

What does death have to do with drinking?

A test of the terror management account of alcohol misuse using subliminal priming

This study examined whether drinking alcohol serves as a distal defence mechanism against death terror by providing a worldview and self-esteem. A convenience sample of students who drank at least 12 alcoholic drinks per week ($N = 57$) were subliminally primed with neutral, painful or dead faces, after which they tasted and rated an alcoholic drink, a placebo, a soft drink and an anti-placebo. Our hypothesis was that participants with low self-esteem would drink more and give higher ratings to the alcoholic drinks in the death condition. Regression analyses partially supported the hypotheses. Limitations and implications of the study are discussed.

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The central paradox of addictive behaviour is that so many people continue this behaviour, even when they realise that it harms them (cf. Wiers & Stacy, 2006a,b). Given that many people understand that addictive behaviours often violate self-preservation and reproduction goals, there must be other reasons why people continue harmful use of alcohol and drugs despite all related problems. A possible reason, central in this paper, is that drinking might serve as a coping mechanism against fear of death. At first sight, this may seem far-fetched; what does death have to do with drinking? The hypothesis is based on the Terror Management Theory (TMT; for a review, see Greenberg, Solomon & Pyszczynski, 1997), which states that people have an existential death terror, which is countered with several defence mechanisms. In this study we test whether alcohol use could be conceived as such a defence mechanism, hence we test the TMTA (Terror Management Theory for Alcohol).

Terror Management Theory

Humans resemble animals in their instinct for self-preservation. However, humans are also aware that their life is finite, and according to TMT, this results in death terror. When people are made

aware of their own mortality, proximal defences such as active suppression and denial counter the accessibility of death thoughts. But when proximal defences slacken over time (Greenberg, Arndt, Simon, Pyszczynski, & Solomon, 2000), or under high cognitive load (Arndt, Greenberg, Solomon, Pyszczynski, & Simon, 1997b) death thoughts regain accessibility and distal defences may come into play.

Distal defences are thought to operate as a dual-component anxiety buffer, consisting of a cultural worldview and self-esteem. A cultural worldview consists of concepts and standards for understanding the world. It can provide a sense of symbolic immortality, such as the idea of contributing to something that goes beyond one's own life or a sense of literal immortality, such as belief in the existence of after-life or reincarnation (Dechesne et al., 2003). Believing in a cultural worldview is not enough to escape death terror: one must also believe that one is a valuable part of that world. In other words, one must have a sense of personal value and self-esteem (Greenberg et al., 1997). A number of studies have provided evidence for the dual-component anxiety buffer. When mortality is salient, people have more accessible worldviews (Arndt, Greenberg, &

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Cook, 2002), form more positive impressions of people who adhere to their religion (Greenberg et al., 1990), and allocate higher penalties and are more aggressive to those who threaten their worldview (McGregor et al., 1998; Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989). When self-esteem is high (either as a trait or after manipulation), effects of mortality salience disappear (Harmon-Jones, Simon, Greenberg, Pyszczynski, Solomon, & McGregor, 1997). Conversely, when self-esteem is low, mortality salience leads people to enhance their self-esteem, for example, by attributing successes to oneself and failures to external factors (Mikulincer & Florian, 2002).

Drinking alcohol as a distal defence mechanism

There are several indications that drinking alcohol can serve as both a direct and an indirect defence against death terror. Alcohol provides direct psychoactive effects, and may therefore provide a way of dealing with conscious death concerns (Arndt, Goldenberg, Greenberg, Pyszczynski, & Solomon, 2000). Alcohol might also provide the two components of a distal defence suggested by TMT: a worldview and sufficient self-esteem. Especially for heavy drinkers, drinking alcohol and the rituals this involves might constitute a worldview, in the sense that people feel they belong to a group of drinkers (e.g. the usual crowd in a bar). Further, in both cross-sectional and longitudinal research, a robust inverse relationship between religiosity and alcohol use and abuse has been found (see for reviews, Booth & Martin, 1998; Gorsuch, 1995). This can be partly explained by the coherence hypothesis (George, Larson, Koenig, & McCullough, 2000), stating that religion reduces substance use by giving meaning and coherence to life, or in terms of TMT, providing a worldview.

