The influence of drinking consequences on alcohol expectancy likelihoods and valences: an item level multilevel approach

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Abstract

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Theories of risk evaluation propose that experiencing an alcohol consequence should alter youth's expectancies of that consequence occurring in the future. Prior studies have found this to be true for positive, but not negative consequences. However, previous research has aggregated across positive and negative consequences. We re-analyzed data from a sample of college students who drank in the past 12-months (n = 378), using Bayesian cross-classified multilevel ordinal regressions to estimate the associations between the experience of 39 different alcohol related consequences, participants' expectancies for future drinking episodes, and the differences in these associations across participants and consequences. Our results align with expectancy theory suggesting that people do update their expectancy likelihoods and valences based on experiences. Implications of this work and avenues for future research are discussed.

Keywords: alcohol, college drinking, expectancies, consequences

Introduction

Adolescents and young adults are more willing to participate in risky behaviors compared to adults (Gibbons et al., 2003), and this willingness independently predicts engaging in risk behaviors regardless of an individual's intentions (Gibbons et al., 2003). However, although adolescents are more willing, it is not the case that adolescents and young adults do not perceive the associated risks of their behaviors. Rather, adolescents and young adults are likely aware of the potential risks, but they may perceive the desirability or likelihood of the benefits as greater than the undesirability or likelihood of the risks involved for a given behavior (Furby & Beyth-Marom, 1992).

Moreover, adolescents and young adults evaluate risky behaviors as less likely when they engage in risky behaviors without experiencing negative consequences (Benthin et al., 1993), and some evidence has shown this applies to alcohol use (Goldberg et al., 2002). Indeed, the more adolescents and young adults engage in risky behaviors, the more knowledge and control they believe to have over the risks (Benthin et al., 1993). These findings align with alcohol expectancy theory (Goldman et al., 1987), which states that individuals develop beliefs (e.g. expectancies) about what consequences will occur as a result of drinking, and these beliefs are shaped via observational learning (Bandura, 1977; Brown et al., 1980; Christiansen et al., 1985) as well as through direct experiences. Over time, expectancies are hypothesized to stabilize with increased learning and direct experience (Christiansen et al., 1982; Rotter et al., 1972), however, they are also believed to be malleable enough to be updated if drinking experience contradicts a certain expectancy concept (Goldman, 1989).

College drinkers make a particularly elucidating sample to explore alcohol expectancies in given the rampant increase in regular drinking in this population. Specifically, 67% of college

students report using alcohol in the past 30-days (Schulenberg et al., 2020) compared to 10% of adolescents (ages 12-17) using alcohol in this same time frame (Bose, 2017). Additionally, 32% of college students reported binge drinking (e.g., five or more drinks in a row) in the past two weeks (Schulenberg et al., 2020). These levels of drinking led half of young adults (19-20 years of age) to experience negative consequences in the past year including emotional or physical problems, relationship consequences, poor academic performance, and unsafe driving (Patrick et al., 2020).

Even more concerning is the prevalence of severe negative consequences such as unintentional death (12.92 per 100,00; Hingson et al., 2017), physical assault (12%; Hingson et al., 2009), and sexual assault with one study finding that 15.4% of women were sexually assaulted in their first year while they were incapacitated from alcohol or other substances (Carey et al., 2015). Additionally, in 2019, 8.7% of full-time college students met criteria for an alcohol use disorder (SAMHSA, n.d.).

However, these negative consequences are often accompanied by positive consequences, such as increased bonding with peers and decreased disinhibition (Colby et al., 2009). Indeed, young adults report positive consequences at much higher rates compared to negative consequences. Studies indicate that young adults report 3 positive consequences for every 0.5 negative consequences on a given drinking day (Lee et al., 2018; Patrick & Terry-McElrath, 2021). This may in part be due to the fact that positive consequences typically occur earlier in drinking events and at lower levels of alcohol (Dasgupta, 2017) meaning that individuals likely experience positive consequences prior to negative consequences and sometimes engage in drinking without experiencing any negative consequences. The differing rates of experienced positive versus negative consequences may contribute to the belief that 63% of young adults (19-

22 years of age) hold: binge drinking multiple times on the weekend is not risky (Schulenberg et al., 2020). It may be that the relative frequency of positive consequences dampens the potential impact of negative experiences on future expectancies about drinking. In fact, the experience of any positive consequences is associated with better evaluations of the drinking experience as a whole (Fairlie et al., 2016). Therefore, experiencing a single negative consequence may be viewed as a necessary cost to achieve the positive consequences that are desired. However, there may come a point when the number or type of positive consequences experienced does not outweigh the cost of the negative consequences which leads an individual to view binge drinking as risky.

Evaluating alcohol expectancies offers a way to understand whether individuals update their beliefs about drinking based on their experiences, but are simply not deterred by the possibility of negative consequences or whether they fail to update their beliefs about drinking base on their experiences. Past research has shown that young adults who report experiencing more positive consequences also endorse greater expectancy likelihoods for positive consequences (Logan et al., 2012; Mallett et al., 2008). This association has been shown to differ by age (Logan et al., 2012; Ramirez et al., 2020), gender (Logan et al., 2012; Read et al., 2004), and race (O'Hare, 1995) although findings on racial differences have been mixed (Banks & Zapolski, 2017). Additionally, differences have been found depending on drinking experience (Ramirez et al., 2020; Read et al., 2004) and personality traits such as impulsivity (Halvorson et al., in press.; Smith & Anderson, 2001). When examining the experience of negative consequences on expectancy likelihoods, the picture is less clear with a quadratic association being found such that high and low levels of experienced negative consequences leads to increased likelihood reports (Logan et al., 2012).

Although not explicitly mentioned in alcohol expectancy theory, researchers have highlighted the importance of examining both positive and negative consequences and examining subjective evaluations of expectancies such as how good or bad (i.e., valence) an expectancy is (Leigh, 1989) because some consequences may be more influential than others. Similar to expectancy likelihoods, the more positive consequences that young adults endorse in the past, the more positively they report the valence of these expectancies to be in the future (Logan et al., 2012). On the other hand, endorsing more negative consequences in the past, is also associated with *more* positively reported valence of expectancies (Logan et al., 2012). Students also tend to consistently overestimate the amount of alcohol required in order to experience the same negative consequences in the future (Mallett et al., 2008). These studies have shown that on average, across experiences, people seem to learn from positive consequences, but not from negative ones, or at least not in ways we would expect. However, there may be individual differences in the degree to which the experience of consequences shapes people's expectancies that prior studies have not captured.

One limitation of this prior work is that these studies have mostly averaged across experienced consequences and expectancies of the likelihood and valence of those consequences. Yet this only allows us to draw conclusions that people who report more positive consequences (for example) *on average* also report more positive expectancies on average. Although this may be a helpful indicator for whether or not someone may be more likely to drink than someone else, it tells us little about how individuals learn from their specific experiences. For example, we would not expect a hangover to impact someone's expectancy for getting into a fight with a friend. Rather, we would expect that specific consequences should alter specific expectancies. Perhaps even more importantly, prior studies have *a priori* classified specific consequences as

positive or negative. However, students do not always agree with researcher defined categorizations of negative consequences. For example, nearly half (46.6%) of students rated experiencing their last blackout as a neutral or positive event (Mallett et al., 2006).

A better test of expectancy theory would pair individual consequences with their specific expectancy likelihoods, and individualized ratings of expectancy valence. This framework would allow for a broader characterization of consequences and their relations with expectancies and allow for various (and nonlinear) functional forms. For example, the associations between the experience of some consequences and their expectancies may follow a simple linear function, while others may be quadratic (e.g. Logan et al., 2012), and others may follow a cubic form. These same patterns may also exist for expectancy valences. In addition to differences across consequences, there are also likely person-level differences with some people more quickly adjusting their expectancy likelihoods and valences based on past experiences, while others are less likely to adjust their expectancy likelihoods and valences or require experiencing consequences frequently prior to adjusting expectancy likelihoods and valences. Pairing specific consequences and expectancy likelihoods and valences together allows for a characterization of the distribution of associations, as well as providing an opportunity to understand potential predictors of this variation.

The goal of this study was to answer two central questions using a test of expectancy theory that we believe better captures how expectancies are influenced by direct drinking experience. We re-analyzed data previously reported (Logan et al., 2012) to demonstrate the feasibility of this analytic approach and to test exploratory moderators. Our first research question was as follows, do people learn to expect *specific* consequences based on previous drinking experiences?

Hypothesis 1a-b: Participants would rate consequences that were experienced more frequently and that were rated to be more positively valenced in the future, to also be more likely.

Hypothesis 1c-n: We explored whether how common each consequence was across the entire sample, the frequency of positive to negative consequences endorsed, and differing functional forms of consequence frequency and expectancy valence moderated these effects.

