POLICY AND PREVENTION

Social Norm Influences on Evaluations of the Risks Associated with Alcohol Consumption: Applying the Rank-Based Decision by Sampling Model to Health Judgments

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Abstract — Aims: The research first tested whether perceptions of other people's alcohol consumption influenced drinkers' perceptions of the riskiness of their own consumption. Second, the research tested how such comparisons are made—whether, for example, people compare their drinking to the 'average' drinker's or 'rank' their consumption amongst other people's. The latter untested possibility, suggested by the recent Decision by Sampling Model of judgment, would imply different cognitive mechanisms and suggest that information should be presented differently to people in social norm interventions. **Methods:** Study 1 surveyed students who provided information on (a) their own drinking, (b) their perceptions of the distribution of drinking in the UK and (c) their perceived risk of various alcohol-related disorders. Study 2 experimentally manipulated the rank of 'target' units of alcohol within the context of units viewed simultaneously. **Results:** In both studies, the rank of an individual's drinking in a context of other drinkers predicted perceptions of developing alcohol-related disorders. There was no evidence for the alternative hypothesis that people compared with the average of other drinkers' consumptions. The position that subjects believed they occupied in the ranking of other drinkers predicted their perceived risk, and did so as strongly as how much they actually drank. **Conclusions:** Drinking comparisons are rank-based, which is consistent with other judgments in social, emotional and psychophysical domains. Interventions should be designed to work with people's natural ways of information processing, through providing clients with information on their drinking rank rather than how their drinking differs from the average.

INTRODUCTION

The alcohol consumption of young adults is a substantial public health concern, with 44% of 18–22-year olds in the USA college education reporting binge drinking in the last 30 days and 18.8% reporting chronic heavy use (Substance Abuse and Mental Health Services Administration, 2003). The problem is slightly less frequent among the general USA population of this age group, with 38.9 and 13.4% of young people respectively reporting binge and heavy drinking (Substance Abuse and Mental Health Services Administration, 2003). Studies of the risks associated with excessive drinking in this population commonly focus on short- to medium-term consequences, such as impaired working ability and legal problems; however, there is growing evidence that longer-term difficulties are associated with early excessive drinking. Up to 15% of 18–25-year olds meet DSM-IV criteria for alcohol dependence (Substance Abuse and Mental Health Services Administration, 2003), and lifetime risk of dependence increases for each year that alcohol use began below age 21 (Grant and Dawson, 1998). Elevated liver enzymes have been observed in excessively drinking adolescents (Clark *et al.*, 2001), possibly indicating the beginning of liver damage which could lead to cirrhosis in later life if drinking is not reduced to safer levels. Very little previous research has focused on how young adult drinkers perceive the risks associated with their consumption, with almost no research focusing on perceptions of the risk of more serious health consequences. Understanding how young people perceive the risks associated with their alcohol consumption is important in order to design the most effective interventions to decrease unsafe alcohol use (Moreira *et al.*, 2009).

One possibility is that people's evaluations of the riskiness of their consumption are based solely on the amount they drink, irrespective of social context. Given that there has been little previous research into how young people perceive the long-term risks of alcohol use this is perhaps an intuitive possibility. However, the social norms perspective, extensively tested in other areas of alcohol research, suggests that this is unlikely. This research has shown that alcohol-related attitudes are influenced by perceptions and misperceptions of the amounts other people drink, which subsequently determine the extent of personal consumption of alcohol and the way in which it is consumed (e.g. Downs, 1987; Baer *et al.*, 1991; Perkins *et al.*, 2005; Moreira *et al.*, 2009). We expand on this previous research in two ways. First, the social norms perspective has generally not been applied to perception of the health risks associated with personal consumption (as highlighted by Lewis & Thombs, 2005), instead focusing on such questions as how people misestimate others' drinking (e.g., Perkins, et al., 2005) and how such misperceptions predict personal consumption (Downs, 1987). We expand social norms research to explain perceived riskiness of alcohol use amongst young people. Second, we examine the cognitive mechanism through which social norms operate; specifically, we ask how people compare their level of consumption to other people's. In addition to providing more specific information about the process of alcohol risk perception, this will advance the understanding of the role of social norms by showing how they operate at the cognitive level.

