The Influence of Drinking Consequences on Alcohol Expectancy Likelihoods and Valences: An Item-Level Multilevel Approach

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ABSTRACT. Objective: Alcohol expectancy theory proposes that beliefs about drinking motivate or deter drinking. Although expectancies influence drinking, less is known about how the consequences of drinking influence expectancies. We modeled a feedback conceptualization of how the experience of specific consequences influenced people's beliefs about how likely a consequence is to occur (i.e., likelihoods) and how positive the consequence will be (i.e., valences). **Method:** We re-analyzed cross-sectional data from college drinkers (n = 504), using Bayesian cross-classified multilevel ordinal regressions to estimate associations between consequences, likelihoods, and valences. We performed a preregistered replication in new data (n = 362). **Results:** Participants had higher likelihoods (95% CI Study 1 = [2.06, 2.43], 95% CI Study 2 = [1.75, 2.12]) and valences (95% CI Study 1 = [0.28, 0.52], 95% CI Study 2 = [0.33, 0.60]) when they had experienced consequences more often, but these associations leveled off at higher consequence frequencies. Participants also believed consequences to be more likely when they viewed them as more positive, and vice versa. Again, these associations leveled off at higher levels of the predictor. Crucially, the strength of these associations varied across both people and consequences. **Conclusions:** Experiencing specific consequences more often was related to people judging them to be more likely and more positive in the future, aligning with alcohol expectancy theory. This may lead to experiencing negative consequences repeatedly because people are not being demotivated from drinking. Given the person and consequence level variability, clinicians should consider an individualized approach when targeting drinking consequences. (*J. Stud. Alcohol Drugs, 86,* 611–625, 2025)

YOUNG ADULTS ARE more willing to engage (Gibbons et al., 2003; Wicki et al., 2018), and do engage, in more risky behaviors (e.g., binge drinking) than adults (Center for Behavioral Health Statistics and Quality, 2022). Alcohol expectancy theory (Goldman et al., 1987) offers a framework to understand why young adults engage in these risky behaviors. Alcohol expectancy theory proposes that people have beliefs (e.g., expectancies) about what consequences will occur as a result of drinking, and these expectancies are shaped via observational learning and experience (see Jones & Gordon, 2017; Zaso et al., 2023), thus influencing people's decisions to drink. Researchers measure these expectancies by their likelihood (e.g., perceptions of how likely each consequence is to occur) and valence (e.g., perceptions of how good or bad a consequence will be). Support for alcohol expectancy theory has demonstrated that likelihoods predict drinking initiation (see Smit et al., 2018, for review) and use (Lac & Brack, 2018), and differ for different drinking levels (Brown et al., 1985). Given that alcohol use (Bose et al., 2017; Schulenberg et al., 2020) and consequences (Carey et al., 2015; Colby et al., 2009; Glenn et al., 2022; Hingson et al., 2009, 2017; Patrick et al., 2020) increase during college, college drinkers are ideal for studying expectancies in individuals who are rapidly gaining direct drinking experiences.

Prior work has suggested that experience shapes the likelihoods and behaviors of college drinkers, and this happens more for positive than for negative consequences (Lee et al., 2018; Logan et al., 2012; Mallett et al., 2022). In general, when people experience consequences, they evaluate them more positively (Leavens et al., 2017; Logan et al., 2012); however, this is not true for all consequences. For example, "creating interpersonal problems" was rated negatively for both people who had and had not experienced it (Leavens et al., 2017). Because prior research has focused primarily on a feed-forward conceptualization of likelihoods (i.e., how likelihoods are positively associated with drinking [Lac & Brack, 2018; Pabst et al., 2014; Patrick et al., 2010, 2016] and consequences [Lee et al., 2020]), it is unclear why these differences occur. We seek to build on this work by using a feed-backwards conceptualization by evaluating how likelihoods and valences might be shaped by consequence frequencies. One study examined how consequences influenced likelihoods at the daily level and found that, in general, after experiencing positive and negative consequences, positive and negative likelihoods increased the following day (Lee et al., 2018). However, it is unclear whether the increased likelihoods were for the consequences that were actually experienced the day before because this and prior research rely on averaging across all consequences and likelihoods. That means it is impossible to determine if experiencing a specific consequence is related to an altered likelihood or

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if some consequences (or kinds of consequences) shape people's likelihoods or valences more than others.

Moreover, positive likelihoods increased more than negative likelihoods (Lee et al., 2018). This finding suggests that when college drinkers perceive consequences more positively, they also perceive them as more likely. This may be because they believe that negative things are less likely to happen to them (i.e., unrealistic optimism; Weinstein, 1980) or that they are more sensitive to rewards (van Duijvenvoorde et al., 2022). To build on this work, we sought to match the experience of consequences with people's judgments about the likelihood and valence for those same consequences in the future to identify whether and to what extent people report higher likelihoods and valences for consequences that have been experienced more in the past. We believe this approach offers a way to more directly model the decision-making process that may occur when people think about later drinking. Specifically, when people have the opportunity to drink, they may reflect on their past experiences to determine what they expect to happen and how good or bad it will be.

This precision approach allows us to identify whether certain consequences are especially likely to influence likelihoods and valences and unlock research aimed at understanding potential moderators of the experience-likelihood/valence association (e.g., research such as exploring how people's likelihoods and valences differ for consequences that are experienced frequently across the whole sample or how likelihoods and valences differ for people who generally experience more positive [or negative] consequences).

This study aimed to test whether people report higher likelihoods and valences when they also report having experienced these consequences more in the past. In the present study, we aimed to model that decision-making process by treating sets of items on consequence frequency, likelihood, and valence of 39 alcohol-related consequences as repeated measures clustered within person and consequence. This may provide insights into whether people's current beliefs are related to past experiences. If this process does occur, we expect that likelihoods and valences would be higher for consequences they experienced more frequently. This approach also allows us to characterize the variation in these associations across people and consequences.

Method

Preregistration and data availability

Our data, scripts, and preregistration for Study 2 are available on the Open Science Framework (https://osf.io/pdvw8).[1]

[1]Based on reviewer comments, we made minor deviations from our preregistration, which can be found on our Open Science Framework page.

Table 1. Demographics

Variable	Study 1	Study 2
Age, in years, *M* (*SD*)	19.26 (1.22)	19.80 (1.08)
Gender, %		
Female	55	52
Male	42	48
Nongendered/agender	N.A.	<1
Transgender	N.A.	<1
Race, %		
White	54	36
Asian/Pacific Islander	33	N.A.
East Asian	N.A.	26
Southeast Asian	N.A.	11
South Asian	N.A.	4
Pacific Islander	N.A.	1
Hispanic/Latino	5	5
Other	5	N.A.
Mixed	N.A.	13
Black/African American	2	1
African	N.A.	<1
American Indian	<1	N.A.
Middle Eastern	N.A.	1

Notes: N.A. = not applicable.

Participants and procedures

Participants were 504 (Study 1) and 362 (Study 2) undergraduate students from a university in the Northwest enrolled in psychology courses. Participant demographics are summarized in Table 1. Participants gave informed consent and completed an online questionnaire that took approximately 60 (Study 1) or 30 minutes (Study 2). Participants received extra credit as compensation. The university's institutional review board approved all study procedures (IRB #35325 and #47091).

Because we were interested in examining the experience of alcohol-related consequences, we excluded participants who did not complete past-year alcohol consumption questions or reported not consuming alcohol in the past year, resulting in a final sample of 378 and 287 participants in Studies 1 and 2, respectively.[2]

Measures

Likelihood. We used 39 items to assess the likelihood of each consequence when under the influence of alcohol regardless of whether the participant reported experiencing the consequences (Cronbach's α = .91 and .94 for Studies 1 and 2, respectively).[3] We took 20 items from the Young Adult Alcohol Problems Screening Test (Hurlbut & Sher, 1992), 10 items from Mallett et al. (2008), and 9 items from the Positive Drinking Consequences Questionnaire (Corbin et al., 2008). We asked participants, "What would you expect to happen if you were under the influence of alcohol?" Response options ranged from 0 (*not at all likely*) to 6 (*extremely likely*).

[2]The final samples did not significantly differ from the full samples regarding age, gender, or race.

[3]See Supplemental Table B for exact items.

Valence. We used the same 39 consequences to assess the valence of each consequence if participants experienced the consequence in the future regardless of whether the participant reported experiencing the consequences (Cronbach's α = .91 and .93 for Studies 1 and 2, respectively). We asked participants, "If you ever were to do/experience the following because of your drinking, how positive or negative would this experience be?" Responses ranged from 0 (*extremely negative*) to 4 (*extremely positive*).

Consequence frequency. We used the same 39 consequences to assess the past year's frequency of experiencing each drinking consequence (Cronbach's α = .94 and .94 for Studies 1 and 2, respectively). Response options were as follows: 0 (*no, never*), 0 (*yes, but not in the last year*), 1 (*1 time*), 2 (*2 times*), 3 (*3 times*), 4 (*4–6 times*), 5 (*7–11 times*), 6 (*12–20 times*), 7 (*21–39 times*), and 8 (*40 or more times*). We calculated the sample average frequency scores for the 39 drinking consequences by averaging the reports for each consequence across all participants separately for each study.

To compute the ratio of positive to negative consequences, we computed a valence-weighted average of the past year's consequences:

$$\tilde{x}_{pc} = x_{pc} - 2$$

$$pos{:}\, f(x) = \begin{cases} 1 & if\ x > 0 \\ 0 & otherwise \end{cases}$$

$$PositiveExpectancyValence_p = \sum_{c}^{C} pos(\tilde{x}_{pc}) \times \tilde{x}_{pc} \times \tilde{z}_{pc}$$

$$NegativeExpectancyValence_p = \sum_{c}^{C} pos(-\tilde{x}_{pc}) \times \tilde{x}_{pc} \times \tilde{z}_{pc}$$

$$Absolute\ Ratio_p = \left| \frac{PositiveExpectancyValence_{\mathrm{p}}}{NegativeExpectancyValence_{\mathrm{p}}} \right|$$

where x is the ExpectancyValence, z is the ConsequenceFrequency, p is the participant index, and c is the consequence index.

Past-year drinking. We used four items to calculate a measure of drinking in the past year, which have been used extensively in prior research (e.g., Chassin et al., 1991; King et al., 2009). Participants responded to two 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*).[4] 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 using the Percent of Maximum Possible procedure (Cohen et al., 1999) to set items on the same 0–1 scale. Then, we multiplied the drinking frequency and quantity items together for alcohol and liquor, respectively, and then took the sum of these two values.

Covariates. We controlled for age, gender, race, father's education status (as a proxy for socioeconomic status), and impulsivity.[5]

Data analysis plan

We conducted all analyses in R (Version 4.2.2; R Core Team, 2022) using the *brm* function and cumulative family from the brms package (Version 2.18.0; Bürkner, 2017) and *tidyverse* (Version 1.3.1; Wickham et al., 2019).[6]

First, we re-analyzed data from a published study (Logan et al., 2012) using a novel analytic approach (Study 1). Given that these data had already been published (albeit with simple regression models), we decided to use this as an opportunity to attempt to overfit our model with a large number of possibly important predictors. Because of convergence issues with the full model, we iteratively added predictors to see when the model would fail to converge. Predictors were added in order of conceptual importance and likelihood of leading to convergence issues. The results of the final model informed a preregistered replication (Study 2). We fit cross-classified multilevel ordinal regression models to the data to

[4]See Supplemental Materials for slight differences in response options for Study 2.

[5]See the Supplemental Materials for scoring and reliability details for covariates.

[6]We preregistered to use the sratio family; however, based on reviewer feedback we changed the model family to cumulative.

account for and model variability between participants and consequences. We accomplished this by modeling separate random intercepts and slopes nested in participants and consequences. This gave us a fixed effect (e.g., the average effect of consequence frequency on likelihood [or valence] across all participants and consequences) and several random effects (e.g., effects for each specific participant and consequence).

Selection of covariates

We also controlled for several covariates. Specifically, a recent meta-analysis supported the effects of impulsive traits on likelihood (Halvorson et al., 2023). Demographic variables such as gender (Read et al., 2004), race (Banks et al., 2020; Smit et al., 2018), and parental education (Wills et al., 1995) have also been linked to differences in drinking, likelihoods, or valences.

Study 1

We fit models using uninformative priors. All noncategorical variables were *z*-scored for easier model estimation and better comparison of effect sizes. For each model, we examined R-hat convergence diagnostics, estimated Bulk Effective Sample Size, Tail Effective Sample Size, and the posterior predictive distributions to evaluate the convergence of the models.[7]

Study 2

We preregistered our Study 2 analysis plan using priors based on the posterior distributions from Study 1. We set (weakly informative) priors based on a normal distribution with a mean equivalent to the mean of the posterior and a standard deviation of two times the estimation error from Study 1 (see Supplemental Materials for model equations). (Supplemental material appears as an online-only addendum to this article on the journal's website.) We made this decision to double the standard deviation because we did not want to be overly confident or restrictive, and we saw this approach as a way to reflect uncertainty. We hypothesized that significant effects would remain significant in Study 2 and be in the same direction. Given criticisms of significance testing and a lack of agreement in the literature on how to determine a successful replication (Nosek & Errington, 2020), we preregistered that a successful replication would mean that 95% of the posterior distribution draws from Study 2 would be within the range of the 95% credible interval (CI) of Study 1. At the time of preregistration, we liked this idea because it is a more stringent criterion than statistical significance. However, applying this criterion in practice made us realize that this is not the most suitable strategy for replication because (a) it is arguably overly stringent, requiring near-perfect alignment between the studies, which is unrealistic given natural sampling variability; and (b) it can lead to an apparent lack of replication even if estimates are close if CIs are narrower in the replication study. Therefore, we discuss our results in light of this preregistered criterion and the overall strength and direction of effects.