Our second research question was as follows, how is the experience of specific consequences related to individual perceptions of their future valence?

Hypothesis 2a-b: Participants would rate consequences that were experienced more frequently and that were rated to be more likely in the future, to also be more positively valenced.

Hypothesis 2c-n: We explored whether how common each consequence was across the entire sample, the frequency of positive to negative consequences endorsed, and differing functional forms of consequence frequency and expectancy likelihood moderated these effects.

Method

Participants and Procedures

Participants were 504 undergraduate students from a public university in the Pacific Northwest currently enrolled in lower-level psychology courses. The sample was 58% female identifying and 56% white, 35% Asian/Pacific Islander, 7% Hispanic, 7% Other, 4% African American, and 3% American Indian. The average age of participants was 19.26 years (SD = 1.22). Participants gave informed consent, completed three experimental tasks, and completed an online questionnaire. The experimental and questionnaire portions each lasted about an hour.

Participants received extra course credit as compensation for their time. All study procedures were approved by the university's Institutional Review Board.

Because we were interested in testing hypotheses about the experience of alcohol related consequences, we excluded participants who did not complete past year alcohol consumption questions (n = 13) or reported not consuming alcohol in the past 12 months (n = 113) resulting in a final sample of 378 participants. The final sample did not significantly differ from the full sample in regard to gender, race, or age.

Measures

Expectancy Likelihood

We used a total of 39 items to assess what participants expected the likelihood of each consequence to be when under the influence of alcohol. We took 18 items from the Young Adult Alcohol Problems Screening Test (YAAPST; Hurlbut & Sher, 1992) and 10 items from Mallett et al. (2008) for a total of 28 items assessing negative consequences with a Cronbach's $\alpha = 0.93$ and Revelle's $\omega = 0.94$. We took 11 items from the Positive Drinking Consequences Questionnaire (PDCQ; Corbin et al., 2008) to assess positive consequences with Cronbach's $\alpha = 0.86$ and Revelle's $\omega = 0.86$. We alternated these positive consequences between the negative consequences. Response options ranged from "0" (Not at all likely) to "6" (Extremely likely). We then z-scored expectancy likelihoods using the mean and standard deviation across all observations.

Expectancy Valence

We used the same 39 consequences as above to assess what participants expected the valence of each consequence to be if they experienced the consequence with Cronbach's $\alpha = 0.93$ and Revelle's $\omega = 0.93$ for negative consequences and Cronbach's $\alpha = 0.84$ and Revelle's ω

= 0.84 for positive consequences. Responses ranged from “0” (Extremely negative) to “4” (Extremely positive). We then z-scored expectancy valences using the mean and standard deviation across all observations.

Consequence Frequency

We used the same 39 consequences as above to assess the past year frequency of experiencing each drinking consequence with Cronbach’s $\alpha = 0.91$ and Revelle’s $\omega = 0.92$ for negative consequences and Cronbach’s $\alpha = 0.90$ and Revelle’s $\omega = 0.91$ for positive consequences. Response options were as follows: “0” (No, Never), “0” (Yes, but not in the last year), “1” (1 time in the past year), “2” (2 times in the past year), “3” (3 times in the past year), “4” (4-6 times in the past year), “5” (7-11 times in the past year), “6” (12-20 times in the past year), “7” (21-39 times in the past year), and “8” (experienced 40 or more times in the past year). We then z-scored consequence frequencies using the mean and standard deviation across all observations.

Consequence Average Frequency (at the consequence-level)

We calculated the average consequence frequency score for each of the 39 drinking consequences by averaging the reports across all 378 participants. We then z-scored consequence average frequencies using the mean and standard deviation across all consequences.

Ratio of Positive to Negative Consequences (at the participant-level)

To compute the ratio of positive to negative consequences for each participant, we computed a valence-weight average of past year consequences. First, we centered each person's expectancy valence scores for every consequence around the middle value (scores ranging from -2 to +2 with values below zero being perceived by a person as negative and values above zero being perceived by a person as positive). Next, we multiplied each person's valence scores by

their respective consequence frequency score. These individual scores represent a person's evaluation of how often they experienced each consequence in the past year weighted by whether the consequence is positive or negative for that person. Then, we summed the total scores for these weighted positive and negative consequences, respectively. Finally, we divided the weighted positive consequences by weighted negative consequences and took the absolute value of this final score. Values greater than one represent a person who experienced more positive than negative consequences in the past year or who experienced an equal number of positive and negative consequences, but evaluated consequences more positively. For example, one person may have experienced 4 consequences once in the past year and rated them as - 1, + 1, + 1, + 1, while another person also experienced 4 consequences once in the past year but rated them as - 1, - 1, + 2, + 1. Both of these people would have an overall weighted ratio score greater than one. We then z-scored the ratio of positive to negative consequences using the mean and standard deviation across all participants.

Past Year Drinking

We used four items to calculate a measure of drinking in the past year. Specifically, participants responded to the following questions on drinking frequency: “How often did you drink alcohol, i.e., beer, wine, wine coolers, or energy drinks with alcohol, in the past year”, “How often did you drink hard liquor in the past year (e.g., vodka, gin, whiskey)?” Response options ranged from “1” (Not at all) to “6” (Every day). Participants also responded to questions on drinking quantity: “When you drink, about how many cans of beer, glasses of wine, bottles of wine cooler, or energy drinks with alcohol do you usually have?”, and “When you drink, about how many drinks of hard liquor do you usually have?” Response options ranged from “1” (No drinks) to “9” (Nine or more drinks). We created a total drinking intensity score by converting all

items to a 0-1 scale by dividing each value by the highest possible value for that item and then taking the sum of the four items. We then z-scored the total drinking variable using the mean and standard deviation across all observations.

Impulsivity

We used the Impulsive Behavior Scale (UPPS; Whiteside & Lynam, 2001) to assess urgency, (lack of) premeditation, and sensation seeking behaviors. We used 12 items in the urgency subscale: the tendency to act rashly when experiencing negative emotions. This facet demonstrated good reliability with a Cronbach's $\alpha = 0.89$ and Revelle's $\omega = 0.89$. We used 11 items in the (lack of) premeditation subscale: the ability to think before acting. This facet demonstrated good reliability with a Cronbach's $\alpha = 0.87$ and Revelle's $\omega = 0.88$. We used 12 items in the sensation seeking subscale, the tendency to pursue excitement. This facet demonstrated good reliability with a Cronbach's $\alpha = 0.92$ and Revelle's $\omega = 0.92$. Responses ranged from "0" (Not at all) to "4" (Very much). We took the mean across all items of each facet and then z-scored each impulsivity facet using the mean and standard deviation of each facet across all observations.

Demographics

Participants provided their age, female status, race, and father education status which we included as control variables to mirror demographics used in Logan et al. (2012). We z-scored age using the mean and standard deviation across all observations. We coded female status as male = -1 and female = +1. We collapsed and effect-coded the race variable to compare white participants and non-white participants due to a lack of diversity in the sample with non-white = -1 and white = 1. Father education status ranged from "0" (8^{th} grade or less) to "10"

(Professional degree). We z-scored father education status using the mean and standard deviation across all observations.

Data Analysis Plan

We conducted all analyses in R (R Core Team, 2020). Because we were re-analyzing data that had already been published on (Logan et al., 2012), we did not preregister our data analysis plan and thus consider the following analyses to be exploratory and should be replicated.

We fit two cross-classified multilevel ordinal regression models to evaluate the study hypotheses and account for the repeated evaluations of 39 drinking consequence measurements from 378 participants. We fit these models using the brm function (Bürkner, 2017). Variables were added to the models in an iterative fashion beginning with the primary variables of interest (expectancy valence and consequence frequency in model 1 and expectancy likelihood and consequence frequency in model 2 (linear, quadratic, and cubic effects)) and random effects (expectancy valence and consequence frequency in model 1 and expectancy likelihood and consequence frequency in model 2 (linear, quadratic, and cubic effects)), followed by control variables (past year alcohol use, impulsivity facets (urgency, (lack of) premeditation, and sensation seeking), demographic variables (age, gender, race, father education status)), exploratory variables (consequence average frequency and ratio of positive to negative consequences), and lastly interaction effects between the primary variables of interest and exploratory variables. For each iteration of the models, we examined R-hat convergence diagnostics, estimated Bulk Effective Sample Size, Tail Effective Sample Size, and the posterior predictive distributions to evaluate convergence of the models. We stopped adding variables to the models once we reached issues with convergence. Due to the lack of theoretical justification and convergence issues, we subsequently removed the cubic effects from both models.

