303	1054.81710	1.211
Most Extreme Differences	Absolute	.209	.185	.118	.125	.104	.213
	Positive	.139	.185	.118	.082	.104	.180
	Negative	-.209	-.106	-.086	-.125	-.102	-.213
Kolmogorov-Smirnov Z		1.203	1.061	.676	.718	.599	1.001
Asymp. Sig. (2-tailed)		.111	.211	.751	.681	.866	.269

Table 1. The results from the K-S test for the quantitative variables with the transformed reaction time and Iowa Gambling Task scores.

Several variables were not found to be normally distributed, including IGT scores (*Z* = 1.25, *p* = 0.09), reaction time (*Z* = 1.28, *p* = 0.07), gain/loss ratio for the first 50 trials (*Z* = 1.78, *p* = 0.004), gain/loss ratio after trial 50 (*Z* = 1.32, *p* = 0.06), post-trial 50 bad deck selections (*Z* = 1.47, *p* = 0.03), post-trial 50 good deck selections (*Z* = 1.54, *p* = 0.02), and level of familiarity with the music (*Z*= 1.36, *p* = 0.05).

IGT scores and reaction time were corrected using a natural-log transformation. After the correction, the K-S test was run again the corrected variables were found to be normally distributed; for IGT scores (*Z* = 0.84, *p* = 0.49) and for reaction time (*Z* = 0.88, *p* = 0.42). Ratios for gain/loss on the IGT were corrected via arctangent transformation, resulting in a normal distribution for the first 50 trials (*Z*= 1.14, *p* = 0.15) and last 50 trials (*Z* = 0.86, *p* = 0.45). The number of good deck selections after trial 50 was also corrected using arctangent transformation (*Z* = 0.98, *p* = 0.29). The number of bad deck selections after trial 50 was corrected using the natural log of the gamma function (*Z* = 1.06, *p* = 0.21). The distribution for the level of familiarity could not be transformed to accommodate an acceptable K-S result and therefore was not used in any further analysis. Tables 2 and 3 provide the K-S results for the transformed variables.

The second assumption was to confirm equality of variance. In the case of IGT scores and reaction times, Levene's test was not significant, indicating equal variance between groups, $F_{(2, 30)} = 0.21$, $p = 0.37$ for IGT scores and $F_{(2, 30)} =1.03$, $p = 0.37$ for reaction times. The cases were independent from each other, concluding the tests for initial ANOVA assumptions. Further tests will be accompanied by their respective Levene’s test results.

Next, ANCOVA assumptions were tested. Levene's test revealed equality of error variances for both of the ANCOCA models. For IGT scores, $F_{(5, 27)} = 1.04$, $p = 0.413$ and for reaction times, $F_{(5, 27)} = 1.35$, $p = 0.27$.

		Gain/Loss Ratio Pre-trial 50	Transformed Gain/Loss Ratio Pre-trial 50	Gain/Loss Ratio Post-trial 50	Transformed Gain/Loss Ratio Post-trial 50	Post-trial 50 Good Deck Selections	Transformed Post-trial 50 Good Deck Selections
N		33	33	33	33	33	33
Normal Parameters	Mean	1.2776	.8391	1.0885	.7899	29.8788	1.5351
	Std. Deviation	.74729	.19326	.47497	.16671	8.51747	.00832
Most Extreme Differences	Absolute	.310	.199	.229	.150	.268	.170
	Positive	.310	.199	.229	.150	.268	.170
	Negative	-.220	-.128	-.134	-.063	-.147	-.090
Kolmogorov-Smirnov Z		1.778	1.141	1.317	.859	1.542	.979
Asymp. Sig. (2-tailed)		.004	.148	.062	.451	.017	.293

Table 2. The first of two tables detailing the transformed variables.

		Gain/Loss Ratio Pre-trial 50	Transformed Gain/Loss Ratio Pre-trial 50	Gain/Loss Ratio Post-trial 50	Transformed Gain/Loss Ratio Post-trial 50
N		33	33	33	33
Normal Parameters	Mean	1.2776	.8391	1.0885	.7899
	Std. Deviation	.74729	.19326	.47497	.16671
Most Extreme Differences	Absolute	.310	.199	.229	.150
	Positive	.310	.199	.229	.150
	Negative	-.220	-.128	-.134	-.063
Kolmogorov-Smirnov Z		1.778	1.141	1.317	.859
Asymp. Sig. (2-tailed)		.004	.148	.062	.451

Table 3. The remaining transformed variables. Please note that participants in the silent condition were excluded from the enjoyment question.

The next assumption in ANCOVA models requires covariates to be independent from the treatment. To test this assumption, ANOVAs were run for both covariates. Scores on the Risk Behavior Questionnaire and the PANAS were found not to differ significantly across music conditions; for the Risk Behavior Questionnaire scores, $F_{(2, 30)} = 0.22$, $p = 0.81$ and for PANAS scores, $F_{(2, 30)} = 0.26$, $p = 0.78$. The Figure below reveals the scatter plots for the covariate scores as grouped by music condition (Figure 3). A second ANOVA was run, this time comparing the covariate scores by music genre preference. The results indicate no relationship, $F_{(1, 31)} = 0.32$, $p = 0.57$ for Risk Behavior Questionnaire and PANAS was $F_{(1, 31)} = 0.16$, $p = 0.67$. This is also represented in Figure 4 as a scatter plot grouped by music genre preference.

