Risky drinking decisions: The influence of party music and alcohol abuse in young adult women

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A B S T R A C T

Music is a ubiquitous feature of young adults' social drinking environments, yet no studies have assessed whether and how it impacts risky decisions to drink alcohol. Previous research on the influence of music on risky decisions is largely based around decision tasks with *monetary* incentives.
Methods: To assess the impact of music listening on risky *drinking* decisions, the current study used visual alcohol cues paired with hypothetical risky drinking scenarios (e.g., "You do not have a safe ride home" for alcohol). Young adult women with a history of alcohol abuse (N = 34) and casual-drinking control women (N = 29) made hypothetical decisions about whether or not to drink alcohol, or eat food (an appetitive control condition), in risky contexts while personal "party music" (music chosen by participants for "going out") and "home music" (music chosen for "staying in") played in the background. The main dependent measure — likelihood of drinking — was reported on a 4-point scale where 1 corresponded to "very unlikely", and 4 to "very likely".
Results: Listening to party music while making decisions increased the likelihood of making risky decisions, regardless of alcohol abuse history, while other personal music did not. Further, party music specifically increased the likelihood of risky *drinking* decisions relative to risky eating decisions. As expected, those with a history of alcohol abuse made more risky drinking decisions in general, regardless of the type of music heard.
Discussion: The results suggest that party music is an important feature of the drinking environment associated with increased risky decisions about drinking alcohol in young adult women, regardless of their history of alcohol abuse. The finding that music plays an important role in risky drinking decisions indicates that further investigation into the real-world drinking environments of young adults is crucial, as it will aid in the development of a more complete picture of risky drinking decisions in young adults.

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Introduction

Young (or emerging) adults show a higher prevalence of substance use, heavy drinking, and binge drinking than any other age group (Chen & Kandel, 1995; Grant et al., 2004; White & Jackson, 2004). A key feature of the vulnerability associated with substance use disorders, including alcohol use disorder (Bickel & Marsch, 2001; Finn, Gerst, Lake, & Bogg, 2017; Garavan & Stout, 2005) is the propensity to make risky decisions, especially in emerging adults (Baer, 2002; Bernheim; Rangel, 2004; Jackson, Sher, & Park, 2005, pp. 85—117). Emerging adulthood is characterized by instability in the social environment (Arnett, 2000) that leads to exploration of novel social bonding possibilities. It is common for these possibilities to be found in nightclubs, house parties, and bars. Background music is a ubiquitous feature of these environments, and is known to affect a variety of behaviors (Kämpfe, Sedlmeier, & Renkewitz, 2011), including the rate of alcohol consumption (Guéguen, Jacob, Le Guellec, Morineau, & Lourel, 2008; Stafford & Dodd, 2013) and the riskiness of gambling decisions (Halko & Kaustia, 2015). Despite some knowledge of the influence of background music on drinking behavior and risk-taking in the context of gambling, relations between

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background music and risky *drinking* decisions have been studied fairly little. In particular, no studies have investigated whether and how music that emerging adults choose for their social drinking environments ("party" music) affects risky drinking decisions.

Risky decision-making is usually studied using tasks that employ monetary incentives, such as gambling tasks (Bechara, 2005; Glimcher & Fehr, 2014) and delay discounting tasks (Finn, Gunn, & Gerst, 2015; MacKillop et al., 2010), and research has shown that music can modulate these decisions. Schulreich and colleagues suggested a domain-general mechanism for music's effect on risky decisions, and have shown that music-evoked happiness can increase risky lottery choices (higher decision weights associated with larger payoffs) when compared to sad music or random tones (Schulreich et al., 2014). Their result suggests that music can affect decisions by improving mood, leading to greater optimism in participants about the chances of a payoff. However, there is discussion in the literature about whether results of gambling tasks can be generalized to risky *drinking* behavior (Bogg & Finn, 2009; Finn et al., 2017; Wiers, Ames, Hofmann, Krank, & Stacy, 2010). Context and situational factors have been shown to influence drinking decisions, and to interact with alcohol-dependence status in complex ways (Bogg & Finn, 2009; Finn et al., 2017). It is therefore reasonable to expect that music would influence risky drinking decisions differently than risky monetary decisions, especially music associated with alcohol use.

An alternative to domain-general accounts of risky decision-making, such as the mood account of Schulreich et al. (2014) are domain-specific accounts that consider associations between context and the decision domain. Halko and Kaustia (2015) proposed an account grounded in classical conditioning. In their study, a modified gambling task was used where risk probabilities were provided to participants and held constant. They showed that individual-specific "liked" background music increased risk-taking in the task (Halko & Kaustia, 2015). Increased riskiness was seen as arising from preference complementarity — an extension of classical conditioning used to explain the influence of environmental context on preferences and consumption (Laibson, 2001). In other words, listening to preferred music could have made a risky gamble more appealing. This result, although found with monetary incentives, illustrates the importance of specific associations between the incentive cue domain (e.g. alcohol) and the background music domain. If associations between a cue and background music are present, one would expect that different types of music would influence risky drinking and gambling decisions in different ways due to different music-cue complementarities. For example, party music may be more associated with risky drinking decisions than risky gambling decisions (and especially so in heavy drinkers), in which case party music would be more likely to evoke a conditioned risky drinking response.