[7]See OSF page for full details.

Results

Descriptive statistics and correlations for both studies are summarized in Supplemental Tables A–D. All models converged and fit the data well.

Replication of fixed effects across studies

Only one (null) effect was replicated based on our preregistered criteria. Although we can be most confident in what we preregistered, we note that (a) most effects were similar in direction and magnitude across studies (Figures 1 and 2), and (b) nearly all significant effects in Study 1 were also significant in Study 2.[8] Therefore, we tentatively conclude that the approach we preregistered may be too stringent of a test of replication. Overall, we are most confident in the significant effects observed across both studies, but we are less confident in the exact strength of the effects. Given this, we are elaborating only on the significant effects in both studies below. Details for all model predictors are shown in Tables 2–5.

Predicting likelihood

Participants reported higher likelihoods when they reported higher consequence frequencies (95% $CI_{Study\ 1}$ = [2.06, 2.43], 95% $CI_{Study\ 2}$ = [1.75, 2.12]). However, the quadratic effect was also significant. This association leveled off (i.e., likelihoods did not continue to increase to the same degree) after a consequence was experienced approximately 4–6 times in the past year (95% $CI_{Study\ 1}$ = [-0.36. -0.22], 95% $CI_{Study\ 2}$ = [-0.29, -0.16]) (Figures 3a and 3c). The sample average frequencies moderated consequence frequency's linear (95% $CI_{Study\ 1}$ = [-0.58, -0.32], 95% $CI_{Study\ 2}$ = [-0.42, -0.11]) and quadratic (95% $CI_{Study\ 1}$ = [0.07, 0.14], 95% $CI_{Study\ 2}$ = [0.04, 0.13]) effects on likelihood, meaning that the as-

[8]As an additional check, we conducted a post hoc analysis by rerunning both models in Study 2 using uninformative priors as we did in Study 1. In general, we found the same effects replicated when using the uninformative priors as they did when using our preregistered priors. Exceptions to this include valence-squared not being significant in Study 2 with uninformative priors and Expectancy Likelihood × Consequence Frequency being significant in Study 2 with uninformative priors (see Supplemental Tables E–H).

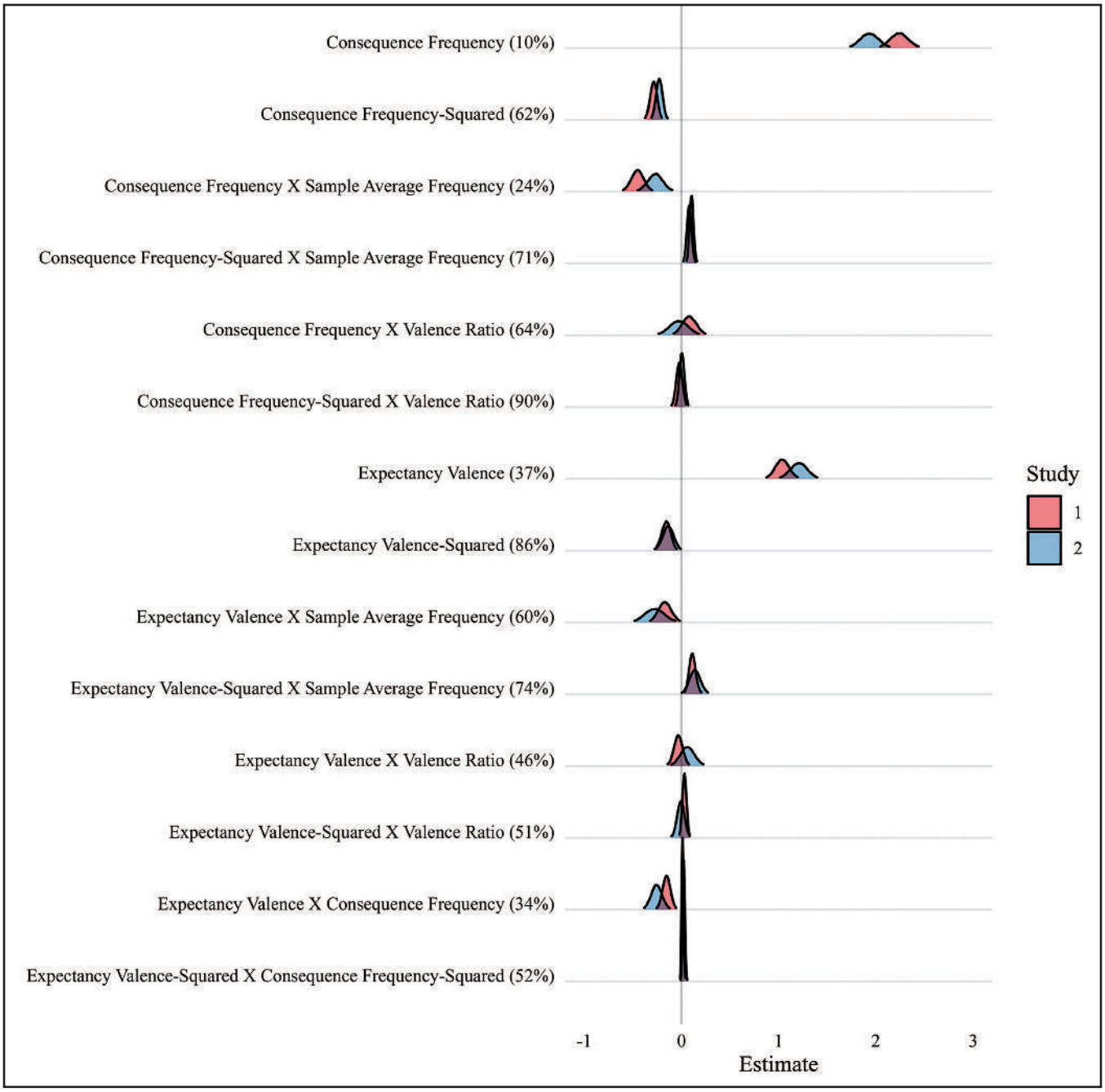

FIGURE 1. Variable estimates for expectancy likelihood. *Note:* This figure displays the estimates from the posterior distributions in both Study 1 and Study 2 for all predictors of interest. In addition, the percentages to the right of each predictor on the left-hand side of the figure show how much of each distribution from Study 1 and Study 2 overlap.

sociation was stronger for consequences that occurred more frequently on average across participants (see Supplemental Figures).

Participants reported higher likelihoods when they reported higher valences (95% $CI_{Study\ 1}$ = [0.90, 1.18], 95% $CI_{Study\ 2}$ = [1.04, 1.38]). However, the quadratic effect was also significant, and this association leveled off when valences were viewed as "not negative or positive" or higher (95% $CI_{Study\ 1}$ = [-0.25, -0.07], 95% $CI_{Study\ 2}$ = [-0.25, -0.03]) (Figures 3b and 3d). The sample average frequencies moderated valence's linear (95% $CI_{Study\ 1}$ = [-0.30, -0.03], 95% $CI_{Study\ 2}$ = [-0.48, -0.07]) and quadratic (95% $CI_{Study\ 1}$ = [0.05, 0.19], 95% $CI_{Study\ 2}$ = [0.03, 0.26]) effects on likelihood, meaning that the association was stronger for consequences that occurred more frequently on average across participants. Consequence frequency also moderated

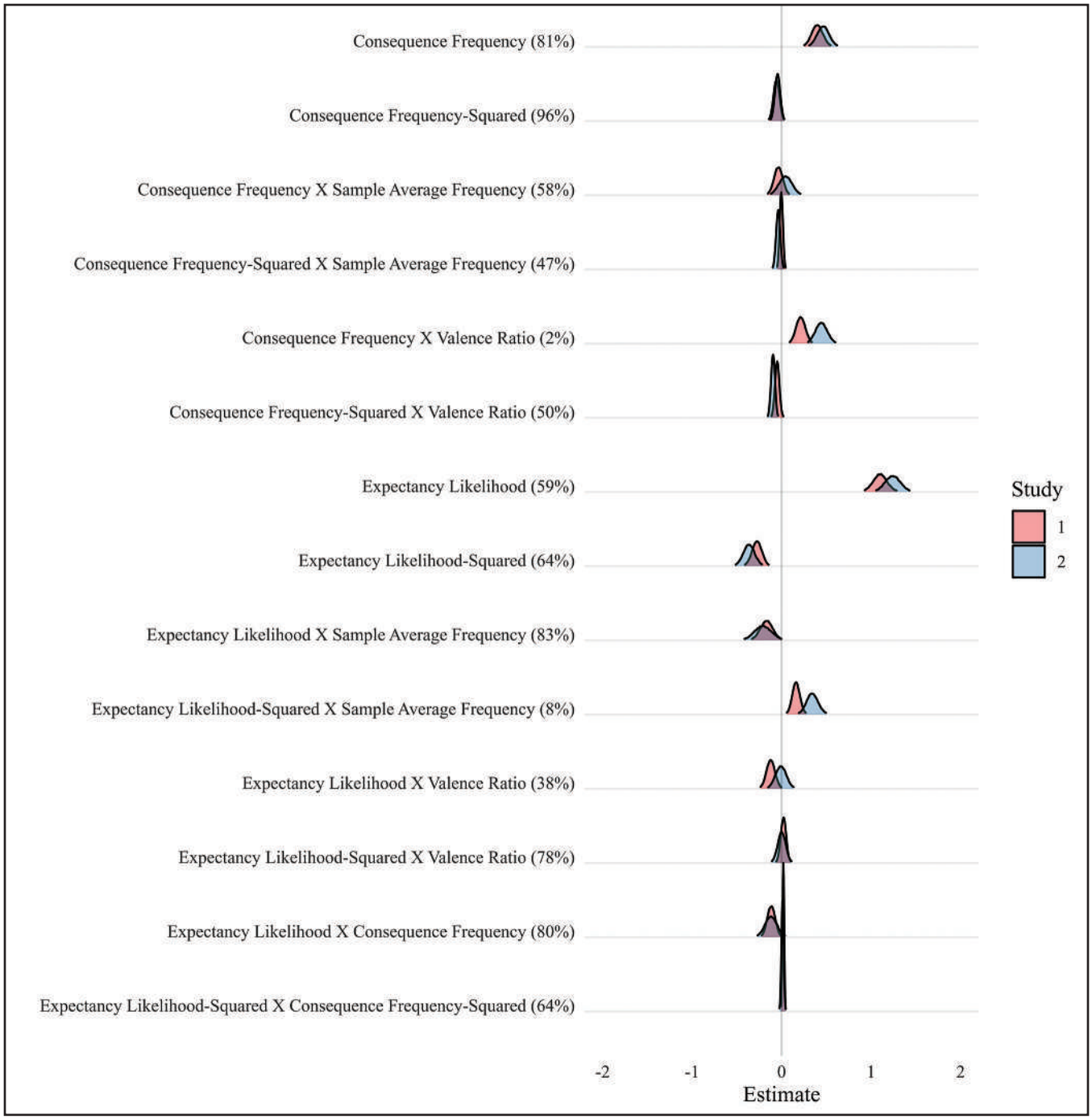

FIGURE 2. Variable estimates for expectancy valence. *Note:* This figure displays the estimates from the posterior distributions in both Study 1 and Study 2 for all predictors of interest. In addition, the percentages to the right of each predictor on the left-hand side of the figure show how much of each distribution from Study 1 and Study 2 overlap.

valence's linear effect on likelihood (95% $CI_{Study\ 1}$ = [-0.23, -0.07], 95% $CI_{Study\ 2}$ = [-0.36, -0.15]), meaning that the association was weaker for consequences that occurred more frequently (see Supplemental Figures).

Moreover, there was significant heterogeneity between people and consequences (Table 3). Although the amount of variability observed across both studies was similar (Figure 3), there was little overlap for specific consequences across both studies. See Figures 4a and 4c, which display select consequences with high, medium, and low consequence frequencies as they compare across the two samples. Rather than seeing similar predictions for the different consequences, it appears that the consequences are more similar within the sample than within the consequence.