Social norms research has previously suggested that perceptions of one's own drinking depend on the drinking of relevant others, such as friends and peers. This assumes a cognitive process whereby one's own drinking is compared the drinking of others, with the outcome of this comparison process influencing perceptions of one's own behavior. How this comparison process occurs is typically not specified by

social norms accounts, even though it must be central to understanding social norm-based judgments. However, some indication of the implicit assumptions in the literature is given by the nature of the questions asked to elicit people's perceptions of social norms. For example, Perkins *et al.* (2002) ask 'how many alcoholic drinks do you think the typical student [drinks]?'. The use of information thus obtained in norm-based interventions implicitly assumes that people compare with a drinker at the mean or median of the population. Similarly, other research asks specifically about the 'average student'.

In the present study, we suggest an account of how people compare themselves with others based on the recently developed Decision by Sampling Model (DbS, Stewart *et al.,* 2006), which has been generating much interest in cognitive science, but which has yet to be applied to the social norms perspective or any area of health and healthcare research.

Applied to alcohol, DbS suggests that people first bring to mind a group of people, sampled either from memory or from the immediate environment. The individual then sequentially compares their own levels of drinking with each other person in this sample, simply encoding whether the other person drinks more or less than them. These comparisons are automatically summed, providing the frequency of others who drink more and less than they do, thus providing their 'relative rank' in the distribution. For example, if an individual called to mind two people believed to drink more than themselves, and four assumed to drink less, their subjective relative rank would be 0.67.

Although untested, it is perhaps intuitive that a person would be more influenced by perceptions of how their drinking ranks among others than how their drinking differs from the average. If a person thinks they are drinking 25 units per week and the average is 18, this could place their drinking at the 55th percentile, 75th or indeed theoretically at any other percentile between 51 and 100 depending on the dispersal of drinkers around the mean. Thus rank-based judgments make better use of all of the available information.

DbS provides a process account of previous research which shows that when making comparative judgments, people are influenced by the rank position of a stimulus in a comparative set, rather than its distance from the average of the set. This effect has been extensively observed in psychophysical (Riskey *et al.,* 1979), economic (Brown *et al.,* 2008), mental health (Wood *et al.,* 2011) and social (Wood *et al.,* 2011; Wood *et al.,* in press) research fields. Interestingly, research in each of these fields has historically followed a path where it was initially assumed that people's judgments depended on the actual magnitude of the stimuli, then assumed judgments depended on how the stimuli differed from the mean of the comparison set, before consensus finally settled on judgments depending on how a stimuli ranks within a set. If the current research hypothesis is supported, social norms research will have followed the same historical path. Finally, DbS is consistent with the evolutionary position that animals are extremely sensitive to rank position in a hierarchy, as an animal's survival often depends on taking actions that are appropriate for its position among its peers (Taylor *et al.,* 2011a). It has been suggested that this evolutionary concern has remained in humans, and that rank-related cognitions can explain behaviors associated with psychopathology (Taylor *et al.,* 2009, 2010, 2011b). The

cognitive and evolutionary evidence converge to suggest a basic concern with rank. If rank position is evolutionarily important then it is likely that basic cognitive processes would have emerged to process information on rank. Equally, if rank-based judgments are the most cognitively efficient, it is likely they would have evolved in a variety of animals, which would then become sensitive to rank position within their hierarchy.

In the current research, we test whether (a) young adults' perceptions of the long-term risks associated with their drinking (e.g. risk of dependence or liver cirrhosis) are influenced by their perceptions of others' consumption, and if so, (b) whether they are influenced by the rank position of their drinking within their perceived distribution of other people's drinking. This second study provides the first test of whether DbS can explain social norm-based judgments, and more widely, will be the first test of the approach in any area of health and health care. In providing this test, it is important to control for two rival predictions. First, people who perceive their drinking rank to be higher will likely genuinely be drinking more. It is therefore important to control for the actual amount a person drinks, to ensure that this is not the explanation of the results. Second, DbS predicts that people will only be influenced by rank position. In contrast, other models of relative judgments predict that people will be influenced by how their drinking differs from the average of others' drinking (cf. Helson, 1947). Rank and distance from the mean are correlated as, for example, people at the seventieth percentile will see themselves as further from the mean than will people who see themselves at the sixtieth percentile. It is thus important to also control for how far participants see themselves from the average drinker. Taken together, these two controls will allow a direct and conservative test that it is specifically perceived drinking rank that influences perception of how at risk one is of alcohol-related disorders.