Results

Descriptive Statistics

On average, participants reported experiencing drinking consequences less than once in the past year (M = 0.8, SD = 1.6). Similarly, when the consequence frequencies were averaged across the individual consequence averages, participants reported experiencing each consequence less than once in the past year (M = 0.8, SD = 0.9). Participants reported that experiencing drinking consequences in the future (M = 1.3, SD = 1.7) were unlikely (where 0 = "Not at all likely"), and that if they did experience drinking consequences in the future, they would be negative (M = 0.8, SD = 1.0, with 0 = "Extremely negative"). Finally, when examining the ratio of positive to negative consequences participants experienced in the past year, participants reported experiencing slightly more positive consequences compared to negative consequences (M = 1.3, SD = 2.5). Zero-order correlations among all variables are given in Table 1. The frequency of experiencing drinking consequences in the past year, expectancy likelihood and valence of future drinking consequence, and the sample average frequency of experiencing drinking consequences in the past year were all correlated with the outcome variables, however, they were also all correlated with each other.

Inspection of the final models suggested they fit the data well. All R-hat values were 1.00, Bulk Effective Sample Size and Tail Effective Sample Size were very large, diagnostic plots indicated that the chains were fully mixed, and trace plots suggested that the models reproduced the outcome distribution well.

Predicting Expectancy Likelihood

Consequence Frequency

As hypothesized, when people experienced consequences more frequently in the past year, they also expected these consequences to be more likely to occur in the future (b = 1.72,

95% CI = [1.56, 1.88]), but this association got weaker at higher levels of experience (b = -0.23, 95% CI = [-0.29, -0.18]) (see Table 2 and Figure 1). Moreover, both the linear and quadratic associations varied between people, with 68% of people ranging from b = 0.93 to b = 2.51 in the linear effect, and from b = -0.43 to b = -0.03 in the quadratic. Moreover, the linear association varied between consequences with 68% of consequences ranging from b = 1.48 to b = 1.96 (see Table 3).

The effect of consequence frequency was moderated by the sample average of past year consequences. This moderation was significant in the linear effect such that the curve of the association became less positive at higher levels of the sample average (b = -0.34, 95% CI = [-0.46, -0.23]). Additionally, this moderation was also significant in the quadratic effect such that the curve became narrower at higher levels of the sample average (b = 0.09, 95% CI = 0.05, 0.12]).

There was no evidence of moderation between consequence frequency and the ratio of positive to negative drinking consequences experienced in the past year.

Expectancy Valence

As hypothesized when people expected consequences to be more positive, they also expected these consequences to be more likely to occur in the future (b = 0.82, 95% CI = [0.71, 0.94]), however, this trend got weaker at higher levels of valence (b = -0.15, 95% CI = [-0.24, -0.07]) (see Table 2 and Figure 2). These associations varied between person with 68% of people ranging from b = 0.28 to b = 1.36 in the linear and b = -0.30 to b = 0.00 in the quadratic effect. These associations also varied between consequences with 68% of consequences ranging from b = 0.63 to b = 1.01 in the linear effect (see Table 3).

The effect of expectancy valence was moderated by the sample average of past year consequences. This moderation was significant in the linear effect such that the curve of the association became less positive at higher levels of the sample average (b = -0.23, 95% CI = [-0.33, -0.13]). Additionally, this moderation was also significant in the quadratic effect such that the curve became narrower at higher levels of the sample average (b = 0.12, 95% CI = [0.07, 0.19]).

There was no evidence of moderation between expectancy valence and the ratio of positive to negative consequences experienced in the past year.

Moderating Effect of Consequence Frequency on Expectancy Valence

The effect of expectancy valence was moderated by consequence frequency. This moderation was significant in the linear effect such that the curve of the association became less positive at higher levels of consequence frequency (b = -0.13, 95% CI = [-0.20, -0.07]) (see Figure 3). There was no evidence of moderation between the quadratic effect of expectancy valence and the quadratic effect of consequence frequency.

Predicting Expectancy Valence

Consequence Frequency

As hypothesized, when people experienced consequences more frequently in the past year, they also expected those consequences to be more positive if they were to occur in the future (b = 0.32, 95% CI = [0.19, 0.45]) (see Table 4 and Figure 4). Moreover, this association varied between people with 68% of people ranging from b = 0.15 to b = 0.49 (see Table 5).

The effect of consequence frequency was moderated by the ratio of positive to negative consequences experienced in the past year. This moderation was significant in the linear effect such that the curve of the association became more positive for people who experienced a higher

number of positive to negative consequences (b = 0.18, 95% CI = [0.08, 0.28]). Additionally, this moderation was also significant at the quadratic effect such that the curve became flatter for people who experienced a higher number of positive to negative consequences (b = -0.06, 95% CI = [-0.10, -0.03]).

There was no evidence of moderation between consequence frequency and the sample average of past year consequences.

Expectancy Likelihood

As hypothesized, when people reported higher expectancy likelihoods, they also expected these consequences to be more positive when they occurred (b = 1.00, 95% CI = [0.83, 1.17]), however, this trend got weaker at higher levels of likelihood (b = -0.26, 95% CI = [-0.37, -0.16]) (see Table 4 and Figure 5). These associations varied between people, with 68% of people ranging from b = 0.29 to b = 1.71 in the linear effect, and from b = -0.55 to b = 0.03 in the quadratic. Moreover, these associations also varied between consequences with 68% of consequences ranging from b = 0.65 to b = 1.35 in the linear effect, and from b = -0.46 to b = -0.06 in the quadratic (see Table 5).

The effect of expectancy likelihood was moderated by the sample average of past year consequences. This moderation was significant in the linear effect such that the curve of the association became less positive at higher levels of the sample average (b = -0.25, 95% CI = [-0.40, -0.11]). Additionally, this moderation was also significant at the quadratic effect such that the curve became flatter at higher levels of the sample average (b = 0.17, 95% CI = 0.09, 0.26]).

The effect of expectancy likelihood was also moderated by the ratio of positive to negative drinking consequences experienced in the past year. This moderation was significant in the linear effect such that the curve of the association became less positive for people who

experienced a higher number of positive to negative consequences (b = -0.13, 95% CI = [-0.23, -0.04]).

Moderating Effect of Consequence Frequency on Expectancy Likelihood

The effect of expectancy likelihood was moderated by consequence frequency (see Figure 6). This moderation was significant in the linear effect such that the curve of the association became less positive at higher levels of consequence frequency (b = -0.10, 95% CI = [-0.18, -0.03]). There was no evidence of moderation between the quadratic effect of expectancy likelihood and the quadratic effect of consequence frequency.

Discussion

The purpose of this study was to evaluate how expectancies (likelihood and valence) change with drinking experience when we pair expectancies with specific consequence frequencies. Specifically, we wanted to test whether participants would rate consequences that they experienced more frequently and consequences that they expected to be more positively valenced as more likely to occur in the future. We were specifically interested in whether these findings replicated prior findings when each consequence-likelihood/valence pairing was modeled at the level of the consequence (rather than averaged across consequences). Indeed, the more a consequence was experienced in the past year and the more positively the consequence was expected to be, the higher the participant evaluated the expectancy likelihood. Similarly, the more a consequence was experienced in the past year and the more likely the consequence was expected to be, the more positively the participant evaluated the expectancy valence. However, both key associations were weaker at higher levels of experience or valence/likelihood, and (importantly), these associations varied across both people and consequences. Additionally, there were significant moderation effects for both consequence frequency and expectancy valence.

Taken together, we illustrated that by pairing individual consequence frequencies with expectancy likelihoods and valences, we open novel opportunities to explore differences at the individual consequence-level. Such that there may be particular consequences that people consistently report as unlikely or extremely likely regardless of experience, while others may be highly influenced by experiences.

This study highlights that we can also take a more fine-grained approach to see how experiencing one consequence impacts people's beliefs about that specific consequence. Results line up with expectancy theory such that the more someone experiences a certain consequence the more likely they think it will occur in the future (Goldman et al., 1987).

Unsurprisingly, we successfully replicated the prior results found by Logan et al. (2012) that in general, as consequence frequency increases so too do the expectancy likelihood and valence. However, this association is weaker at higher levels of experience potentially indicating stabilization noted by Rotter et al. (1972). Although we have replicated the results of the prior study, our approach was quite different in that we paired individual consequence frequency scores with expectancy likelihoods and valences rather than taking an aggregate of positive and negative consequences, and used a cross-classified model to account for variability at both the person-level and the level of the consequence.

Accounting for this variability allows for a greater understanding of the sample-level effects observed. While past experience tended to increase expectancies across the sample, this effect may be truer for some people and not others. For example, one person may be particularly sensitive to changing their expectancies based on a single experience while others may need to experience a consequence multiple times before changing their expectancies. Additionally, by examining variability at the level of the consequence, we can see that some consequences across

the whole sample may be more susceptible to being updated as a result of experience rather than others. Maybe some consequences regardless of experience have lower expectancies due to situational factors that make it more likely to experience it in one circumstance, but still unlikely in most circumstances. For instance, following the experience of getting pulled over as a result of driving while intoxicated, a person may vow to no longer drive to drinking events. Thus, even though they did experience this consequence it is possible that they changed their behavior to avoid it in the future and subsequently report the likelihood of driving while intoxicated to be extremely unlikely. Alternatively, other consequences may be experienced in a wide variety of contexts and thus experiencing it once will increase the likelihood of it being experienced again in the future.

