Alcohol narrows physical distance between strangers

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Pandemic management is likely to represent a global reality for years to come, but the roadmap for how to approach pandemic restrictions is as yet unclear. Of the restrictions enacted during COVID-19, among the more controversial surround alcohol. Like many infectious diseases, the principal mode of transmission for COVID-19 is direct respiration of droplets emitted during close social contact, and health officials warn that alcohol consumption may lead to decreased adherence to physical distancing guidelines. Governing bodies have acted to close bars before restaurants and have also specifically restricted alcohol sales, while at the same time those in the nightlife industry have labeled such actions unfounded and discriminatory. Complicating such debates is the lack of evidence on alcohol's effects on physical distance. In the current study we employed a randomized alcohol-administration design paired with computer-vision measures, analyzing over 20,000 proximity readings derived from video to examine the effect of alcohol consumption on physical distance during social interaction. Results indicated that alcohol caused individuals to draw significantly closer to an unfamiliar interaction partner during social exchange, reducing physical proximity at a rate with potentially important implications for public health. In contrast, alcohol had no effect on physical distance with a familiar interaction partner. Findings suggest that alcohol might act to overcome a natural caution people feel towards strangers and thus promote virus transmission between previously unconnected social groups.

alcohol | social behavior | physical distance | pandemic | COVID-19

> "You could open a bottle and build yourself a liquid bridge. That may be one of liquor's most profound and universal appeals . . . the way it generates a sense of connection to others. . .. One drink, and the bridge—so elusive in the cold, nerve-jangled sensitivity of sobriety—appears, waiting only to be crossed."
>
> —Caroline Knapp, *Drinking: A Love Story*

> "Bars . . . that's a perfect setup for the spread of infection. Fundamental things like masking, distancing, washing hands, closing bars—if you do that, I think it will be a giant step toward interfering with the spread in your community."
>
> —Dr. Anthony S. Fauci, 7 July 2020, Press conference with US Sen. Doug Jones

With COVID-19 the world was introduced to the age of pandemic planning, but the roadmap for how to approach restrictions during pandemic times is as yet unclear (1). Despite the budding availability of vaccines in some countries, COVID-19 is likely to be a global reality for months, and possibly years, to come. Research is needed to inform science-based policy in response to COVID-19 and to further ensure preparedness for future pandemics (2).

Of COVID-19 restrictions enacted to date, among the more controversial surround alcohol (3, 4). Like many infectious diseases, the principal mode of transmission for COVID-19 is direct respiration of droplets emitted during close social contact (5). Both the Centers for Disease Control and Prevention and the World Health Organization have advised against combining alcohol consumption and social interaction during COVID-19, indicating that alcohol is likely to decrease adherence to physical distancing guidelines (6, 7). Governing bodies have acted to close bars and clubs before restaurants and have also specifically restricted alcohol sales, while at the same time those in the nightlife industry have labeled these actions unfounded and discriminatory (3, 4). Complicating these debates is a lack of empirical evidence, as prior research has not examined the effects of alcohol on physical distance.

Alcohol consumption in the context of on-site outlets has raised particular concern for COVID-19 spread, affording opportunities for disease transmission amongst previously unconnected social groups. Bars, pubs, and nightclubs are sometimes referred to as "open regions," featuring communal seating and open floorplans specifically designed to promote interaction between unfamiliar individuals (8, 9). While interactions with strangers can be experienced as exciting and pleasurable, as they have the potential to lead to the formation of new social connections, these novel social spaces can also give rise to feelings of uncertainty and self-consciousness (10). Alcohol, which is widely consumed for its anxiolytic properties (11), has been theorized to diminish the natural sense of caution individuals feel towards strangers, and thus it is perhaps no surprise that societal spaces designed to facilitate novel social interaction also tend to centralize alcohol consumption (8, 9, 12). Affording a social context fecund for eliciting alcohol's social cohesive effects, unfamiliar social spaces may also offer a setting fruitful of the proximity-seeking behavior that facilitates virus transmission.

Developing policy effective in mitigating virus spread will require a broad and diverse base of scientific evidence, spanning from large-scale epidemiological studies to finely controlled experimental trials. The present experiment, among the largest human alcohol-administration trials conducted to date (cf. refs. 8 and 13), employed a randomized design and computer vision measures to explore alcohol's impact on physical distance. Participants were assigned to consume alcohol or a control beverage in the company of either a friend or a stranger, and change in physical distance over time was estimated based on continuous video of dyadic interaction (Fig. 1).

