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Stereotype Threat Contributes to Poorer Recall Performance Among Undergraduate Students With Problematic Drinking Patterns

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Stereotype threat occurs when individuals from stigmatized groups feel they are expected to conform to a negative stereotype associated with their group. Studies show that activating stereotype threat can impair performance on cognitive tasks in various marginalized groups. Individuals with problematic alcohol use are subject to stigmatized views related to cognitive abilities and socialization skills; thus, we examine for the first time whether eliciting stereotype threat impairs performance on a memory and a theory of mind task in undergraduate students with varying drinking patterns. We randomized 205 students to a neutral or a stereotype threat condition, which informed participants that the purpose of the study was to assess memory performance and theory of mind skills in relation to different patterns of alcohol consumption. In the stereotype threat group, individuals with problematic drinking patterns demonstrated significantly worse memory performance than nonproblematic drinkers and nondrinkers. The same was not true in the neutral condition, where memory recall did not differ significantly as a function of drinking status. Experimental group and drinking status failed to reveal significant effects on cognitive and affective theory of mind performance. Problematic alcohol use patterns were only associated with poorer memory when stereotype threat was elicited, which indicates that assessments of neurocognitive profiles may be biased, at least for memory performance, if stereotype threat is inadvertently elicited in substance users. Broader implications support the imperative to avoid stigmatization of problematic substance use in scientific communication and clinical settings.

Public Health Significance
This study provides evidence that undergraduate students with problematic drinking patterns may be susceptible to stereotype threat and one of the ways this manifests is through reduced recall performance when stereotype threat is elicited. Our findings underscore the importance of avoiding the stigmatization of conditions during cognitive assessment (e.g., by minimizing cues related to substance-use effects on task performance) as well as avoiding the perpetuation of stereotypes in dissemination of scientific research.

Keywords: alcohol drinking, stereotype threat, theory of mind, recall

Problematic alcohol use is associated with poorer performance on neurocognitive (e.g., memory; Carbia et al., 2018) and social-cognitive tasks (e.g., theory of mind; Fluharty et al., 2018; Maurage et al., 2016; Onuoha et al., 2016). These performance deficits may translate to real-world impairment by effecting functioning at work, social interactions, and the potential for relapse (Maurage et al., 2016). However, it is also important to consider the role of societal stigma on the cognitive profile of people who drink heavily, given the pervasive stereotypes that these individuals have poorer cognitive or social abilities (e.g., regarded as "stupid," "bad character," or "abnormal"; Kilian et al., 2021). Indeed, contexts that elicit stereotype threat, a phenomenon in which the awareness of stereotypes related to one's group and the expectation to conform to these becomes self-threatening, can impair cognitive performance (Cole et al., 2006; Corrigan & Holtzman, 2001). As such, here, we assess whether eliciting drinking-related stereotypes contributes to memory or social cognition task performance.

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While exact mechanisms of stereotype threat on task performance remain unclear, stress, and rumination about stereotypes relevant to a given context (e.g., concerns about how one will be perceived or doubts of one's ability) may occupy central executive resources and increase cognitive load, thus interfering with performance (Beilock et al., 2007). Others posit that increases in negative emotions and cognitive load in relation to negative stereotypes interfere with working memory processes, which then undermine performance on cognitive and social tasks that require controlled processing (Schmader et al., 2008). For example, studies have found that eliciting stereotypes regarding aging-related decreases in cognition and intelligence in older individuals results in poorer performance on math tests (Nicolas et al., 2020). Tasks that rely on working memory, including episodic memory (Wagner, 1999) and theory of mind (Lecce & Bianco, 2018; Lecce et al., 2017; Mutter et al., 2006), may be particularly affected by stereotype threat.

Stereotype threat regarding substance-related deficits contributes to reduced cognitive performance in people with neurological and psychiatric conditions, including substance-use disorders (Cole et al., 2006; Henry et al., 2010; Kit et al., 2008; von Hippel et al., 2017). For example, individuals who reported ecstasy use were shown to perform worse on a delayed recall task when relevant stereotypes were primed via a vignette conveying that ecstasy causes long-term impairment in neurocognitive performance (Cole et al., 2006), relative to users who were not primed and nonusers. Importantly, this study found that the latter two groups did not differ in memory performance, thus supporting that stereotype threat may account for memory differences associated with substance use, as opposed to consequences of the substance itself, and presents an important potential confound (Cole et al., 2006). Further supporting this, Looby and Earleywine (2010) observed similar effects of stereotype threat on performance in measures of verbal recall, verbal fluency, and processing speed among individuals who reported regular cannabis use. Thus, stereotype threat can affect cognitive performance beyond the direct biological consequences of drug consumption.