Using this approach also allowed us to demonstrate how variation across consequences and people might be predicted by features of those consequences or individual differences between people. We found that when consequences were more common across the sample, there was a weakening effect of the association between consequence frequency and expectancies in that people's beliefs were less influenced by experience when they were commonly experienced. This finding is particularly important for clinical interventions focusing on providing normative feedback to people. Typical feedback approaches will show an individual's drinking results compared with their beliefs about their peers drinking and then data on young adult drinking. The idea being that an individual believes certain drinking behaviors are more common than they truly are. However, the present results may indicate that there may be a risk to presenting this information if the individual believed a behavior to be less common, but in fact was experienced more frequently. This may lead to the opposite of the intended effect where the person's beliefs are less likely to change.

We did not find a significant main effect of valence ratio on expectancy likelihood meaning that experiencing more or less positive consequences compared to negative consequences did not impact an individual's expectancy likelihoods. However, we did find a significant main effect of valence ratio on expectancy valence meaning that people who reported a greater ratio of positive to negative past year consequences reported that experiencing consequences would be more positive.

While we explored the frequency of consequences across the sample and the valence ratio of consequences to begin to unpack what consequence specific factors may contribute to the experience-expectancy relationship, other factors may be important to explore. For example, we could examine life-time frequency of consequences to determine if there is a leveling off effect in terms of when someone's belief about whether a consequence occurs is solidified. We could also explore the number of contexts an expectancy takes place in. Perhaps one consequence only occurs at bars or with a certain friend group while others occur any time an individual drinks. In addition to valence, we could also identify other characterizations of consequences such as how important it is to experience or avoid a particular consequence when someone drinks or how long the effects of a certain consequence will last.

These results lead to several important clinical considerations. Results showed that when people viewed consequences more positively, they also viewed them to be more likely to occur in the future. This may lead patients to have a false sense of control/confidence around their ability to avoid less positive consequences while still experiencing more positive consequences. Clinical practice from a CBT framework may want to explore the evidence for and evidence against these beliefs by looking at what past drinking experiences have been like and how the patient successfully or unsuccessfully avoided these less positive consequences. Additionally,

findings highlight significant effects of sample average frequency such that people's expectancies differed depending on how normative a particular consequence was across the sample. Because consequences are seen as more positive when the consequence is seen as common, it is important for clinicians to determine whether normative feedback will be useful to a particular patient or if it may reinforce their current drinking expectancies.

The results of this study can also go on to inform future prevention interventions by taking a more individualized approach. Current practice for college campuses is to have a required standardized online courses for incoming freshman on college campuses targeting hazardous drinking and alcohol related problems which have been shown to have short-term benefits (Paschall et al., 2011a, 2011b). It is possible that the consequences being targeted are ones that occur at relatively low frequencies in these samples and thus as students engage in hazardous drinking and successfully avoid these consequences, their expectancies decrease. Future prevention efforts may focus on the specific expectancies that the individual has. One challenge to moving away from a standardized prevention effort is the extra time it would require to develop a new prevention program that could be tailored to individual students. Additionally, the program may not be able to account for all of the expectancies that an individual endorses. However, these efforts may ultimately lead to longer term success of these prevention programs that are administered across the country.

Although the present study adds to the literature and offers opportunities for clinical intervention, it is not without its limitations. One of the biggest limitations of the study is the lack of diversity of the sample. Given that expectancies develop via social learning (Bandura, 1977), it is possible that there are significant racial/ethnic differences in the types of expectancies that individuals have and how they are evaluated. The present study offers a way for future

research to look at how specific consequences may differ depending on one's ethnicity, however, the present study is not able to evaluate this due to the majority white sample. Another limitation related to the sample is that the sample was made up of relatively infrequent and low drinkers and thus experienced consequences (at least those assessed) infrequently with a sample average of experiencing each consequence approximately once in the past year. This is a notable limitation as low-drinkers who experience infrequent consequences are not often the target of interventions. However, this work still aids in the understanding of what people expect to happen as a result of drinking even with low levels of direct experience.

A limitation of the method of the present study is the cross-sectional nature of the design and thus, results are susceptible to recall bias as participants are being asked to reflect on the past 12 months of drinking experiences. This may lead to inaccurate reports due to incorrectly recalling experiences they had further from the assessment. Another limitation of the cross-sectional study design is that expectancies may depend on the context for which they are experienced and so an individual's beliefs about what consequences may occur when drinking may differ depending on the drinking situation they are anticipating themselves being in. Lastly, the present study was exploratory due to using data that had already been published on. Because of the exploration of the data, it is possible that the results of the present study will not replicate and interpretations drawn from these results should be taken with caution until the present findings can be replicated in a new sample.

With these limitations in mind, it is important to highlight the strengths of the present study. Firstly, the study uses a large sample of undergraduate students primarily under the legal drinking age which allowed us to explore how a sample of newer drinkers think about future drinking experiences. Along the same vein, we also assessed a large number of different positive

and negative consequences which allowed us to see what consequences were common and uncommon across the sample. Lastly, the analytical approach of the present study is rather novel and allows for work to start better characterizing individual consequences and the specific expectancy trajectories present as individuals gain direct experience with them.

Building on the present study, it is important for the results of the present study to be replicated given the exploratory nature of the study. It would be especially insightful to examine how the variability across consequences changes in a new sample. Additionally, future research would benefit from targeting a sample that engages in more frequent or heavy drinking in order to see how varying levels of drinking experience alter the results of the present study.

Given that expectancies are believed to develop through observational learning (Goldman et al., 1987), future research would also benefit from recruiting a more diverse sample of college students and using measures that are able to assess a diverse array of consequences that may be unique to different cultures. Doing so would allow for a better understanding of how experienced consequences and subsequent expectancies differ across different racial/ethnic groups.

Lastly, future work could explore how these associations change in real time by conducting an ecological momentary assessment study to observe how peoples' expectancies change based on experiences over several drinking occasions.

Overall, the results of this study highlight that regardless of valence, people do update their expectancy likelihoods based on their actual experiences. However, the more they experience a given consequence, the more positively they view this consequence to be in the future. While this study largely supports the current literature on alcohol expectancies, it also demonstrates the feasibility of looking at variability at the individual and consequence-level. Accounting for the variability at the consequence-level presents an opportunity to do more extensive exploration on

what consequences might be motivating drinking and what may deter drinking or lead to behavior change for a particular individual. This study highlights that when we look at consequences from an aggregate positive versus negative level, we may be missing how people think about negative consequences that they do experience (being hungover) due to equal emphasis on consequences that are experienced more infrequently (driving while under the influence or being arrested). Future research should explore consequence specific differences and use a similar analytic strategy in longitudinal data to explore differences over time.

REFERENCES

Bandura, A. (1977). *Social learning theory*. Prentice Hall. https://catalog.hathitrust.org/Record/000313256

Banks, D. E., & Zapolski, T. C. B. (2017). Racial differences in the link between alcohol expectancies and adolescent drinking. *Addictive Behaviors*, *67*, 34–37. https://doi.org/10.1016/j.addbeh.2016.12.005

Benthin, A., Slovic, P., & Severson, H. (1993). A Psychometric study of adolescent risk perception. *Journal of Adolescence*, *16*(2), 153–168. https://doi.org/10.1006/jado.1993.1014

Bose, J. (2017). *Key Substance Use and Mental Health Indicators in the United States: Results from the 2017 National Survey on Drug Use and Health*.