Table 2. Fixed effects for expectancy likelihood

Variable	Study 1 Est.	Study 1 Est. error	Study 1 [95% CI]	Study 2 Est.	Study 2 Est. error	Study 2 [95% CI]	
Consequence frequency	2.24	0.09	[2.06, 2.43]	1.94	0.10	[1.75, 2.12]	*
Consequence frequency-squared	-0.29	0.04	[-0.36, -0.22]	-0.23	0.03	[-0.29, -0.16]	*
Consequence Frequency × Sample Average Frequency	-0.45	0.07	[-0.58, -0.32]	-0.27	0.08	[-0.42, -0.11]	*
Consequence Frequency-Squared × Sample Average Frequency	0.10	0.02	[0.07, 0.14]	0.08	0.02	[0.04, 0.13]	*
Consequence Frequency × Ratio of Positive-to-Negative Consequences	0.08	0.07	[-0.06, 0.23]	-0.03	0.10	[-0.22, 0.16]	
Consequence Frequency-Squared × Ratio of Positive-to-Negative Consequences	-0.02	0.03	[-0.08, 0.04]	0.01	0.02	[-0.04, 0.06]	
Valence	1.04	0.07	[0.90, 1.18]	1.21	0.09	[1.04, 1.38]	*
Valence-squared	-0.16	0.05	[-0.25, -0.07]	-0.14	0.06	[-0.25, -0.03]	*
Valence × Sample Average Frequency	-0.17	0.07	[-0.30, -0.03]	-0.27	0.10	[-0.48, -0.07]	*
Valence-Squared × Sample Average Frequency	0.11	0.03	[0.05, 0.19]	0.14	0.06	[0.03, 0.26]	*
Valence × Ratio of Positive to Negative Consequences	-0.03	0.05	[-0.12, 0.06]	0.06	0.07	[-0.08, 0.21]	
Valence-Squared × Ratio of Positive to Negative Consequences	0.03	0.02	[-0.01, 0.07]	-0.01	0.04	[-0.08, 0.07]	
Valence × Consequence Frequency	-0.15	0.04	[-0.23, -0.07]	-0.26	0.06	[-0.36, -0.15]	*
Valence-Squared × Consequence Frequency-Squared	0.01	0.01	[0.00, 0.03]	0.03	0.01	[0.01, 0.04]	†
Sample average frequency	0.57	0.10	[0.37, 0.77]	0.56	0.09	[0.39, 0.73]	*
Ratio of positive to negative consequences	0.08	0.08	[-0.08, 0.23]	-0.04	0.08	[-0.20, 0.12]	
Age	-0.07	0.06	[-0.19, 0.05]	-0.13	0.08	[-0.29, 0.04]	
White race	-0.03	0.07	[-0.16, 0.10]	-0.12	0.09	[-0.29, 0.06]	
Female status	-0.18	0.07	[-0.31, -0.05]	0.03	0.09	[-0.15, 0.21]	†
Father education status	-0.01	0.06	[-0.13, 0.12]	-0.01	0.08	[-0.17, 0.15]	
Past-year alcohol use	-0.26	0.07	[-0.41, -0.12]	-0.18	0.09	[-0.36, 0.00]	†
UPPS (Lack of) Premeditation	0.13	0.07	[-0.01, 0.27]	0.19	0.09	[0.00, 0.37]	
UPPS Negative Urgency	0.25	0.06	[0.13, 0.37]	0.21	0.09	[0.02, 0.39]	*
UPPS Sensation Seeking	0.02	0.07	[-0.11, 0.15]	0.09	0.09	[-0.09, 0.26]	
UPPS (Lack of) Perseverance	-0.12	0.07	[-0.25, 0.01]	-0.03	0.09	[-0.20, 0.15]	

Notes: Est. = estimate; CI = credible interval; UPPS = UPPS Impulsive Behavior Scale. *Indicates that the estimate did not include zero and was in the same direction across both studies; †indicates that the estimate was not consistent across both studies.

Table 3. Random effects for expectancy likelihood

Variable	Study 1 *SD* est.	Study 1 *SD* est. error	Study 1 [95% CI]	Study 2 *SD* est.	Study 2 *SD* est. error	Study 2 [95% CI]	
Consequence frequency (person-level)	1.04	0.06	[0.92, 1.17]	0.95	0.10	[0.76, 1.15]	*
Consequence frequency-squared (person-level)	0.29	0.03	[0.23, 0.34]	0.18	0.04	[0.11, 0.25]	*
Consequence frequency (consequence-level)	0.28	0.05	[0.19, 0.40]	0.24	0.07	[0.12, 0.41]	*
Consequence frequency-squared (consequence-level)	0.03	0.02	[0.00, 0.08]	0.04	0.03	[0.00, 0.09]	
Valence (person-level)	0.55	0.05	[0.46, 0.65]	0.84	0.07	[0.71, 0.98]	*
Valence-squared (person-level)	0.18	0.04	[0.08, 0.25]	0.30	0.06	[0.19, 0.41]	*
Valence (consequence-level)	0.31	0.06	[0.20, 0.43]	0.53	0.08	[0.39, 0.70]	*
Valence-squared (consequence-level)	0.09	0.05	[0.01, 0.21]	0.26	0.06	[0.15, 0.38]	*

Notes: Est. = estimate; CI = credible interval. *Indicates that the estimate did not include zero and was in the same direction across both studies.

Table 4. Fixed effects for expectancy valence

Variable	Study 1 Est.	Study 1 Est. error	Study 1 [95% CI]	Study 2 Est.	Study 2 Est. error	Study 2 [95% CI]	
Consequence frequency	0.40	0.06	[0.28, 0.52]	0.46	0.07	[0.33, 0.60]	*
Consequence frequency-squared	-0.06	0.03	[-0.12, 0.01]	-0.04	0.03	[-0.10, 0.01]	
Consequence Frequency × Sample Average Frequency	-0.04	0.05	[-0.13, 0.06]	0.04	0.07	[-0.10, 0.19]	
Consequence Frequency-Squared × Sample Average Frequency	0.00	0.02	[-0.04, 0.03]	-0.04	0.02	[-0.08, 0.01]	
Consequence Frequency × Ratio of Positive to Negative Consequences	0.21	0.05	[0.11, 0.31]	0.44	0.07	[0.32, 0.58]	*
Consequence Frequency-Squared × Ratio of Positive to Negative Consequences	-0.05	0.02	[-0.10, 0.00]	-0.10	0.02	[-0.14, -0.06]	†
Likelihood	1.10	0.08	[0.94, 1.26]	1.24	0.09	[1.07, 1.41]	*
Likelihood-squared	-0.28	0.06	[-0.39, -0.17]	-0.37	0.06	[-0.49, -0.24]	*
Likelihood × Sample Average Frequency	-0.17	0.07	[-0.31, -0.02]	-0.21	0.10	[-0.40, -0.02]	*
Likelihood-Squared × Sample Average Frequency	0.16	0.04	[0.08, 0.25]	0.34	0.07	[0.21, 0.48]	*
Likelihood × Ratio of Positive to Negative Consequences	-0.12	0.05	[-0.22, -0.03]	-0.01	0.06	[-0.13, 0.11]	†
Likelihood-Squared × Ratio of Positive to Negative Consequences	0.02	0.03	[-0.04, 0.08]	0.00	0.05	[-0.09, 0.09]	
Likelihood × Consequence Frequency	-0.12	0.04	[-0.20, -0.03]	-0.12	0.07	[-0.25, 0.02]	†
Likelihood-Squared × Consequence Frequency-Squared	0.02	0.01	[0.01, 0.03]	0.01	0.01	[-0.01, 0.03]	†
Sample average frequency	1.34	0.22	[0.91, 1.78]	0.93	0.16	[0.62, 1.25]	*
Ratio of positive to negative consequences	0.50	0.06	[0.37, 0.62]	0.39	0.06	[0.26, 0.52]	*
Age	0.02	0.05	[-0.07, 0.12]	-0.01	0.07	[-0.15, 0.12]	
White race	-0.02	0.05	[-0.12, 0.09]	-0.01	0.07	[-0.15, 0.14]	
Female status	0.22	0.05	[0.11, 0.32]	-0.27	0.07	[-0.41, -0.12]	†
Father education status	0.06	0.05	[-0.03, 0.16]	0.12	0.07	[-0.01, 0.26]	
Past-year alcohol use	0.08	0.06	[-0.03, 0.19]	0.24	0.07	[0.10, 0.39]	†
UPPS (Lack of) Premeditation	-0.08	0.06	[-0.19, 0.03]	-0.16	0.08	[-0.32, -0.01]	†
UPPS Negative Urgency	-0.02	0.05	[-0.12, 0.07]	-0.02	0.08	[-0.16, 0.13]	
UPPS Sensation Seeking	-0.01	0.05	[-0.12, 0.09]	-0.17	0.07	[-0.31, -0.02]	†
UPPS (Lack of) Perseverance	-0.07	0.05	[-0.17, 0.03]	-0.14	0.07	[-0.28, 0.01]	

Notes: Est. = estimate; CI = credible interval; UPPS = UPPS Impulsive Behavior Scale. *Indicates that the estimate did not include zero and was in the same direction across both studies; †indicates that the estimate was not consistent across both studies.

Table 5. Random effects for expectancy valence

Variable	Study 1 *SD* est.	Study 1 *SD* est. error	Study 1 [95% CI]	Study 2 *SD* est.	Study 2 *SD* est. error	Study 2 [95% CI]	
Consequence frequency (person-level)	0.22	0.06	[0.11, 0.35]	0.25	0.10	[0.03, 0.45]	*
Consequence frequency-squared (person-level)	0.03	0.02	[0.00, 0.09]	0.04	0.03	[0.00, 0.10]	
Consequence frequency (consequence-level)	0.10	0.05	[0.01, 0.20]	0.13	0.06	[0.02, 0.27]	*
Consequence frequency-squared (consequence-level)	0.02	0.01	[0.00, 0.05]	0.02	0.02	[0.00, 0.07]	
Likelihood (person-level)	0.68	0.06	[0.57, 0.79]	0.66	0.07	[0.53, 0.80]	*
Likelihood-squared (person-level)	0.33	0.04	[0.24, 0.41]	0.30	0.09	[0.10, 0.46]	*
Likelihood (consequence-level)	0.34	0.06	[0.23, 0.46]	0.47	0.08	[0.33, 0.65]	*
Likelihood-squared (consequence-level)	0.20	0.04	[0.14, 0.28]	0.30	0.07	[0.18, 0.44]	*

Notes: Est. = estimate; CI = credible interval. *Indicates that the estimate did not include zero and was in the same direction across both studies.

However, some similarities across samples were observed. Whereas most consequences fluctuated over or under the average likelihood across the full range of consequence frequencies, several were consistent across both samples. For instance, "having told a funny story or joke and made others laugh" and "felt like they needed a drink just after waking up" were both consistently below average across all values of consequence frequency. This means that at equal levels of consequence frequency, these consequences were reported as less likely than average at the same consequence frequency. Alternatively, "gotten into physical fights" and "found a creative solution to a problem" were consistently above average across all values of consequence frequency. Again, this means that at equal levels of consequence frequency, these

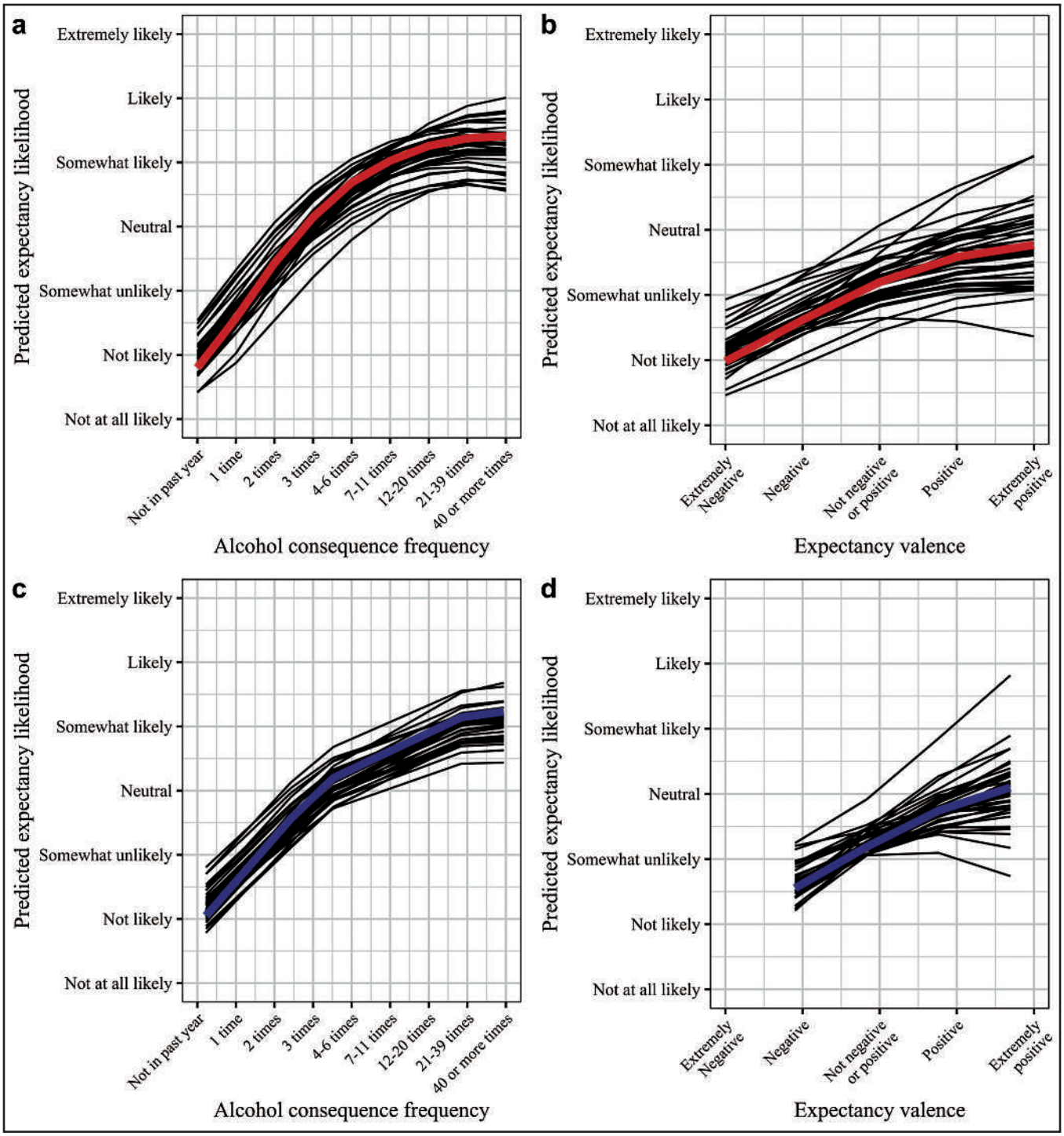

FIGURE 3. Fixed and random effect predictions of expectancy likelihood. *Note:* In panels a and c, the red and blue lines represent the fixed effect for alcohol consequence frequency predicting expectancy likelihood for Study 1 and Study 2, respectively. In panels b and d, the red and blue lines represent the fixed effect for expectancy valence predicting expectancy likelihood for Study 1 and Study 2, respectively. In each plot, there are 39 black lines representing the random effect of each consequence predicting expectancy likelihood.