The overarching question that this study was designed to answer was whether listening to personal party music would influence risky drinking decisions (relative to risky food decisions), over and above listening to other types of personal music or no music at all. The current study is focused on women, who are understudied in the alcohol literature, and for whom alcohol abuse leads to greater health consequences when compared to men (Ashley et al., 1977). Our general hypothesis was that party music would increase risky alcohol decisions (and not risky food decisions) relative to no music. We also wanted to assess the possibility that music would have a different effect on young adult women who are Alcohol Abusers (AAs). We predicted that party music would increase risky decisions to drink alcohol in alcohol-abusing women more than in control women due to the increased sensitivity to alcohol cues observed in those with alcohol use problems (Bechara, Dolan, & Hindes, 2002; Witteman et al.,

2015). In addition, we hypothesized that both party and home music would increase risky decisions relative to the no-music condition, based on previous research showing that preferred music can increase the rate of risky decision-making.

Materials and methods

Participants

Recruitment. Two groups of participants, a group with and without a history of alcohol abuse, were recruited using classified ads and flyers placed around a large Midwestern university and in local bars. In addition, some of the participants in the Alcohol Abuse (AA) group were recruited from a sample of women with an Alcohol Use Disorder (AUD) that were part of an ongoing study of disinhibitory processes in AUD conducted by P. Finn. Participants from P. Finn's project were contacted via email if they indicated that they would like to be contacted for other studies. Flyers were used to recruit female participants who were both heavy drinkers and light drinkers. These flyers are effective in recruiting individuals varying in levels of alcohol use and alcohol problems (Arcurio, Finn, & James, 2015). This study was reviewed and approved by the Indiana University − Bloomington Institutional Review board (IRB: protocol # 1003001199).

Study inclusion criteria. To qualify for participation in the study, individuals had to have: 1) been between the ages of 18 and 28, 2) been female, 3) not been undergoing treatment for depression or anxiety, 4) no current drug use except for occasional marijuana use, 5) not been seeking treatment for alcohol abuse, and 6) a preference of songs they associated with going out with friends. Participants were excluded if they did not refrain from drinking alcohol and/or using any illicit psychoactive drug for a period of at least 24 h before testing. At each test session, participants submitted to a breath alcohol test using an AlcoSensor IV (Intoximeter, Inc., St. Louis, Missouri, United States). If a participant's breath alcohol concentration was greater than .0%, or she did not meet any other test session requirements, she was asked to reschedule.

Group inclusion criteria. The Alcohol Use Disorders Identification Test (AUDIT; (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993) is a questionnaire widely used to identify excessive and harmful alcohol consumption. This questionnaire includes 10 items that fall into the categories of alcohol consumption, drinking behaviors, and alcohol-related problems. A score of 8 or more is recommended as an indicator of harmful or hazardous alcohol use, as well as possible dependence. Control women had the following inclusion criteria: 1) a score of 7 or less on the AUDIT, 2) no recreational drug use in the last three months, 3) no history of drug use besides marijuana in their lifetime, and 4) had consumed alcohol on a regular basis, at least one time per month, for the past six months. A participant was included in the AA group if she had a score of 8 or more on the AUDIT. Past use of psychoactive drugs and past or present use of marijuana was allowed in the AA group due to high rates of co-occurrence between alcohol dependence and drug use (Finn et al., 2009).

Sample characteristics. A total of 86 participants were recruited for the study. Eighteen participants were excluded due to not qualifying for the study or not following up with scheduling one or more sessions. Four more participants were excluded due to technical difficulties resulting in incomplete data, and one participant was excluded due to not meeting test session criteria. Thus, a total of 63 participants (34 AAs, 29 controls) completed the study, constituting our sample for all reported analyses. Participants had a mean age of 21.7 (1.71), and primarily described themselves as Caucasian (66.7%). The remaining participants described themselves as Hispanic (7.9%), Asian (7.9%), Black (4.8%), multiple races

(11.1%), and other (1.6%). Most participants were either currently in college (50.8%) or had completed a college (36.5%) or graduate (6.3%) degree. Table 1 shows sample characteristics of participants in both groups, including drinking frequency and quantity and average AUDIT scores.

Materials

Song list. All participants were asked to generate a list of their 12 "favorite" songs, six that they "listen to while going out" (herein, party songs) and six that they "listen to while staying in or studying" (home songs). They were asked to email this list before the first test session, and if this list was not emailed, they were given a worksheet asking for their list of songs at the beginning of the session. Participants were told that they were to include "different types of songs to allow for more variety among song samples". The term "favorite music" was used to ensure that subjects would list songs that were individually familiar and preferred, thus controlling for level of familiarity and preference across subjects. The term "going out" music was used to elicit choices of songs that were likely to be associated with drinking and drinking environments, but without limiting subjects' choices to songs explicitly connected with drinking, drinking environments, or "partying". Songs were downloaded from the internet (https://www.youtube.com/) and transferred to MP3 files using a free internet converter (http://www.youtube-mp3.org/). The experimenter listened to the tracks to identify long sections that did not contain music (for example, introductions that were monologue/dialogue or background sounds), and these sections were cut from the file in Audacity software (http://audacity.sourceforge.net). A script programmed in Matlab (https://depts.washington.edu/phonlab/resources/rmsLeveler.m) was used to normalize RMS amplitude across song files to equate perceived loudness.

