

Drinking among Strangers: A Meta-Analysis Examining Familiarity as a Moderator of Alcohol's

Rewarding Effects

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SOCIAL FAMILIARITY ALCOHOL

Abstract

Drinking in unfamiliar social settings has long been linked to alcohol problems. A large body of indirect evidence has accumulated to suggest that alcohol's rewarding subjective effects—both tension relieving and positive-mood enhancing—will be magnified when it is consumed among strangers versus among familiar individuals. But the link between social familiarity and alcohol reward has never been examined. We conducted a meta-analysis of 21 alcohol-administration studies featuring social context (Total N=2,046), examining the effects of alcohol on self-reports of mood and social outcomes and on behaviors in the context of social interactions. Studies were classified according to whether participants involved in the social interaction were previously acquainted prior to study participation (“familiarity” condition), and also according to other characteristics of the social interaction and alcohol dosing procedure. Results of random effects meta-regression models revealed a significant effect of familiarity in moderating alcohol response, $Q(1)=9.80$, $p=.0002$. Alcohol-related social-emotional enhancement was significantly larger when studies examine interactions among strangers, $d=0.48$, 95% CI=0.34-0.61, versus when they examined interactions among familiar individuals, $d=0.09$, 95% CI=-0.12-0.29. Of note, in analyses examining self-reports and behaviors separately, findings indicated that alcohol consumption leads to similar behavioral disinhibition across familiar and unfamiliar contexts, but that the consequences of this disinhibition for internal subjective experience may differ depending on familiarity. Overall, results suggest that individuals may gain more subjective reward from alcohol in unfamiliar social contexts, pointing to familiarity as a potentially promising line of inquiry for research examining mechanisms of risk for alcohol problems.

Keywords: Alcohol, emotion, social context, social relationships, laboratory research, meta-analysis, familiarity

SOCIAL FAMILIARITY ALCOHOL

Researchers have long been interested in exploring risk factors associated with alcohol use disorder (AUD) as well as the mechanisms that support risk (Sher, Grekin, & Williams, 2005). Studies have examined a host of risk factors, including variables associated with the social and physical context of drinking (Single & Wortley, 1993), and have further explored a range of potential mechanisms underlying risk, including processes associated with alcohol-related subjective reward (Sher & Wood, 2005). One factor that has received little attention in this literature, but yet is nonetheless important for understanding problem drinking, is the drinker's level of familiarity with other individuals present in regular drinking contexts.

The current paper draws on a pharmacologically-based alcohol reinforcement perspective, together with research documenting social settings as the predominant context for alcohol consumption, to present initial evidence for a factor altering subjective reward¹ from alcohol. This paper examines the human alcohol-administration literature to explore whether subjective reward from alcohol differs when alcohol is consumed among strangers vs. among individuals with pre-established relationships.² This paper presents the view that alcohol will decrease the negative emotions and further enhance the hedonic responses associated with stranger interactions, leading to increased subjective reward from alcohol in unfamiliar vs. familiar social context. Meta-analytic methods are used to conduct an initial test of this hypothesis.

Familiarity and Alcohol Use

The majority of alcohol consumption occurs in social context (Fairbairn & Sayette, 2014). Both heavy drinkers (Bourgault & Demers, 1997; Creswell, Chung, Clark, & Martin,

¹ Within the context of this article, reward is used as an umbrella term to refer to increases in positive affective states, decreases in negative affective states, as well as increases in pleasurable social experiences (Fairbairn, Sayette, Amole, et al., 2015).

² Throughout this paper, the assumption is adopted that the extent to which a relationship is perceived as established (vs. fluid/actively changing) will map closely to level of acquaintance.

SOCIAL FAMILIARITY ALCOHOL

2014) and moderate drinkers (Cahalan, Cisin, & Crossley, 1969; Demers et al., 2002; Single & Wortley, 1993) mainly drink alcohol in the company of other people. These social drinking settings sometimes involve individuals who are well-known to each other, including romantic couples (Leonard & Eiden, 2007), family groups (Heath, 1995), and groups of friends (Bartholow, Sher, & Krull, 2003), whereas at other times drinking contexts involve people who have little to no acquaintance (Lang, Stockwell, Rydon, & Lockwood, 1995).