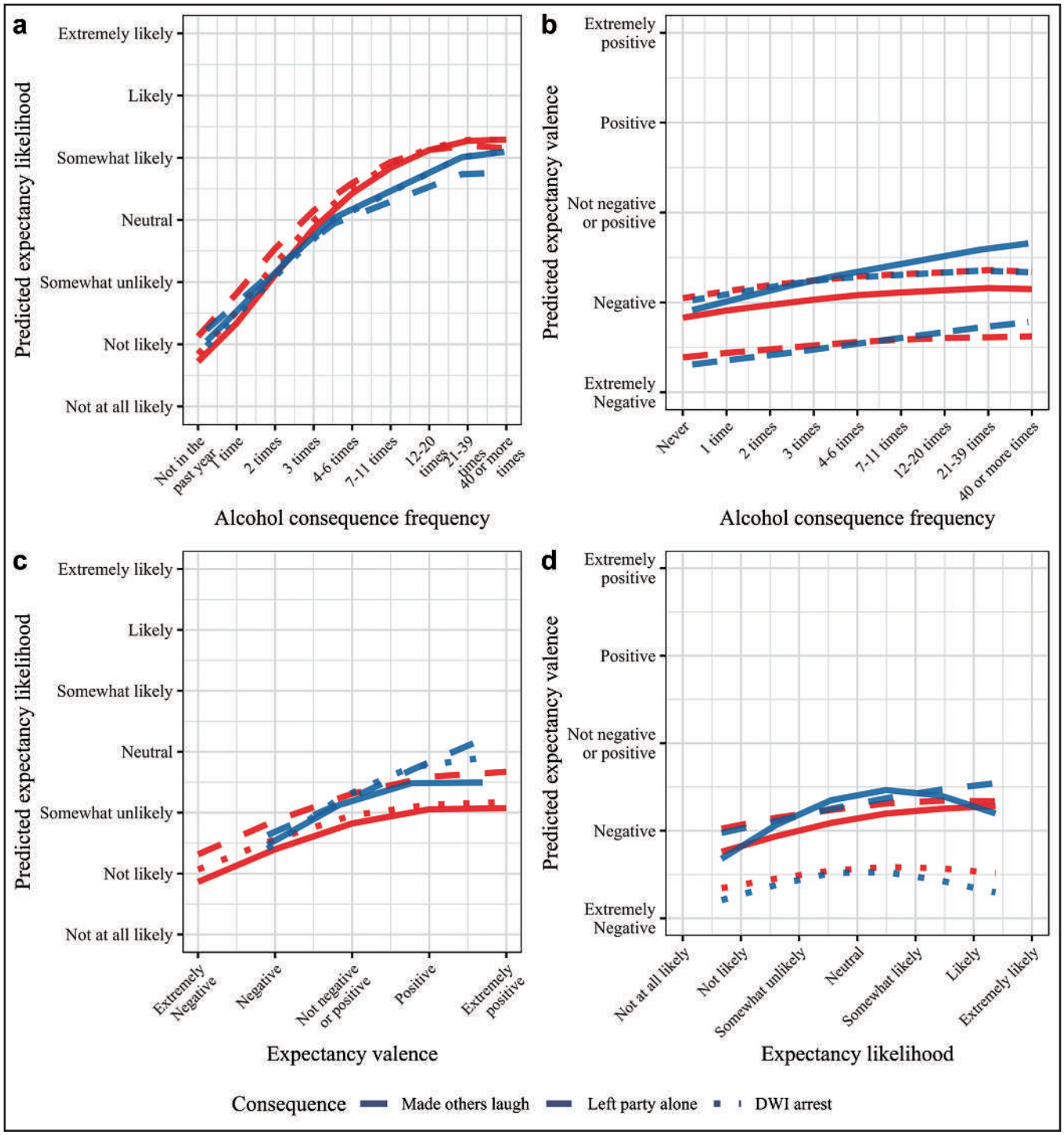

FIGURE 4. Prediction comparison of high, medium, and low endorsed consequences across the sample. *Note:* Red lines represent predictions from Study 1, and blue lines represent predictions from Study 2. Three consequences are displayed: one with a high likelihood (Made others laugh), one with a low likelihood (Driving while intoxicated [DWI] arrest), and one with a likelihood in between (Left party alone). The solid lines represent the consequence "Have you ever told a funny story or joke and made others laugh while drinking?" The dashed lines represent the consequence "Have you ever left a party alone when you had originally planned not to because you had been drinking?" The dotted lines represent the consequence "Have you ever been arrested for drunk driving, driving while intoxicated, or driving under the influence of alcohol?"

consequences were reported as more likely than average at the same consequence frequency.

Predicting valence

Participants reported higher valences when they reported higher consequence frequencies (95% $CI_{Study\ 1}$ = [0.28, 0.52], 95% $CI_{Study\ 2}$ = [0.33, 0.60]; Figures 5a and 5c). The ratio of positive to negative consequences moderated the consequence frequency's linear effect on valence (95% $CI_{Study\ 1}$ = [0.11, 0.31], 95% $CI_{Study\ 2}$ = [0.32, 0.58]), meaning that the association was weaker for participants who reported experiencing more positive consequences than negative consequences.

Participants reported higher valences when they reported higher likelihoods (95% $CI_{Study\ 1}$ = [0.94, 1.26], 95% $CI_{Study\ 2}$ = [1.07, 1.41]). However, the quadratic effect was also significant. This association leveled off (i.e., valences did not continue to increase to the same degree) when a consequence was seen as "neutral" or higher (95% $CI_{Study\ 1}$ = [-0.39, -0.17], 95% $CI_{Study\ 2}$ = [-0.49, -0.24]; Figures 5b and 5d). The sample average frequencies moderated the likelihood's linear (95% $CI_{Study\ 1}$ = [-0.31, -0.02], 95% $CI_{Study\ 2}$ = [-0.40, -0.02]) and quadratic (95% $CI_{Study\ 1}$ = [0.08, 0.25], 95% $CI_{Study\ 2}$ = [0.21, 0.48]) effects on valence, meaning that the association was stronger for consequences that occurred more frequently on average across participants (see Supplemental Figures).

Across studies, there was significant heterogeneity between people and consequences (Table 5). Moreover, there was notable overlap in the predictions across studies when examining specific consequences. See Figures 4b and 4d, which display select consequences with high, medium, and low consequence frequencies as they compare across the two samples. In particular, the predictions for both samples were nearly identical for the medium and low consequence frequency consequences. For the high consequence frequency, patterns were less consistent, with valence predicted to be higher when making others laugh, which was endorsed more frequently in Study 2 compared with Study 1. Moreover, there was a larger quadratic effect for making others laugh in Study 2 compared with Study 1, with valence predicted to be higher when the likelihood was "neutral" but low when the likelihood was "not likely" or "likely" (Figure 4d).

Discussion

In the present study, we sought to model how the decisional process may occur for people when deciding whether to drink. That is, people reflect on the consequences they experienced when they drank in the past, and this information (at least in part) informs the likelihoods and valences of future consequences. By modeling the associations between past consequence frequencies and future likelihoods and valences at the level of the individual consequence, we were able to demonstrate that these associations varied across consequences and people, suggesting that accounting for consequence and person-level characteristics may be important to understanding how college student drinkers form beliefs about their drinking behaviors.

When college students reported higher consequence frequencies, they also reported higher likelihoods for those same consequences. These results align with alcohol expectancy theory (Goldman et al., 1987) and empirical studies that averaged across consequences and expectancies (Lee et al., 2018; Logan et al., 2012). Moreover, we found that when participants reported higher consequence frequencies, they also reported higher valences, replicating our prior work where we averaged across consequences (Logan et al., 2012). This aligns with other work demonstrating that people evaluate consequences they have experienced as more positive (Leavens et al., 2017). This suggests that people may view many consequences of alcohol use more negatively before actually experiencing them, and the experience of even relatively aversive consequences leads to more positive (potentially realistic) perceptions. At the same time, the impact of specific consequences may vary because of the nature of the consequence itself or the context of the consequence. For example, "problems with my friends" could be capturing a minor disagreement or a major row with friends. Similarly, "missing class" could be capturing a person missing out on participation points or missing their midterm. Future research should seek to better understand how and when the experience of consequences shapes people's perceptions of them.

We also observed associations between expectancy characteristics (e.g., likelihoods and valences) such that higher likelihoods were associated with higher valences and vice versa, replicating our prior findings (Logan et al., 2012). Evaluating how likelihoods and valences are related is less studied in the literature. College student drinkers may have higher future likelihoods when they believe a consequence will have a higher valence because likelihood captures not only what they expect to happen, but also what they desire to happen (i.e., the most positive consequences). One study found that the likelihood of consequences predicts experiencing these consequences that night even while controlling for drinking (Lee et al., 2020). These results highlight that people may have some control over the consequences they experience, almost as if setting the intention or desire to have a certain consequence makes it more likely.

Alternatively, cognitive dissonance (Festinger, 1962) may also play a role. Cognitive dissonance is a state in which people have a belief about something, and their actions are currently in conflict with this belief (Festinger, 1962). For example, people may have a belief that engaging in heavy drinking increases the likelihood that they experience negative consequences, and yet they engage in heavy drinking. To reduce this discomfort, people can either change their

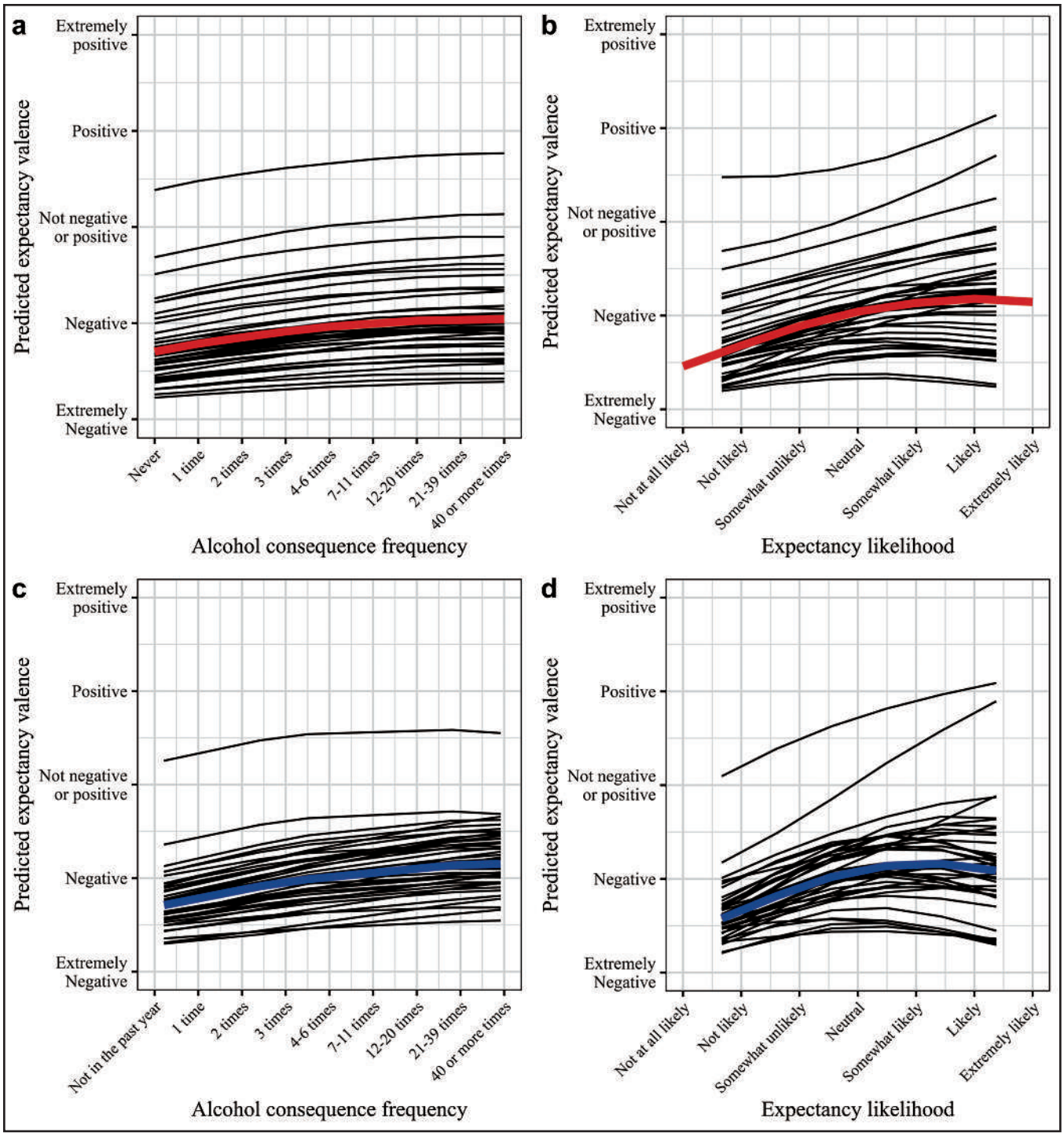

FIGURE 5. Fixed and random effect predictions of expectancy valence. *Note:* In panels a and c, the red and blue lines represent the fixed effect for alcohol consequence frequency predicting expectancy valence for Study 1 and Study 2, respectively. In panels b and d, the red and blue lines represent the fixed effect for expectancy likelihood predicting expectancy valence for Study 1 and Study 2, respectively. In each plot, there are 39 black lines representing the random effect of each consequence predicting expectancy valence.

actions to align with their beliefs or change their beliefs. For example, people may believe that a consequence has a high likelihood of happening the next time they drink. If they decide to drink anyway, they may change their belief or rationalize that the consequence will not be very negative when they experience it. The reverse could also be the case: When a consequence is expected to be very negative, a rationalization may be made that the consequence does not have a high likelihood.