Study 1

Method

Two hundred and fifty undergraduate students who drink alcohol (42.4% male, 94.8% aged 18–22) completed a three section questionnaire in a one-to-one session with an experimenter. Students who did not drink alcohol were not eligible for the study. Participants were first given an A4 sheet which detailed the number of units of alcohol in different drinks, with information provided both graphically and in text. This sheet remained in front of the participants throughout the study. In Section 1, participants reported how many pints of beer, glasses of wine ('pub measures', 125 ml) and spirits ('pub measures', 25 ml) they drank on average in a normal week. At the data analysis stage these responses were coded into weekly units of alcohol.

In Section 2, participants answered four questions, each beginning 'if you continue your current levels of drinking for 20 years, what would be the percentage chance that you will personally develop ... ', and respectively ending (a) 'any alcohol-related illness', (b) 'any serious psychological difficulties as a direct result of alcohol use', (c) 'a dependency on alcohol' and (d) 'cirrhosis of the liver'. Participants responded to each question with any percentage value between 0 and 100.

In Section 3, participants answered nine questions about the distribution of other adults' average weekly levels of drinking in the UK. Each question was of the form: 'The top $x\%$ of the UK adult population consume more than *how many* units of alcohol per week on average?', where x took values of 10, 20, 30, 40, 50, 60, 70, 80 and 90. This elicitation procedure was used to allow the calculation of people's rank position within their spontaneously elicited distribution. Such a procedure is more implicit than asking people 'how do you rank among UK drinkers or similar, which may be more susceptible to self-enhancement biases. Further, if the DbS account is correct, people would first have to mentally create their assumed distribution of drinkers to work out their rank position—it seemed more parsimonious to ask them directly for the assumed distribution rather ask them for a less direct proxy.

Data analysis

Four regressions were performed to predict participants' responses to the Section 2 questions from (a) their level of drinking, (b) how they thought their drinking ranked among other UK drinkers ('perceived drinking rank'), (c) how their levels of drinking differed from the perceived mean of other people's drinking, and two covariates: (d) gender and (e) age, with all variables entered simultaneously. The perceived drinking rank, assumed mean of others' drinking and the distance from the average drinker variables were formed by (a) estimating each participant's cumulative distribution function (using either a lognormal or a linear function depending on best fit) from the answers to the Section 3 'deciles' questions, and (b) calculating the mean of each participant's subjective distribution function and the relative ranked position of the participant's own experience ('subjective rank') within it.

RESULTS AND BRIEF DISCUSSION

Drinking ranged from 0 to 125.5 units per week ($M = 19.55$, $SD = 16.51$, median = 15.00, interquartile range 7–28 units). On average, people thought that the mean level of others' drinking was 25.86 units ($SD = 16.56$), implying that the average participant thought they drank around six units below the mean of others' consumption.

The three highest drinking participants were excluded for being extreme outliers (>4 SD above the mean), leaving a range of 0–88. Perceived risk for the four health problems ranged from 0 to 100% for each question, with median-perceived risks of 20% (any alcohol-related illness and cirrhosis of the liver) and 10% (serious psychological difficulties and dependence).

The pattern of results was identical for each of the four problems; perceived risk was predicted from level of drinking and perceived rank, but not from how personal drinking differed from the perceived mean. First, perceived risk of any alcohol-related illness was predicted [$R^2 = 0.28$, $F (5, 241) = 19.03$, $P < 0.001$] from drinking level ($\beta = 0.32$, $P < 0.001$) and perceived rank ($\beta = 0.26$, $P < 0.01$) but not from distance from the mean ($\beta = 0.06$, $P = 0.40$). Second, perceived risk of any serious alcohol psychological difficulty was similarly predicted [$R^2 = 0.24$, $F (5, 241) = 15.15$, $P < 0.001$] from

drinking level ($\beta = 0.26$, $P < 0.01$) and perceived rank ($\beta = 0.28$, $P < 0.01$) but not from the distance from the mean ($\beta = 0.09$, $P = 0.20$). Third, perceived risk of alcohol dependence was likewise predicted [$R^2 = 0.48$, $F (5, 241) = 14.421$, $P < 0.001$] from drinking level ($\beta = 0.28$, $P < 0.01$) and perceived rank ($\beta = 0.24$, $P = 0.01$) but not from distance from the mean ($\beta = 0.08$, $P = 0.26$). Fourth, perceived risk of cirrhosis of the liver was also predicted [$R^2 = 0.26$, $F (5, 241) = 17.07$, $P < 0.001$] from drinking level ($\beta = 0.29$, $P < 0.01$) and perceived rank ($\beta = 0.27$, $P < 0.01$) but not from distance from the mean ($\beta = 0.09$, $P = 0.21$). The results were totally consistent; perceived riskiness of drinking is predicted from perceived rank but not from distance from the mean. Notably, perceived rank was as large a predictor of perceived risk as actual levels of drinking.