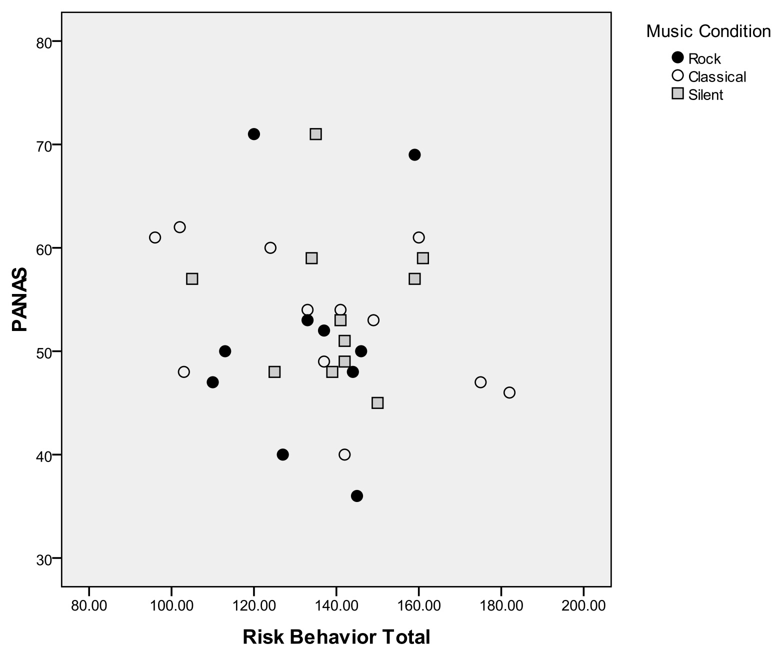

Figure 3. Covariate scores plotted against each other and grouped by music condition.

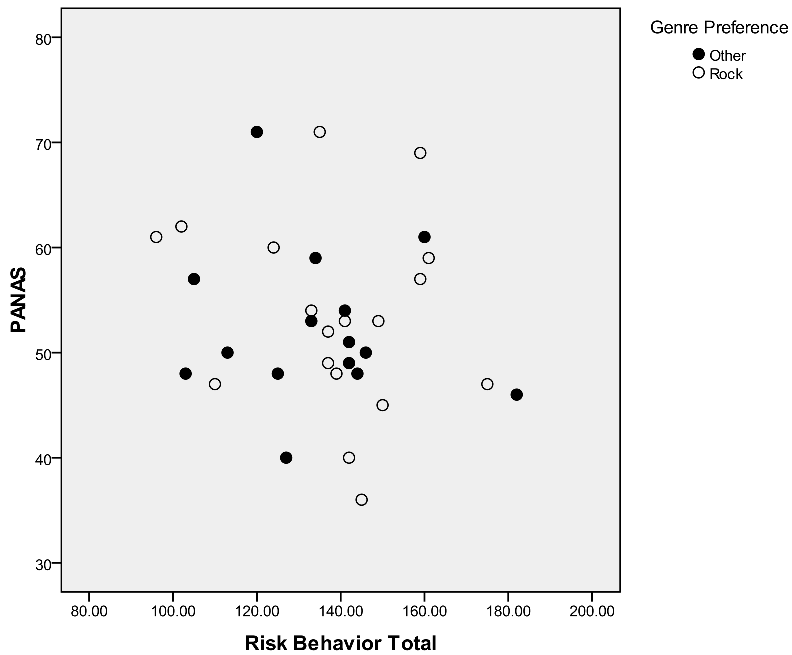

Figure 4. Covariate scores plotted against each other and grouped by music genre preference.

To assess any possible interaction effects between the music condition and the covariates, an ANOVA was run for each of the dependent variables. For reaction time, PANAS and Risk Behavior Questionnaire scores did not significantly differ across music conditions, $F_{(3, 29)} = 1.60$, $p = 0.21$ and $F_{(3, 29)} = 0.41$, $p = 0.75$ respectively. IGT scores also showed no relationship with the PANAS and Risk Behavior Questionnaire scores across music conditions, $F_{(3, 29)} = 0.16$, $p = 0.849$ and $F_{(3,29)} = 0.71$, $p = 0.55$, respectively. The findings indicate no evidence of covariate by treatment interaction, thus completing the necessary tests for ANCOVA assumptions.

Descriptives

After beginning with $2000 and completing 100 trials, the mean IGT score was $1910 (*SD*=$908). The rock condition maintained the highest overall mean with $2143 (*SD*=$1183) followed by the classical music condition with $1915 (*SD*=939) and finally the silent condition with $1695 (*SD*= $550). Table 4 provides descriptives for IGT scores and Figure 5 provides a visual depiction of IGT scores.

Genre Preference	Music Condition	Mean IGT Score ($)	Std. Deviation	N
Other	Rock	1616.67	514.458	6
	Classical	1912.50	599.479	4
	Silent	1960.00	320.936	5
	Total	1810.00	477.512	15
Rock	Rock	2931.25	1540.749	4
	Classical	1915.63	1109.451	8
	Silent	1475.00	628.888	6
	Total	1994.44	1160.488	18
Total	Rock	2142.50	1182.867	10
	Classical	1914.58	938.777	12
	Silent	1695.45	550.547	11
	Total	1910.61	907.693	33

Table 4. Mean Iowa Gambling Task Scores by music condition and music genre preference.