Investigations of alcohol-related stereotype threat are remarkably recent and less common. One study found that eliciting stereotype threat related to alcohol-based cognitive decline in a university sample resulted in reduced response accuracy in inhibitory control, relative to those who were in the neutral condition (via a Cued Go/No-Go Association Task; Pennington et al., 2016). Interestingly, presented findings that, contrary to expectations, alcohol-related stereotype threat enhanced performance on a false-memory paradigm in older adults; notably, however, their sample had notably minimal levels of problematic drinking. Thus, there is a need for more research on stereotype threat effects on cognitive performance, particularly with memory-related tasks, in alcohol use.

Stereotype threat may also affect social-cognitive task performance in stigmatized groups. For instance, individuals with schizophrenia have more difficulty initiating a conversation and switching topics on a social interaction task when they believe that confederates are aware of their diagnosis (Henry et al., 2010). Other studies have similarly found negative effects of stereotype threat on social interactions in members of sexual/ethnic social groups, including increased signs of nonverbal anxiety (Bosson et al., 2004), and greater difficulty maintaining fluid interpersonal interactions (Richeson & Shelton, 2012). Applying these findings to the scope of the present study, stereotype threat may thus impact social-task performance in individuals with problematic substance use, if elicited in relevant contexts.

Negative perceptions of poor social skills in people with problematic alcohol use are societally widespread (Hammarlund et al., 2018; Kilian et al., 2021; Schomerus et al., 2011) and thus, the awareness of these stereotypes may become a source of internalized stress for these individuals. Internalization of these stereotypes may contribute to self-stigma; persons with alcohol-use disorders report perceiving themselves as less empathetic (Bora & Zorlu, 2017) and exhibit impaired reasoning of social rules (Kornreich et al., 2011), which may result in the belief that they have lower abilities for navigating social situations more generally (Wackernah et al., 2014). Moreover, they may feel embarrassed about their behavior while inebriated (Usdan et al., 2008), further internalizing that they have poor social skills. Self-stigma may in turn contribute to lower performance on social-cognitive tasks among those with heavy or problematic drinking; however, this has not yet been investigated.

In sum, stereotypes about problematic drinking patterns are prevalent, and therefore may affect neurocognitive and/or social-cognitive performance if they are brought to participants' attention at the time of testing. Stereotype threat may thus present a potential confound when assessing cognitive profiles in drinkers. In clinical and laboratory settings, where awareness of substance use and evaluation of task performance are salient to participants, professionals may inadvertently elicit stereotype threat when they inform individuals with problematic alcohol use patterns that they are being assessed on cognitive tasks to investigate expected deficits. This may interfere with performance on tasks, such as those assessing recall or recognition of social cues.

The Present Study

Given the effects of stereotype threat in other stigmatized groups, and some evidence for alcohol-related stereotype threat on inhibitory control, we hypothesized that eliciting stereotype threat would result in significantly worse performance on a recall task and a theory of mind task in those with problematic drinking patterns compared to those with no or low alcohol consumption. We also expected that performance would be similar across conditions of drinking status in a comparison group that did not undergo stereotype threat elicitation. We assessed this hypothesis in a sample of university students, as this population often reports drinking levels of ranging severities (Arbour-Nicitopoulos et al., 2010) and are a common population recruited for studies on the effects of substance use. The nonclinical sample also helps to minimize confounds that can accompany clinical samples with alcohol-use disorder, such as serious medical and psychiatric comorbidities.

Method

Participants

We recruited 237 students from the psychology undergraduate research participant pool at Toronto Metropolitan University. Among those with complete survey responses who reconsented at debrief, 100 were randomly assigned to the stereotype threat (ST) and 103 to the neutral task condition. After data collection, three naturalistic drinking groups were formed based on levels of reported drinking

(see below). Based on a large effect size found for differences in memory performance under stereotype threat in ecstasy users (d = 1.28; Cole et al., 2006), we aimed to recruit a minimum of 17 participants per cell, thus giving 95% power to detect between-group contrasts. Participants completed the study online via Qualtrics. The protocol was approved by the Toronto Metropolitan University Research Ethics Board; informed consent was provided by all participants prior to beginning the study. All participants were fully debriefed at the end of the study. These articles report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study. This study design was not preregistered. All data have been made publicly available at the https://rshare.library.torontomu.ca/ and can be accessed at https://doi.org/10.32920/23937189.v1.