A number of factors—including, but not limited to, cultural practices—constrain the range of social drinking environments that an individual will be regularly exposed to (Heath, 2000; Lang et al., 1995; Single & Wortley, 1993). Importantly, evidence has accumulated to indicate a link between regular drinking in the company of unfamiliar individuals and problematic patterns of alcohol consumption (Fairbairn & Sayette, 2014). Drinking among strangers and/or within contexts that facilitate stranger interaction (e.g., public drinking establishments, large parties, social groups including unfamiliar individuals) is a robust predictor of heavy drinking (Brown, 1985b; Casswell & Zhang, 1997; Senchak, Leonard, & Greene, 1998). In contrast, regular drinking mainly among familiar individuals (e.g., within families, couples, and groups of close friends) is indicated as a protective factor against problem alcohol use (Ahlström-Laakso, 1976; Reboussin, Song, & Wolfson, 2012; Roberts & Leonard, 1998; Room & Makela, 2000). Further, key factors determining the likelihood that an individual will encounter unfamiliar social settings—e.g., metropolitan dwelling, young age, recent geographic relocation, male gender—also represent what are among the most robust risk factors for AUD (Dawson, Grant, & Ruan, 2005; Fairbairn & Sayette, 2014; Johnston, O'Malley, Bachman, & Schulenberg, 2000; Sher et al., 2005; SAMHSA, 2013). Taken together, this research suggests

SOCIAL FAMILIARITY ALCOHOL

that social familiarity within drinking contexts is overdue for systematic investigation as a framework for understanding AUD risk (Fairbairn & Sayette, 2014).

Some indirect evidence has accrued to suggest that drinking among strangers may be associated with increased alcohol-related reward and tension reduction, which are themselves associated with AUD risk. Alcohol consumption leads to variety of subjective effects that are highly rewarding—it can increase positive mood, decrease negative mood, and is often perceived as helping the drinker attain motivationally-salient goals—and the intensity of subjective response to alcohol has been associated with risk for the later emergence of alcohol problems (King, McNamara, Hasin, & Cao, 2014; Sher & Levenson, 1982; Sher & Walitzer, 1986). Survey research exploring alcohol expectancies indicates that individuals expect more mood and social enhancement from alcohol when drinking among strangers vs. familiar individuals (Fairbairn & Bresin, in press), and, further, individuals who tend to consume alcohol in the company of strangers hold stronger beliefs about alcohol’s positive social and emotional effects than people who drink among familiar individuals (Beck, Thombs, & Summons, 1993; Brown, 1985a, 1985b). Finally, in systematic observations of drinking across cultures, sociologists and anthropologists have long documented differing subjective responses to alcohol according to social context (Heath, 1990), observing that where alcohol consumption takes place among individuals with long-standing, established relationships “drinking reflects sociability and social cohesion rather than [being] a means to achieve them” (Heath, 1995, p. 309).

Familiarity and Alcohol’s Subjective Effects

Research in both alcohol studies and social psychology provides a conceptual basis for predicting increased subjective reward from alcohol in unfamiliar vs. familiar social settings. Perhaps partially for evolutionary reasons, people have a fundamental “need to belong” and to

SOCIAL FAMILIARITY ALCOHOL

form close social connections with others (Baumeister & Leary, 1995). Social interactions can thus give rise to powerful emotions, both positive and negative (Leary, 2010). In particular, changes in an individual's "belongingness" status have been shown to have especially potent effects on mood states (Baumeister & Leary, 1995). Established relationships that remain strong do not exert sway over our conscious emotions in the way that the addition of a new relationship might (Baumeister & Leary, 1995; Clark & Lemay, 2010). Alcohol is often referred to as a "social lubricant" or a "social stimulant," and can disinhibit social behaviors in a manner that might lead to a social interaction that is perceived as positive (Fairbairn, Sayette, Aalen, & Frigessi, 2015; Kirkpatrick & de Wit, 2013; Sayette et al., 2012). For example, alcohol can increase speech, decrease silences, increase self-disclosure, and increase expressions of affiliation during social exchange (Caudill, Wilson, & Abrams, 1987; Fairbairn, Sayette, Amole, et al., 2015; Kirkpatrick & de Wit, 2013; Sayette et al., 2012). Of note, however, these altered interactions may be interpreted differently and, thus, exert a more or less powerful impact on mood state depending on the specific nature of the social context (Baumeister & Leary, 1995). As remarked upon by sociological researchers, where alcohol is consumed among individuals with pre-existing relationships, alcohol's socially lubricating effects might simply be perceived as "reflect[ing]" something that already exists, whereas, when consumed among unfamiliar individuals, it might be thought of as "promoting" the acquisition of something new (Heath, 1995). Thus, while alcohol may alter behaviors during social interactions to an equal extent across social settings, the consequences for subjective experience and mood may be different depending on the social context.

Finally, social contexts involving strangers not only have the potential to induce positive mood states and feelings of affiliation, associated with the formation of a new relationship, but