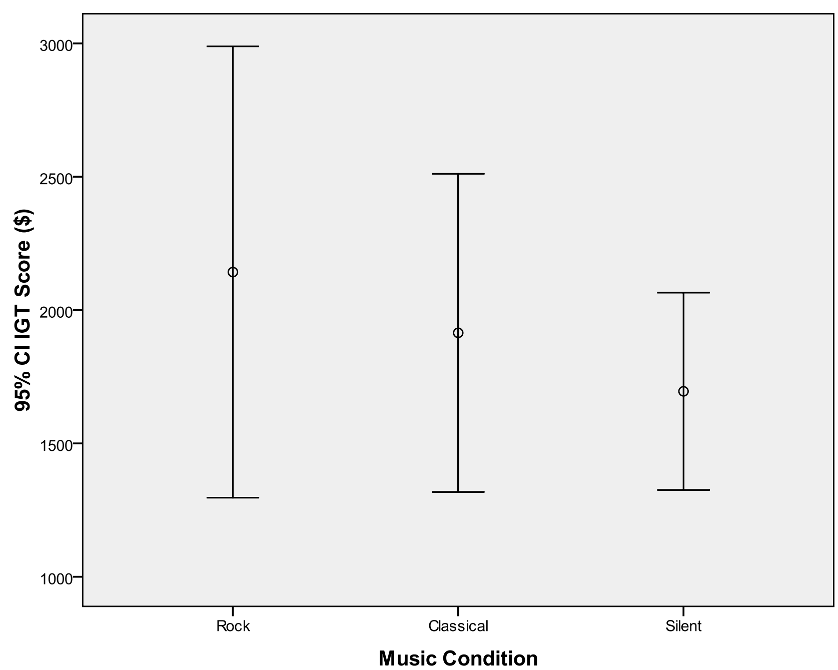

Figure 5. Mean score for the Iowa Gambling Task grouped by music condition.

As shown in Figure 6, the overall mean reaction time was 189.25 seconds (*SD*=70.77). The classical music condition completed the IGT in the fastest time with a mean of 173.44 seconds (*SD* = 45.80) followed by the rock condition with a mean of 194.31 seconds (*SD*= 77.36) and finally the silent condition completed the task with a mean of 201.90 seconds (*SD*= 88.48). The overall mean for the average trial reaction time was 1.91 seconds (*SD*= 0.71) and the average penalty reaction time was also 1.91 seconds (*SD*= 1.05). Table 5 provides descriptive statistics for reaction times for each music condition as well as each genre preference.

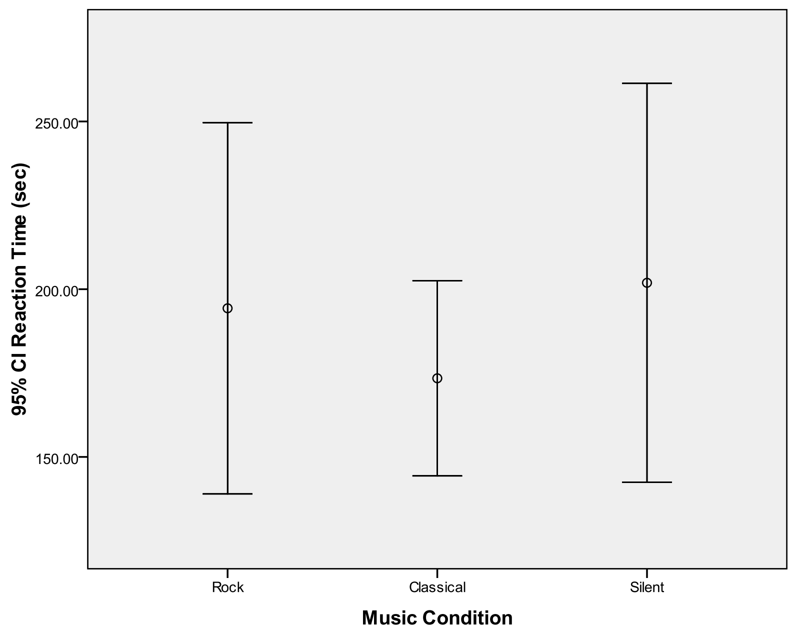

Figure 6. Mean reaction times (in milliseconds) for completing the Iowa Gambling Task grouped by music condition.

Music Condition	Genre Preference	Mean Reaction Time (sec)	Std. Deviation	N
Rock	Other	234.02	76.04	6
	Rock	134.75	20.89	4
	Total	194.31	77.36	10
Classical	Other	177.46	37.87	4
	Rock	171.43	516.49	8
	Total	173.44	45.80	12
Silent	Other	171.56	22.33	5
	Rock	227.19	116.50	6
	Total	201.90	88.48	11
Total	Other	198.12	58.66	15
	Rock	181.87	80.41	18
	Total	189.25	70.77	33

Table 5. Mean reaction times by music condition and music genre preference.

The covariate means are provided in Table 6 by music condition and by genre preference in Table 7. The overall mean for the PANAS was 52.97 (*SD*= 8.36) out of 100, thus indicating an overall moderate level of emotional response to music, as level of intensity rises with this score. The mean score on the Risk Behavior Questionnaire was 136.70 (*SD*= 20.38) out of a possible 305. This indicates the sample as a whole was not excessively engaged in risky behaviors or attitudes, as a higher score is indicative of higher involvement in risky behaviors. The participants' enjoyment and familiarity with the music in their condition, if applicable, was assessed on a five-point Likert scale with a mean of 2.21 (*SD* = 1.87) for enjoyment and 1.38 (*SD* = 1.29) for familiarity with the music. Overall, participants were indifferent to the music of their condition and were mostly unfamiliar with the songs selected.

Music Condition		PANAS	Risk Behavior Questionnaire
Rock	Mean	51.60	133.4000
	N	10	10
	Std. Deviation	11.047	15.84088
Classical	Mean	52.92	137.0000
	N	12	12
	Std. Deviation	7.103	27.68327
Silent	Mean	54.27	139.3636
	N	11	11
	Std. Deviation	7.377	15.55167
Total	Mean	52.97	136.6970
	N	33	33
	Std. Deviation	8.357	20.38303

Table 6. Mean scores for both covariates (PANAS and Risk Behavior Questionnaire) grouped by music condition.

Genre Preference		PANAS	Risk Behavior Questionnaire
Other	Mean	52.33	134.4667
	N	15	15
	Std. Deviation	7.394	20.64623
Rock	Mean	53.50	138.5556
	N	18	18
	Std. Deviation	9.263	20.56617
Total	Mean	52.97	136.6970
	N	33	33
	Std. Deviation	8.357	20.38303

Table 7. Mean scores for both covariates (PANAS and Risk Behavior Questionnaire) grouped by music genre preference.