Research has demonstrated a clear fixed effect of consequence frequencies on expectancies (likelihoods and valences). However, we still do not understand how these processes unfold over time for specific consequences. For instance, Lee et al. (2018) found that likelihoods increased following consequences from the prior night of drinking. However, future work should explore whether these increases are sustained over multiple timescales. For instance, an ecological momentary assessment study might see if consequences from one day to the next lead to the same increase in likelihood or valence for the next time a person drinks while controlling for prior experience. Consequences experienced more recently may have a larger impact on likelihoods and valences rather than the absolute frequency of consequences. Alternatively, future work could also explore whether past consequence frequencies reach a point where likelihoods and valences no longer change but remain stable.

Accounting for variation

By modeling the association between consequence frequencies and likelihoods and valences at the consequence level, we were able to model differences in these associations across people and consequences. This approach was particularly insightful when modeling the association between consequence frequency and likelihood. Our analysis revealed (as expected) substantial variation in intercepts, indicating diverse average likelihood ratings across different alcohol consequences. However, to our surprise, we observed minimal variation in slopes, suggesting a consistent positive association between consequence frequency and likelihood across consequences. This pattern implies that regardless of whether a consequence is generally perceived as likely, increased consequence frequency is associated with higher likelihood ratings. For instance, "finding a creative solution to a problem" was consistently rated as more likely than "missing work or class," but the likelihood of both increased as consequence frequency increased.

Future work should model this process closer to when the experience/evaluation process occurs, such as in an ecological momentary assessment design, and follow people for a series of weeks or in monthly surveys over a year. Surveys could assess likelihoods and valences of commonly experienced consequences (e.g., feeling buzzed, being hungover, feeling more confident) before drinking and follow up with what consequences were experienced and what the valence of those consequences were after drinking. We could then compare likelihoods and valences at the start of the study with the end of the study to see how much change in likelihoods or valences occurred based on the frequency of reported consequences. In addition, contextual information could be collected to determine if certain settings (e.g., bar, house party, home) had specific likelihoods or valences associated with drinking in these locations.

Moderators

Our findings have important implications for understanding consequence-specific likelihoods and valences. We observed that consequences with higher frequencies in the sample were also seen as more likely and more positive and (importantly) showed little evidence of leveling off (e.g., curvilinear). This means that at higher levels of consequence frequency or valence, likelihoods continued to increase rather than remain stable. In prior work, when young adult drinkers believed that their friends would drink more on a given day, participants were also more likely to drink and drink more (Lewis et al., 2020). Moreover, young adults who had higher reports of "fear of missing out" were predicted to experience more blackouts following their peak number of drinks (Lewis et al., 2023). These results highlight the social influences of young adult drinking behaviors. In the present study, it may be the case that peers discuss their drinking experiences and talk about them frequently and positively.

A qualitative study of adolescents found that a majority of participants were exposed to substance use on social media posts, and it was always portrayed positively (Hashemi & Vogel, 2024). This may occur because the consequences were positive or they want to make light of the situation (e.g., don't want to admit that they experienced something negative). These conversations may then influence how other people view these consequences, seeing them as more likely and more positive. We also observed that participants perceived consequences more positively when consequence frequencies were higher and when they saw the consequences as more likely, but these effects were even greater for participants who experienced more positive versus negative consequences compared with others. This finding highlights the possibility of a positivity bias (Hoorens, 2014) (e.g., rose-colored beer goggles; Logan et al., 2012), with some college students who drink being more likely to see any given consequence more positively if they tend to experience more positive consequences on average compared with someone else.

Limitations

The main limitation of this study is that the data are cross-sectional; thus, the results are susceptible to recall bias,

which is notable since retrospective reports for positive and negative consequences have been shown to differ (Merrill et al., 2020). Moreover, both samples opted in to participating and endorsed low rates of consequences; thus, this work may not generalize to other drinkers who experience more consequences. In addition, the consequences we assessed were primarily negative and severe (e.g., getting arrested). Moreover, because of researcher error, 14 consequences were excluded from the data set; thus, none of the consequence measures included all items. Future work examining consequence-level effects should assess less severe and more frequently occurring consequences and seek to explore these associations in samples of heavier drinkers using longitudinal methodologies. Future work should also evaluate consequence valence in addition to expectancy valence. These modifications would allow for a greater understanding of the variation of the observed associations based on the population and the consequences used.

Intervention implications

Interventions such as expectancy challenge interventions have shown at least temporary effects of increasing negative and lowering positive expectancies (see Scott-Sheldon et al., 2012, for review). However, the effects are often not maintained. Although one advantage of current approaches is the ability to be widely disseminated, one downside is that they are not tailored to the individual. Our findings suggest that tailoring may improve the outcomes of these interventions because people have different associations between their experiences and expectancies; a standardized intervention will likely not be equally effective. Treatments that aim to target people's beliefs about drinking would benefit from taking a more individualized approach. Moreover, clinicians may seek to explore what expectancies a patient rates as most positive and identify ways that they can experience these consequences safely while incorporating protective behavioral strategies to reduce the likelihood of experiencing negative consequences. However, these findings are preliminary and need to be corroborated in clinical populations because of the low-risk nature of the present sample. Moreover, future research should work to understand what specific consequences may be more amenable to interventions and for whom.

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Supplemental Materials

Methods and Materials: Additional Details

Measures

Past Year Drinking

For Study 2, response options for the drinking frequency items ranged from "1" (Not at all) to "7" (Every day), and response options for the drinking quantity items ranged on a continuous scale from 0-30.

Impulsivity

We used 12 items in the urgency subscale, the tendency to act rashly when experiencing negative emotions (Cronbach's α = 0.88 and 0.87 for Study 1 and Study 2, respectively). We used 11 items in the (lack of) premeditation subscale, the ability to think before acting (Cronbach's α = 0.86 and 0.86 for Study 1 and Study 2, respectively). We used 12 items in the sensation-seeking subscale, the tendency to pursue excitement (α = 0.91 and 0.83 for Study 1 and Study 2, respectively). We used 10 items in the (lack of) perseverance subscale, the ability to sustain effort (α = 0.85 and 0.86 for Study 1 and Study 2, respectively). Responses ranged from "0" (Not at all) to "4" (Very much) for Study 1 and from "0" (Strongly Disagree) to "4" (Strongly Agree). After reverse scoring items 22, 37, and 45, we took the mean across all items of each subscale.

Demographics

We effect coded gender as female = +1 and male/other = -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 white = 1 and non-white = -1. Father education status ranged from "0" (8th grade or less) to "10" (Professional degree).

Analysis Plan

Valence

We calculated the frequencies of endorsing researcher-defined negative expectancies by summing the number of participants who reported a given expectancy as 'Extremely negative' or 'Negative' and dividing by the total number of responses. We then multiplied this number by 100 to get an overall percentage of participants who perceived a given future consequence to be negative. Similarly, we calculated the frequencies of endorsing researcher-defined positive expectancies by summing the number of participants who reported a given expectancy as 'Positive' or 'Extremely positive' and dividing by the total number of responses. We then multiplied this number by 100 to get an overall percentage of participants who perceived a given future consequence as positive.

Study 2

Expectancy Likelihood Model:

$$explik\_ord_{ij} = (\beta_0 + u_{0i} + u_{0j}) + (\beta_1 + u_{1i} + u_{1j}) * aconfreqz_{ij} + (\beta_2 + u_{2i} + u_{2j}) * expvalz_{ij} + (\beta_3 + u_{3i} + u_{3j}) * (aconfreqz_{ij})^2 + (\beta_4 + u_{4i} + u_{4j}) * (expvalz_{ij})^2 + \beta_5 *$$

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$dem\_agez + \beta_6 * gender + \beta_7 * race + \beta_8 * feduz + \beta_9 * past\_yr\_alcz + \beta_{10} * upps\_nopremedz + \beta_{11} * upps\_negurgz + \beta_{12} * upps\_senssekz + \beta_{13} * upps\_nopersevz + + \beta_{14} * valratioz + \beta_{15} * aconfreqz\_avgz + \beta_{16} * (aconfreqz_{ij} * expvalz_{ij}) + \beta_{17} * (aconfreqz_{ij} * valratioz) + \beta_{18} * (aconfreqz_{ij} * aconfreqz\_avgz) + \beta_{19} * (expvalz_{ij} * valratioz) + \beta_{20} * (expvalz_{ij} * aconfreqz\_avgz) + \beta_{21} * ((aconfreqz_{ij})^2 * (expvalz_{ij})^2) + \beta_{22} * ((aconfreqz_{ij})^2 * valratioz) + \beta_{23} * ((aconfreqz_{ij})^2 * aconfreqz\_avgz) + \beta_{24} * ((expvalz_{ij})^2 * valratioz) + \beta_{25} * ((expvalz_{ij})^2 * aconfreqz\_avgz) + \in_{ij}$

Priors:

$$\beta_1 \sim N(2.24, 0.18)$$
$$\beta_2 \sim N(1.04, 0.14)$$
$$\beta_3 \sim N(-0.29, 0.08)$$
$$\beta_4 \sim N(-0.16, 0.10)$$
$$\beta_5 \sim N(0, 1)$$
$$\beta_6 \sim N(0, 1)$$
$$\beta_7 \sim N(0, 1)$$
$$\beta_8 \sim N(0, 1)$$
$$\beta_9 \sim N(0, 1)$$
$$\beta_{10} \sim N(0, 1)$$
$$\beta_{11} \sim N(0, 1)$$
$$\beta_{12} \sim N(0, 1)$$
$$\beta_{13} \sim N(0, 1)$$
$$\beta_{14} \sim N(0.08, 0.16)$$
$$\beta_{15} \sim N(0.57, 0.20)$$

Study 2

Expectancy Valence Model:

$expval\_ord_{ij} = (\beta_0 + u_{0i} + u_{0j}) + (\beta_1 + u_{1i} + u_{1j}) * aconfreqz_{ij} + (\beta_2 + u_{2i} + u_{2j}) * explikz_{ij} + (\beta_3 + u_{3i} + u_{3j}) * (aconfreqz_{ij})^2 + (\beta_4 + u_{4i} + u_{4j}) * (explikz_{ij})^2 + \beta_5 * dem\_agez + \beta_6 * gender + \beta_7 * race + \beta_8 * feduz + \beta_9 * past\_yr\_alcz + \beta_{10} * upps\_nopremedz + \beta_{11} * upps\_negurgz + \beta_{12} * upps\_senssekz + \beta_{13} * upps\_nopersevz + + \beta_{14} * valratioz + \beta_{15} * aconfreqz\_avgz + \beta_{16} * (aconfreqz_{ij} * explikz_{ij}) + \beta_{17} * (aconfreqz_{ij} * valratioz) + \beta_{18} * (aconfreqz_{ij} * aconfreqz\_avgz) + \beta_{19} * (explikz_{ij} * valratioz) + \beta_{20} * (explikz_{ij} * aconfreqz\_avgz) + \beta_{21} * ((aconfreqz_{ij})^2 * (explikz_{ij})^2) + \beta_{22} * ((aconfreqz_{ij})^2 * valratioz) + \beta_{23} * ((aconfreqz_{ij})^2 * aconfreqz\_avgz) + \beta_{24} * ((explikz_{ij})^2 * valratioz) + \beta_{25} * ((explikz_{ij})^2 * aconfreqz\_avgz) + \in_{ij}$

Priors:

$$\beta_1 \sim N(0.40, 0.12)$$
$$\beta_2 \sim N(1.10, 0.16)$$
$$\beta_3 \sim N(-0.06, 0.06)$$
$$\beta_4 \sim N(-0.28, 0.12)$$

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$$\beta_5 \sim N(0,1)$$
$$\beta_6 \sim N(0,1)$$
$$\beta_7 \sim N(0,1)$$
$$\beta_8 \sim N(0,1)$$
$$\beta_9 \sim N(0,1)$$
$$\beta_{10} \sim N(0,1)$$
$$\beta_{11} \sim N(0,1)$$
$$\beta_{12} \sim N(0,1)$$
$$\beta_{13} \sim N(0,1)$$
$$\beta_{14} \sim N(0.50, 0.12)$$
$$\beta_{15} \sim N(1.34, 0.44)$$

Results

Expectancy Valence Descriptive Statistics

When examining the frequencies of reported valence across negative consequences, we found that in Study 1, over 75% of participants rated all these consequences as negative except 'eating a large amount of food late at night' because of their drinking, with only 44% reporting this as being negative if it were to occur. This differs from participants in Study 2, when less than 75% of participants evaluated consequences negatively for five consequences. These included losing memories from the night before (64%), eating a large amount of food late at night (43%), being embarrassed physically (73%), leaving a party with people that they did not know (69%), and leaving a party (73%).