SOCIAL FAMILIARITY ALCOHOL

can also elicit negative emotions and anxiety (Fairbairn & Sayette, 2014). People regularly experience feelings of unease, discomfort, and dislike in response to unknown others (Martin et al., 2015; Moreland & Beach, 1992; Reis, Maniaci, Caprariello, Eastwick, & Finkel, 2011; Zajonc, 1968). A recent study found that relatively low levels of empathy among stranger vs. familiar dyads could be explained by feelings of stress during stranger interactions, and that administration of Metyrapone, a drug that blocks the production of cortisol, causes stranger interactions to resemble interactions among familiar individuals (Martin et al., 2015). Alcohol can act as a powerful stress-reliever, and is particularly effective at relieving negative emotions when these negative emotions are associated with outcomes that are perceived as uncertain or unpredictable (Bradford, Shapiro, & Curtin, 2013; Moberg & Curtin, 2009), and also when anxiety is associated with a negative awareness of self (Hull, 1981). Interactions with strangers reliably elicit feelings of uncertainty (Berger & Calabrese, 2006), since we have no framework for predicting the thoughts and actions of unknown individuals, and also give rise to heightened feelings of self-consciousness (Leary & Kowalski, 1995). Thus, given research indicating stranger interactions as a source of negative affect, and work indicating that alcohol may be especially effective at relieving the negative feelings that arise in these contexts, stranger interactions may represent particularly fertile territory for alcohol's tension reducing effects to manifest.

In sum, a large body of evidence provides conceptual grounds for predicting that subjective reward from alcohol would be magnified when drinking takes place among strangers vs. among those with pre-established relationships. In a 2014 review paper, I proposed a model of alcohol reward and, in discussing potential implications and applications of the model, put forward the tentative prediction that alcohol would be associated with greater reward when

SOCIAL FAMILIARITY ALCOHOL

consumed during interactions with strangers vs. familiar individuals (Fairbairn & Sayette, 2014). But sufficient experimental studies had not been conducted at the time to systematically examine this hypothesis, and therefore this previous contribution failed to expand on this prediction or provide any evidence in its support. Experimental studies represent a strong test of the relationship between familiarity and alcohol response, which might, if studied using other methods, easily be confounded with other factors such as drinking quantity and individual-difference criteria associated with choice of drinking setting. But there are significant methodological challenges associated with conducting alcohol-administration studies involving social interaction between multiple naïve participants (Sayette et al., 2012), particularly when the study seeks to examine interactions among familiar individuals and thus requires the recruitment of previously acquainted dyads and groups, and so the literature is not large and, until recently, sufficient research had not accrued to permit this review. Thus, the relationship between familiarity and alcohol response has never been systematically examined.³ Here I update and expand the previous review to address this important issue, using meta-analytic methods to examine the human alcohol-administration literature and conduct an initial test of the relationship between familiarity and subjective alcohol reward.

Methods

Studies were identified by searching electronic databases including PsycINFO, Medline, and Google Scholar (search terms: [alcohol or ethanol] and [social interaction, social groups, social setting, social stress, or social anxiety]). In order to discover relevant studies not identified by formal searches the reference sections of several studies and review articles were also scanned

³ One group of researchers in Finland did examine the effects of both alcohol and previous acquaintance within a single experimental study (Lindfors & Lindman, 1987), but, with a total sample size of 16 and a between-subjects design, power was extremely low for moderation analyses. Only main effects of these two factors, and not their interactions, are included in the report.

SOCIAL FAMILIARITY ALCOHOL

(e.g., Bushman & Cooper, 1990; Hull & Bond, 1986; Newlin & Thomson, 1990; Sayette, 1993; Steele & Southwick, 1985). Finally, solicitations for unpublished articles were sent out to individual authors of papers identified in this review as well as to the members of the Research Society on Alcoholism (Fairbairn & Sayette, 2014). Note that this research did not involve the collection of information from human subjects—only the aggregation of de-identified material in published research reports—and therefore was exempt from IRB approval. Studies were required to meet the following inclusion criteria: 1) The study involved an alcohol-administration paradigm including an alcohol condition in which participants were administered a fixed dose (or several fixed doses) of alcohol, along with a no-alcohol comparison condition. To avoid mixing randomized and quasi-experimental designs (Borenstein, Hedges, Higgins, & Rothstein, 2009), studies involving only choice-based drinking procedures were excluded (e.g., Jacob & Leonard, 1988). 2) The study featured a discrete period during which the participant was placed in a room together with at least one other study participant and was encouraged, via explicit (direct instruction) or implicit (proximity to other individuals or nature of the task) means to interact with this individual(s). Since alcohol reward is often less pronounced when social interactions involve study confederates, and since studies examining interactions between familiar individuals would necessarily involve only naïve participants, studies examining interactions with study confederates were excluded (Fairbairn & Sayette, 2014). Where studies examined multiple discrete social interactions, I examine the results pertaining to the first social interaction (Fairbairn & Sayette, 2014).

Finally, studies were required to measure social-emotional experience through indexing either: 1) behavioral expressions of mood or sociability observed during the social interaction (“behavioral” outcomes), including measures of speech frequency/duration and verbal and

SOCIAL FAMILIARITY ALCOHOL

nonverbal expressions of positivity or negativity or 2) self-reports of mood or sociability immediately after the social interaction (“subjective” outcomes). Subjective measures were classified as those measuring “positive mood,” “negative mood/anxiety,” or “sociability/perceived social outcomes,” chosen as measures thought to be indicative of the level of social-emotional reward an individual derived from the exchange (Baumeister & Leary, 1995). Studies employing self-reports that indexed both mood and sociability as well as other outcomes—e.g., physiological reactions—were not included if effects for mood and sociability could not be parsed from other outcomes based on the presentation of results.