Correlations

A table of correlations among the dependent variables and the covariates was run to assess the univariate relationships among the continuous variables (Table 8). Several significant relationships were found. There was a significant correlation between a participant's reaction time and the number of times they selected a bad deck after trial 50, *r* = 0.39, *p* = 0.03. Penalty reaction time was negatively correlated with a participant's gain/loss ratio for the last 50 trials, *r* = -0.37, *p* = 0.04. This indicates that a participant who is gaining money is not impaired by a large penalty, whereas participants running low on money towards the end of the IGT were more likely to slow down if they receive a large penalty.

PANAS scores were correlated with a participant's number of bad deck selections for the first 50 trials (*r* = 0.36, *p* = 0.04) and negatively correlated with good deck selection of the first 50 trials (*r* = -0.34, *p* = 0.05). Contrary to the initial hypotheses, a participant's score on the Risk Behavior Questionnaire and level of enjoyment of the music were not found to be correlated with IGT score or any reaction time breakdown. No additional significant correlations were found.

		Penalty Reaction Time	Bad Deck Selection Before Trial 50	Gain/loss Ratio Trials 51-100	PANAS	Reaction Time	Good Deck Selection Before Trial 50	Good Deck Selection After Trial 50	Selecting A Bad Deck After Trial 50
Penalty Reaction Time	Pearson Correlation	1	.179	-.365	-.039	.492	-.159	-.058	.150
	Sig. (2-tailed)		.320	.037	.829	.004	.377	.748	.406
	N	33	33	33	33	33	33	33	33
Bad Deck Selection	Pearson Correlation	.179	1	-.521	.357	.233	-.900	-.486	.453

Before Trial 50	Sig. (2-tailed)	.320		.002	.041	.192	.000	.004	.008
	N	33	33	33	33	33	33	33	33
Gain/loss Ratio Trials 51-100	Pearson Correlation	-.365	-.521	1	-.125	-.272	.611	.241	-.118
	Sig. (2-tailed)	.037	.002		.489	.126	.000	.177	.515
	N	33	33	33	33	33	33	33	33
PANAS	Pearson Correlation	-.039	.357	-.125	1	.340	-.344	-.077	.164
	Sig. (2-tailed)	.829	.041	.489		.053	.050	.671	.363
	N	33	33	33	33	33	33	33	33
Reaction Time	Pearson Correlation	.492	.233	-.272	.340	1	-.236	-.152	.385
	Sig. (2-tailed)	.004	.192	.126	.053		.185	.398	.027
	N	33	33	33	33	33	33	33	33
Good Deck Selection Before Trial 50	Pearson Correlation	-.159	-.900	.611	-.344	-.236	1	.254	-.263
	Sig. (2-tailed)	.377	.000	.000	.050	.185		.153	.140
	N	33	33	33	33	33	33	33	33
Good Deck Selection After Trial 50	Pearson Correlation	-.058	-.486	.241	-.077	-.152	.254	1	-.673
	Sig. (2-tailed)	.748	.004	.177	.671	.398	.153		.000
	Pearson Correlation	.150	.453	-.118	.164	.385	-.263	-.673	1
Selecting A Bad Deck After Trial 50	Sig. (2-tailed)	.406	.008	.515	.363	.027	.140	.000	

IGT scores and Reaction Times

Types of music did not affect IGT scores ($F_{(7,25)} = 0.998$, $p = 0.456$) with an observed power of 34% ($\alpha = 0.05$, two-tailed). There was no significant association even when both covariates, Risk Behavior Questionnaire and PANAS, were removed from the model ($F_{(5,27)} = 1.202$, $p = 0.335$) with an observed power or 36% ($\alpha = 0.05$, two-tailed). Figure 7 displays IGT scores by music condition and genre preference.

The second ANCOVA was performed using the same covariates but using with reaction time as the dependent variable. Again, no significance was found ($F_{(7, 25)} = 1.966$, $p = 0.101$) with an observed power of 64% ($\alpha = 0.05$, two-tailed). However, several trends are noteworthy. PANAS scores approached significance in regard to the total reaction time ($F_{(1, 25)} = 3.957$, $p = 0.058$). The hypothesized interaction between music genre preference and music condition approached significance as well ($F_{(1,25)} = 3.225$, $p = 0.057$; Figure 8).

Using data from the Familiarity, Enjoyment, and Music Genre Questionnaire, an ANOVA was run using the question regarding enjoyment of the music that played during their condition. This eliminated participants in the silent condition ($N = 11$) from this analysis as condition had no music. The ANOVA was not significant for IGT scores ($F_{(4, 17)} = 0.59$, $p = 0.68$; Levene's $F_{(3, 17)} = 0.99$, $p = 0.42$) or reaction time ($F_{(4, 17)} = 0.07$, $p = 0.99$; Levene's $F_{(3, 17)} = 0.63$, $p = 0.48$).

Of particular interest is the 'penalty reaction time.' This is the reaction time after a participant experiences a large penalty during the IGT. An ANOVA was run to determine if the penalty reaction time differed across music conditions. The results reveal no significant differences across music conditions, $F_{(2, 30)} = 2.29$, $p = 0.12$ (Levene's $F_{(2, 30)} = 0.38$, $p = 0.69$).