Study 2

Study 1 showed that students' perceptions of the riskiness of their drinking were predicted both by how much they drank and by the perceived rank of their consumption among other UK drinkers. Study 2 tested whether rank position of alcohol consumption in a context causally influenced risk perception. Specifically, the study tested whether simply seeing other units at the same time as rating a given 'target' consumption (e.g. 19 units/week) influenced how risky the consumption was judged to be (if the distribution of the other units changed the rank position of the target consumption in the context).

Method

Eighty-one undergraduate students (60 female, 82% aged 18–22) were randomly assigned to one of two groups (termed 'unimodal' or 'bimodal'). As in Study 1, participants were first given an information sheet detailing the number of units of alcohol in different drinks. Both groups were presented with an A4 sheet of paper on which were written 11 different numbers of units of alcohol. The quantities that participants saw varied between the groups as the key experimental manipulation.

For each stated number of units, participants were asked to sequentially rate the percentage chance that a person who drank this number of units on average every week for 20 years would develop (a) any alcohol-related illness, (b) any serious psychological difficulties as a direct result of alcohol use, (c) a dependency on alcohol and (d) cirrhosis of the liver (mirroring the questions in Study 1). Each question was asked twice, once referring to a man drinking this number of units and once referring to a woman (so each participant answered eight questions about each unit of alcohol, covering a range of consequences of excessive drinking for both genders). Questions were presented in counterbalanced order to control for presentation effects.

The procedure follows common practice in the experimental rank research paradigm (e.g. Brown et al., 2008; Wood et al., 2011). The unimodal group saw the following amounts of units; 5.0, 19.0, 26.5, 30.0, 32.0, 33.0, 34.0, 36.0, 39.5, 47.0 and 61.0, and the bimodal group saw 5.0, 6.0, 8.0, 11.5, 19.0, 33.0, 47.0, 54.5, 58.0, 60.0 and 61.0. Note that both groups saw 11 amounts of units ranging from 5 to 61, the average of all of the units in the context was equal between the groups (36), and the groups had three

target amounts in common (19, 33 and 47). (Note also that each target unit was the same distance from the mean of all the other units.) If participants simply rated the target units in isolation to the other units seen, or judged them according to how far they were from the mean of the units seen, then each of the common units should be seen as equally risky in both group. However, if judgments are based on rank, then the common units should be seen as differently risky between the conditions. Specifically, the first common point (19 units) should be seen as less risky in unimodal group (where rank = 2, i.e. it is the second lowest unit) than in the bimodal group (rank = 5). The second common point (33 units) should be seen as equally risky in each group, as rank = 6 in both cases. The third common point (47 units) should be seen as more risky in the unimodal group (rank = 10) than in the bimodal group (rank = 7). Note that this implies a cross-over interaction; the unimodal group should see the first common unit (19) as less risky, but the third common unit (47) as more risky, with the cross-over meeting at the second common unit (33).

RESULTS

We first examined the mean ratings in both groups for each of the common points, separately for each question. As can be seen in Fig. 1, for each of the questions the expected interaction was clear and consistent; common point 1 (19 units) was rated as 'less' risky in the unimodal group

(where rank = 2) than in the bimodal group (where rank = 5); common point 2 (33 units, rank = 6 in both groups) attracted approximately equal ratings in each group; and common point 3 was rated as more risky in the unimodal group (where rank = 10) than in the bimodal group (where rank = 7). The interaction was tested with a 2 (between: group) X 3 (within: common point) X 8 (within: question) mixed model analysis of variance. As expected, there was a main effect of comparison point, with consuming higher units of alcohol considered more risky [F (2, 158) = 392.84, $P < 0.001$]. The critical interaction between group and comparison point was highly significant [F (2, 158) = 46.60, $P < 0.001$], suggesting that the riskiness associated with drinking a given number of units of alcohol depended on the rank of those units in the context. There was no main effect of group, comparison point X question, or comparison point X question X group, suggesting that the rank principle is equally applicable to each of the eight questions (four risk domains across two genders). We also performed maximum likelihood data modeling, testing whether adding a rank parameter improved fit beyond a range-only model (see Brown *et al*., 2008). For each question, the rank parameter significantly improved fit (smallest $\chi^2 = 68.68$, $P < 0.001$).