Study characteristics were coded independently by the first author and two research assistants (Average interrater agreement=91%; Range 71%-100%). We coded studies for level of familiarity (“familiarity”) among participants in the social interaction. A study was classified as involving interactions with familiar individuals (“familiar study”) if participants were specifically recruited in dyads and groups based on substantial previous acquaintance, and was considered as involving strangers (“stranger study”) if individuals involved in the social interaction were not known to be acquainted with one another prior to the study.⁴ In order to examine potential confounds in this relationship, we also systematically coded studies for a number of factors that tended to differ across stranger studies and familiar studies including the average number of individuals involved in the interaction (“group size”), whether dyads/groups

⁴ Of 16 stranger studies, 9 reports either contained explicit statements indicating that all participants were strangers/minimally acquainted or outlined specific methodological procedures taken to ensure that this was the case. In the remainder of these studies, lack of familiarity among most participants was assumed based on the community-based recruiting procedures used. In one stranger study, half of participants had spent 2 hours together prior to the experimental procedures (Lindfors & Lindman, 1987) but were otherwise unacquainted. Eight stranger studies used within-subjects designs (see Table 1), involving repeated study visits. One of these reports explicitly notes that social groups change with each study visit (Kirkpatrick & de Wit, 2013), while the others contain no comment on the consistency/inconsistency of social configurations over study visits. Note that we have argued that a relatively high level of social familiarity, such as that achieved through months and years of acquaintance, is required before significant dampening of alcohol reward is observed (Fairbairn & Sayette, 2014), but this hypothesis is yet to be directly tested (see discussion).

SOCIAL FAMILIARITY ALCOHOL

included mixed gender interactions or were same gender (“gender composition”), and whether all members of the social interaction were assigned to the same beverage condition (“concordant beverage”). We also coded whether social interactions involved prompts that might promote negative emotions and/or negative social experiences—e.g., discussion topics focusing on an area of disagreement (“negatively arousing task”). Studies were also coded for whether the no-alcohol comparison group involved placebo, control beverage, or both (“control comparison”). In a placebo comparison condition, participants are deceived regarding the contents of their experimental beverage, being administered a non-alcoholic beverage but being informed that they are receiving alcohol. This has the advantage of allowing researchers to isolate pharmacological from expectancy effects of alcohol, but unanticipated compensatory reactions have sometimes been documented to placebo manipulations (Testa et al., 2006). In contrast, in a control comparison condition, participants are not deceived regarding the contents of their experimental beverage, being administered a non-alcoholic beverage and being correctly informed that they are not receiving alcohol. We also coded for the average peak BAC reached by participants (“Peak BAC”). Finally, the first author coded all studies for the timing of relevant behavioral and self-report measures in relation to the peak of the BAC curve (“BAC limb”). More specifically, a continuous proportion was created by dividing the latency to measurement of study outcomes by the latency to peak BAC, both measured in minutes relative to the onset of drink administration. In the few cases where the exact timing of peak BAC was not explicitly stated in the research reports, this value was estimated using equations presented in Watson et al. (1981; see also Curtin & Fairchild, 2003).

Data Analysis: Effects were estimated as Cohen’s *d*, and then adjusted for bias according to recommendations by Hedges (1981). When studies featured nested designs, procedures were

SOCIAL FAMILIARITY ALCOHOL

used to calculate effect sizes that accounted for this clustering (Hedges, 2009). When relevant results were presented only in figures, the necessary statistics were independently hand measured by the first author and a research assistant and then used to calculate effect sizes. Results from studies reporting on the same sample of participants were aggregated and treated as a single study (e.g., Fairbairn & Sayette, 2013; Sayette et al., 2012). One study was excluded because sufficient information was not provided to calculate a precise or approximate effect size (Doty, Zacny, & de Wit, 1994).

Random effects models were used across all analyses (Raudenbush, 1994). The heterogeneity of effect sizes was tested with the Q statistic (Cochran, 1954). Initial analyses examined behaviors and subjective reports together as a single indicator of social-emotional experience, such that, if a single study included both behaviors and subjective reports, effect sizes were averaged across these measures for that study (Borenstein et al., 2009). Follow-up analyses then parsed behavioral from subjective measures and also examined different classes of subjective measures to explore whether differences emerged across these indexes. Meta-regression with maximum likelihood estimation was used to examine the effects of familiarity while controlling for the seven study characteristics identified as potential moderators of alcohol/response and/or factors that tended to diverge across stranger and familiar studies.