Participants completed the Alcohol-Use Disorders Identification Test (AUDIT; Saunders et al., 1993) to assess problematic drinking patterns. The AUDIT queries frequency and amount of alcohol use as well as presence of drinking-related problems, such as missing social/occupational responsibilities or blacking out. Scores range from 0 to 40, with higher scores reflecting higher levels of consumption and greater problematic drinking tendencies. Groups were defined by drinking status as individuals who did not drink at all ("nondrinkers", AUDIT score = 0), who reported nonproblematic alcohol use ("nonproblematic", AUDIT score = 1–5), and who reported potentially problematic alcohol use ("problematic", AUDIT score $\geq$ 6). Per previous research in university student populations, we used the cutoff of 6+ to indicate potential problematic drinking (Kokotailo et al., 2004; Vinci et al., 2016), which has demonstrated a sensitivity of 91% and specificity of 60% for detecting high risk alcohol consumption in students (Kokotailo et al., 2004).

The sample's sex, gender, and ethnicity distributions by group and drinking status are presented in Table 1, along with the mean age and lifetime reports of other substance use. With respect to other substances, cannabis use was most consistently reported, followed by "other" drugs (e.g., anabolic steroids or prescription pill misuse), stimulants, and sedatives. Lifetime use of these substances were not correlated to any of the cognitive task variables ($p > .05$).

Cognitive Tasks

Memory Task

We adapted a verbal memory paradigm used previously by our group (Johnstone et al., 2022). This neurocognitive task was chosen as recall may be particularly vulnerable to stereotype threat in people who use substances (Cole et al., 2006), and given that the task is relevant to alcohol use research and has previously been assessed in relation to alcohol use in undergraduate students (Johnstone et al., 2022). In the learning phase, participants intentionally encoded 30 trait adjectives and indicated whether each word was self-referent (or not); each word was presented for 5 s. Subsequently, participants completed the test phase in which they typed as many of the words as they could recall within 2 min.

Movie for Assessment of Social Cognition

The multiple-choice version of the Movie for Assessment of Social Cognition (MASC; Dziobek et al., 2006) was used to assess cognitive and affective theory of mind abilities. It consists of a 15-minute movie divided into 49 short video clips ranging from 3 to 71 s. The video depicts common interpersonal situations and participants respond to questions requiring them to decode the characters' cognitive and affective mental states from available cues (e.g., intonation, body language), as in real life. The movie depicts two women and two men having dinner and engaging in a variety of interpersonal interactions (e.g., misunderstandings, flirting, joy, gratitude, contempt, irritation). No instructions are given as to whether participants should focus on body language, intonation, semantic content of speech, facial expressions, or other social indicators. Each short clip is followed by a multiple-choice question assessing cognitive theory of mind (e.g., Why did the character do that? What is the character thinking?) or affective theory of mind (e.g., How is the character feeling?), with one correct answer from four choices. Scores on affective (out of 18) and cognitive scales (out of 28) reflect the number of correct responses. Each erroneous answer is scored as related to either overmentalizing (over interpreting the characters' intentions/actions), undermentalizing (insufficient interpretation), or nonmentalizing (absence of theory of mind or complete lack of social interpretation). Finally, there are six control questions to ensure participants are paying attention and understand the global content of the video. The MASC has high internal consistency (α = .82 for total score and each subscale) and high test–retest reliability (intraclass correlation, ICC = .97; Dziobek et al., 2006). We selected the MASC as it is a real-world analogous assessment of social-cognitive functioning and involves asking participants to assess alcohol use in a social setting, which is relevant to our sample and aim.