Cues and risky scenarios. Two categories of cues were used, alcoholic beverages and restaurant food items. Thirty-seven pictures of both alcohol and food (74 total) were used from a previously normed set of stimuli (Arcurio et al., 2015). Risk information was used to create no-risk, and risky contexts. There were eight different risky scenarios (four for food decisions and four for alcohol decisions) and two different no-risk scenarios (one for food and one for alcohol). Two of the risky scenarios and the two no-risk scenarios were the same as those used in a previous study (Arcurio et al., 2015). The risky scenarios were "You do not have a safe ride home" for alcohol cues and "The restaurant did not pass its health and safety inspection" for food cues. The remaining six risky scenarios were added to decrease trial redundancy across the

experiment, and pilot studies showed that these scenarios were treated as risky (see Supplementary Materials for full text of all risky scenarios). No-risk scenarios were used in order to provide a reference for participants and to confirm that risk was integrated into decisions. They were "You have a safe ride home" for alcohol cues and "The restaurant passed its health and safety inspection" for food cues. The current study focused mainly on scenarios involving risk, because our lab previously showed no effects in no-risk drinking contexts (Arcurio et al., 2015).

Procedure

The study consisted of two sessions: a behavioral test session and an interview and questionnaire session. At the beginning of the behavioral test session, each participant was asked to wait for 15 min while her specific song selections were incorporated into the testing programs. She then completed a risky decision-making task followed by a cue-rating task. The decision-making and cue-rating tasks were programmed using Matlab 7.10 and the Psychophysics Toolbox (http://www.mathworks.com/, http://psychtoolbox.org/; Brainard, 1997; Pelli, 1997) on an Apple Macbook Pro laptop.

The first test in the behavioral test session was the risky decision-making task. The task was first explained to the participant while seated in front of the testing computer. A sheet with sample food and alcohol pictures, along with 10 different risky scenarios she would see during the experiment, was used to aid in explaining the task. Once the participant confirmed that she understood the task, the experimenter left the room and the participant was instructed to begin when ready.

On each trial of the risky decision-making task, a cue was presented simultaneously with text indicating a risky situation or context (Fig. 1). Trials were presented in 18 blocks (one block per song) of 10 trials each, totaling 180 trials. For each block, one sound file was chosen pseudorandomly, without replacement, from 18 possible files (six participant-selected party songs, six participant-selected home songs, and six silent audio files) and was played continuously throughout the block. A new song or sound file would begin playing once the participant initiated each new block of trials. Each block consisted of five food trials and five alcohol trials, eight of which were shown with a risky scenario and two with a no-risk scenario. Images and risky scenarios were pseudorandomly chosen for each trial. On each trial, the participant was asked to report her likelihood of drinking or eating the pictured item on a computer keyboard using a 4-point scale where 1 = very unlikely, 2 = unlikely, 3 = likely, and 4 = very likely. The participant was told to imagine she was out, all items had been paid for, that drinks were "strong" (defined as the strongest drink they would consume while still enjoying themselves), and that all food items were similar in caloric content. The task was self-paced, and both cue and risk information remained on the screen until the participant made her decision.

After the decision-making task was completed, the participant completed the cue-rating task, where she rated cues on the level of arousal they invoked, their valence, and their desirability. This was done to confirm that pictures were generally seen as appetitive. Stimuli from each category were rated by 62 of the participants from the main study (one participant did not complete the task). A sample sheet with the scales used to report valence, desirability, and arousal was reviewed with the participant before beginning the task. Once the task was understood, the experimenter left the room and the participant was instructed to begin when ready. All ratings were completed in one block. On each trial, an image of either food or alcohol was pseudorandomly chosen without replacement from the 74 stimuli used in the decision-making task, and presented along with a scale below the cue. Pictures were rated

Table 1
Sample characteristics.

	Alcohol Abuse	Controls
Sample characteristics		
N	34	29
Age, *Mean (± SD)*	21.56 (1.62)	21.86 (1.83)
Drinking habits, *Mean (± SD)*		
Two-week drinking		
Occasions per week	1.94 (1.48)	1.22 (1.01)
Amount per week	10.12 (9.01)	2.57 (2.95)
Three-month drinking		
Occasions per week	3.12 (1.25)	1.81 (1.08)
Amount per week	15.96 (9.83)	4.48 (3.28)
Average AUDIT score	12.85 (4.40)	3.62 (1.72)

Characteristics of alcohol abuse and control groups (all women).
Participants were interviewed about how many standard alcoholic drinks they usually consumed on each day of the week for the last two weeks, and for the last three months. The Alcohol Use Disorder Identification Test (AUDIT) was given to all participants, with a score of 8 or more indicating alcohol abuse.

Sample Alcohol Trial

Sample Food Trial

You are on medications that could interact harmfully with alcohol.

The restaurant did not pass its health and safety inspection.

Fig. 1. Two sample trials pairing an alcohol or food cue with a relevant risky scenario.

on levels of arousal, valence, and desirability using a 1—9 scale, and were acquired using the same procedures as for the International Affective Picture System (IAPS; Bradley & Lang, 1994). Desirability was added as a new measure, defined as how likely the participants were to eat or drink the food, while the definitions of arousal and valence were not altered from the original version of this task. All 74 images were rated in this manner. Based on previous norming, it was expected that participants would rate them with positive valence and above average arousal and desirability (indicated by a mean greater than 5).

The interview and questionnaires were administered when the participant came back for the interview session. The "Song Experience Questionnaire" (SEQ, see Questionnaires section below for description) was administered first, followed by the interviews and remaining questionnaires (all administered in a private interview room). At the end of the session, all questionnaires were checked for completion and the participant was debriefed and asked whether she had guessed the purpose of the experiment.