Results

Twenty-one studies involving a total of 2,046 participants were identified as meeting inclusion criteria—5 familiar studies (total N=670) and 16 stranger studies (total N=1,376) (See Table 1). When all studies were examined together, the overall effect of alcohol on behavioral and subjective measures of social-emotional experience was moderate, $d=.37$, 95% $CI=.23$ to 0.50 . Significant heterogeneity was observed across the studies, suggesting that alcohol's effects

SOCIAL FAMILIARITY ALCOHOL

differed significantly depending on the study in question, $Q(20)=38.70, p=.007$. Importantly, moderation analyses suggested that the effect of alcohol on social-emotional experience differed significantly between studies involving strangers vs. those involving familiar individuals, $Q(1)=9.80, p=.0002$. Among familiar studies, there was no evidence that alcohol significantly enhanced social-emotional experience, $d=0.09, 95\% CI=-.12$ to 0.29 . In contrast, in stranger studies, alcohol exerted a significant positive effect on social-emotional experience, $d=0.48, 95\% CI=.34$ to 0.61 . No significant variability in effect sizes remained after accounting for the familiarity distinction, $Q(19)=24.51, p=.18$.

Next, analyses examine whether effects were consistent across subjective and behavioral measures of social-emotional experience. When behaviors alone were examined, alcohol's effects emerged as similar across stranger and familiar studies, $p=.796$. In contrast to these null effects for behaviors, a significant effect of familiarity emerged when *subjective* indexes of social-emotional experience were examined, $Q(1)=7.69, p=.005$. Alcohol's tendency to enhance subjective reports of mood and perceived social experience was significantly larger within stranger studies, $d=0.536, 95\% CI=.425$ to 0.647 (a moderate effect) compared with familiar studies, $d=0.207, 95\% CI=.004$ to 0.411 (a small effect). This pattern of findings—significant effects for subjective reports and not for behavior—emerged not only when considering all 21 studies in the sample (results reported above) but also when considering only the subset of 8 studies that included both measures of behavior and subjective experience within the same study [subjective reports: $Q(1)=7.77, p=.005$; behaviors: $Q(1)=0.67, p=.41$]. Next, I employed meta-regression models to explore the robustness of the familiarity effect to the inclusion of 7 covariates. Within meta-regression models exploring subjective effects, alcohol's tendency to enhance subjective reports of mood and perceived social experience was significantly larger

SOCIAL FAMILIARITY ALCOHOL

within stranger studies than in familiar studies even after controlling for group size, gender composition, concordant beverage, negative task, peak BAC, control comparison, and BAC limb (all p 's<.045). [In meta-regression models isolating *behavioral* outcomes, familiarity did not impact alcohol's effect on social behaviors regardless of the covariates included in the model.]

Finally, exploratory models examined the effect of familiarity across the three types of subjective measures independently⁵: positive mood, negative mood/anxiety, and perceived social outcomes. Effects of alcohol on subjective reward emerged as stronger in stranger vs. familiar studies across all three of these subjective indexes independently—all p 's<.049—although the familiarity distinction emerged as strongest with respect to measures of anxiety/negative-mood. In studies involving interactions among strangers, alcohol's tendency to relieve negative emotions was large in magnitude, $d=0.774$, 95% $CI=.573$ to 0.975 whereas, in studies involving familiar individuals, alcohol's effects on negative emotions were small, $d=0.319$, 95% $CI=.094$ to 0.545 .

Discussion

This paper explores the hypothesis that drinking in social contexts involving strangers may amplify alcohol-related reward and thus serve as a potential risk factor for alcohol problems. Results of a meta-analysis of alcohol-administration studies provides the first evidence in support of this possibility. Findings indicated that alcohol is associated with greater increases in positive mood, decreases in negative mood, and improvements in perceived social experience when consumed among strangers vs. among those with pre-established relationships. Further, an examination of alcohol's effects across different domains of experience—behavioral

⁵ These analyses are referred to as exploratory because the number of studies that explored outcomes within each of these subcategories was relatively small [$N=6$ (Anxiety/Negative)- $N=11$ (Positive Mood)], and the exact sample of studies differed depending on the outcome in question.

SOCIAL FAMILIARITY ALCOHOL

vs. subjective self-reports—helps provide further information about the processes impacted by alcohol across these various social contexts.

While alcohol tended to “lubricate” social interactions across all studies—increasing speech, increasing positive social expressions and decreasing negative expressions—the extent to which these positive behavioral effects were accompanied by corresponding positive “subjective” effects for mood and perceived social experience depended on whether there were established relationships between interaction partners. Thus, while alcohol enhanced behavioral measures of social-emotional experience to an equal extent within stranger studies and familiar studies, alcohol’s tendency to enhance subjective experience was significantly greater within studies that featured interactions among strangers. One interpretation of this pattern of findings is that alcohol’s tendency to enhance social experience is appraised differentially depending on the specific nature of the social context—as something that was already taken for granted between those with established relationships vs. as evidence of something new between strangers. Finally, familiarity among interaction partners emerged as an especially potent moderator of alcohol reward when the outcome of self-reported negative emotion was examined: alcohol’s tendency to relieve anxiety and negative emotions emerged as particularly pronounced within studies featuring stranger interactions (large effect size), whereas effects of alcohol on negative moods were small within studies examining familiar individuals. It is possible these results reflect the discomfort and negative emotion that often accompany stranger interactions, which are generally absent within interactions between familiar individuals, and alcohol’s effectiveness at relieving these negative emotions.