Stereotype Threat Manipulation

Following stereotype threat elicitation approaches used in the previous studies (Nicolas et al., 2020; Pennington et al., 2016), participants in the ST condition were told that the study objective was to investigate relations between alcohol use and performance on memory and social cue skills. During the consent process, participants were told that deficits in both areas were expected in those with higher levels of alcohol use. Speed, accuracy, and reliance on memory/social skills were emphasized to participants prior to the beginning each task to increase performance pressure. Moreover, as part of the stereotype threat manipulation in the experimental condition, participants also completed the AUDIT before the memory and social tasks, with the intent to strengthen self-identification as "problematic drinkers" in those with high scores before they began the tasks

Participants in the neutral condition were told that the goal of the study was to assess individual variations in memory and social cue interpretation skills. There was no mention of examining these differences in relation to alcohol use status, and no mention of speed or overreliance on memory/social skills. In this condition, participants completed the AUDIT after the memory and social cognition tasks to reduce inadvertent activation of stereotype threat during task completion.

Statistical Analysis

Omnibus two-way bootstrapped analysss of variance (ANOVAs) are first reported to assess overall differences between experimental

Table 1
Demographic Characteristics

Group Drinking status	Stereotype threat			Neutral		
	None	Nonproblematic	Problematic	None	Nonproblematic	Problematic
Sex female: male: no answer	28: 8: 0	27: 6: 0	26: 4: 1	34: 5: 1	37: 11: 0	11: 4: 0
Gender woman: man: nonbinary: no answer	27: 8: 1	27: 6: 0	26: 3: 1:1	31: 5: 3: 1	32: 10: 6	9: 4: 2
Age (*M*/*SD*)	19.3 (4.7)	20.2 (5.5)	20.9 (5)	19.7 (3.9)	23 (7)	21.8 (6)
Ethnicity (%)						
White/European	19.4	45.5	45	22.5	40	63
East/South East Asian or Pacific Islander	16.7	15	19	15	23	13
Hispanic or Latino	0	9	3	5	4.2	0
Black	2.8	0	0	2.5	8.3	0
Indigenous	0	0	0	0	0	0
South Asian	30.6	15	6	32.5	12.5	6
Middle Eastern	13.9	9	6	10	2.1	6
Mixed	6	9	13	7.5	10	12
AUDIT (*M*/*SD*)	0	2.4 (1.5)	9.5 (3.8)	0	2.5 (1.4)	9.1 (2.1)
Frequency of drinking	0	2–4 times a month	2 times a month—4 times a week	0	Monthly or less	2–4 times a month
Number of drinks	0	1–2	1–6	0	1–2	3–6
Frequency of binge episodes	0	Never—less than monthly	Less than monthly—monthly	0	Never—less than monthly	Less than monthly—monthly
Reasons for not drinking (%)						
Religious	33			28		
Personal preference	50			49		
Family history or in recovery	5			5		
Underage	19			15		
Other drug use (lifetime %)						
Cannabis (Y)	8	70	73	23	44	63
Stimulants (Y)	0	6	20	0	19	19
Opioids (Y)	3	9	17	5	10	19
Sedatives (Y)	0	12	10	10	15	19
Hallucinogenics (Y)	0	6	27	0	10	31
PCP/Ketamine (Y)	0	6	3	0	0	0
Inhalants (Y)	0	0	0	0	0	6
Other (Y)	11	24	3	18	15	38

Note. AUDIT frequency, number of drinks, and frequency of binge episodes reflect most commonly selected answers in each group. "Other drugs" include anabolic steroids, nitrous oxide (laughing gas, "whippets"), nitrites (amyl nitrite, butyl nitrite, "poppers" "snappers"), diet pills (phentermine), or over-the-counter medicine for allergies, colds, cough, or sleep. AUDIT = Alcohol-Use Disorders Identification Test; PCP = Phencyclidine; Y = yes.

conditions (ST, neutral), drinking status (none, nonproblematic, problematic), and their interaction on immediate recall performance, and MASC affective and cognitive subscales. We evaluate these results in terms of statistical significance ($\alpha = .05$) and whether they yielded at least medium-effect sizes. Following arguments that omnibus tests involving multiple groups are diffuse and may be inappropriate and subject to Type II error, particularly when several cells are not expected to differ (i.e., within our neutral condition) or when ordered effects are likely (i.e., across alcohol use levels), we also applied focused linear contrasts to assess our main a priori relations of interest (Rosnow & Rosenthal, 1988). More specifically, within each experimental condition, we contrast task performance across those who reported problematic alcohol use, nonproblematic alcohol use, and nondrinkers (contrast weights: −1 0 1, respectively). All analyses were conduct in R v.4.1.2 (R Core Team, 2021) and JASP v0.16.1 (JASP, 2023).