When examining the frequencies of reported valence across positive consequences, we found that some consequences were indeed seen as positive by a majority of the sample, such as telling a funny story or joke and making others laugh (84% and 85%) and finding it easy to make conversations (75% and 77%). Others were mostly seen as positive but with some variability, such as feeling especially confident others found them attractive (53% and 58%), finding a creative solution to a problem (50% and 62%), feeling as though they had enough energy to stay out all night (36% and 52%), approaching someone they would not have normally spoken to (54% and 54%), and standing up for a friend (54% and 47%). However, other positive consequences were not seen as particularly positive by most of the sample, such as revealing a personal feeling or emotion (35% and 17%) and feeling fearless in a frightening situation (7% and 9%).

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Supplemental Table A: Descriptive Statistics

Variable	Study 1 Mean (SD)	Study 2 Mean (SD)
Consequence Frequency	0.97 (1.75)	0.68 (1.59)
Expectancy Valence	0.89 (1.09)	0.99 (1.17)
Expectancy Likelihood	1.46 (1.80)	1.84 (1.91)
Valence Ratio	1.74 (2.97)	2.90 (5.39)
Past Year Beer/Wine Quantity	0.49 (0.24)	0.44 (0.26)
Past Year Beer/Wine Frequency	0.48 (0.25)	0.17 (0.15)
Past Year Hard Liquor Quantity	0.38 (0.25)	0.42 (0.27)
Past Year Hard Liquor Frequency	0.37 (0.25)	0.23 (0.16)

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Supplemental Table B: Expectancy Likelihood Items

Item
I would drive a car when I knew I would have too much to drink to drive safely.
I would have a headache (hangover) in the morning after I had been drinking.
I would smoke cigarettes because I was drinking.
I would approach a person that I probably wouldn't have spoken to otherwise.
I would feel very sick to my stomach or throw up after drinking.
I would show up late for work or school because of drinking, a hangover, or an illness caused by drinking.
I would take illegal drugs.
I would tell a funny story or joke and make others laugh.
I would miss work or classes at school because of drinking, a hangover, or an illness caused by drinking.
I would get into physical fights when drinking.
I would get embarrassed physically (e.g., fall in public) because of my drinking.
I would reveal a personal feeling or emotion that I had previously kept secret.
I would get into trouble at work or school because of drinking.
I would get fired from a job or suspended or expelled from school because of my drinking.
I would get embarrassed socially (e.g., reveal personal information) because of my drinking.
I would feel like I have enough energy to stay out all night partying or dancing.
I would damage property, set off a false alarm, or other things like that.
My boyfriend girlfriend (or spouse), parent(s), or other near relative would complain to me about my drinking.
I would urinate on myself.
I would find it easy to make conversation in a situation in which I would usually have stayed quiet.
My drinking would create problems between me and my boyfriend girlfriend (or spouse) or another near relative.
I would lose friends (including boyfriends or girlfriends) because of my drinking.
I would unintentionally wake up somewhere other than my own bed after a night drinking.
I would stand up for a friend or confront someone who is in the wrong.
I would neglect my obligations, my family, my work, or school work for two or more days in a row.
I would find myself in a sexual situation I will later regret.
I would get kicked out of a party because of drinking and/or other behavior.
I would find myself in a frightening situation and feel surprisingly fearless.
I would receive a lower grade on an exam or paper than I should have.
I would get arrested for drunk driving, driving while intoxicated, or driving under the influence of alcohol.
I would leave a party with people I do not know.
I would find a creative solution to a problem I might otherwise have had difficulty solving.
I would get arrested, even for a few hours, because of any drunken behaviors.
I would awaken in the morning after a good bit of drinking and find that I cannot remember a part of the evening before.
I would leave a party alone when I had originally planned not to.
I would feel especially confident that other people find me attractive.
I would have the shakes after stopping or cutting down on drinking
I would feel like I need a drink just after I get up (that is, before breakfast).
I would eat a large amount of food late at night.

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Supplemental Table C: Zero-order correlations for Study 1

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Consequence Frequency	1														
2. Consequence Frequency-Squared	0.86	1													
3. Expectancy Valence	0.47	0.36	1												
4. Expectancy Valence-Squared	0.37	0.33	0.72	1											
5. Expectancy Likelihood	0.65	0.49	0.62	0.45	1										
6. Expectancy Likelihood-Squared	0.55	0.52	0.48	0.49	0.76	1									
7. Sample Average Frequency	0.58	0.44	0.60	0.48	0.60	0.48	1								
8. Valence Ratio	-0.08	-0.05	0.10	0.06	0.02	0.02	0.00	1							
9. Age	-0.01	0.01	-0.01	0.00	-0.02	-0.02	0.00	0.03	1						
10. Father Ed. Status	0.05	0.04	0.02	0.00	0.02	0.00	0.00	-0.06	-0.07	1					
11. Past Year Alcohol Use	0.36	0.31	0.07	0.02	0.11	0.06	0.00	-0.22	-0.04	0.12	1				
12. UPPS-(Lack of) Premeditation	-0.11	-0.11	-0.06	-0.01	-0.05	-0.02	0.00	0.05	0.04	-0.06	-0.22	1			
13. UPPS-Negative Urgency	0.07	0.06	0.04	0.03	0.10	0.07	0.00	-0.03	-0.08	-0.06	0.07	-0.14	1		
14. UPPS-Sensation Seeking	0.08	0.07	0.05	0.04	0.03	0.03	0.00	0.05	0.01	0.10	0.18	-0.22	0.12	1	
15. UPPS-(Lack of) Perseverance	-0.04	-0.03	-0.06	0.00	-0.07	-0.01	0.00	-0.04	0.08	0.03	-0.06	0.40	-0.05	0.09	1

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Supplemental Table D: Zero-order correlations for Study 2

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Consequence Frequency	1														
2. Consequence Frequency-Squared	0.91	1													
3. Expectancy Valence	0.50	0.40	1												
4. Expectancy Valence-Squared	0.39	0.35	0.66	1											
5. Expectancy Likelihood	0.60	0.48	0.63	0.41	1										
6. Expectancy Likelihood-Squared	0.48	0.47	0.35	0.44	0.55	1									
7. Sample Average Frequency	0.52	0.44	0.57	0.44	0.56	0.41	1								
8. Valence Ratio	0.01	0.01	0.09	0.08	0.01	0.03	0.01	1							
9. Age	0.01	0.02	0.00	-0.01	-0.04	-0.01	0.02	-0.04	1						
10. Father Ed. Status	0.07	0.08	0.05	0.00	0.02	-0.02	-0.01	0.03	-0.02	1					
11. Past Year Alcohol Use	0.29	0.26	0.12	0.05	0.11	0.02	-0.04	0.02	-0.01	0.12	1				
12. UPPS-(Lack of) Premeditation	-0.11	-0.09	-0.07	-0.02	-0.04	0.01	0.00	0.00	0.07	-0.02	-0.18	1			
13. UPPS-Negative Urgency	0.10	0.10	0.06	0.02	0.11	0.02	0.00	-0.02	0.07	-0.01	0.14	-0.33	1		
14. UPPS-Sensation Seeking	0.09	0.09	0.00	0.03	0.03	0.04	-0.02	-0.03	-0.02	0.00	0.25	-0.20	0.12	1	
15. UPPS-(Lack of) Perseverance	0.00	0.00	-0.08	0.02	-0.07	0.04	-0.03	0.04	-0.02	-0.07	0.07	0.18	-0.23	0.11	1

Schultz, M. E., Dora, J., & King, K. M. (2024). The influence of drinking consequences on alcohol expectancy likelihoods and valences: An item-level multilevel approach. *Journal of Studies on Alcohol and Drugs, 86*(4), 611–625. https://doi.org/10.15288/jsad.24-00035

Tables E-H using Uninformative Priors in Study 2

Supplemental Table E: Fixed Effects for Expectancy Likelihood

	Study 1			Study 2			
Variable	Est.	Est. Error	95% CI	Est.	Est. Error	95% CI	
Consequence Frequency	2.24	0.09	[2.06, 2.43]	1.72	0.11	[1.50, 1.94]	*
Consequence Frequency-Squared	-0.29	0.04	[-0.36, -0.22]	-0.17	0.04	[-0.24, -0.10]	*
Consequence Frequency X Sample Average Frequency	-0.45	0.07	[-0.58, -0.32]	-0.22	0.08	[-0.38, -0.07]	*
Consequence Frequency-Squared X Sample Average Frequency	0.10	0.02	[0.07, 0.14]	0.06	0.02	[0.02, 0.11]	*
Consequence Frequency X Ratio of Positive-to-Negative Consequences	0.08	0.07	[-0.06, 0.23]	-0.04	0.09	[-0.21, 0.14]	
Consequence Frequency-Squared X Ratio of Positive-to-Negative Consequences	-0.02	0.03	[-0.08, 0.04]	0.01	0.02	[-0.03, 0.05]	
Valence	1.04	0.07	[0.90, 1.18]	1.32	0.11	[1.09, 1.54]	*
Valence-Squared	-0.16	0.05	[-0.25, -0.07]	-0.10	0.07	[-0.24, 0.03]	†
Valence X Sample Average Frequency	-0.17	0.07	[-0.30, -0.03]	-0.31	0.10	[-0.51, -0.10]	*
Valence-Squared X Sample Average Frequency	0.11	0.03	[0.05, 0.19]	0.12	0.06	[0.01, 0.23]	*
Valence X Ratio of Positive-to-Negative Consequences	-0.03	0.05	[-0.12, 0.06]	0.07	0.07	[-0.07, 0.21]	
Valence-Squared X Ratio of Positive-to-Negative Consequences	0.03	0.02	[-0.01, 0.07]	0.00	0.04	[-0.07, 0.07]	
Valence X Consequence Frequency	-0.15	0.04	[-0.23, -0.07]	-0.24	0.05	[-0.34, -0.13]	*
Valence-Squared X Consequence Frequency-Squared	0.01	0.01	[0.00, 0.03]	0.02	0.01	[0.00, 0.04]	
Sample Average Frequency	0.57	0.10	[0.37, 0.77]	0.56	0.09	[0.38, 0.75]	*
Ratio of Positive-to-Negative Consequences	0.08	0.08	[-0.08, 0.23]	-0.11	0.10	[-0.30, 0.07]	
Age	-0.07	0.06	[-0.19, 0.05]	-0.09	0.08	[-0.26, 0.07]	
white Race	-0.03	0.07	[-0.16, 0.10]	-0.09	0.09	[-0.26, 0.09]	
Female Status	-0.18	0.07	[-0.31, -0.05]	0.00	0.09	[-0.18, 0.18]	†
Father Ed. Status	-0.01	0.06	[-0.13, 0.12]	-0.03	0.09	[-0.20, 0.13]	
Past Year Alcohol Use	-0.26	0.07	[-0.41, -0.12]	-0.28	0.09	[-0.47, -0.10]	*
UPPS-(Lack of) Premeditation	0.13	0.07	[-0.01, 0.27]	0.09	0.09	[-0.09, 0.28]	
UPPS-Negative Urgency	0.25	0.06	[0.13, 0.37]	0.20	0.09	[0.02, 0.38]	*
UPPS-Sensation Seeking	0.02	0.07	[-0.11, 0.15]	0.03	0.09	[-0.14, 0.21]	

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	Study 1			Study 2		
Variable	Est.	Est. Error	95% CI	Est.	Est. Error	95% CI
UPPS-(Lack of) Perseverance	-0.12	0.07	[-0.25, 0.01]	0.00	0.09	[-0.17, 0.18]

Notes: Est. = estimate; CI = credible interval; UPPS = UPPS Impulsive Behavior Scale.
***** indicates that the estimate did not include zero and was in the same direction across both studies. † indicates that the estimate was not consistent across both studies.

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Supplemental Table F: Random Effects for Expectancy Likelihood

	Study 1			Study 2			
Variable	**SD est.**	**SD est. error**	**95% CI**	**SD est.**	**SD est. error**	**95% CI**	
Consequence Frequency (Person-Level)	1.04	0.06	[0.92, 1.17]	0.91	0.10	[0.72, 1.11]	*
Consequence Frequency-Squared (Person-Level)	0.29	0.03	[0.23, 0.34]	0.16	0.03	[0.09, 0.22]	*
Consequence Frequency (Consequence-Level)	0.28	0.05	[0.19, 0.40]	0.26	0.08	[0.13, 0.43]	*
Consequence Frequency-Squared (Consequence-Level)	0.03	0.02	[0.00, 0.08]	0.04	0.03	[0.00, 0.10]	
Expectancy Valence (Person-Level)	0.55	0.05	[0.46, 0.65]	0.87	0.07	[0.75, 1.01]	*
Expectancy Valence-Squared (Person-Level)	0.18	0.04	[0.08, 0.25]	0.31	0.06	[0.20, 0.42]	*
Expectancy Valence (Consequence-Level)	0.31	0.06	[0.20, 0.43]	0.53	0.08	[0.39, 0.69]	*
Expectancy Valence-Squared (Consequence-Level)	0.09	0.05	[0.01, 0.21]	0.25	0.06	[0.16, 0.37]	*

Notes: SD = Standard Deviation; est. = estimate; CI = credible interval.
*Indicates that the estimate did not include zero and was in the same direction across both studies.