Questionnaires

Recent alcohol and other substance use. A time line follow-back interview was conducted to quantify alcohol and other substance use during the past two weeks (Sobell & Sobell, 1992). Alcohol use also was quantified as the typical use within the past three months. Participants were asked how much alcohol they typically consumed on each day of an average week in the past three months. Alcohol use was quantified as the sum of the usual amount of alcohol consumed for each day of the week (average quantity per day), and the number of days per week (frequency per week) where drinking usually occurred within the past three months. Drug use was quantified as the number of times used in their lifetime.

Other questionnaires. All but one questionnaire, the "Song Experience Questionnaire" (SEQ), were given to participants directly following the interview on recent alcohol and substance use. Questionnaires inquired about: (1) demographics, (2) general health, (3) drinking-related habits and attitudes (AUDIT; Alcohol Outcomes Expectancies Scale, AEOS), (4) impulsivity and motivation (UPPS-P Impulsive Behavior Scale; Behavioral Inhibition Scale/ Behavioral Approach scale, BIS/BAS), and (5) participants' experience with their chosen songs (SEQ). The AEOS (Leigh & Stacy, 1993) is commonly used to assess motivations for drinking, and has been

shown to predict alcohol use. The BIS/BAS (Carver & White, 1994) was designed to assess general motivation, and posits two underlying motivational systems thought to underlie behavior — one that regulates aversive motives and one to regulate appetitive motives. The UPPS-P (Whiteside & Lynam, 2001) is a scale designed to assess different facets of impulsivity. Lastly, the SEQ included questions regarding the types of activities or feelings that the participants' chosen songs evoked, one question regarding the degree of association between the participants' chosen party songs and drinking alcohol (hereafter, association), and a question regarding the participant-perceived appropriateness for drinking-related activities (hereafter, matching; see Supplemental Materials for the full questionnaire). Each song was rated for both association and matching on a scale from 1 to 100, where 1 indicated no association or no matching, and 100 indicated complete association or the best possible match. This questionnaire was created and administered using Qualtrics software (http://www.qualtrics.com). Reliability calculations are reported in Results.

Analysis

Decision likelihood

To analyze the data based on the likelihood of deciding to accept a given item (drink or food), participants' trial-by-trial responses were recoded into a "Decision Likelihood" (DL) dependent measure, indicating how likely or unlikely they were to decide to drink or eat. Responses of Likely (3) and Very Likely (4) were considered a decision to accept and were recoded as 1, while responses of Unlikely (2) and Very Unlikely (1) were considered a decision to reject and recoded as 0. Recoding as DL allowed for analysis using a binomial distribution (see below), which was deemed preferable to analyzing the raw Likert-type scale that was not normally distributed even after log transform. Nevertheless, an ANOVA on average full-scale responses was also performed for comparison (see Supplemental Materials).

Model description

All analyses were performed using IBM SPSS Statistics 24. A generalized linear mixed model (GLMM) with a binomial distribution and logit link function was conducted with DL as the

dependent measure (risky trials only), stimulus (alcohol, food), music (party, home, none), and group (AA, control) as fixed effects, as well as all possible interactions of the fixed effects. As random effects, random intercepts for participants were used to account for the repeated measures for each participant. This was the maximal converging random effects structure justified by the design (Barr, Levy, Scheepers, & Tily, 2013). A separate GLMM was conducted with DL as the dependent measure (no-risk trials), stimulus (alcohol, food), music (party, home, none), and group (AA, control) as fixed effects, as well as all possible interactions of the fixed effects. As random effects, random intercepts for participants were used to account for the repeated measures for each participant.

Results

The GLMM on risky trials showed main effects of music, $F_{(2,9060)} = 32.79$, $p < 0.001$, and stimulus, $F_{(1,9060)} = 8.88$, $p = 0.003$, and two-way interactions of music and stimulus, $F_{(2,9060)} = 3.98$, $p = 0.019$, and stimulus and group, $F_{(1,9060)} = 98.10$, $p < 0.001$. No other main effects or interactions were significant. To further explain the interactions, sequential Bonferroni-corrected pairwise comparisons were performed on the estimated marginal means.

The effect of music

The interaction between music and stimulus is shown in Fig. 2. It is best explained by noting that increased DL for alcohol relative to food was only seen in the party music condition, and though party music (relative to other music conditions) increased DL for both alcohol and food, the effect on alcohol was

significantly more pronounced. Importantly, home music consistently showed no influence on DL in any context relative to a no-music baseline. DL for alcohol was significantly greater than food when participants were listening to party music (difference = .06, SE = .02, 95% CI = [.03, .09], $t = 3.95$, $p < 0.001$), but was not significant for no music (difference = .00, SE = .01, CI = [.02, .02], $t = .21$, $p = 0.833$) and home music conditions (difference = .01, SE = .01, CI = [−.01, .03], $t = 1.02$, $p = 0.307$). DL for alcohol was significantly greater in the party music condition relative to home music (difference = .08, SE = .02, CI = [.05, .12], $t = 5.22$, $p < 0.001$) and no-music (difference = .10, SE = .02, CI = [.06, .14], $t = 5.89$, $p < 0.001$) conditions, and DL for food was also significantly greater when participants were listening to party music than when they were listening to home music (difference = .04, SE = .01, CI = [.01, .06], $t = 2.82$, $p = 0.010$) and no music (difference = .04, SE = .01, CI = [.01, .07], $t = 3.15$, $p = 0.005$).