The second criteria for alcohol to be a distal defence is that it should enhance people's self-esteem. People often drink to feel confident (an enhancement motive; Cooper, 1994). An inverse relation between self-esteem and drinking alcohol has been found in cross-sectional research (Luhtanen & Crocker, 2005; Pullen, 1994; Wills, 1994), but results of longitudinal research are mixed (Crocker, 2002; Wills, 1994; Zimmerman, Copeland, Shope, & Dielman, 1997).

The inverse relationship between alcohol use and both religion and self-esteem supports the view that drinking alcohol can provide the two ingredients of a distal defence against death terror. However, drinking constitutes a risk behaviour and thus in fact goes against the self-preservation

instinct. TMT explains paradoxical defence mechanisms by indicating that the main function of distal defences is to take away death terror, not to enhance survival (Taubman Ben-Ari, Florian, & Mikulincer, 1999). Therefore, distal defences sometimes conflict both with proximal defences and with the instinct for self-preservation. When a risk behaviour is relevant to one's self-esteem, it becomes more attractive under mortality salience conditions (e.g. sun tanning, Routledge, Arndt, & Goldenberg, 2004; reckless driving, Taubman Ben-Ari, Florian, & Mikulincer, 2000). In a review on Terror Management and Health Models, factors influencing whether mortality salience leads to health-defeating outcomes or health-facilitating outcomes are discussed (Goldenberg & Arndt, 2008).

To our knowledge, only two studies using mortality salience manipulations have focussed on substance use. In a study by Hirschberger and colleagues, participants indicated how willing they were to try an array of drugs, ranging from alcohol and cigarettes to ecstasy and cocaine (Hirschberger, Florian, Mikulincer, Goldenberg, & Pyszczynski, 2002). Three different scenarios were presented, in which drugs were being offered either under medical supervision by the University for research purposes, or by a close friend, or by a stranger at a party. When mortality was salient, men were more willing to use drugs in all three scenarios. For women, no effect was found. Cox and colleagues (Cox, Arndt, Goldenberg, & Piasecki, 2008) studied effects of mortality salience on smoking behaviour of casual and habitual smokers. They found that, when mortality was salient, casual smokers reduced their smoking behaviour, while habitual smokers increased their smoking. It can be reasoned that for habitual smokers, smoking is part of their worldview, and therefore serves as a distal defence. The current study further investigates substance use as a distal defence, with alcohol being the drug of interest and subliminal priming the means by which mortality salience was induced.

This study

In this study, mortality was made salient by priming participants with pictures of faces of dead people (mortality salience condition). Results were compared with a neutral control condition in which neutral faces were shown, and a negative affect contrast condition with painful faces. This last condition was included to distinguish between mortality salience and a general negative priming effect. In all conditions, the pictures were shown for 16 milliseconds and masked by neutral pictures. Using subliminal priming to

induce mortality salience has the advantage that participants are not aware of the manipulation and therefore cannot bias the results. Additionally, as death thoughts do not become consciously accessible, distal defences are activated without a delay or distraction (Arndt et al., 2002; Arndt et al., 1997b). In earlier experiments (Arndt, Allen, & Greenberg, 2001; Arndt et al., 2002; Arndt, Greenberg, Pyszczynski, & Solomon, 1997a), subliminal priming with death-related words successfully induced mortality salience. In this study, pictures of faces were presented as was done by Winkielman, Berridge, and Wilbarger (2005).

Effects of the priming procedure on desire to drink alcohol were measured with an alleged tasting session (similar to Marlatt, Demming & Reid, 1973), in which participants tasted and rated four drinks. The drinks were an alcoholic drink (beer), a placebo (non-alcoholic beer), a soft drink and an anti-placebo (soft drink with vodka). This within-subjects variety of the balanced placebo design (Marlatt & Rohsenow, 1980) was used in order to distinguish between the effects of expecting to drink alcohol and actually drinking alcohol. Dependent variables were the amount consumed and the ratings of the drinks. The design of the study was approved by the Institutional Review Board (Maastricht University).