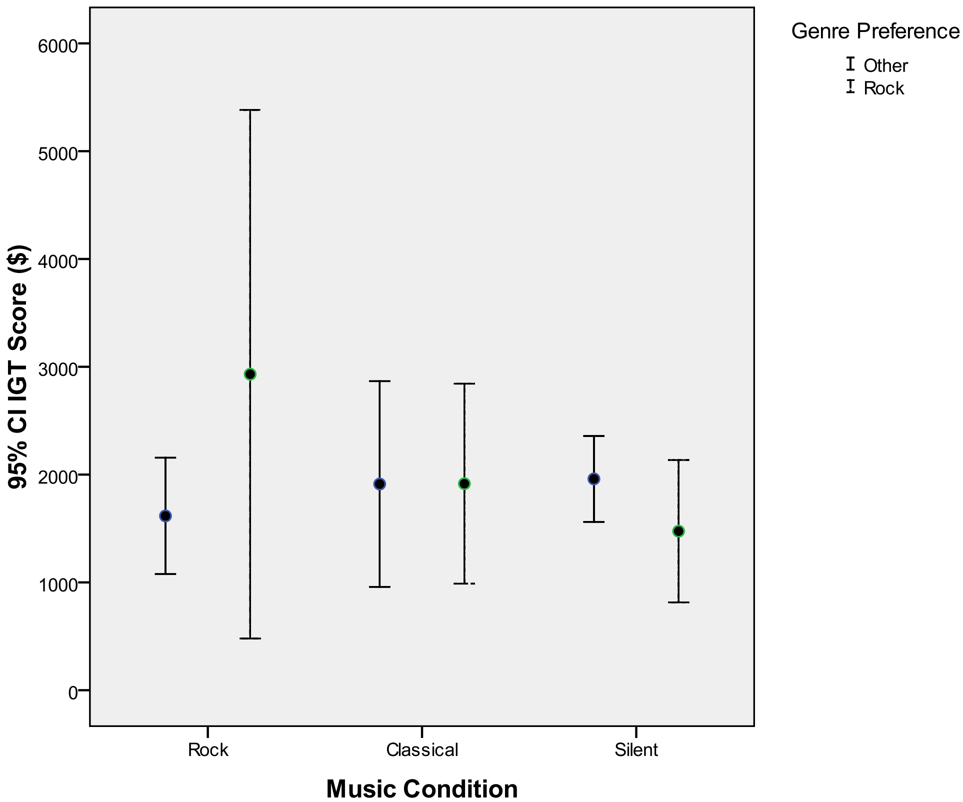

Figure 7. Mean IGT scores by music condition, grouped by genre preference.

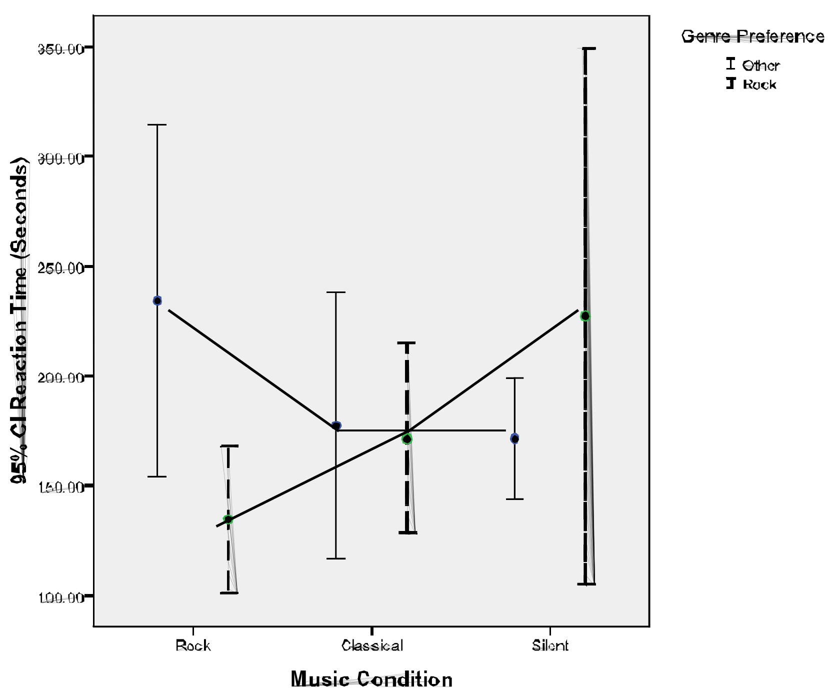

Figure 8. The interaction between music genre preference and music condition on mean reaction times for the Iowa Gambling Task scores.

To investigate how participants may have altered their IGT strategy after experiencing 50 trials, the card deck selections were reviewed. An ANOVA revealed no significant differences across music conditions. For the 'good decks,' $F_{(2, 30)} = 1.06$, $p = 0.36$ (Levene's $F_{(2, 30)} = 1.02$, $p = 0.37$). and for 'bad decks', $F_{(2, 30)} = 0.72$, $p = 0.50$ (Levene's $F_{(2, 30)} = 0.52$, $p = 0.60$). Deck selections also did not differ across genre preferences. For good decks, $F_{(1, 31)} = 0.55$, $p = 0.46$ (Levene's $F_{(1, 31)} = 1.78$, $p = 0.19$) and for bad decks, $F_{(1, 31)} = 0.22$, $p = 0.64$ (Levene's $F_{(1, 31)} = 1.52$, $p = 0.23$).

An additional assessment was created to evaluate the strategy of the participants in the IGT. A cumulative gain/loss ratio was calculated for each participant for trials 1-50 and for 51-100. The higher the ratio, the more the participant earned during the specified block of trials. The average ratio for the first 50 trials was 1.28 (*SD*= 0.75) and 1.09 (*SD*= 0.47) for the last 50 trials, indicating that the participants earned more money during the first 50 trials.

		N	Mean	Std. Deviation	Std. Error
Gain/Loss Ratio Trials 1-50	Rock	10	1.2930	.64177	.20295
	Classical	12	1.3575	.91444	.26398
	Silent	11	1.1764	.69089	.20831
	Total	33	1.2776	.74729	.13009
Gain/Loss Ratio Trials 51-100	Rock	10	1.0650	.49639	.15697
	Classical	12	1.2325	.59559	.17193
	Silent	11	.9527	.25346	.07642
	Total	33	1.0885	.47497	.08268

Table 9. Mean gain/loss ratios for the first and last 50 trials of the Iowa Gambling Task by music condition.