The main effect of music is explained by this overall increase of DL for both food and alcohol when participants listened to party music. No difference was found in the DL for home music compared to no music for food (difference = .00, SE = .01, CI = [−.02, .03], $t = .39$, $p = 0.700$) or alcohol (difference = .01, SE = .01, CI = [−.01, .04], $t = 1.17$, $p = 0.243$) decisions.

Group and stimulus interaction

The significant two-way interaction of group and stimulus (Fig. 3) showed the expected pattern that AAs had greater DL for alcohol than controls (difference = .12, SE = .04, CI = [.05, .20], T = 3.20, $p = 0.001$), with no group difference for food (difference = −.02, SE = .03, CI = [−.09, .04], T = −.73, $p = 0.464$). The main effect of
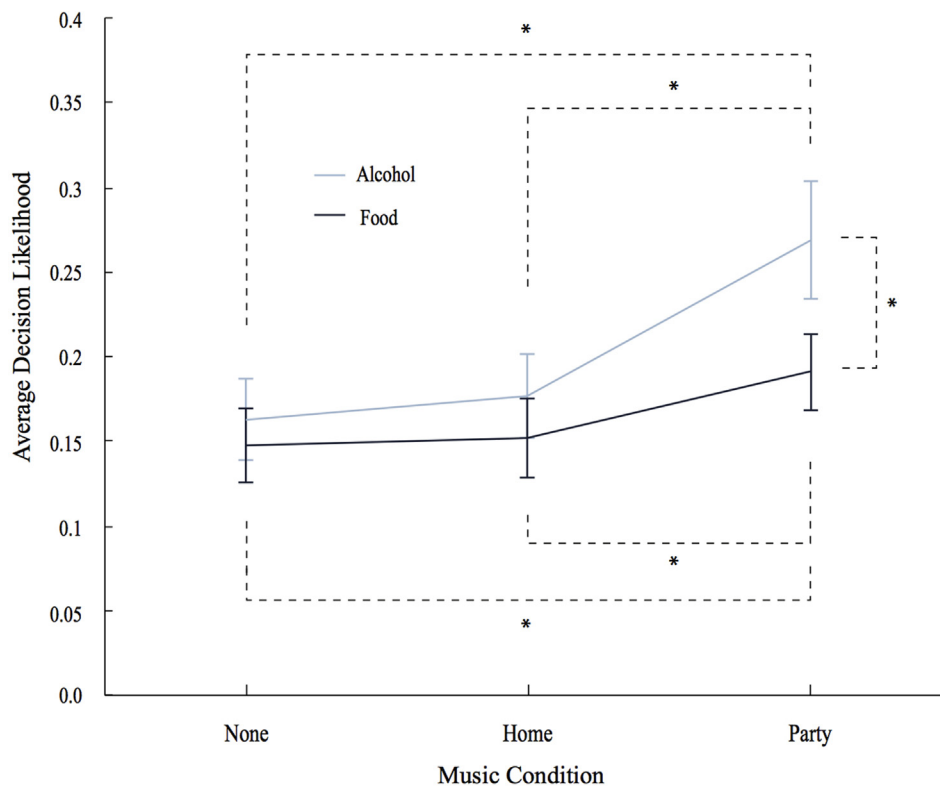

Fig. 2. Average Decision Likelihood (DL) as a function of the type of cue presented (alcohol, light blue; food, dark blue) plotted for each musical context (no music, home music, and party music) across groups. Values on the y-axis indicate the likelihood of deciding to drink or eat, with zero indicating that food or alcohol was never accepted, and 1 indicating that food or alcohol was always accepted. A significant difference between alcohol and food DL was found only in the party music context. DL was found to be significantly higher in the party music context compared to other music contexts. Asterisks indicate significant differences in DL when using pairwise tests (*$p < 0.05$). Error bars represent ±1 SEM.

stimulus, where participants were overall more likely to accept alcohol than food, is explained by these interactions.

No-risk GLMM

The GLMM on no-risk trials showed a main effect of stimulus, $F(1,2256) = 8.08$, $p = 0.005$, and a two-way interaction between stimulus and music, $F(2,2256) = 4.83$, $p = 0.008$. No other effects or interactions were significant. Pairwise tests for the two-way interaction between stimulus and music showed that participants were more likely to decide to eat than drink when home music was playing (difference = .08, SE = .02, 95% CI = [.04, 13], T = 3.78, $p < 0.001$), while food and alcohol were treated the same in no-music (difference = .02, SE = .02, CI = [−.02, 07], T = 1.14, $p = 0.254$) and party music (difference = −.006, SE = .02, CI = [−.05, 03], T = −.29, $p = 0.775$) conditions. Overall, participants were highly likely to decide to eat and drink in the no-risk trials (88% of all no-risk responses were "likely" responses, while, for comparison, only 18% were "likely" responses for trials with risky scenarios), indicating that the addition of any level of risk led to a large decrease in decisions to drink and eat.

Response times

A GLMM with a normal distribution and identity link function was conducted with Response Time (RT) as the dependent measure, stimulus (alcohol, food), music (party, home, none), group (AA, control), and all possible interactions of these fixed effects, and participants as random intercepts. For the purposes of analysis, the first trial of the session was removed for all participants. The GLMM showed a main effect of music, $F(2,9005) = 19.89$, $p < 0.001$. No other main effects or interactions were significant, though there was a marginal interaction of group and music, $F(2,9005) = 2.992$, $p = 0.050$.