Brown, S. A., Goldman, M. S., Inn, A., & Anderson, L. R. (1980). Expectations of reinforcement from alcohol: Their domain and relation to drinking patterns. *Journal of Consulting and Clinical Psychology*, *48*, 419–426. https://doi.org/10.1037/0022-006X.48.4.419

Bürkner, P.-C. (2017). brms: An R Package for Bayesian Multilevel Models Using Stan. *Journal of Statistical Software*, *80*, 1–28. https://doi.org/10.18637/jss.v080.i01

Carey, K. B., Durney, S., Shepardson, R. L., & Carey, M. P. (2015). Incapacitated and Forcible Rape of College Women: Prevalence Across the First Year. *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine*, *56*(6), 678–680. https://doi.org/10.1016/j.jadohealth.2015.02.018

Christiansen, B. A., Goldman, M. S., & Brown, S. A. (1985). The differential development of adolescent alcohol expentancies may predict adult alcoholism. *Addictive Behaviors*, *10*(3), 299–306. https://doi.org/10.1016/0306-4603(85)90011-5

Christiansen, B. A., Goldman, M. S., & Inn, A. (1982). Development of alcohol-related expectancies in adolescents: Separating pharmacological from social-learning influences. *Journal of Consulting and Clinical Psychology*, *50*, 336–344. https://doi.org/10.1037/0022-006X.50.3.336

Colby, S. M., Colby, J. J., & Raymond, G. A. (2009). College versus the real world: Student perceptions and implications for understanding heavy drinking among college students. *Addictive Behaviors*, *34*(1), 17–27. https://doi.org/10.1016/j.addbeh.2008.07.023

Corbin, W. R., Morean, M. E., & Benedict, D. (2008). The Positive Drinking Consequences Questionnaire (PDCQ): Validation of a new assessment tool. *Addictive Behaviors*, *33*(1), 54–68. https://doi.org/10.1016/j.addbeh.2007.06.003

Dasgupta, A. (2017). 1 - Alcohol a double-edged sword: Health benefits with moderate consumption but a health hazard with excess alcohol intake. In A. Dasgupta (Ed.), *Alcohol, Drugs, Genes and the Clinical Laboratory* (pp. 1–21). Academic Press. https://doi.org/10.1016/B978-0-12-805455-0.00001-4

Fairlie, A. M., Ramirez, J. J., Patrick, M. E., & Lee, C. M. (2016). When do college students have less favorable views of drinking? Evaluations of alcohol experiences and positive and negative consequences. *Psychology of Addictive Behaviors*, *30*(5), 555–565. https://doi.org/10.1037/adb0000190

Furby, L., & Beyth-Marom, R. (1992). Risk taking in adolescence: A decision-making perspective. *Developmental Review*, *12*(1), 1–44. https://doi.org/10.1016/0273-2297(92)90002-J

Gibbons, F. X., Gerrard, M., & Lane, D. J. (2003). A social reaction model of adolescent health risk. In *Social psychological foundations of health and illness* (pp. 107–136). Blackwell Publishing. https://doi.org/10.1002/9780470753552.ch5

Goldberg, J. H., Halpern-Felsher, B. L., & Millstein, S. G. (2002). *Beyond Invulnerability: The Importance of Benefits in Adolescents' Decisions to Drink Alcohol and Smoke Marijuana*. 29.

Goldman, M., Brown, S., & Christiansen, B. (1987). Expectancy Theory—Thinking about Drinking. *Psychological Theories of Drinking and Alcoholism*, 181–226.

Goldman, M. S. (1989). Alcohol expectancies as cognitive-behavioral psychology: Theory and practice. In *Addictive behaviors: Prevention and early intervention* (pp. 11–30). Swets & Zeitlinger Publishers.

Halvorson, M. A., Lengua, L. J., Smith, G. T., & King, K. M. (n.d.). Pathways of personality and learning risk for addictive behaviors: A systematic review of mediational research on the acquired preparedness model. *Journal of Personality*, *n/a*(n/a). https://doi.org/10.1111/jopy.12761

Hingson, R. W., Zha, W., & Weitzman, E. R. (2009). Magnitude of and Trends in Alcohol-Related Mortality and Morbidity Among U.S. College Students Ages 18-24, 1998-2005. *Journal of Studies on Alcohol and Drugs. Supplement*, *16*, 12–20.

Hingson, R., Zha, W., & Smyth, D. (2017). Magnitude and Trends in Heavy Episodic Drinking, Alcohol-Impaired Driving, and Alcohol-Related Mortality and Overdose Hospitalizations Among Emerging Adults of College Ages 18–24 in the United States, 1998–2014. *Journal of Studies on Alcohol and Drugs*, *78*(4), 540–548. https://doi.org/10.15288/jsad.2017.78.540

Hurlbut, S. C., & Sher, K. J. (1992). Assessing Alcohol Problems in College Students. *Journal of American College Health*, *41*(2), 49–58. https://doi.org/10.1080/07448481.1992.10392818

Lee, C. M., Rhew, I. C., Patrick, M. E., Fairlie, A. M., Cronce, J. M., Larimer, M. E., Cadigan, J. M., & Leigh, B. C. (2018). Learning From Experience? The Influence of Positive and Negative Alcohol-Related Consequences on Next-Day Alcohol Expectancies and Use Among College Drinkers. *Journal of Studies on Alcohol and Drugs*, *79*(3), 465–473. https://doi.org/10.15288/jsad.2018.79.465

Leigh, B. C. (1989). In search of the seven dwarves: Issues of measurement and meaning in alcohol expectancy research. *Psychological Bulletin*, *105*, 361–373. https://doi.org/10.1037/0033-2909.105.3.361

Logan, D. E., Henry, T., Vaughn, M., Luk, J. W., & King, K. M. (2012). Rose-colored beer goggles: The relation between experiencing alcohol consequences and perceived likelihood and valence. *Psychology of Addictive Behaviors*, *26*(2), 311–317. https://doi.org/10.1037/a0024126

Mallett, K. A., Bachrach, R. L., & Turrisi, R. (2008). Are all negative consequences truly negative? Assessing variations among college students' perceptions of alcohol related consequences. *Addictive Behaviors*, *33*(10), 1375–1381. https://doi.org/10.1016/j.addbeh.2008.06.014

Mallett, K. A., Lee, C. M., Neighbors, C., Larimer, M. E., & Turrisi, R. (2006). Do we learn from our mistakes? An examination of the impact of negative alcohol-related consequences on college students' drinking patterns and perceptions. *Journal of Studies on Alcohol*, *67*(2), 269–276. https://doi.org/10.15288/jsa.2006.67.269

O'Hare, T. (1995). Differences in asian and white drinking: Consumption level, drinking contexts, and expectancies. *Addictive Behaviors, 20*(2), 261–266. https://doi.org/10.1016/0306-4603(94)00061-1

Paschall, M. J., Antin, T., Ringwalt, C. L., & Saltz, R. F. (2011a). Effects of AlcoholEdu for College on Alcohol-Related Problems Among Freshmen: A Randomized Multicampus Trial. *Journal of Studies on Alcohol and Drugs, 72*(4), 642–650. https://doi.org/10.15288/jsad.2011.72.642

Paschall, M. J., Antin, T., Ringwalt, C. L., & Saltz, R. F. (2011b). Evaluation of an Internet-Based Alcohol Misuse Prevention Course for College Freshmen: Findings of a Randomized Multi-Campus Trial. *American Journal of Preventive Medicine, 41*(3), 300–308. https://doi.org/10.1016/j.amepre.2011.03.021

Patrick, M. E., & Terry-McElrath, Y. M. (2021). Drinking Motives and Drinking Consequences across Days: Differences and Similarities between Moderate, Binge, and High-Intensity Drinking. *Alcoholism: Clinical and Experimental Research*, *45*(5), 1078–1090. https://doi.org/10.1111/acer.14591

Patrick, M. E., Terry-McElrath, Y. M., Evans-Polce, R. J., & Schulenberg, J. E. (2020). Negative alcohol-related consequences experienced by young adults in the past 12 months: Differences by college attendance, living situation, binge drinking, and sex. *Addictive Behaviors*, *105*, 106320. https://doi.org/10.1016/j.addbeh.2020.106320

Ramirez, J. J., Rhew, I. C., Patrick, M. E., Larimer, M. E., & Lee, C. M. (2020). A Daily-Level Analysis of Moderators of the Association between Alcohol Expectancies and Alcohol Use among College Student Drinkers. *Substance Use & Misuse, 55*(6), 973–982. https://doi.org/10.1080/10826084.2020.1717535

Read, J. P., Wood, M. D., Lejuez, C. W., Palfai, T. P., & Slack, M. (2004). Gender, Alcohol Consumption, and Differing Alcohol Expectancy Dimensions in College Drinkers. *Experimental and Clinical Psychopharmacology*, *12*(4), 298–308. https://doi.org/10.1037/1064-1297.12.4.298

Rotter, J. B., Phares, E. Jerry., & Chance, J. E. (1972). *Applications of a social learning theory of personality*. Holt, Rinehart and Winston. https://catalog.hathitrust.org/Record/000428070

SAMHSA. (n.d.). *Center for Behavioral Statistics and Quality. 2019 National Survey on Drug Use and Health. Table 6.23B—Alcohol Use Disorder in Past Year among Persons Aged 18 to 22, by College Enrollment Status and Demographic Characteristics: Percentages, 2018 and 2019.* Retrieved July 18, 2022, from https://www.samhsa.gov/data/sites/default/files/reports/rpt29394/NSDUHDetailedTabs2019/NSDUHDetTabsSect6pe2019.htm#tab6-23b

Schulenberg, J. E., Johnston, L. D., O'Malley, P. M., Bachman, J. E., Miech, R. A., & Patrick, M. E. (2020). *Monitoring the Future national survey results on drug use, 1975-2019: Volume II, college students and adults ages 19-60.* Institute for Social Research, The University of Michigan. http://monitoringthefuture.org/pubs.html#monographs

Smith, G. T., & Anderson, K. G. (2001). Personality and learning factors combine to create risk for adolescent problem drinking: A model and suggestions for intervention. In *Adolescents, alcohol, and substance abuse: Reaching teens through brief interventions* (pp. 109–141). Guilford Press.