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Supplemental Table G: Fixed Effects for Expectancy Valence

	Study 1			Study 2			
Variable	Est.	Est. Error	95% CI	Est.	Est. Error	95% CI	
Consequence Frequency	0.40	0.06	[0.28, 0.52]	0.45	0.09	[0.28, 0.62]	*
Consequence Frequency-Squared	-0.06	0.03	[- 0.12, 0.01]	-0.04	0.03	[- 0.11, 0.02]	
Consequence Frequency X Sample Average Frequency	-0.04	0.05	[- 0.13, 0.06]	0.05	0.07	[- 0.09, 0.18]	
Consequence Frequency-Squared X Sample Average Frequency	0.00	0.02	[- 0.04, 0.03]	-0.03	0.02	[- 0.07, 0.01]	
Consequence Frequency X Valence Ratio	0.21	0.05	[0.11, 0.31]	0.42	0.06	[0.29, 0.54]	*
Consequence Frequency-Squared X Valence Ratio	-0.05	0.02	[- 0.10, 0.00]	-0.09	0.02	[- 0.12, - 0.05]	†
Expectancy Likelihood	1.10	0.08	[0.94, 1.26]	1.34	0.10	[1.14, 1.55]	*
Expectancy Likelihood-Squared	-0.28	0.06	[- 0.39, - 0.17]	-0.38	0.07	[- 0.53, - 0.24]	*
Expectancy Likelihood X Sample Average Frequency	-0.17	0.07	[- 0.31, - 0.02]	-0.20	0.10	[- 0.38, - 0.01]	*
Expectancy Likelihood-Squared X Sample Average Frequency	0.16	0.04	[0.08, 0.25]	0.31	0.06	[0.20, 0.43]	*
Expectancy Likelihood X Valence Ratio	-0.12	0.05	[- 0.22, - 0.03]	-0.02	0.06	[- 0.13, 0.10]	†
Expectancy Likelihood-Squared X Valence Ratio	0.02	0.03	[- 0.04, 0.08]	0.01	0.05	[- 0.08, 0.10]	
Expectancy Likelihood X Consequence Frequency	-0.12	0.04	[- 0.20, - 0.03]	-0.14	0.07	[- 0.27, - 0.01]	*
Expectancy Likelihood-Squared X Consequence Frequency-Squared	0.02	0.01	[0.01, 0.03]	0.01	0.01	[- 0.01, 0.03]	†
Sample Average Frequency	1.34	0.22	[0.91, 1.78]	0.87	0.17	[0.55, 1.20]	*

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	Study 1			Study 2			
Variable	**Est.**	**Est. Error**	**95% CI**	**Est.**	**Est. Error**	**95% CI**	
Valence Ratio	0.50	0.06	[0.37, 0.62]	0.32	0.07	[0.17, 0.47]	*
Age	0.02	0.05	[- 0.07, 0.12]	-0.01	0.07	[- 0.14, 0.13]	
white Race	-0.02	0.05	[- 0.12, 0.09]	-0.01	0.07	[- 0.16, 0.13]	
Female Status	0.22	0.05	[0.11, 0.32]	-0.27	0.07	[- 0.41, - 0.13]	†
Father Ed. Status	0.06	0.05	[- 0.03, 0.16]	0.10	0.07	[- 0.04, 0.23]	
Past Year Alcohol Use	0.08	0.06	[- 0.03, 0.19]	0.26	0.07	[0.12, 0.41]	†
UPPS-(Lack of) Premeditation	-0.08	0.06	[- 0.19, 0.03]	-0.12	0.08	[- 0.27, 0.03]	
UPPS-Negative Urgency	-0.02	0.05	[- 0.12, 0.07]	0.00	0.07	[- 0.14, 0.15]	
UPPS-Sensation Seeking	-0.01	0.05	[- 0.12, 0.09]	-0.16	0.07	[- 0.30, - 0.01]	†
UPPS-(Lack of) Perseverance	-0.07	0.05	[- 0.17, 0.03]	-0.18	0.07	[- 0.32, - 0.03]	†

Notes: Est. = estimate; CI = credible interval; UPPS = UPPS Impulsive Behavior Scale.
* indicates that the estimate did not include zero and was in the same direction across both studies. † indicates that the estimate was not consistent across both studies.

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Supplemental Table H: Random Effects for Expectancy Valence

	Study 1			Study 2			
Variable	**SD est.**	**SD est. error**	**95% CI**	**SD est.**	**SD est. error**	**95% CI**	
Consequence Frequency (Person-Level)	0.22	0.06	[0.11, 0.35]	0.29	0.10	[0.11, 0.49]	*
Consequence Frequency-Squared (Person-Level)	0.03	0.02	[0.00, 0.09]	0.04	0.03	[0.00, 0.10]	
Consequence Frequency (Consequence-Level)	0.10	0.05	[0.01, 0.20]	0.13	0.06	[0.02, 0.27]	*
Consequence Frequency-Squared (Consequence-Level)	0.02	0.01	[0.00, 0.05]	0.02	0.02	[0.00, 0.06]	
Expectancy Likelihood (Person-Level)	0.68	0.06	[0.57, 0.79]	0.66	0.07	[0.53, 0.79]	*
Expectancy Likelihood-Squared (Person-Level)	0.33	0.04	[0.24, 0.41]	0.34	0.08	[0.16, 0.49]	*
Expectancy Likelihood (Consequence-Level)	0.34	0.06	[0.23, 0.46]	0.48	0.08	[0.35, 0.65]	*
Expectancy Likelihood-Squared (Consequence-Level)	0.20	0.04	[0.14, 0.28]	0.25	0.06	[0.13, 0.37]	*

Notes: SD = Standard Deviation; est. = estimate; CI = credible interval.
*Indicates that the estimate did not include zero and was in the same direction across both studies.

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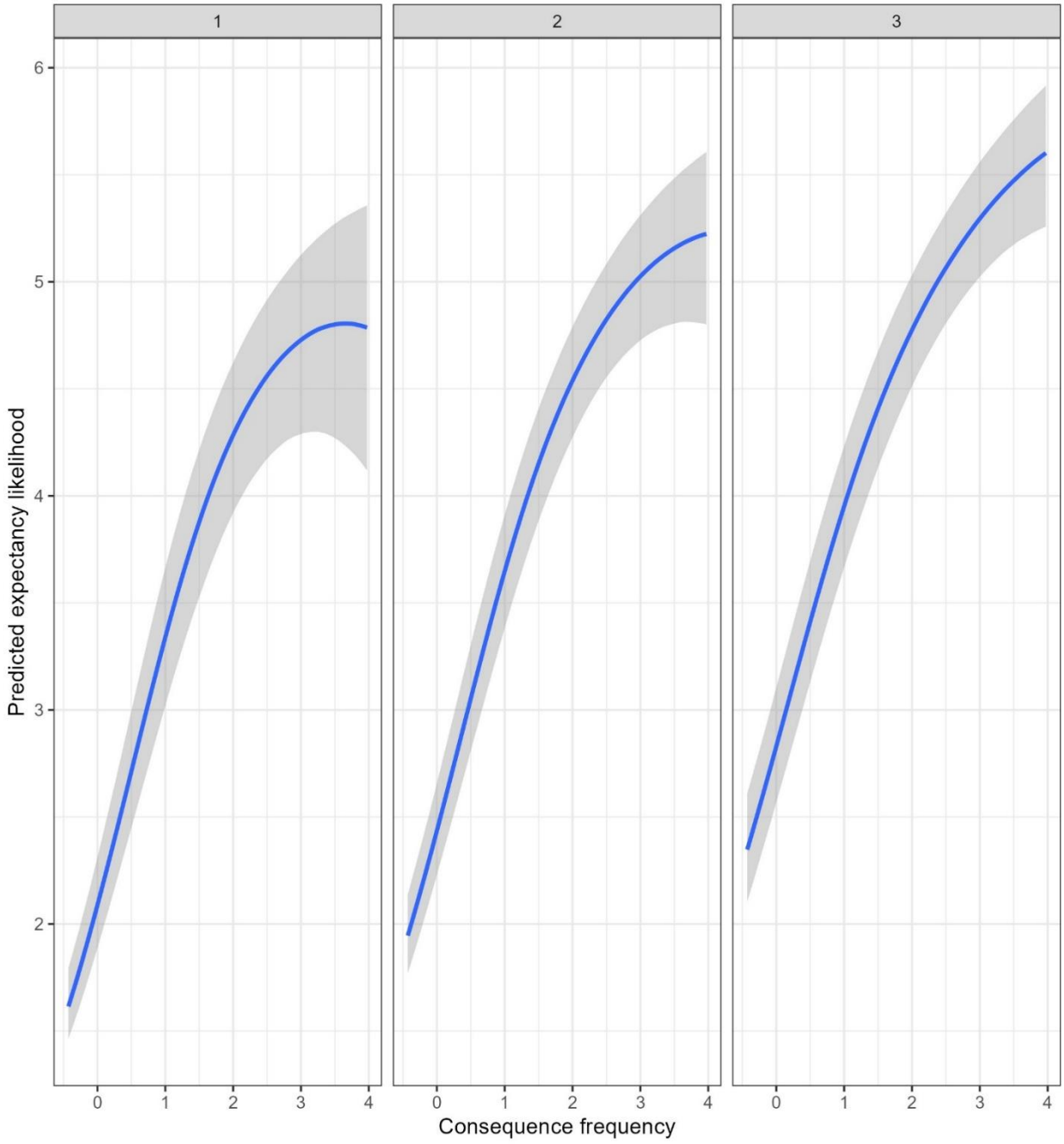
Supplemental Figure A: Average Consequence Frequency Moderated the Effect of Consequence Frequency on Likelihood in Study 2



Note: Panels 1, 2, and 3 represent 1 standard deviation below the mean, the mean, and 1 standard deviation above the mean respectively for the moderating variable of the average consequence frequency.

Supplemental Figure B: Average Consequence Frequency Moderated the Effect of Valence on Likelihood in Study 2

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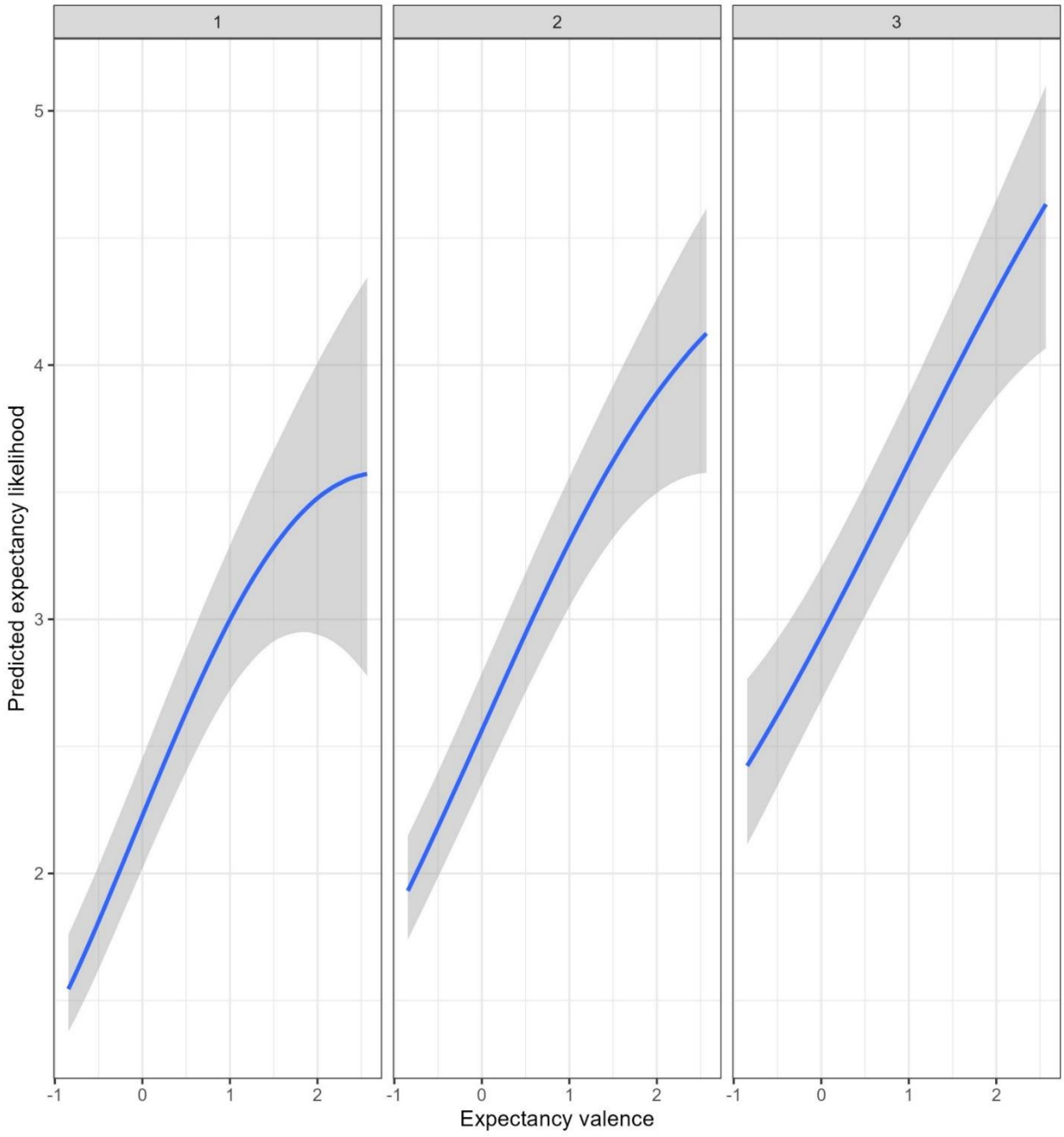

Note: Panels 1, 2, and 3 represent 1 standard deviation below the mean, the mean, and 1 standard deviation above the mean respectively for the moderating variable of the average consequence frequency.