Note that the review presented in this paper is intended to initiate a conversation—to raise promising ideas and questions that might be productively pursued in future research—and

SOCIAL FAMILIARITY ALCOHOL

that the results of the meta-analysis should be viewed as an initial foray into a potentially promising new area, rather than as any sort of summary judgement upon it. Limitations should be noted. As noted earlier, given significant methodological challenges associated with conducting alcohol-administration studies involving “naturalistic” social interaction (Sayette et al., 2012), it is unsurprising that the sample of studies identified in this review was somewhat small and, given additional challenges accompanying the recruitment of subjects in dyads and groups, that the sample of studies specifically examining familiar individuals was particularly modest. Most, although not all, of the studies exploring social contexts involving familiar individuals examined interactions between couples which, although a popular and widely researched context for alcohol consumption, by no means represents the full range of “familiar” drinking contexts. Further, as is the case with many meta-analytic moderation analyses, studies involving interactions among familiar individuals vs. strangers differed in a number of ways, including the average size of the social group, the nature of the interaction, and the type of behavioral coding system employed. Furthermore, modal position of the BAC curve differed across stranger and familiar studies, with familiar studies being more likely to assess behavior and experience on the descending limb and stranger studies on the ascending limb. Our coding of studies indicated that none of these factors were fully confounded with familiarity and, further, that the effects of familiarity emerged even after controlling for 7 other potential moderators of alcohol reward. But these study-level confounds cannot be ruled out through statistical analysis alone, and future research that examines familiarity as a moderator of alcohol reward within a single study is warranted.

Other important future directions should be noted. First, studies should seek to identify the level of previous acquaintance required for diminished alcohol reward to manifest. Social

SOCIAL FAMILIARITY ALCOHOL

stimuli represent highly complex cues, and prolonged exposure is often required before novelty-related reactions (e.g., negative emotions) attenuate (Reis et al., 2011; Zajonc, 1968). Based on this prior work, we have hypothesized that substantial social familiarity, such as that acquired through months and years of regular interaction, would be required before the pronounced alcohol reward observed within stranger contexts diminishes significantly (Fairbairn & Sayette, 2014). But this hypothesis has never been directly tested and is therefore left for future research to examine. Relatedly, everyday social contexts often involve a mix of strangers and familiar individuals, and it is unclear how these mixed settings would impact alcohol reward.

Second, research should examine the extent to which the acute, reward-based mechanisms identified here directly predict drinking behavior. Importantly, the current framework identifies a broad learning-based process surrounding alcohol consumption that we predict will, over the longer term, help explain general patterns of alcohol consumption. Of note, this framework does not necessarily predict increased drinking in a particular setting. As noted earlier, stranger settings may increase vigilance and also self-presentational concerns, and therefore it's feasible that, despite increased reward, the presence of strangers may sometimes suppress heavier patterns of drinking within a given drinking episode. We therefore don't necessarily predict that people will consistently drink alcohol in greater quantities when in the presence of strangers, but instead that the same quantity of alcohol consumed in the presence of strangers will lead to a greater subjective sense of reward and that therefore, over time, consuming alcohol consistently in stranger contexts will be associated with heavy drinking. Studies employing multiple methods, integrating laboratory, ambulatory, and longitudinal designs, could be useful in testing this hypothesis (Cranford, Tennen, & Zucker, 2015; Fairbairn & Cranford, 2016), examining frequency of drinking in stranger contexts as a predictor of

SOCIAL FAMILIARITY ALCOHOL

longitudinal drinking trajectories, while also exploring the mediating role of social reward in explaining these effects. Studies might also productively examine individual difference criteria as moderators of alcohol reward in stranger context, including male gender (Fairbairn, Sayette, Amole, et al., 2015; Fairbairn & Bresin, in press; Fairbairn, Sayette, Aalen, et al., 2015) as well as personality traits associated with sociability and sensation-seeking (Fairbairn, Sayette, Wright, et al., 2015). Finally, future research should further clarify alcohol's effects on behavioral expression in familiar and stranger social settings. Behaviors in social context can take a variety of forms and may result from a range of underlying psychological processes, including level of disinhibition and social evaluative concerns, as well as underlying emotional states. The majority of studies reviewed here employed systems of behavioral coding that were not designed to directly assess the felt emotional states of the actor, but rather more directly assess social-communicative processes. Behavioral coding systems have been developed that distinguish “felt” from “displayed” emotions (e.g., the Facial Action Coding System Ekman, Friesen, & Hager, 2002), and such systems might serve to help further clarify alcohol's effects on subjective reward across social contexts.