Table 1

Zero-order correlations

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1. Consequence Frequency	1															
2. Consequence Frequency-Squared	0.87	1														
3. Expectancy Valence	0.43	0.31	1													
4. Expectancy Valence-Squared	0.31	0.26	0.72	1												
5. Expectancy Likelihood	0.64	0.49	0.59	0.41	1											
6. Expectancy Likelihood-Squared	0.56	0.52	0.44	0.44	0.79	1										
7. Sample Average Frequency	0.55	0.42	0.54	0.39	0.58	0.47	1									
8. Valence Ratio	-0.04	-0.02	0.11	0.08	0.03	0.03	0.00	1								
9. Age	-0.01	0.02	-0.01	0.00	-0.01	-0.01	0.00	-0.02	1							
10. white Race	0.13	0.11	0.02	0.01	0.03	0.02	0.00	-0.07	0.09	1						
11. Female Status	-0.03	-0.05	-0.08	-0.02	-0.02	0.03	0.00	-0.11	-0.06	0.02	1					
12. Father Ed. Status	0.05	0.04	0.02	0.01	0.02	0.00	0.00	-0.05	-0.07	0.21	0.01	1				
13. Past Year Alcohol Use	0.32	0.28	0.06	0.02	0.10	0.06	0.00	-0.15	-0.06	0.25	-0.16	0.12	1			
14. UPPS-(Lack of) Premeditation	-0.11	-0.10	-0.07	-0.02	-0.05	-0.03	0.00	0.01	0.04	-0.05	-0.06	-0.06	-0.21	1		
15. UPPS-Negative Urgency	0.08	0.07	0.04	0.03	0.11	0.07	0.00	0.00	-0.08	-0.17	-0.05	-0.06	0.07	-0.14	1	
16. UPPS-Sensation Seeking	0.08	0.07	0.05	0.04	0.03	0.03	0.00	0.07	0.01	0.10	-0.32	0.10	0.18	-0.22	0.12	1

Table 2

Fixed Effects for Expectancy Likelihood

Variable	Estimate	Estimate Error	95% CI
Consequence Frequency	1.72	0.08	[1.56, 1.88]
Consequence Frequency-Squared	-0.23	0.03	[-0.29, -0.18]
Consequence Frequency X Sample Average Frequency	-0.34	0.06	[-0.46, -0.23]
Consequence Frequency-Squared X Sample Average Frequency	0.09	0.02	[0.05, 0.12]
Consequence Frequency X Valence Ratio	0.02	0.06	[-0.09, 0.14]
Consequence Frequency-Squared X Valence Ratio	0.00	0.02	[-0.04, 0.04]
Expectancy Valence	0.82	0.06	[0.71, 0.94]
Expectancy Valence-Squared	-0.15	0.04	[-0.24, -0.07]
Expectancy Valence X Sample Average Frequency	-0.23	0.05	[-0.33, -0.13]
Expectancy Valence-Squared X Sample Average Frequency	0.12	0.03	[0.07, 0.19]
Expectancy Valence X Valence Ratio	-0.04	0.04	[-0.12, 0.04]
Expectancy Valence-Squared X Valence Ratio	0.03	0.02	[0.00, 0.06]
Expectancy Valence X Consequence Frequency	-0.13	0.03	[-0.20, -0.07]
Expectancy Valence-Squared X Consequence Frequency-Squared	0.01	0.00	[0.00, 0.02]
Sample Average Frequency	0.49	0.09	[0.31, 0.68]
Valence Ratio	0.03	0.06	[-0.09, 0.16]
Age	-0.05	0.05	[-0.14, 0.05]
white Race	0.00	0.06	[-0.11, 0.11]
Female Status	0.15	0.06	[0.04, 0.26]
Father Ed. Status	-0.03	0.05	[-0.13, 0.07]
Past Year Alcohol Use	-0.22	0.06	[-0.34, -0.11]
UPPS-(Lack of) Premeditation	0.06	0.05	[-0.04, 0.16]
UPPS-Negative Urgency	0.19	0.05	[0.09, 0.29]
UPPS-Sensation Seeking	0.03	0.05	[-0.08, 0.13]

Table 3

Random Effects for Expectancy Likelihood

Variable	SD Estimate	SD Estimate Error	95% CI
Consequence Frequency (Person-Level)	0.79	0.05	[0.68, 0.90]
Consequence Frequency-Squared (Person-Level)	0.20	0.02	[0.16, 0.25]
Consequence Frequency (Consequence-Level)	0.24	0.05	[0.16, 0.34]
Consequence Frequency-Squared (Consequence-Level)	0.03	0.02	[0.00, 0.08]
Expectancy Valence (Person-Level)	0.53	0.04	[0.45, 0.62]
Expectancy Valence-Squared (Person-Level)	0.15	0.03	[0.09, 0.21]
Expectancy Valence (Consequence-Level)	0.19	0.05	[0.11, 0.29]
Expectancy Valence-Squared (Consequence-Level)	0.11	0.04	[0.03, 0.20]

Table 4

Fixed Effects for Expectancy Valence

Variable	Estimate	Estimate Error	95% CI
Consequence Frequency	0.32	0.06	[0.19, 0.45]
Consequence Frequency-Squared	-0.06	0.03	[-0.11, 0.00]
Consequence Frequency X Sample Average Frequency	0.01	0.04	[-0.08, 0.09]
Consequence Frequency-Squared X Sample Average Frequency	-0.01	0.02	[-0.04, 0.02]
Consequence Frequency X Valence Ratio	0.18	0.05	[0.08, 0.28]
Consequence Frequency-Squared X Valence Ratio	-0.06	0.02	[-0.10, -0.03]
Expectancy Likelihood	1.00	0.09	[0.83, 1.17]
Expectancy Likelihood-Squared	-0.26	0.05	[-0.37, -0.16]
Expectancy Likelihood X Sample Average Frequency	-0.25	0.07	[-0.40, -0.11]
Expectancy Likelihood-Squared X Sample Average Frequency	0.17	0.04	[0.09, 0.26]
Expectancy Likelihood X Valence Ratio	-0.13	0.05	[-0.23, -0.04]
Expectancy Likelihood-Squared X Valence Ratio	0.05	0.03	[-0.01, 0.10]
Expectancy Likelihood X Consequence Frequency	-0.10	0.04	[-0.18, -0.03]
Expectancy Likelihood-Squared X Consequence Frequency-Squared	0.01	0.01	[0.00, 0.02]
Sample Average Frequency	1.04	0.21	[0.63, 1.45]
Valence Ratio	0.41	0.06	[0.30, 0.52]
Age	0.03	0.04	[-0.05, 0.11]
white Race	0.00	0.05	[-0.09, 0.09]
Female Status	-0.17	0.05	[-0.26, -0.08]
Father Ed. Status	0.04	0.04	[-0.04, 0.13]
Past Year Alcohol Use	0.06	0.05	[-0.03, 0.16]
UPPS-(Lack of) Premeditation	-0.08	0.04	[-0.17, 0.00]
UPPS-Negative Urgency	-0.01	0.04	[-0.09, 0.08]
UPPS-Sensation Seeking	0.01	0.05	[-0.08, 0.10]

Table 5

Random Effects for Expectancy Valence

Variable	SD Estimate	SD Estimate Error	95% CI
Consequence Frequency (Person-Level)	0.17	0.07	[0.03, 0.30]
Consequence Frequency-Squared (Person-Level)	0.04	0.02	[0.00, 0.08]
Consequence Frequency (Consequence-Level)	0.05	0.04	[0.00, 0.14]
Consequence Frequency-Squared (Consequence-Level)	0.02	0.01	[0.00, 0.05]
Expectancy Likelihood (Person-Level)	0.71	0.06	[0.60, 0.82]
Expectancy Likelihood-Squared (Person-Level)	0.29	0.04	[0.22, 0.37]
Expectancy Likelihood (Consequence-Level)	0.35	0.06	[0.25, 0.48]
Expectancy Likelihood-Squared (Consequence-Level)	0.20	0.03	[0.14, 0.27]