Table 9 provides the mean ratios for each music condition. An ANOVA was run to determine if the strategies were different across music conditions. There was no significant result found for the first 50 trials ($F_{(2, 30)}$ = 0.16, p = 0.85; Levene's $F_{(2, 30)}$ = 0.91, p = 0.42) or the last 50 trials ($F_{(2, 30)}$ = 1.01, p = 0.38; Levene's $F_{(2, 30)}$ = 1.46, p = 0.25).

Discussion

This study examined performance on the Iowa Gambling Task among adolescent participants assigned to one of three music conditions (rock, classical, and silent). Contrary to the initial hypothesis, there were no differences in Iowa Gambling Task scores or reaction times found across music conditions. Scores and reaction times were also independent of the level of risk-behavior as assessed by the Risk Behavior Questionnaire and emotional response to music as indicated by the PANAS. Although a small sample size is a limiting factor, there are several trends worth noting.

The interaction between music genre preference and music condition was approached significance with regard to reaction time. Those who preferred rock completed the IGT with rock music in 134.75 seconds (*SD* = 77.36) and those who do not prefer rock music completed the IGT in a slower 234.02 seconds (*SD* = 76.04). This indicates that music may have the most effect on IGT performance when it is the genre of the participant's choice. This trend is represented in Figure 8; note the large gap in reaction time between the genre preferences within the rock music condition.

IGT scores were also more revealing when examined by genre preference and music condition. Those who preferred rock music earned more on the IGT than those who did not prefer rock and were in the rock condition [$2931 (*SD* = 1541) vs. $1617 (*SD* = 514)]. Also, those who preferred rock music earned an average of $2931 (*SD* = 1541) if in the rock condition and only earned $1475 (*SD* = 629) if in the silent condition. These trends may reveal the increased impulsivity and risk-behavior associated with listening to music that is subjectively enjoyable, which was rock music in this case.

Strategies and performance in the IGT were also assessed by computing gain/loss ratios and tallying the total good and bad deck selections for the first and second 50 trials. No differences were found across music conditions. However, there were several significant correlations found among the continuous variables. Interestingly, the more a participant selected a bad deck in the IGT, the slower they were to make a decision for the next trial. This longer period of analysis between trials may indicate an acknowledgement that the deck is bad, but the promise of a large payout supersedes the initial hesitation of selecting a known bad deck. Furthermore, penalty reaction time was negatively correlated with gain/loss ratio after trial 50. This indicates that participants were unphased by the large penalty if they were still receiving intermittent rewards during the later trials of the IGT. On the other hand, they were more cautious in selecting a deck if they had a lower score at the time and would be severely impacted by another large penalty. Overall reaction time was found to be correlated with the number of bad deck selections during the last 50 trials of the IGT. As participants made more bad deck selections, they took increasingly longer to decide which deck to select for the next trial. This may indicate that the participants knew the deck was subject to both large payouts as well as large penalties.

The findings from this study validate previous research in this field and provide a promising view of what may be revealed by future studies. As expected, an interaction between music genre preference and the music condition was found to approach significance. Figure 8 displays this interaction’s effect on participant reaction time in the Iowa Gambling Task. This study reveals possible behavioral changes induced by music and its activation of specific neural pathways as measured by reaction time and scores on the Iowa Gambling Task. Further research is needed to confirm the trends revealed by the current study.

Previous research has shown the effect of music on brain activity associated with higher levels of impulsivity and risk-behavior. The current study attempted to identify behavioral changes caused by the presence of music and the activation of these proposed neural pathways. Although the findings of the present study are limited, it appears that genre preference may alter one's behavior on a risky, decision-making task if music playing during the task is preferred by the participant. Any changes in impulsivity or risk-taking behavior caused by music are important to identify so that undesired consequences can be avoided.

The Iowa Gambling Task score was found to be ineffective in determining smaller differences in performance among individuals and across groups for the present study. For example, a single score produced by the IGT can be obtained in many different ways, thus necessitating the other calculated variables such as gain/loss ratio and number of good and bad decks selected throughout the IGT. However, reaction time on the task, specifically after a large penalty, was found to be a more promising method of measuring changes in impulsivity in decision-making on the IGT. Again, a larger sample size may eliminate this situation.

Limitations and Future Research

Findings from this study may point to a need for more research with teens and music during decision-making and risk-taking tasks. Whereas thousands of adolescents die behind the wheel of a car each year, the circumstances of such accidents may not be fully understood without taking into account the possible effect of music on the risk-taking behavior (speeding) and decision-making (running red lights) of teenage drivers. Results from future studies may also be used to identify types of music, tempo, or volume levels that have a more profound effect on human behavior with regards to risky and/or pleasure-seeking activities. This information could be useful when educating young drivers on proper precautions to take while behind the wheel or in other risky situations to help reduce risky decisions, accidents and save lives.

The current study could also be adapted for future research with animals to identify musical patterns, such as simulated mating calls, that elicit changes in behavioral responses. Furthermore, identifying neural pathways and areas of the brain associated with the detection, identification, and response to an audible stimulus are an important component in the understanding of how language is processed, why and how specific sounds elicit different behavioral responses, and isolation of music genre characteristics that distinguish one type from another.

There are several limiting factors for the current study. Sample size was smaller than desired, thus limiting any findings. Age of the participants could also be a limitation. This study utilized only adolescents who are over 18 years old; however much of the current literature focuses on the full range of adolescence. Differing saturation levels from the music was also a limitation. The Iowa Gambling Task is not time restricting thus allowing some participants to be exposed to their music condition longer than others who complete the IGT at a faster pace, which allows for more time to be affected by the music. The music for the rock condition also consisted of music that was solely instrumental to remove any possible emotional cues from the lyrics. This, however, is not typical of adolescent music listening behavior. Future research may incorporate lyrical music to identify the effects, if any, of lyrics on behavior.