Results

All study data and code are included in the article and supporting information. At baseline (minutes 0 to 6) there were no significant effects of alcohol on physical distance within either stranger, $P = 0.292$, or familiar interaction conditions, $P = 0.424$ (Table 1). In the stranger condition, a significant interaction emerged between beverage condition and time, $b = 0.23$, $P = 0.035$, 95% CI[0.02,0.44]. Among stranger dyads assigned to

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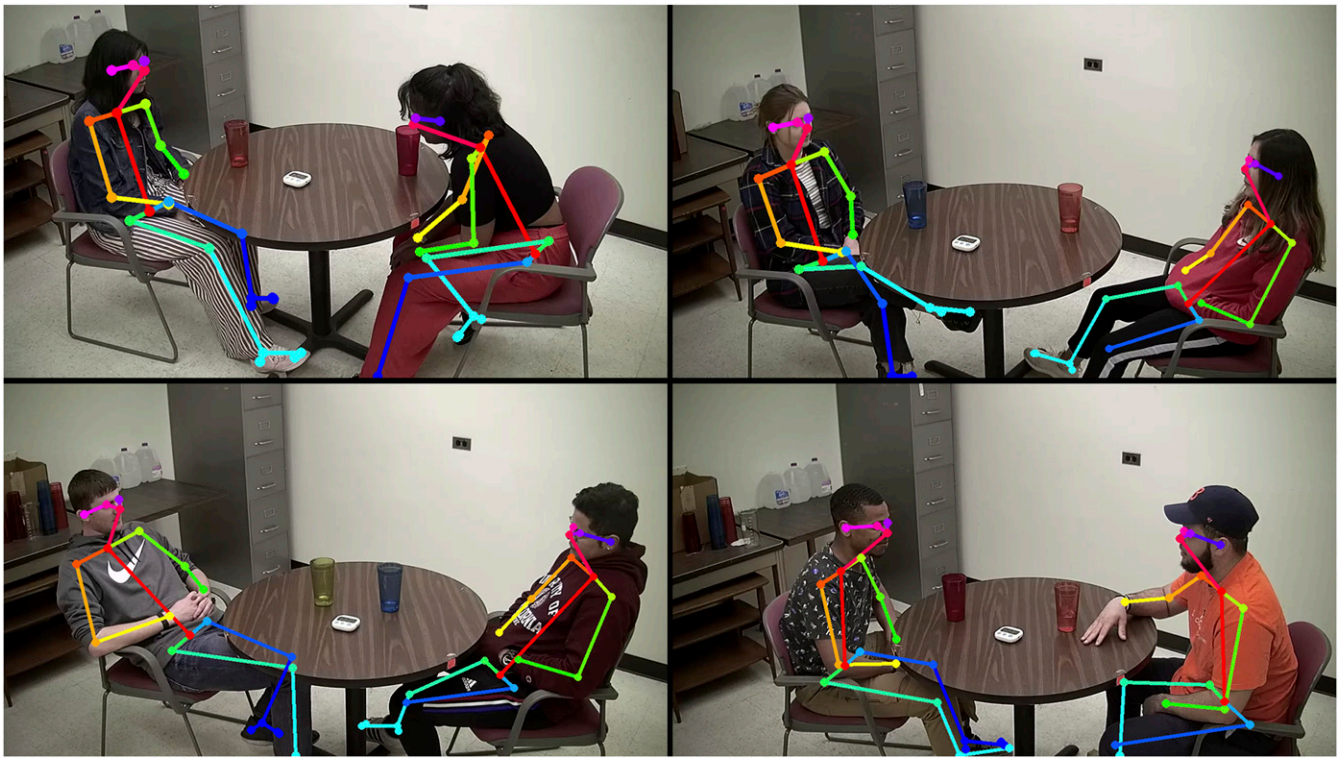

Fig. 1. Computer-vision algorithms recognized the relative position of participants' bodies from video of dyadic interaction. Participants displayed above provided their consent for dissemination.

consume alcohol, physical distance decreased significantly during the interaction (−0.29 cm/min; Table 1 and *SI Appendix*, Fig. S1). In contrast, among strangers assigned to consume a nonalcoholic beverage the reduction in distance was substantially smaller and nonsignificant (−0.06 cm/min). Of note, there was no interaction between beverage condition and time among those assigned to drink with a friend—familiar dyads consuming both alcohol and control beverages tended to move closer as the interaction progressed, with no significant differences in the extent of physical distance reductions across beverage conditions, $b = -0.08$, $P = 0.671$, 95% CI[−0.43, 0.28].