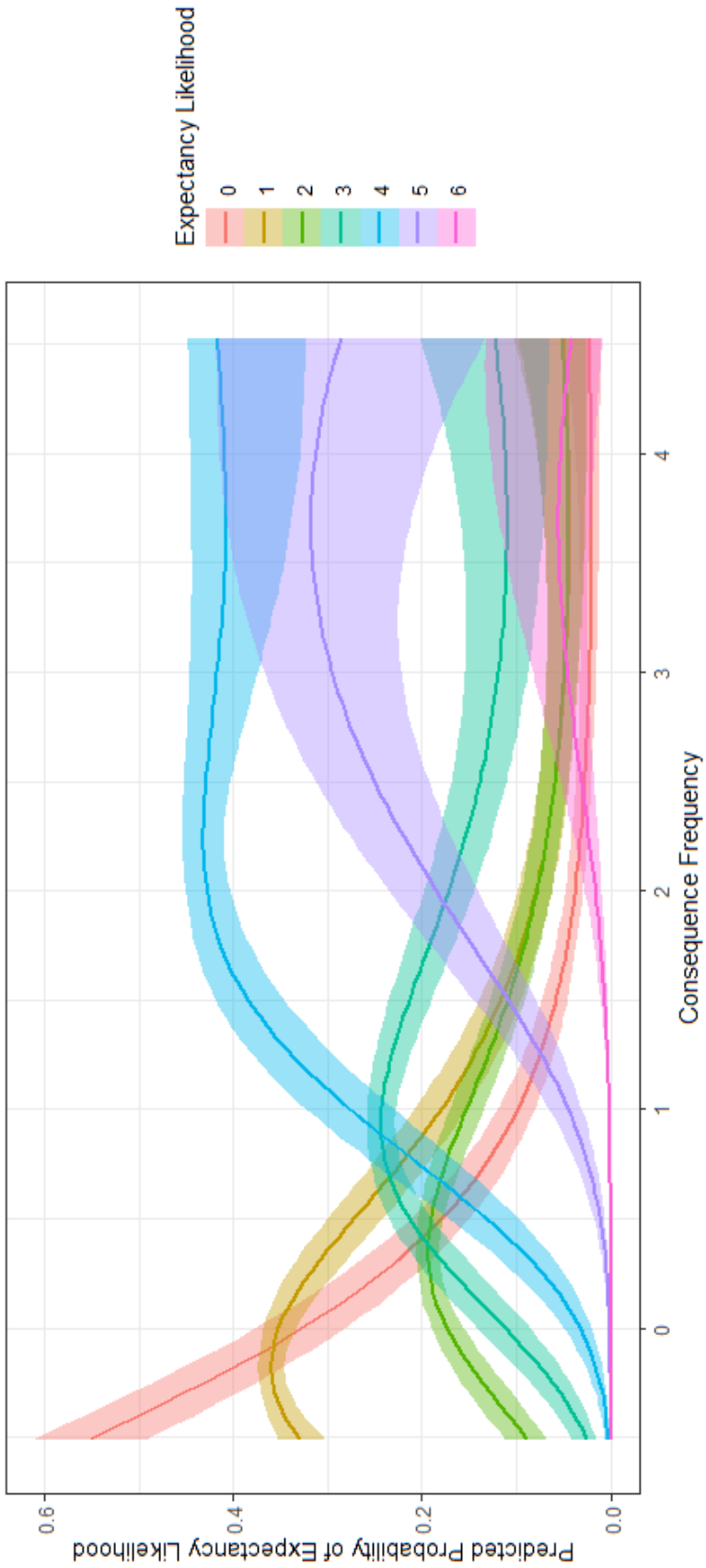

Figure 1.

Main Effect of Consequence Frequency on Expectancy Likelihood

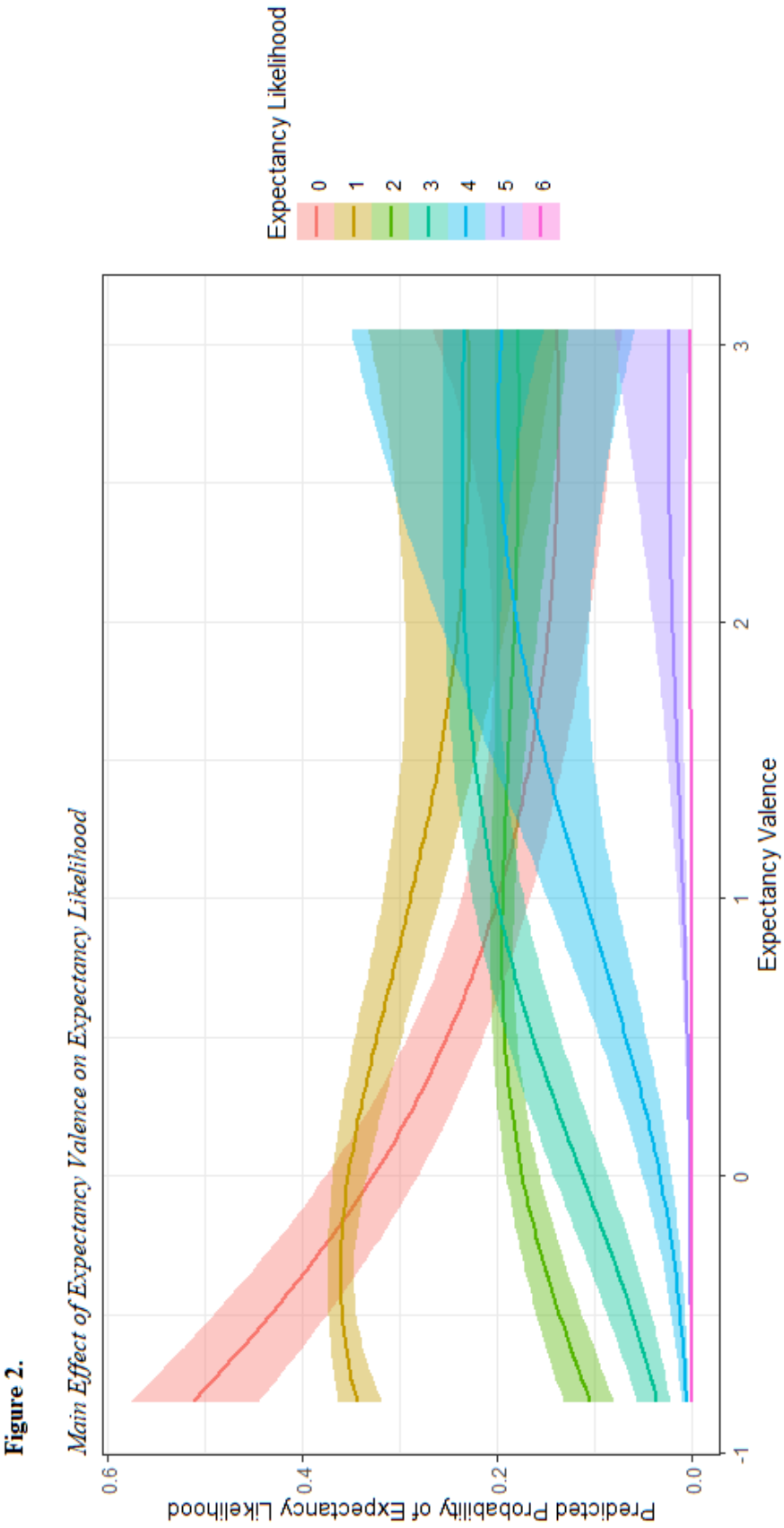

Figure 2.

Main Effect of Expectancy Valence on Expectancy Likelihood

Figure 3.