Results

Effect of Stereotype Threat on Recall Performance

The omnibus ANOVA revealed significant effects of the ST condition, $F(1, 199) = 4.14$, $\eta_p^2 = .02$, $p = .004$, and of drinking status, $F(1, 200) = 17.96$, $\eta_p^2 = .05$, $p < .001$ on memory performance (see Table 2). The ST Condition × Drinking Status interaction failed to reach significance, $F(1, 199) = 1.78$, $\eta_p^2 = .01$, $p = .169$. Based on visual representation of the data showing nonoverlapping confidence intervals, and aligning with our a priori hypothesis that those with problematic alcohol use in the ST condition would perform worse than the other five groups, we conducted linear contrast analyses. Among individuals in the ST condition, the a priori contrast provided strong evidence for a pattern of lower recall with increasing levels of problematic drinking, $t(97) = -4.61$, $d = 0.94$, $p < .001$ (see Figure 1); pairwise contrasts showed that there was significantly lower recall in problematic drinkers relative to nonproblematic drinkers, $t(62) = -3.18$, $d = 0.81$, $p = .002$ and nondrinkers, $t(65) = -4.30$, $d = 1.07$, $p < .001$. Conversely, performance on the recall task in the neutral condition failed to reveal significant differences among the three groups based on drinking status, $t(100) = -1.53$, $d = 0.31$, $p = .140$.

Effect of Stereotype Threat on Cognitive and Affective Theory of Mind Performance

The omnibus ANOVA on cognitive MASC scores failed to reveal main effects of group, $F(1, 199) = 1.17$, $\eta_p^2 < .01$, $p = .297$, drinking status, $F(1, 199) = 0.54$, $\eta_p^2 < .01$, $p = .474$, or of their interaction, $F(1, 200) = 0.15$, $\eta_p^2 < .01$, $p = .707$. This was corroborated by the planned linear contrasts between groups, as was done with the memory task. Likewise, the ANOVA on the affective subscale of the MASC showed no effect of group, $F(1, 199) = 0.02$, $\eta_p^2 < .01$, $p = .868$, drinking status, $F(1, 199) = 0.24$, $\eta_p^2 = .01$, $p = .626$, or their interaction, $F(1, 200) = 0.72$, $\eta_p^2 < .01$, $p = .390$, which was again corroborated by linear contrasts across drinking groups (see Figure 2).

Despite the lack of significant differences in scores on both the cognitive and affective subscales, further inspection of the total MASC by error type revealed that those in the ST condition who reported problematic alcohol use made significantly more overmentalizing mistakes relative to nonproblematic drinkers and nondrinkers, $t(97) = 2.29$, $d = 0.47$, $p = .024$, whereas this was not the case in the neutral condition, $t(100) = 1.51$, $d = 0.30$, $p = .132$. Comparatively, undermentalizing mistakes and nonmentalizing mistakes did not differ as a function of group or drinking status, $p > .05$.

Discussion

This study examined the effects of stereotype threat on the memory performance and theory of mind skills of undergraduate students with varying levels of alcohol use using an experimental manipulation. In the ST condition, individuals who reported alcohol consumption above the problematic drinking cutoff had significantly lower recall performance relative to nonproblematic drinkers and nondrinkers. This was not the case in the neutral condition without ST induction, such that there was no significant difference in recall performance between alcohol consumption categories. It should be noted that the problematic drinking groups in the present study scored a mean of 9.1 and 9.5 out of a possible 40 on the AUDIT; thus, in the neutral group, a lack of significant memory differences between drinking conditions may reflect relatively moderate AUDIT scores reported in the present sample and are not implicative of a lack of alcohol effects on memory generally. These findings support the detrimental impact of stereotype threat on task performance in students who met the cutoff indicating possible problematic drinking patterns and suggest that stereotype threat may contribute, at least in part, to the drinking-related memory deficits reported in students.