Supplemental Figure C: Consequence Frequency Moderated the Effect of Valence on Likelihood in Study 2

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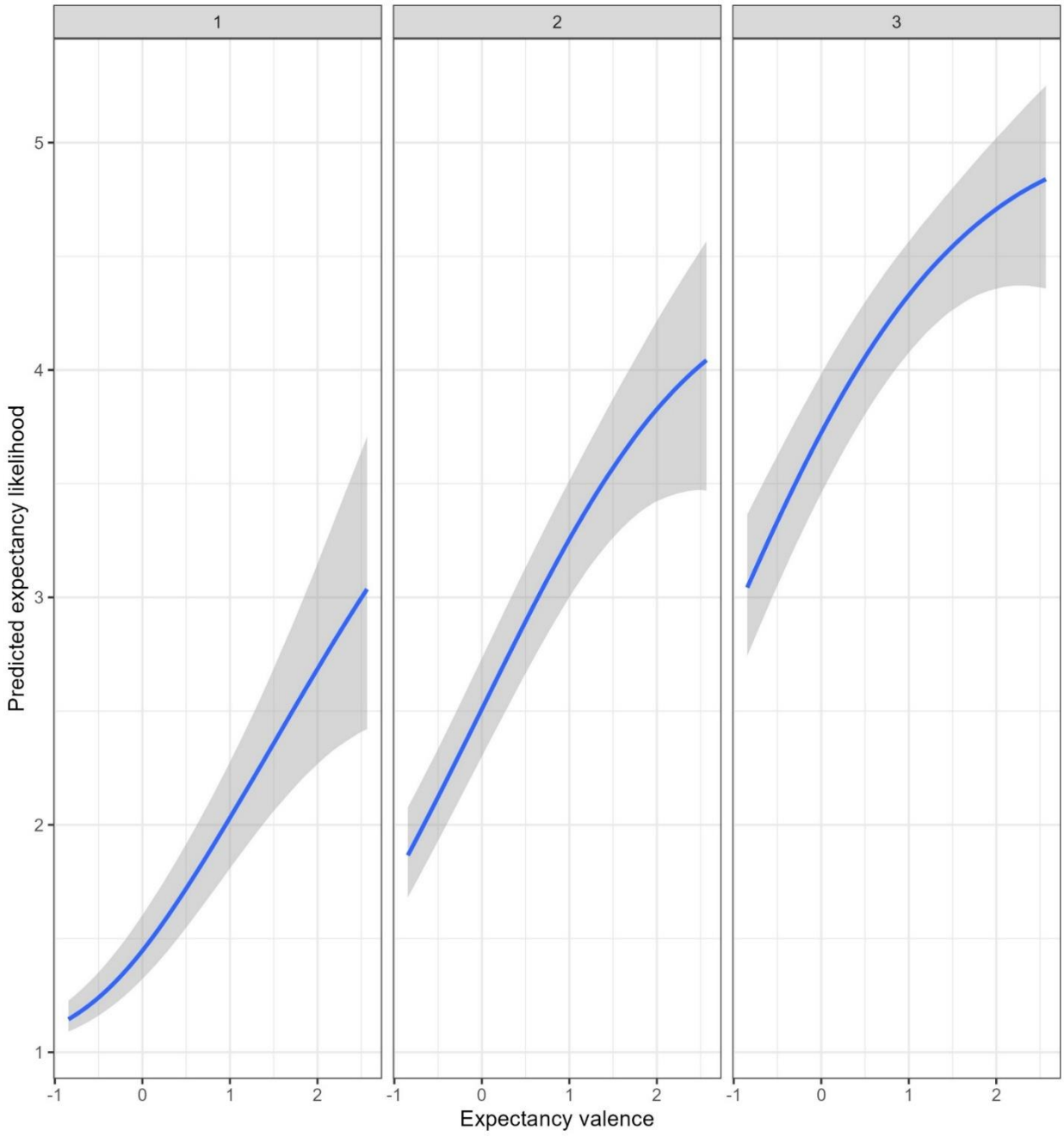

Note: Panels 1, 2, and 3 represent 1 standard deviation below the mean, the mean, and 1 standard deviation above the mean respectively for the moderating variable of consequence frequency.

Supplemental Figure D: Ratio of Positive to Negative Consequences Moderated the Effect of Consequence Frequency on Valence in Study 2

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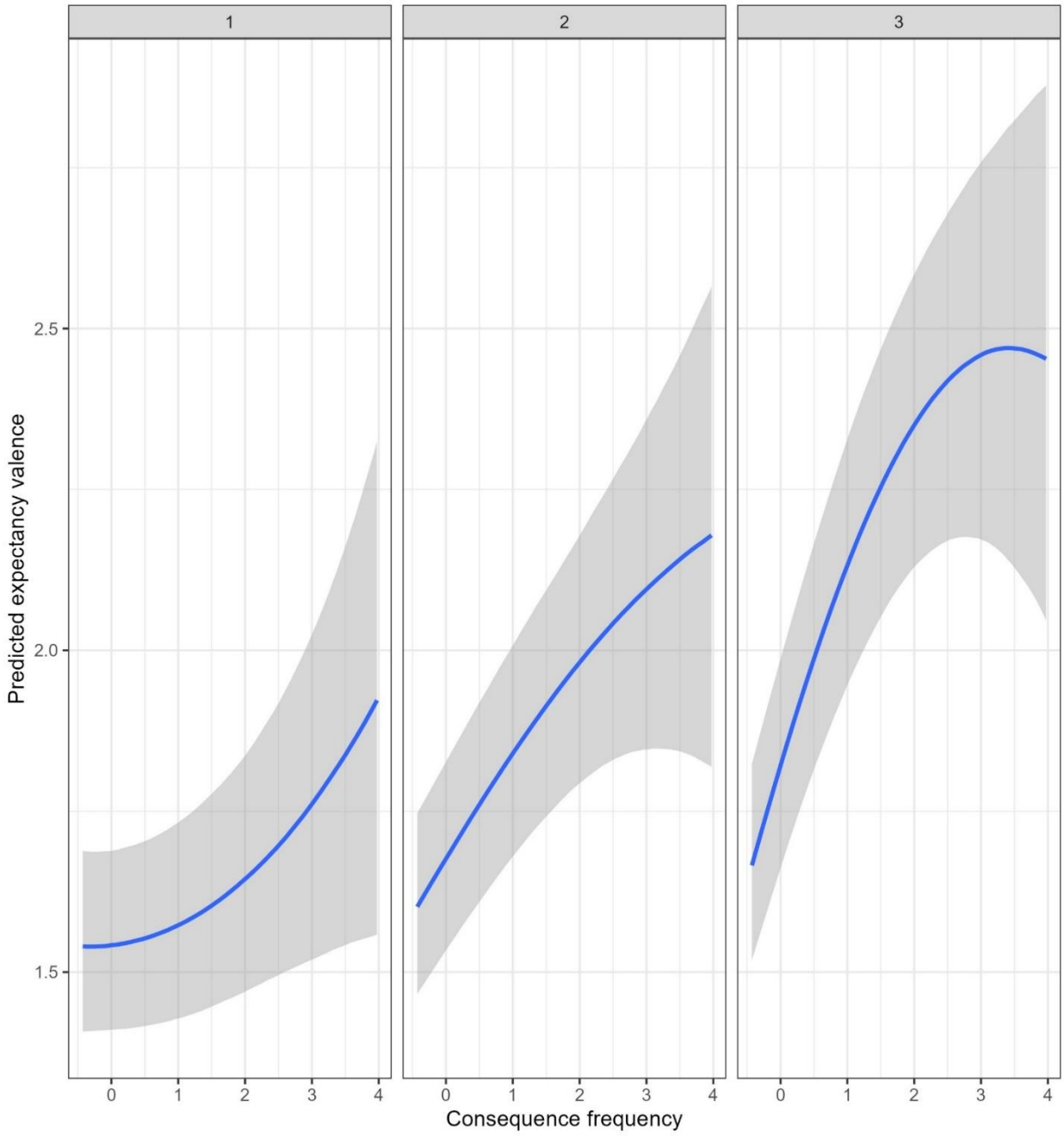

Note: Panels 1, 2, and 3 represent 1 standard deviation below the mean, the mean, and 1 standard deviation above the mean respectively for the moderating variable of the ratio of positive to negative consequences.

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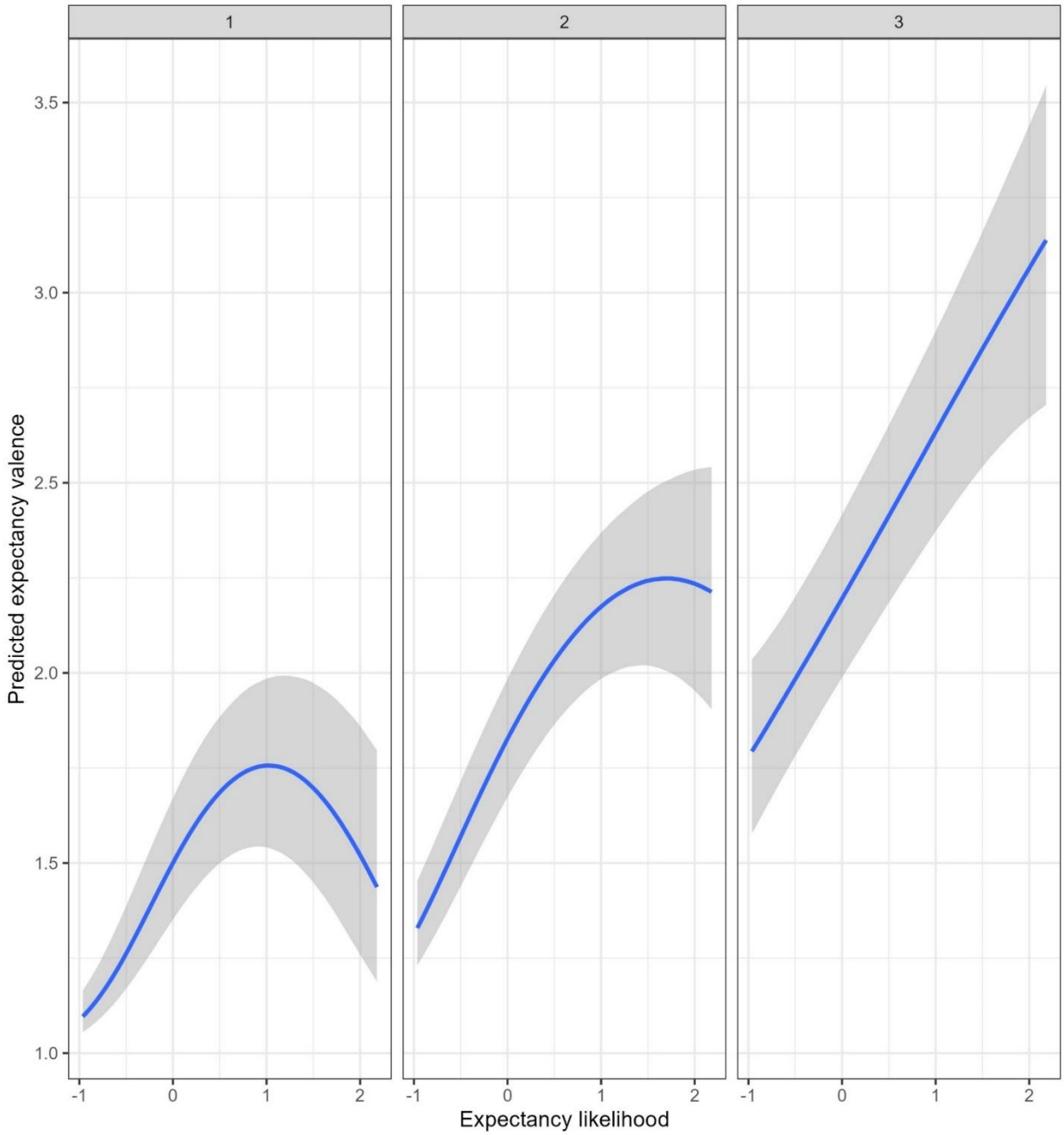
Supplemental Figure E: Average Consequence Frequency Moderated the Effect of Likelihood on Valence in Study 2



Note: Panels 1, 2, and 3 represent 1 standard deviation below the mean, the mean, and 1 standard deviation above the mean respectively for the moderating variable of the average consequence frequency.

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