DISCUSSION

The results showed that people's judgments about the risks associated with their drinking are influenced by how their
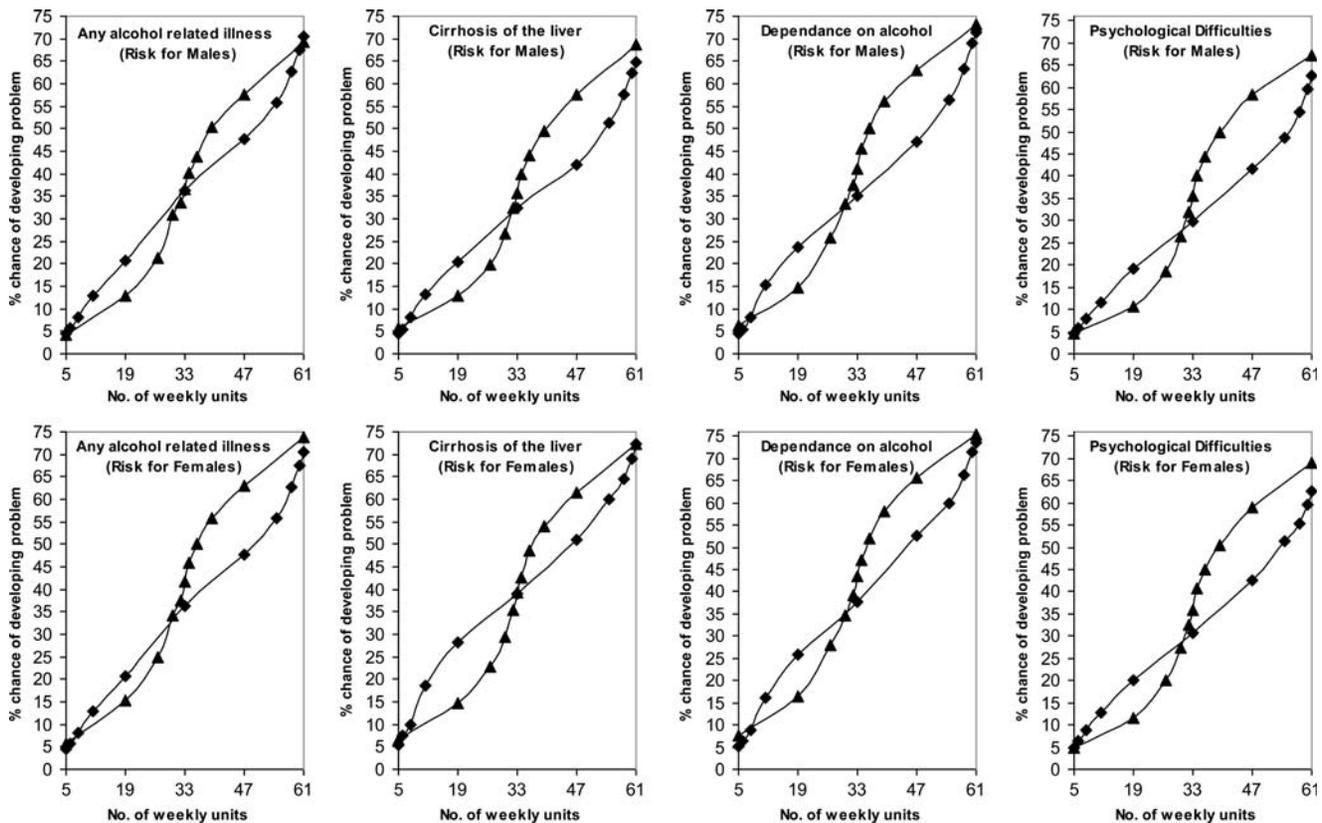
Fig. 1. Mean perceived risks associated with drinking 11 different units of alcohol each week for 15 years (unimodal group triangles, bimodal group diamonds). Note how the line rises more sharply when there is greater change in rank position, forming the expected 'helix' shaped graph.

consumption 'ranks' among what they perceive others to be drinking. Controlling for rank position, people's judgments were not affected by how their drinking differed from their perception of average levels of drinking. These findings were shown in two complementary ways, through a cross-sectional survey of people's perceptions of the distribution of other peoples drinking and an experiment where the rank position of a given number of units was manipulated.