Our findings build on the previous research showing that eliciting stereotype threat in individuals who use substances can impair memory performance (Cole et al., 2006) and further show that

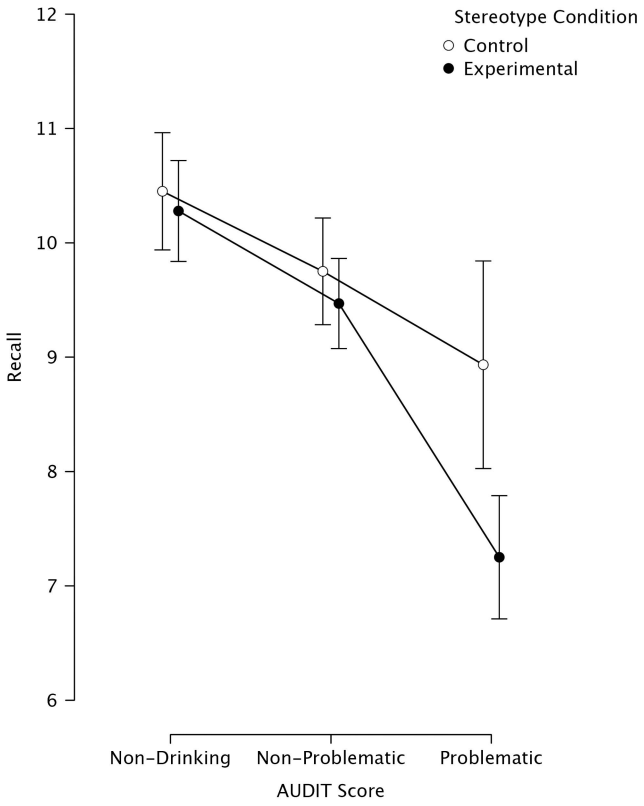
Table 2
Mean (Standard Deviation) Task Performance Across Experimental Conditions and Drinking Groups

Group	Stereotype threat			Neutral		
Drinking status	None	Nonproblematic	Problematic	None	Nonproblematic	Problematic
Recall	10.3 (2.6)	9.3 (2.2)	7.2 (3.1)	10.5 (3.2)	9.8 (3.2)	8.3 (3.5)
MASC cognitive	19.6 (4.2)	20.7 (4.7)	18.7 (5)	20.3 (3.5)	20.6 (4.0)	19.7 (5.1)
MASC affective	11.9 (2.7)	12.9 (2.2)	11.9 (3.9)	12.4 (2.7)	12.6 (2.5)	11.2 (2.8)
MASC mistakes						
Overmentalizing	7.3 (3.0)	6.1 (3.0)	8 (3.3)	6.3 (2.8)	6.0 (2.9)	7.7 (3.5)
Undermentalizing	4.8 (4.0)	4.1 (3)	4.7 (3.5)	4.4 (2.4)	4.1 (2.7)	4.4 (3.4)
No mentalizing	2.3 (2.4)	2.1 (2.4)	2.3 (3)	1.9 (1.8)	2.5 (2.6)	2.6 (2.6)

Note. MASC = movie for assessment of social cognition.

Figure 1

Mean (Standard Error) Recall Performance Across Experimental Conditions and Drinking Groups



Note. Greater levels of problematic drinking related to lower recall only in the stereotype threat condition, $p < .001$. AUDIT = Alcohol-Use Disorders Identification Test.

this extends to problematic alcohol use. These findings underscore the importance of carefully executing research procedures. Indeed, the extent to which studies inadvertently elicit stereotype threat, for instance, by administering a measure of alcohol use *before* cognitive tasks, might contribute to mixed findings in the literature regarding problematic alcohol use and memory in undergraduate students (e.g., Heffernan et al., 2010; Heffernan & O'Neill, 2012). Nonetheless, we deliberately manipulated stereotype threat cues in the present study. It will be important for future work to examine the extent to which stereotype threat affects performance in clinical samples with more consistently reported memory deficits and under more typical testing procedures.

In contrast to memory performance, there was no significant effect of the stereotype threat manipulation on theory of mind. Performance on the affective MASC scale was similar across drinking groups and between experimental conditions, suggesting that affective theory of mind, or the ability to infer others' emotional mental states, may not be vulnerable to stereotype threat in students with problematic alcohol use. Of note, prior research has not yet directly investigated stereotype threat in relation to affective theory of mind in other populations. While impairments in affective theory of mind have been observed in a clinical alcohol-dependent sample (Maurage et al., 2016), awareness of this specific deficit/stereotype may be less known and therefore results in fewer stereotype threat effects on performance. Further, these stereotypes may have been less relevant among our student sample who had lower levels of problematic drinking. Whether stereotype threat contributes to this aspect of social cognition in clinical and in nonclinical samples warrants further study.