Sequential Bonferonni-corrected pairwise comparisons for the main effect of music showed that listening to home music led to longer RTs than no music (difference = .36, SE = .07, CI = [.20, .53], T = 4.94, $p < 0.001$), and listening to party music led to longer RTs than no music (difference = .43, SE = .07, CI = [.26, .61], T = 5.86, $p < 0.001$) (Fig. 4). In sum, listening to any type of music increased RT relative to not listening to music, while only party music influenced decisions according to the GLMM on Decision Likelihood. No pairwise comparisons for the marginal interaction of music and group were significant.

Associations of songs and alcohol

The internal consistency of association and matching responses was assessed using the split-half technique, where values for the first three songs in a given music category (party or home) were correlated with the second three songs in that category. The estimated, Spearman-Brown corrected, reliability was computed and shown to be acceptable for both association (.793) and matching (.716). Responses to the two questions also showed a high positive correlation ($R^2 = .662$), suggesting that they successfully tap the same underlying construct of alcohol-relatedness.

Association and matching ratings (on a scale from 1 to 100) from the SEQ for each song were averaged within participants for each music type (party, home) for the purpose of analysis. A three-way repeated-measures ANOVA was conducted with average ratings as the dependent measure, music type (party, home) and question type (associations, matching) as within-subject variables, and group as a between-subject variable. Where the assumption of homogeneity of variance was violated, effects are reported with Greenhouse-Geisser correction. The ANOVA showed a main effect of music, $F(1,61) = 221.55$, $p < 0.001$, a two-way interaction of question type and music type, $F(1,61) = 22.2$, $p < 0.001$, and a three-way interaction of question type, music type, and group, $F(1,61) = 10.20$, $p = 0.002$. *Post hoc* pairwise tests were performed using Tukey's HSD. Greenhouse-Geisser-corrected MSE was used in
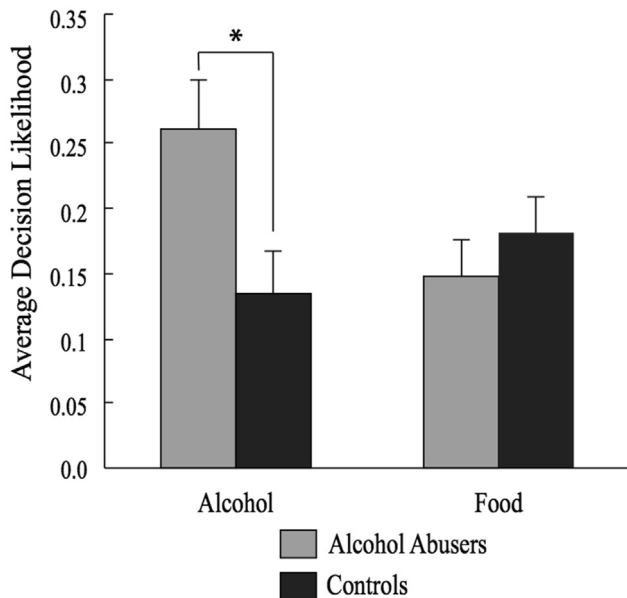

Fig. 3. Average Decision Likelihood (DL) as a function of group (AA or Control) plotted for alcohol and food cues. Asterisks indicate significant differences in DL when using pairwise tests (*$p < 0.05$). Values on the y-axis indicate the likelihood of deciding to drink or eat, with zero indicating that food or alcohol was never accepted, and 1 indicating that food or alcohol was always accepted. Error bars represent +1 *SEM*.
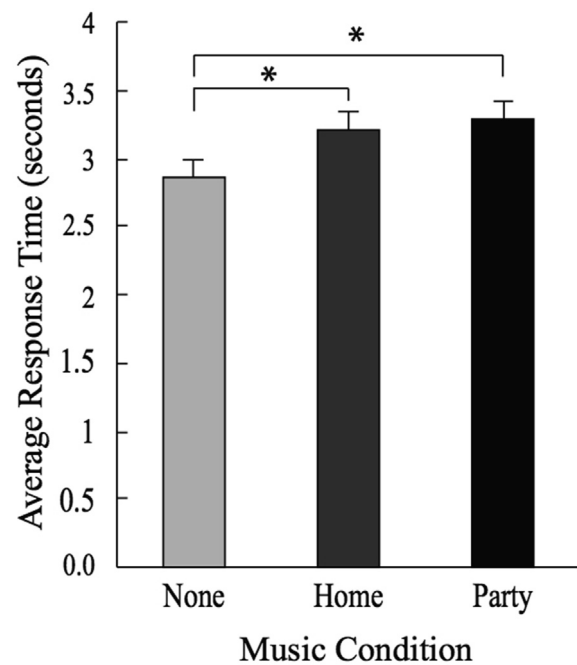
Fig. 4. The effect of music condition on average Response Times (RTs). Participants had significantly longer RTs when listening to both home music and party music when compared to no music. Asterisks indicate significant differences in DL when using pairwise tests (*$p < 0.05$). Error bars represent +1 *SEM*.

cases where the homogeneity of variance assumption was violated. Association with drinking was greater for party music than home music in AAs, q (1,61) = 37.827, and controls q (1,61) = 31.753. Match to drinking environment was also greater for party music than home music for AAs, q (1,61) = 35.590, and controls, q (1,61) = 20.993. These tests reflect the large main effect of music type and indicate that the request for participant-selected party and home music created music types that greatly differed in their relationship to drinking behavior.