The results are novel in two ways. First, they show that perceptions of risks associated with drinking alcohol are influenced by norms, much as they influence other alcohol attitudes. Second, the results suggest how such norms operate, specifically that people rank themselves among others rather than suggesting compare themselves to the mean or median. This subtle difference is important as it suggests (a) the cognitive mechanisms through which people make these judgments (as outlined by DbS, Stewart *et al.*, 2006), (b) that the cognitive mechanisms are the same as those used in psychophysical judgments, linking alcohol research with more general models of decision making and (c) how information should be presented in social norm interventions. The first two implications are likely to be of interest to cognitive scientists and to promote dialogue between these researchers and people working in the alcohol field. The latter implication is more tentative, as much more work is needed before interventions can be rolled out. However, in other fields behavioral change has been greater when providing information in line with people's information processing tendencies (Thaler and Sunstein, 2008). Such findings suggest that social norms interventions (Moreira *et al.*, 2009) should specifically consider providing people with information on their rank position among other drinkers rather than how their consumption differs from the average.

We found a large relationship between how a person perceived their drinking to rank among other UK drinkers and how at risk of health complications they saw themselves to be—indeed, perceived rank was as strong a predictor as how much alcohol they actually drank. It is possible that previous research into social comparison influences on alcohol judgments may have underestimated the size of this relationship through questions comparing personal drinking to the average (only a proxy for rank, thus increasing error).

There was great disagreement between participants about how much other people drank both in terms of the mean and skew of the distribution. This suggests that many unsafe drinkers have a false sense of security about the riskiness of their consumption, purely based on a systematic overestimation of other people's drinking (possibly motivated by self-enhancement biases). This underscores the importance of norm-based interventions. Norms-based interventions use diverse methodology; most give information about the typical or average drinker, whilst a very small minority have given information on rank position (Moreira *et al.*, 2009). A difficulty encountered by the designers of these interventions is that there has been no scientific basis on which to choose how to present information; telling people how they differ from the average drinker, for example, has seemed as intuitive as providing information on the person's rank position. The current studies provide empirical justification for future interventions to provide information on rank position. Research in behavioral economics has shown that superior behavioral change occurs when information is presented in a format that is consistent with people's natural ways of information processing (Thaler and Sunstein, 2008; Brown *et al.*, 2010). We suggest that future interventions give people the message 'you are in the top *x%* of drinkers' (rank information), instead of 'recommended drinking limits are x units' (non-relative information), or 'the average drinker consumes x units' (average information). Future research should directly provide different groups of participants with either rank, average or non-relative information, to directly test whether providing rank information leads to greater decreases in alcohol consumption. Such research should also experiment with providing information in different ways; interventions commonly provide graphical information, for example, which may be more effective at causing behavioral change than simply providing information in text form.

Limitations included a reliance on college students and there is no guarantee the results will generalize to other drinkers—although college student drinkers are an important population to understand and to engage in an intervention, and given that rank underlies so many types of judgments, generalization should be expected. Participants self-reported on their drinking in Study 1 and these reports are likely to be inaccurate or biased. However, it is these biased beliefs that are essential to understanding perceptions of risk, hence stating objective levels of drinking would actually have provided less useful information. Equally, participants' judgments of other people's drinking are similarly likely to be a motivated misestimation—this again was the focus of the inquiry. We assumed that participants compared themselves to all other drinkers in the UK—it is likely that people may compare themselves more to similar others. This, however, would only add error to the prediction, and count against our hypothesis, which was strongly supported. Finally, by design the research focused on the relatively understudied area of perceptions of the riskiness of alcohol use. Of course, it is a separate and important question whether such rank based social comparisons relate to actual behavior. The model should now be tested on the wider social norms enquiry of how others' behavior relates to one's own objective consumption.

At the most general level, the results supported the DbS model of alcohol judgments. This shows that alcohol judgments are made in the same way as those within psychophysics, social psychology and economics. This identification of common mechanisms underlying judgment in different fields is in line with a wider aim to promote a more unified psychology (cf. Sternberg and Grigorenko, 2001). Such identification can also promote better dialogue between applied fields (where the concern is primarily behavioral change) with cognitive science (where the concern is primarily identifying models of thought and behavior). This research is the first application of DbS and rank-based judgments in any area of health research, potentially starting out a new area of research which will ultimately show this model explains how all (or most) health judgments are made. A program of research into these possibilities is indicated.

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