Discussion

Maintaining physical distance during social exchange is among the most effective means of curtailing virus spread, but evidence is lacking surrounding the effects of the world's most widely consumed social drug on physical distancing behaviors. In the current study, alcohol caused individuals to draw significantly closer to an unfamiliar interaction partner as time passed and intoxication level increased. In contrast, alcohol had no impact on physical distance among those in a familiar social context. Considered together with prior research (8, 9, 12), results of the current study suggest that alcohol might act to overcome the natural caution that often characterizes novel social spaces and promote proximity seeking with a stranger. Alcohol is known to impair judgment and promote violations of social restrictions (14), and thus it is notable that we observed significant effects of alcohol on physical distance even in a trial conducted prepandemic, and further that we observed such effects even given natural constraints on proximity seeking imposed by the seated paradigm. When considered in terms of the length of a typical drinking session, the rate of change estimated in the current study would result in physical distance reductions with potentially important implications for virus spread (>50 cm reduction per 3-h drinking session).

The effects of consuming alcohol present us with an inherent contradiction. The same substance that lifts the spirits and forges social connections can fuel addiction, rupture close relationships, and drive risky decisions (8, 14). Rarely has the fundamental tension of alcohol's effects appeared so stark as it has during the COVID-19 pandemic. At a time of increased isolation and monotony, and a resultant yearning for a sense of community and novelty offered by drinking environments, these findings offer a sobering piece of evidence to consider in developing public health policy.

Materials and Method

All procedures were reviewed and approved by the University of Illinois Institutional Review Board. Young, healthy social drinkers ($N = 212$) were recruited from December 2018 to March 2020 for a trial examining alcohol's effects in social context (NCT03449095; see *SI Appendix, Supplementary Information Text* for detailed methods). To enroll, participants were required to identify at least one eligible friend. On the day of their visits, after signing consent, participants were randomly assigned to drink either an alcoholic (target peak BAC 0.08%) or a nonalcoholic beverage in the company of either their own friend (i.e., familiar condition) or the friend of another participant (i.e., stranger condition). To ensure no prior familiarity in the stranger condition, participants were individually introduced at study initiation (12). In line with alcohol-administration guidelines that address carryover effects (12, 15), the present study employed a between-subject design yielding a total of four experimental conditions: Alcohol/Familiar ($N = 52$; 46% female), Alcohol/Strangers ($N = 56$; 57% female), Control/Familiar ($N = 48$; 50% female), and Control/Strangers ($N = 56$; 57% female). Participants were aware of their beverage condition assignment (*SI Appendix, Supplementary Information Text*). For beverage administration, dyad members were seated across from one another around a round table (~90-cm diameter). Beverages were administered in three equal parts over 36 min, during which time participants were allowed to interact freely while their behaviors were videotaped. Computer-vision algorithms were employed to identify the position of each participant's face at 10-s intervals throughout the drink

Table 1. Baseline (cm) and change over time (cm/min) in physical distance estimations within stranger and friend dyads assigned to receive alcohol and control beverages

	Strangers			Friends		
	b	95% CI	*P*	*b*	95% CI	*P*
Change over time in distance (minutes 6–36)						
Alcohol	−0.29	−0.43, −0.16	<0.001	−0.19	−0.41, 0.02	0.078
Control	−0.06	−0.23, 0.10	0.458	−0.27	−0.55, 0.01	0.059
Baseline distance* (minutes 0–6)						
Alcohol	142.86	136.19, 149.52	<0.001	134.43	125.53, 143.33	<0.001
Control	137.19	128.86, 145.52	<0.001	139.34	130.95, 147.73	<0.001

Alcohol/Friends ($N = 52$), Alcohol/Strangers ($N = 56$), Control/Friends ($N = 48$), and Control/Strangers ($N = 56$). Change over time values are derived from mixed models capturing linear slopes (cm/min) in physical distance from >6 min to the end of the interaction—the time period during which pharmacological alcohol effects were expected to emerge. Baseline values refer to the average estimated physical distance (centimeters) minutes ≤6 of the interaction.
*For both Friend and Stranger dyads there were nonsignificant baseline group differences in physical distance between alcohol and control conditions: Strangers, $b = -5.67$, $P = 0.292$; Friends, $b = 4.91$, $P = 0.424$. In contrast to within-dyad effects, which hold constant many sources of noise, direct between-group comparisons in the current study are more likely to be impacted by variability associated with extraneous factors—e.g., precise angle of participants' chairs and large height differentials. Thus, primary analyses focus on within-dyad change over time. See *SI Appendix, Supplementary Information Text* for details of physical distance approximations.

period, resulting in a dataset comprising over 20,000 observations (Fig. 1). Linear mixed models estimating random slopes examined change over time within dyads in physical distance over the course of the interaction. Given delays in pharmacological alcohol action (12), over-time analyses focused on the final 30 min of the interaction as the time period during which pharmacological alcohol effects were expected to emerge (Table 1).

Data Availability. All study data are included in the article and/or supporting information.

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