Although not statistically significant, individuals who reported problematic alcohol use in the ST condition achieved the lowest mean scores on the MASC cognitive scale compared to all other groups, with effect sizes in the small-to-medium range in the predicted direction. This pattern, while not significant, aligns with our hypothesis and may be interesting to further assess in a larger sample size or in clinical populations. Comparatively, individuals who reported nonproblematic alcohol use scored numerically higher than those who reported no drinking in both experimental conditions, which is surprising. These findings may relate to the MASC task itself, as several video segments depict friends consuming alcoholic beverages at dinner, and participants are asked a few questions about one of the character's reactions to other characters' alcohol consumption. As consumption of alcohol, or lack thereof, may affect scenario interpretation (i.e., Zack et al., 1999, 2002), in future research, it would be useful to probe more in-depth how the interpretation of these scenarios or the questions asked might differ among people based on their experience using alcohol.

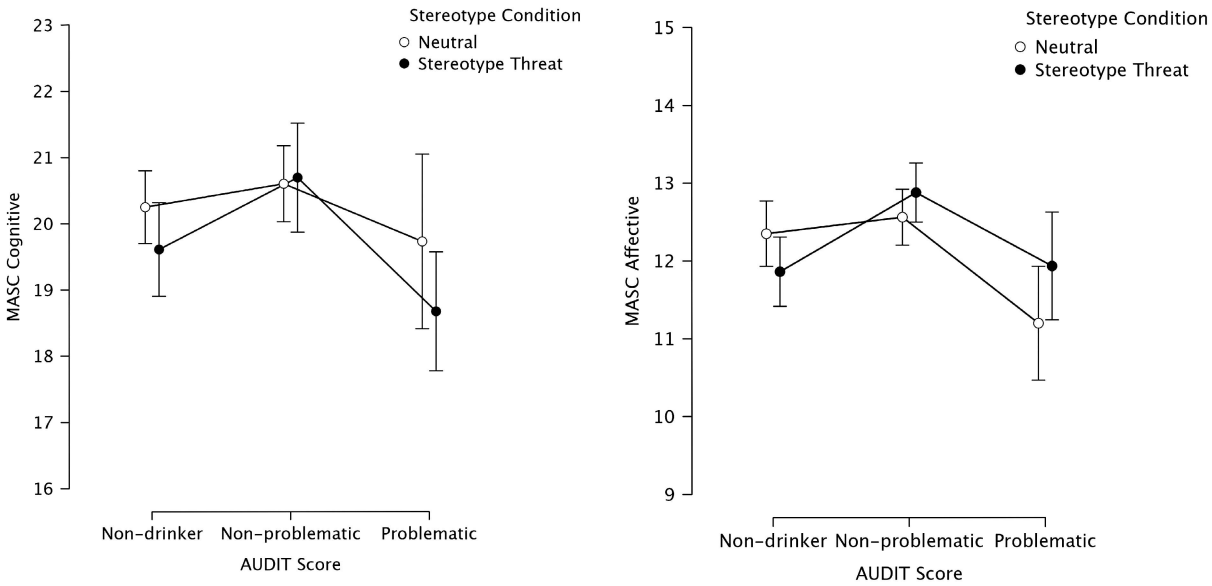
Mechanisms of Stereotype Threat

Decreased memory performance as a result of stereotype threat elicited in a stigmatized group is a robust finding across several populations, for example, older individuals (Armstrong et al., 2017), socially marginalized groups (Schmader et al., 2008), and people who use ecstasy (Cole et al., 2006). Notably, tasks that rely on verbal working memory, including explicit recall tasks, are particularly vulnerable to stereotype threat (Beilock et al., 2007; Coles et al., 2018; Schmader et al., 2008), in part due to reliance on working memory for the ability to perform under acute stressors or high cognitive load (Schmader et al., 2008). Thus, it would be interesting to assess the extent to which working memory might mediate these effects on episodic memory tasks as observed in the present study.