If confirmed and replicated, the results of this research could have important implications for prevention and intervention measures. Many effective harm-reduction and preventative programs center not around promoting abstinence per se, but instead on reorganizing the individual's life so as to maximize reward gained outside of drinking and minimize reward that is dependent on alcohol (Hunt & Azrin, 1973; Miller, Meyers, & Hiller-Sturmhofel, 1999). By identifying specific real-world drinking settings associated with magnified (and minimized) alcohol reward, results of this research might inform promising new directions for such interventions. The results of this research might further help reduce rates of relapse. During

SOCIAL FAMILIARITY ALCOHOL

recovery from AUD, rates of relapse to drinking are high (Marlatt & Donovan, 2005), with the desire to drink often emerging suddenly, triggered by specific contexts (Marlatt, 1996). Results could help refine the understanding of “high risk” settings, and further, by identifying specific affective functions of alcohol in these contexts, help inform appropriate coping measures.

Finally, the results of this research could ultimately have implications for policy. The neighborhood density of public (“on-site”) drinking establishments such as restaurants, clubs, and bars—sometimes described as “open regions” that provide unique opportunities to interact with strangers (Cavan, 1966)—predicts neighborhood level drinking to a greater extent than off-site establishments such as liquor stores (Scribner et al., 2008; Shih et al., 2015). This review of experimental studies might lend weight to such correlational findings by linking alcohol use in such unfamiliar settings to affective processes that directly motivate drinking, and thus might eventually have policy implications.

Conclusion

To end with a more general comment, within the experimental alcohol field, as well as in the broader literature exploring alcohol’s perceived reinforcing effects, hundreds of studies have been conducted exploring how individual-difference criteria might moderate response to alcohol and thus indicate risk for AUD. Psychologists have identified personality traits (Sher & Levenson, 1982), gender (Kandel, Chen, Warner, Kessler, & Grant, 1997), family history (Chassin, Mann, & Sher, 1988), comorbid psychiatric illness (Grant & Harford, 1995), genetic profiles (Creswell et al., 2012), and a variety of other factors as markers of AUD vulnerability. But researchers have frequently observed that it is not simply *who* is doing the drinking but *where* this drinking takes place that influences alcohol’s rewards and, in fact, that this effect of context may be the primary influence on alcohol response (Steele & Josephs, 1990).

SOCIAL FAMILIARITY ALCOHOL

Furthermore, a number of factors (e.g., culture, gender, age group, etc.) constrain the range of drinking environments an individual will encounter, and these drinking environments vary dramatically in the extent to which they confer alcohol-related reward (Heath, 2000). Of note, however, while these sometimes powerful contextual effects have been observed, they have not yet been used as a framework for understanding risk for alcohol problems. Here I identify one context, level of familiarity, with potential implications for understanding alcohol reward with the aim that these initial findings and comments might inspire research exploring context as a factor in understanding alcohol reward and thus risk for AUD.

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Table 1.
Studies included in the meta-analysis together with covariates and effect sizes

Study	N	Fam	Grp Size	Same Sex	Neg Soc	Ctrl Cmp	Peak BAC	BAC Limb	Same Bev	Stud Dsgn	Self Report Outcome	Self Report g [95% CI]	Behavior Outcome	Behavior g [95% CI]
Abrams et al. 2001	61	ST	5.7	No	Yes	Plac+ Ctrl	0.05		No	BS	VAS, AAS, Positive thoughts inventory	0.45 [-0.08,0.99]		
Babor et al. 1983	16	ST	2	Yes	Yes	Ctrl	0.11	0.75	Yes	WS	POMS	0.51 [0.01,1.01]	Bales Interaction Process Analysis	-0.82 [-1.36,-0.27]
de Wit & Doty, 1994	27	ST	4	No	No	Plac	0.046	0.5	No	WS	POMS	0.42 [0.04,0.81]		
del Porto & Masur, 1984	40	ST	4	No	No	Plac	0.06	0.99	No	WS	Structured mood interview	0.75 [0.12,1.38]		
Doty & de Wit, 1995a	41	ST	3.5	Yes	No	Plac	0.065	0.46	No	WS	POMS	0.51 [0.19,0.83]		
Doty & de Wit, 1995b	13	ST	3.5	No	No	Plac	0.05	1	No	WS	POMS	0.84 [0.24,1.44]		
Doty et al., 1997	25	ST	3.5	No	No	Plac	0.03	1.6	No	WS	VAS	0.48 [0.08,0.89]		
Frankenstein et al., 1985	16	FAM	2	No	Yes	Ctrl	0.099	1.33	No	WS			Marital Interaction Coding System	0.57 [0.06,1.07]
Holdstock et al., 1999	27	ST	3.5	No	No	Plac	0.053	0.63	No	WS	POMS	0.39 [0.01,0.77]		
Kirchner et al., 2006	54	ST	3	Yes	No	Plac	0.067	0.67	Yes	BS	Perceived social bonding	0.54 [-0.06,1.14]	Facial Action Coding System and content-free speech	0.68 [-0.08,1.44]