Moderating Effect of Consequence Frequency on Expectancy Valence

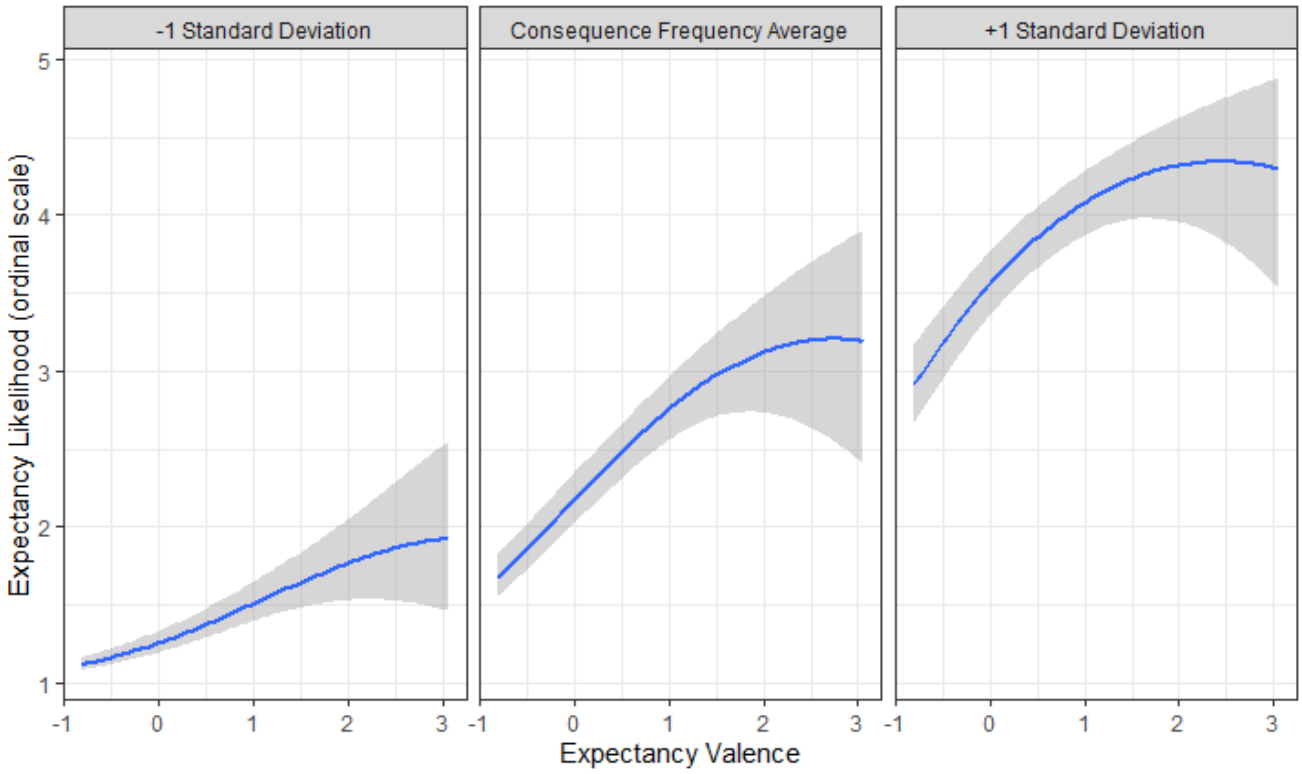

Figure 4.

Main Effect of Consequence Frequency on Expectancy Valence

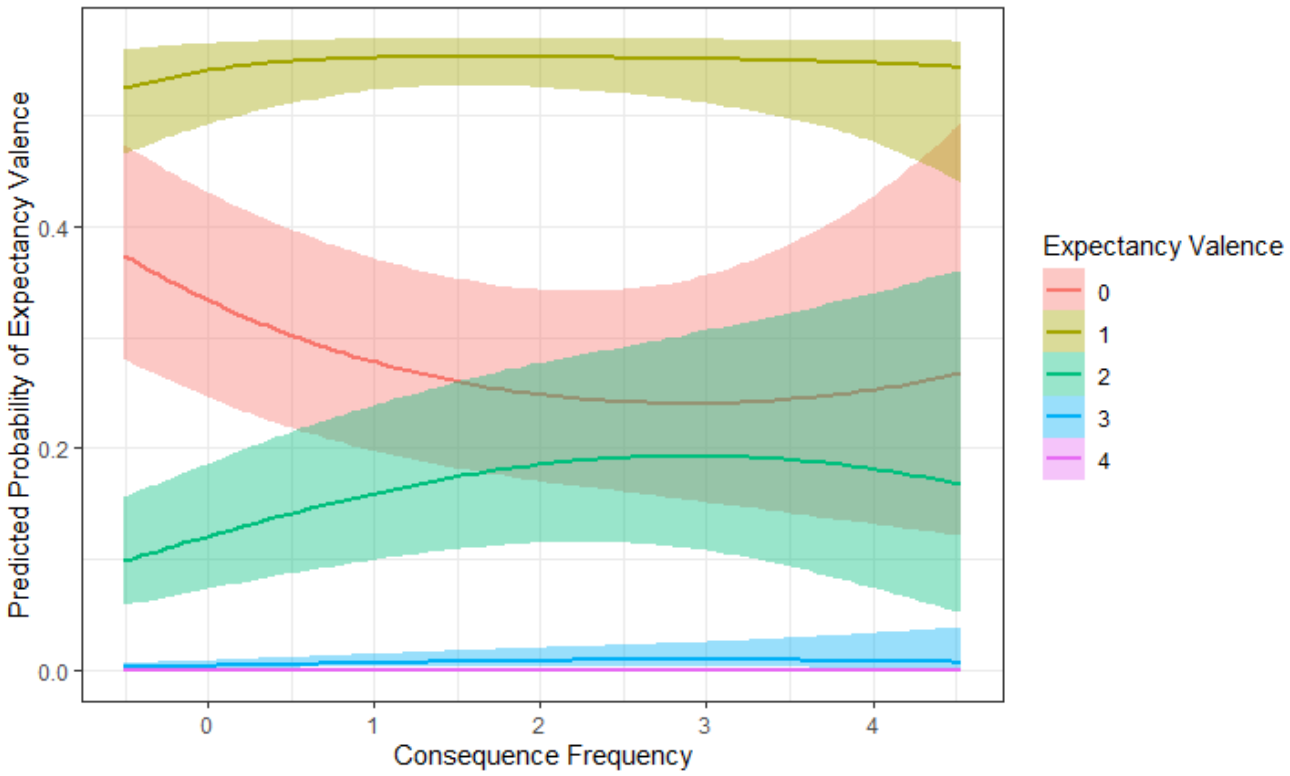

Figure 5.

Main Effect of Expectancy Likelihood on Expectancy Valence

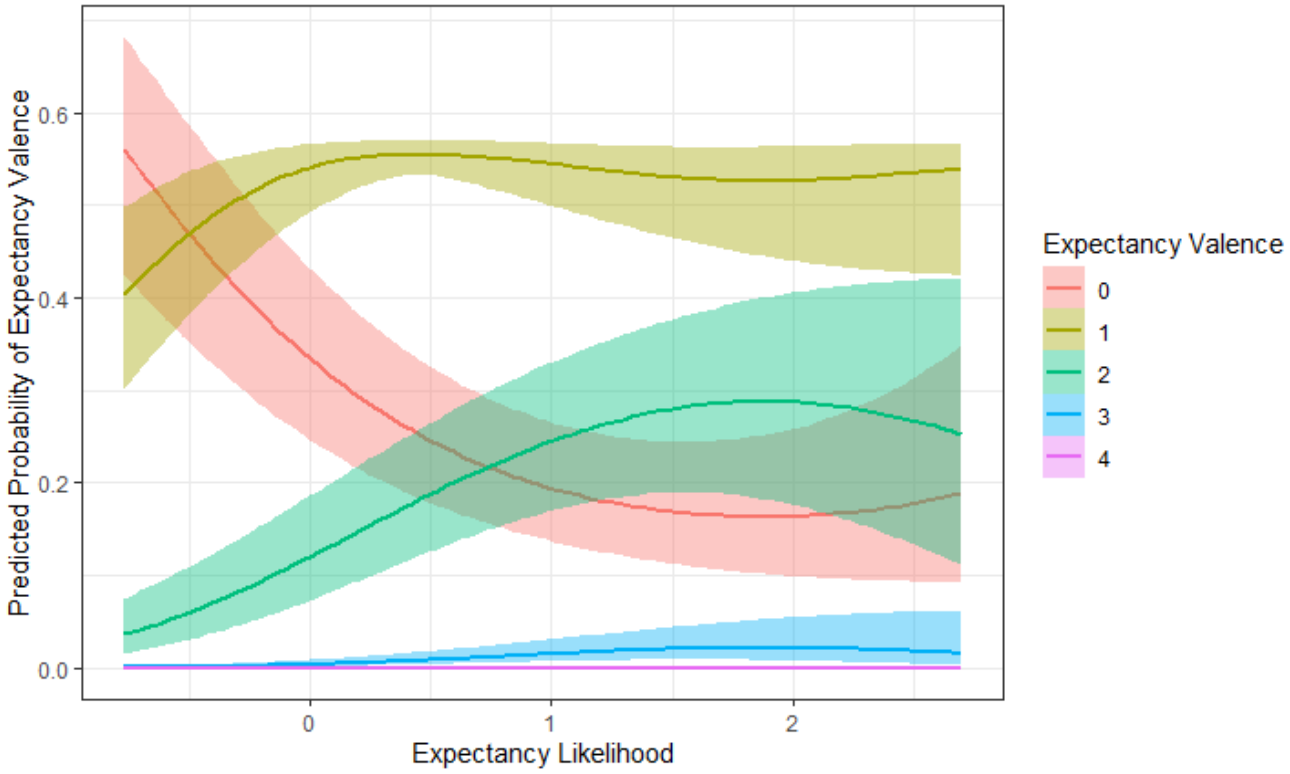

Figure 6.

Moderating Effect of Consequence Frequency on Expectancy Likelihood