The lack of information about the neural pathway activated during the IGT paired with music is a limitation of the present research. In the absence of this information, we cannot rule out the possibility that the association between kind of music and risk behavior is mediated by other indirect mechanisms.

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Appendix A

The Risk Behavior Questionnaire

What is your age? ________Years

This questionnaire will ask you to think about issues concerning your family, friends, and school experiences, as well as the way you and your friends might use drugs and/or alcohol.

When answering these questions, remember that there are no right or wrong answers – rather each question is asking you to give your opinion on how things are happening for you personally.

Please answer the following questions without spending a lot of time thinking about your answer.
It is important to remember that there are no right or wrong answers.

When a question asks you to circle a number, please use the following scale for your answers:

1 = I strongly disagree with the statement
2 = I disagree with the statement
3 = I am not sure either way
4 = I agree with the statement
5 = I strongly agree with the statement

1. I follow family rules	1	2	3	4	5
2. I often get into trouble at home.	1	2	3	4	5
3. When I go out I usually tell my parents where I'll be.	1	2	3	4	5
4. I don't like taking my friends home.	1	2	3	4	5
5. I almost always tell my parents who I'm going out with at night	1	2	3	4	5
6. There are often arguments at home.	1	2	3	4	5
7. I think my family really cares about me.	1	2	3	4	5
8. My parents disapprove of my friends.	1	2	3	4	5
9. I do my jobs around the house	1	2	3	4	5
10. If I go out at night I come home when I feel like it.	1	2	3	4	5
11. My parents would agree with my friends about the important things in life.	1	2	3	4	5
12. I've got into trouble with teachers at school.	1	2	3	4	5

PLEASE CONTINUE ON THE NEXT PAGE

1 = I strongly disagree with the statement
2 = I disagree with the statement
3 = I am not sure either way
4 = I agree with the statement
5 = I strongly agree with the statement

13. On most nights, our family eats together at the table.	1	2	3	4	5
14. I've been in trouble with the police.	1	2	3	4	5
15. I believe I am a valued family member.	1	2	3	4	5
16. I get into fights sometimes.	1	2	3	4	5
17. It is important to get good marks at school.	1	2	3	4	5
18. I sometimes carry a weapon.	1	2	3	4	5
19. Staying at school is important for my future.	1	2	3	4	5
20. I have vandalized property.	1	2	3	4	5
21. I like school.	1	2	3	4	5
22. I miss classes at school.	1	2	3	4	5
23. I always do my homework and completing assignments.	1	2	3	4	5
24. I have wagged/skipped school sometimes.	1	2	3	4	5
25. I have been on dates.	1	2	3	4	5
26. I have had sex.	1	2	3	4	5
27. I feel close to my family.	1	2	3	4	5
28. In my school-work I find that I fail at more things than I succeed.	1	2	3	4	5
29. My parents set clear limits for what I do.	1	2	3	4	5
30. I don't like school – school sucks.	1	2	3	4	5
31. Putting in my best effort at school makes me feel good about myself.	1	2	3	4	5
32. Quite a lot of my friends get into trouble at home.	1	2	3	4	5
33. Giving time to my school-work is just as important as giving time to enjoyable things out of school.	1	2	3	4	5
34. My friends misbehave and get into trouble at school.	1	2	3	4	5
35. The kids I hang around with don't skip/wag school.	1	2	3	4	5

1 = I strongly disagree with the statement
2 = I disagree with the statement
3 = I am not sure either way
4 = I agree with the statement
5 = I strongly agree with the statement

36. Some of my friends sometimes destroy property or vandalize places.	1	2	3	4	5
37. My friends think school is really important.	1	2	3	4	5
38. My friends don't really care about their marks at school.	1	2	3	4	5
39. My friends like school.	1	2	3	4	5
40. Most of my friends are older than I am.	1	2	3	4	5
41. My friends usually do their homework and assignments.	1	2	3	4	5
42. My friends pressure me not to do well at school.	1	2	3	4	5
43. My parents are warm towards me.	1	2	3	4	5
44. A fair few of my friends skip classes or wag school.	1	2	3	4	5
45. My parents always listen to me.	1	2	3	4	5
46. A lot of my friends get into trouble at school.	1	2	3	4	5
47. My parents enjoy talking to me.	1	2	3	4	5
48. My parents often yell at me.	1	2	3	4	5
49. My parents are strict with me.	1	2	3	4	5
50. My parents are cold and distant towards me.	1	2	3	4	5
51. My parents are not abusive towards me.	1	2	3	4	5
52. My parents always expect me to ask before I can go out.	1	2	3	4	5
53. My parents expect me to come home at a set time.	1	2	3	4	5
54. My parents always want to know where I am going.	1	2	3	4	5
55. My parents always want to be told whom I am with.	1	2	3	4	5

56. How many of your friends would use:

a.	Alcohol:	None	25%	50%	75%	100%
b.	Tobacco:	None	25%	50%	75%	100%
c.	Marijuana:	None	25%	50%	75%	100%

on a regular basis?

57. When I am with my friends, I tend to:

a. Drink alcohol Yes No

b. Smoke Tobacco Yes No

c. Use alcohol regularly Yes No

d. Get drunk often Yes No

e. Use other drugs Yes No

END OF QUESTIONNAIRE

THANK YOU!

Appendix B

Positve and Negative Affect Schedule

PANAS

Directions

This scale consists of a number of words that describe different feelings and emotions. Read each item and then circle the appropriate answer next to that word. Indicate to what extent you have felt this way during the past week.

Use the following scale to record your answers.