Post hoc pairwise tests for the significant three-way music by group by question interaction showed that AAs associated their party songs with drinking more than controls, q (1,61) = 6.722, and reported that their party songs more closely matched their drinking environment, q (1,61) = 10.985. These group differences were not found for home songs, q (1,61) = 3.416; q (1,61) = 1.353. Lastly, control participants reported a higher match between their home songs and drinking environment relative to association with drinking, q (1,61) = 5.947, while this difference was not found for controls' party songs, q (1,61) = 4.813, nor for party or home songs in AAs, q (1,61) = .768, q (1,61) = 1.469.

Cue ratings

The mean (SD) desirability ratings of the stimulus sets were alcohol 5.8 (1.19), food 6.1 (1.64). The mean (SD) valence ratings were alcohol 6.0 (1.11), food 6.1 (1.02). The mean (SD) arousal ratings were alcohol 5.5 (1.50), food 5.5 (1.52). As expected, all means were greater than 5, indicating that stimuli were above average in both desirability and arousal, were positively valenced, and alcohol and food were equally appetitive.

Discussion

The goal of the current study was to test the hypothesis that "party" music would influence a specific domain of risky decisions — decisions to drink alcohol. The results demonstrate that listening to self-selected party music influenced the reported likelihood of drinking decisions in emerging adult women, suggesting that party music plays a role in the decision-making process of this group. Emerging adults tend to congregate in social gathering locations (bars, house parties, etc.) that have a constellation of stereotypic environmental attributes. In this study, an effect of party music was found in the absence of other factors. This demonstrates its power to influence risky decisions even when not interacting with other environmental variables.

The current study extends previous research on the influence of music on risky decision-making. First, we predicted an effect of both categories of preferred music, party and home, based on past research using gambling tasks. Interestingly, we found that only party music influenced the likelihood of risky decisions relative to the no-music condition. The lack of any effect of preferred home music suggests that music preference or familiarity alone did not drive risky decision-making. Rather, factors specific to the party music category were behind the observed effects. Given that associations between party music and drinking were stronger than associations between home music and drinking, a possible mechanism of the domain-specific influence of party music on risky alcohol decisions is preference complementarity or classical conditioning (Halko & Kaustia, 2015). If party music is paired more often with risky drinking decisions than home music, exposure to party music may lead to an increased likelihood of risky decisions in these domains. However, despite stronger reported associations between party music and alcohol in AAs relative to controls, party music did not have a greater influence on risky decisions in AAs. It is possible that the difference in associations between AAs and

controls was not large enough (relative to the difference in associations with drinking between the two music categories) to drive this effect. Future research could explore whether artificially creating associations with a set of songs leads to effects in the associated decision domains.

The study focused primarily on whether there was a domain-specific effect of party music, but a domain-general effect of party music was also found. While this study was not designed to reveal the factors contributing to this effect, some potential candidates for future investigation include the effects of the mood induced by music, as well as the influence of the lyrical content and tempo of the music on decisions. For example, past work by Schulreich et al. (2014) suggests that party music might influence risky decisions in general by inducing more positive affect in participants. Increased positive affect tends to prime greater approach responses (and attention paid to specific rewarding aspects of engaging in a behavior) and decrease attention paid to the potential negative consequences of a specific choice, thereby leading to a greater likelihood of making a risky decision to engage in that behavior. In regard to alcohol, risky drinking decisions may result in part because the party music may highlight the rewarding aspects of drinking/partying and at the same time reduce the possibility of considering the potential negative consequences of drinking, which would result in an increased likelihood to decide to drink without regard to potential risk. Finn and colleagues have found that alcohol party incentives can increase how much alcohol young adults decide to consume and their likelihood of deciding to attend the alcohol party events regardless of the negative consequences (Finn et al., 2017). Party music may have therefore contributed to the particular domain-specific effect found in the current study by specifically highlighting the positive aspects of drinking. Overall, the presence of both a domain-specific and a domain-general effect of party music on risky decisions suggests that it is important to consider both the attributes of music that may influence a wide range of activities (such as mood), and attributes that may link it to more specific activities. The latter could be especially crucial when investigating the factors influencing a specified activity, such as alcohol consumption.

Group differences

Party music increased risky drinking and eating decisions in both groups (AAs and Controls). However, significant group differences in the likelihood of risky drinking decisions were found, regardless of music condition. Previous work on risky decision-making in women with Alcohol Use Disorder (AUD) showed that this group decided to drink alcohol in risky contexts more than controls (Arcurio et al., 2015). This previous study and the current study both investigated decisions in heavy- (AUD and AA) and light-drinking (control) groups. The results of the current study are consistent with past findings. Alcohol abusers had a greater likelihood of making risky drinking decisions (but not food decisions) than controls in decision contexts involving risk, but not in no-risk contexts. Importantly, party music consistently increased the likelihood of risky drinking decisions in both groups, despite these baseline differences in the likelihood of risky drinking decisions between groups.

The influence of risk

While party music influenced decisions to drink in risky contexts, the only influence of music on no-risk decisions was an increased likelihood to eat food while listening to home music. By contrast, home music did not influence risky food decisions relative to risky alcohol decisions. In the absence of risk, decision likelihood

was at ceiling. In other words, when young adult women were offered free hypothetical food or drinks, they almost always decided to eat or drink. This suggests that in a hypothetical bar scenario, an additional factor is needed to increase participants' uncertainty of accepting food or drinks in order to keep the effects from reaching ceiling. The risky scenarios used in the current study were an effective way of accomplishing this.