However, the lack of significant stereotype threat effects observed on the MASC in this study is surprising given the role of working memory in theory of mind abilities. For example, theory of mind abilities have been shown to develop in tandem with working memory abilities in childhood (Lecce & Bianco, 2018; Lecce et al., 2017; Mutter et al., 2006) and decrease in tandem with declining working memory abilities in older adulthood (Lecce et al., 2019). Moreover, in the context of social-working memory, Meyer and Collier (2020) observed performance decrements when participants were asked to assess the mental states of four characters as opposed to that of one or two characters, indicating that theory of mind abilities are sensitive to cognitive load. In line with this, our finding that problematic drinkers in the ST condition were more likely than other groups to commit overmentalizing mistakes on the MASC may be reflective of increased cognitive load, anxiety, or an effort to avoid fulfilling the stereotype (Schmader et al., 2008). In addition, we also found that, individuals in the problematic drinking group of the ST condition scored the lowest on the cognitive subscale of the MASC. Previous evidence has found that cognitive reasoning of others' mental states (cognitive theory of mind) is more reliant on verbal working memory abilities than is perceptual decoding of

Figure 2

Mean (Standard Error) Performance on the MASC Cognitive and Affective Task Across Experimental Conditions and Drinking Groups



Note. MASC = movie for assessment of social cognition; AUDIT = Alcohol-Use Disorders Identification Test.

others' emotional states (affective theory of mind; Gokcen et al., 2009). Thus, future research should assess whether cognitive theory of mind is more susceptible to stereotype threat under higher cognitive loads, as well as the potential role of stereotype threat on cognitive theory of mind in clinical samples.

Implications and Future Directions

Our findings support that undergraduate students may be vulnerable to substance-related stereotype threat in a study setting. Indeed, while students may have more relaxed attitudes toward heavy drinking generally, negative perceptions of people with alcohol use "problems" are often still present (Borsari & Carey, 2001; Brown, 2011; Topkaya et al., 2021). For example, Enzmann et al. (2021) reported that approximately one-third of students had high levels of alcohol-related stigma that encompassed social/occupational functioning stereotypes (e.g., not deserving of employment opportunities or viewed as untrustworthy), which were reduced via an educational intervention. However, it is possible that the results from our paradigm may differ if examined with a different cohort, such as adults with clinically diagnosed alcohol use disorders who may experience different, or more pronounced, shame-related stigmas including losing employment, dissolution of marriages, and other such consequences that may differ qualitatively from peer judgement. Given the limited research on stereotype threat in people with substance use disorders, further examination of other cohorts and comparisons of the degree to which certain stereotypes are present may be beneficial.

The findings of this study have relevant implications for design procedures in research assessing cognitive functioning in relation to substance use in undergraduate students. Indeed, undergraduate students are a common target population in this research field due to their heavy substance use and sampling convenience. In addition, from a broader public health perspective, it may be valuable to ensure that findings of scientific studies are communicated in a way that minimizes the stigmatization of people with problematic or disordered substance use. Similarly to effects of stereotype threat found across sociocultural groups (Aronson et al., 2013), it is plausible that inadvertent activation of substance-related cues could also affect interactions and performance in academic and clinical settings, with potential educational and health-care implications (Pennington et al., 2016).

Future research may benefit from extending our findings both to different severities of alcohol use problems and to other neurocognitive tasks (e.g., executive functioning; Pennington et al., 2016). We also note that our study took place online through written instructions, whereas the previous research typically elicited stereotype threat with a facilitator in the room. The potential role of an experimenter's presence in person rather than virtually, perhaps adding social pressure or anxiety, on stereotype threat effects would be worthy of investigation. In addition, this study took place at a Canadian "commuter" university, which may differ from other universities (i.e., with fraternities) in terms of drinking culture (Leontini & Corney, 2023). Broader replication at several universities may be fruitful for generalizing across different student cultures. Finally, future studies may also benefit from assessing whether individuals explicitly self-identify as problematic users when undergoing a stereotype threat manipulation, or if people with problematic alcohol use are more likely to attribute their performance to alcohol use in the stereotype threat condition rather than the neutral condition.

Conclusions

Our findings indicate that recall performance among students with problematic drinking patterns may be influenced by stereotype threat. As such, we recommend that researchers be cognizant of

such confounds and take particular care to not induce or amplify feelings of stereotype threat when assessing neurocognitive domains that may be stigmatized. Of course, any withholding of information should be balanced with considerations of informed consent. In addition, discussing findings of research with the public requires proficiency in scientific communication so as to not contribute to further stigmatization of stereotyped groups that may occur inadvertently (e.g., through public health campaigns; Cortland et al., 2019). We encourage further research to characterize the extent to which stereotype threat related to alcohol and drug use affects performance across cognitive task domains in healthy and clinical samples, and the extent to which this may have impacted the cognitive profiles reported in the extant literature.

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