(1) = Very slightly or not at all (2) = A little (3) = Moderately (4) = Quite a bit (5) = Extremely

	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
1. Interested	1	2	3	4	5
2. Distressed	1	2	3	4	5
3. Excited	1	2	3	4	5
4. Upset	1	2	3	4	5
5. Strong	1	2	3	4	5
6. Guilty	1	2	3	4	5
7. Scared	1	2	3	4	5
8. Hostile	1	2	3	4	5
9. Enthusiastic	1	2	3	4	5
10. Proud	1	2	3	4	5
11. Irritable	1	2	3	4	5
12. Alert	1	2	3	4	5
13. Ashamed	1	2	3	4	5
14. Inspired	1	2	3	4	5
15. Nervous	1	2	3	4	5
16. Determined	1	2	3	4	5
17. Attentive	1	2	3	4	5
18. Jittery	1	2	3	4	5
19. Active	1	2	3	4	5
20. Afraid	1	2	3	4	5

Appendix C

Enjoyment, Familiarity, and Music Genre Questionnaire

Please circle the choice that most applies to you.

1. How much did you enjoy the music that played during the Iowa Gambling Task?

1	2	3	4	5
Not at all		Neither like/dislike		Very much

2. How familiar were you with the music that played during the Iowa Gambling Task?

1	2	3	4	5
Not at all		Somewhat		Very much

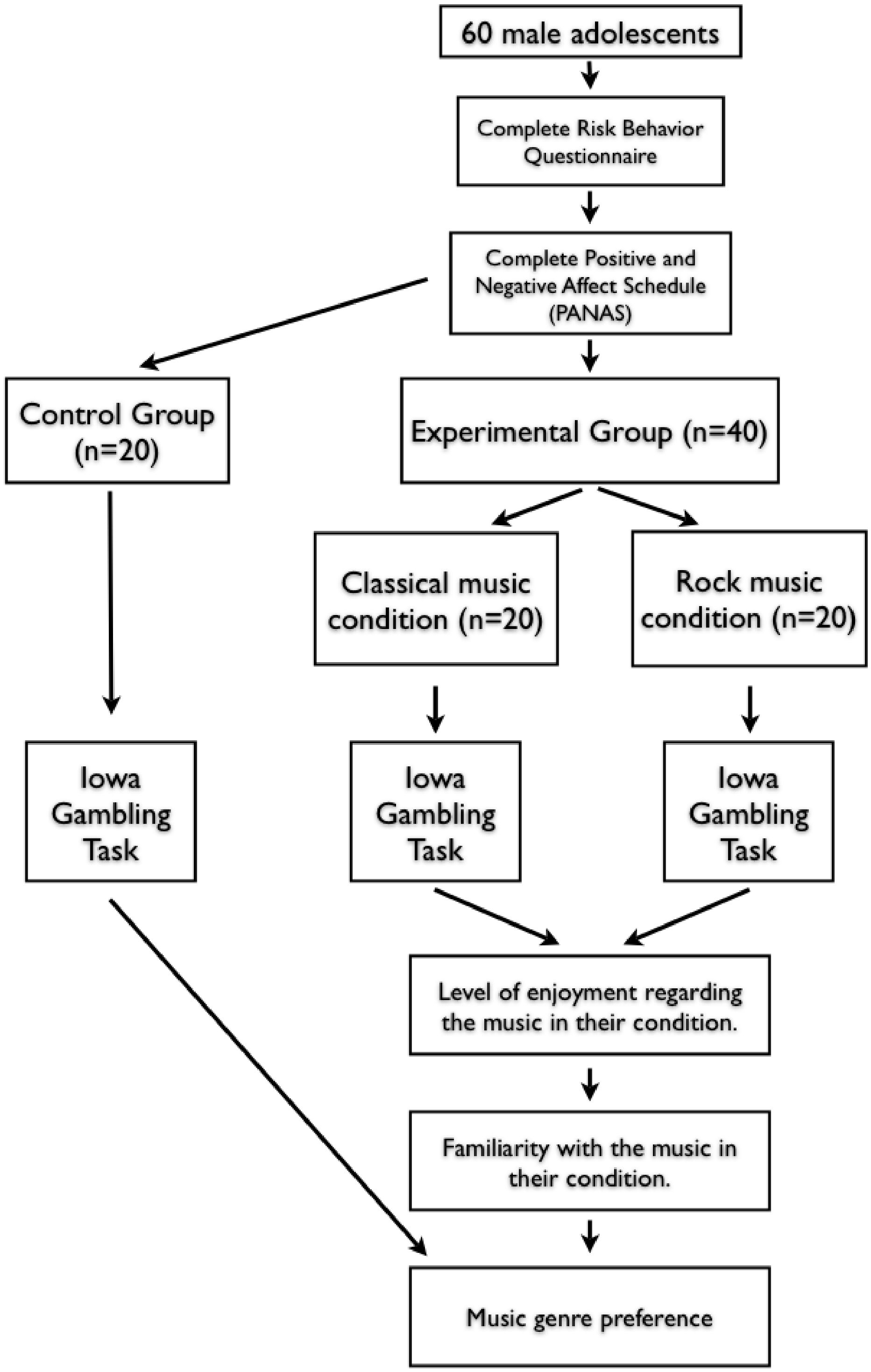
3. Please indicate your music genre preference. If selecting "Other" please write in your genre preference.

1	2	3	4	5
Jazz	Rock	Hip Hop	Classical	Other:__________

Appendix D

Screen shot of the Iowa Gambling Task. The version used in this study will have decks labeled 1-4 instead of A-D. For each of the 100 trials, participants will select a card from one of the decks and receive a reward of money or a punishment of reduction of money. In the picture above, the participant has selected from the A deck and received an award of $120. The more money the participants have at the end, the better the decisions they have made with card/deck selection.

Appendix E



Experimental Flow Chart.