The findings of the prior study by Arcurio et al. (2015) are also shown to be generalizable to three new risky alcohol-related scenarios in the current study. This indicates that alcohol-abusing young women not only make risky drinking decisions related to getting a ride home, but that this tendency extends to other risky scenarios (see Supplementary Materials for additional analyses). Further, in the current experiment, risk was manipulated only by changing the risky scenario that is presented, whereas the previous study also changed the strength of the alcoholic drink to achieve different levels of risk. Despite this alteration to the paradigm, the tendency of alcohol-abusing women to make riskier drinking decisions persisted.

Limitations

In the current cue-based decisions paradigm, decisions were hypothetical; participants were shown visual images and text describing a scenario and asked to imagine the decision they would make in that situation. Participants were not rewarded for their decisions and were not made to suffer negative consequences. However, the lack of tangible incentives or disincentives does not seem to lead participants to make idealized decisions based on societal expectations. Both AA and control groups made a number of risky decisions, and, consistent with previous work (Arcurio et al., 2015), this number was greater for the AA groups than controls, and even greater for alcohol decisions than food. Though decisions in this case are hypothetical, studies have shown that hypothetical risky decisions can closely approximate decisions in the real world (see Kühberger, Schulte-Mecklenbeck, & Perner, 2002 for a discussion). In sum, the cue-based paradigm used in the current study advances our understanding of the role of sensory cues and environmental context in the decision-making process, while avoiding much of the uncontrolled complexity found in real-world settings. Future research using this paradigm could include real incentives and disincentives to study those specific mechanisms more closely.

Future directions

This research opens up many interesting possibilities for examining how ecologically relevant music types such as party music may influence risky decisions. Aside from the increase in association between party music and drinking (compared to home music and drinking), party music may also be associated with other aspects of emerging adults' social environments. For example, if music encourages social interaction through its lyrics or by providing a good beat to dance to, and the participant believes that drinking alcohol will act as a social facilitator, then listening to this music may increase her likelihood of deciding to drink. Other aspects of the lyrical content may also differ between these music types. Studies have shown that popular music contains more references to alcohol (Primack, Dalton, Carroll, Agarwal, & Fine, 2008), and music that participants listen to when they are in social drinking situations seems more likely to fall into this category. It is therefore reasonable to expect that the lyrical content of party music may be different from that of home music. References to substance use in the personal music of emerging adults has been linked to increased substance use (Miller, Kelley, Midgett, & Parent, 2016); therefore, lyrical content found in party songs could be an important source of influence. Other aspects of musical structure such as tempo have been linked to an increase in drinking rate, and thus may also contribute to the risky decision-making process (Stafford & Dodd, 2013).

The current study is focused on women, but similar studies in other groups may reveal interesting differences in the influence of party music on drinking decisions. It is known that gender can interact with alcohol use in complex ways (Erol & Karpyak, 2015). For example, women report drinking more in response to a negative mood than men (Lau-Barraco, Skewes, & Stasiewicz, 2009). Given the widespread use of music to influence mood, music listening is likely to alter the process of drinking decisions mediated by mood, and may do so differently depending on gender. These differences make gender-based comparisons an interesting avenue for future research.

Implications

The results of this study and future research on "party" music may have clinical implications. The associations between party music and drinking revealed by the music questionnaire suggest that party music may be operating as an auditory alcohol-related cue. If the association were strong enough, then (like other alcohol-related cues) party music could induce alcohol cravings. Some studies have found craving to be predictive of relapse (Bottlender & Soyka, 2004; Stohs, Schneekloth, Geske, Biernacka, & Karpyak, 2019), while others have not found a relationship (Witteman et al., 2015). These mixed findings suggest that craving induced by alcohol-related cues is predictive of relapse in a contextually dependent way. Although more work clearly needs to be done to be definitive, it is possible that party music may act as an auditory alcohol-related cue and a potential trigger for craving and relapse.

Party music only influenced alcohol decisions in high-risk conditions. Therefore, in low-risk environments where alcohol is not present, listening to party music is not a risk factor. An aspect of party music (or other types of music) that has not been explored here is its potential benefits. Combined with a safe environment, party music's potential to positively influence mood may be beneficial in a variety of ways, perhaps even helping with alcohol use problems. The reality, though, is that most party music environments are not safe and usually involve heavy drinking. Establishing safer party music-listening environments (e.g., sober parties) and educating young adults about the negative consequences of drinking in unsafe party music-listening environments would both be helpful for public health, especially for young adults.

The effects of different music types on alcohol decisions in the current study opens up the question of whether music therapy could be used for individuals with alcohol use problems. There is currently no consensus as to whether music therapy can successfully treat addiction (see Mays, Clark, & Gordon, 2008 for a review), but research has shown that young people often use music with the intention of reducing symptoms of other disorders such as depression and anxiety (Thomson, Reece, & Di Benedetto, 2014). The ever-increasing portability and personalization of music make it increasingly viable as a tool for self-regulation. Current therapies may be able to capitalize on these characteristics by helping young people with alcohol use disorder curate playlists not associated with drinking or playlists that avoid highlighting positive aspects of environments containing alcohol. This line of research can also have implications beyond the clinical setting, and help both casual drinkers and those struggling with alcohol abuse make more-informed decisions about their music-listening habits.

Conclusions

The findings of the current study demonstrate that passive music listening can influence decision-making, that the type of music and category of decision are important factors in determining the strength of the influence, and that risky drinking decisions are affected by party music in both alcohol abusers and casual drinkers.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.alcohol.2019.05.003.

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