SOCIAL FAMILIARITY ALCOHOL

Kirkpatrick & de Wit, 2013	44	ST	2	Yes	No	Plac	0.075	0.2	No	WS	Multi-item mood inventory	0.54 [0.22,0.86]		
Leonard & Roberts, 1998	270	FAM	2	No	Yes	Plac+ Ctrl	0.1	1.43	No	BS			Marital Interaction Coding System	-0.42 [-0.78,-0.06]
Lindfors & Lindman, 1987	16	ST	4	No	No	Ctrl	0.105		Yes	BS	Multi-item mood inventory	0.99 [-0.15,2.14]	Bales Interaction Process Analysis	-1.22 [-2.91,0.48]
Monahan & Samp, 2007; Samp & Monahan, 2007*	42	ST	2	Yes	Yes	Ctrl	0.08	0.56	No	BS	STAI	0.62 [0.01,1.23]	Coders rated vocal, facial, and body expression	-0.62 [-1.23,-0.01]
Pliner et al., 1974	120	ST	3	Yes	No	Plac	0.05	0.76	Yes	BS	Multi-item mood inventory	0.77 [0.20,1.35]	Schachter & Wheeler amusement index	0.78 [-0.09,1.65]
Rohrberg et al., 1976	32	ST	2	Yes	No	Plac	0.059	0.62	Yes	BS			Amount and depth of self-disclosure	0.51 [-0.4,1.41]
Samp & Monahan, 2009	44	FAM	2	No	Yes	Ctrl	0.08	1.18	No	BS			Coders rated vocal, facial, and body expression	-0.31 [-0.93,0.3]
Sayette et al., 2012; Fairbairn & Sayette, 2013*	720	ST	3	No	No	Plac+ Ctrl	0.06	0.47	Yes	BS	Multi-item mood inventory, perceived social bonding	0.59 [0.32,0.86]	Facial Action Coding System and content-free speech	0.43 [0.15,0.71]
Sher, 1985	98	ST	4.1	Yes	No	Plac	0.10	1	No	BS	Multi-item mood inventory	0.43 [0.04,0.83]		
Smith et al., 1975a, 1975b*	36	FAM	2	No	No	Plac	0.085	0.73	Yes	WS	Multi-item mood inventory	0.20 [-0.28,0.68]	Gottschalk-Gleser Hostility Scale, units laughter, qualitative affect coding,	0.47 [0.01,0.93]

SOCIAL FAMILIARITY ALCOHOL

													content free speech	
Testa et al., 2014; Fairbairn & Testa, in press*	304	FAM	2	No	Yes	Ctrl	0.071	0.71	No	BS	Multi-item mood inventory	0.21 [-0.02,0.43]	Rapid Marital Interaction Coding System	0.26 [0.03,0.48]

“Fam”=familiarity condition: FAM (familiar)= participants were specifically recruited in dyads and groups based on previous acquaintance, ST (strangers)=individuals involved in the social interaction were not known to be acquainted with one another prior to the study. “Grp Size”=the average number of individuals involved in the interaction; “Same Sex”=the “gender composition” of the group—whether dyads/groups were same gender, or whether they instead involved mixed gender interactions; “Neg Soc”=whether social interactions involved prompts that might promote negative emotions and/or negative social experiences. “Ctrl Cmp”=whether the no-alcohol comparison group involved placebo (plac), control (ctrl) beverage, or both. “Peak BAC”=Peak Blood Alcohol Content reached by participants. “BAC Limb”=A proportion created by dividing the time (in minutes) that relevant outcomes were assessed by the time that peak BAC was reached, both measured relative to the onset of drinking. “Same Bev”=whether all members of the social interaction were assigned to the same beverage condition. “Stud Dsgn”=whether the study examined the effect of alcohol using a between subject (BS) or a within subject (WS) design. “AAS”=Audience Anxiousness Scale; “STAI”=State Trait Anxiety Inventory; “POMS”= Profile of Mood States; “VAS”= Visual Analogue (mood) Scale. Effect sizes are represented as Hedges *g*. Effect size calculations adjust for the effects of nesting and average effects across all outcomes for which sufficient information was provided to inform these calculations.

Effects are coded such that positive effect sizes represent an enhancing effect of alcohol on social-emotional experience—alcohol improved mood and/or facilitated social interaction compared to no-alcohol—whereas negative effect sizes represent a detrimental effect of alcohol on social-emotional experience—alcohol was associated with lower mood and/or diminished social interaction compared with no-alcohol.

*Where effect size estimates for a single study were derived from more than one publication (e.g., behavioral results were reported in one publication and self-reports in another), all citations from which effect size estimates were derived are listed under the “study” column.