It was expected that participants in the death condition would drink significantly more of the alcoholic beverages, and rate the alcoholic beverages more positively than participants in the neutral and pain conditions. Yet, according to TMT, a distal defence against death terror is only to be expected if self-esteem is low. Therefore, the mortality salience effect was expected to occur only in those participants with low self-esteem. Thus, the first hypothesis was that there would be a significant interaction between priming condition and self-esteem.

In previous terror management studies, mortality salience manipulations did not alter conscious affect. Therefore, it was not expected that the priming procedure used in this study would have an effect on subjective mood, which was measured at several points in the experiment. Hence, the second hypothesis was that mood would not change after the priming procedure (cf. Winkielman et al., 2005). The third hypothesis was that the primes used in the study would not reach conscious awareness, because they were shown for only 16 milliseconds, using both forward and backward masks.

Method

Participants

Given less problematic ethical procedures for drinking alcohol in males (no risk of pregnancy) and the fact that heavy drinking is especially prevalent in male students, only men were recruited, resulting in a convenience sample of male students. Participants were recruited by posters, flyers and e-mails which presented the research as a combination of two independent experiments: a computer task and a tasting session with several drinks. Potential participants were administered a brief telephone interview to estimate their weekly alcohol use. Only students with an above average alcohol consumption of at least 12 Dutch standard drinks (containing approximately 10 grams of ethanol per drink) per week were included. Sixty male students with a mean age of 21.7 years (± 5.2 , range 18-45) participated. Average alcoholic consumption per week was 28.5 (± 11.4) drinks. All participants were Caucasian. Three participants had to be excluded from the analyses; two of them completed the tasks in the wrong order, and the third could not complete the tasks because of language problems. All other participants were fluent in Dutch. This left an analytic sample of 57 participants, 19 per condition. Background characteristics of the sample can be found in Table 1.

Table 1 Background characteristics of the sample

Variable	M	SD
Age	21.70	5.22
Alcoholic drinks (per week)	28.50	11.42
Self-esteem	2.76	0.55
Self-esteem through alcohol	2.92	0.51
Amount of hunger (scale: 1-10)	5.16	1.66
Amount of thirst (scale: 1-10)	3.89	2.47
Affect (valence, neg-pos)	6.63	1.34
Affect (arousal, low-high)	5.02	1.40

Materials

Pictures in subliminal priming

The pictures of the neutral faces were the same as used by Winkielman et al. (2005) and were originally developed by Matsumoto and Ekman (1988). Only the Caucasian faces were used, because of the great majority of Caucasian students at Maastricht University. The pictures of painful and dead faces were taken from the internet and from the International Affective Pictures System (IAPS) CD-ROM (Lang, Bradley, & Cuthbert, 1995). We selected dead faces which were clearly dead, to ensure that they would be perceived as dead rather than as asleep. These faces had often been

mutilated. The pictures were adapted with Adobe Photoshop to resemble the neutral pictures as much as possible in all aspects except for the contents (face with neutral background). The faces are available upon request. The primes and masks were presented to the participants in a computer task (described in more detail later) developed in E-Prime (Schneider, Eschman, & Zuccolotto, 2002).

Questionnaires

Mood was measured several times during the experiment with affect grids (Russell, Weiss, & Mendelsohn, 1989). The affect grid is a single-item scale in the form of a grid, on which participants indicate their arousal and valence. In four studies, the affect grid showed adequate reliability, convergent validity, and discriminant validity (Russell, et al., 1989).

Self-esteem was measured with the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1989). The internal consistency (Cronbach) of the scale was 0.89 in our sample.

Alcohol use was measured with a self-report questionnaire (Wiers, Hoogeveen, Sergeant, & Gunning, 1997). Participants indicated how many alcoholic beverages they had drunk on each day during the past week, and how many drinks they would normally consume on each day of the week. All beverages were converted to standard drinks. From these data, the average number of alcoholic drinks consumed per week was computed. Current thirst and hunger were assessed with a ten-point Likert scale.

Dependent variable: alcohol consumption

The tasting session included a light alcoholic beer (alcohol percentage of 3.5%), a non-alcoholic beer (placebo), a slightly sparkling soft drink, and the same soft drink mixed with 17.5 ml. vodka (alcohol percentage of 3.5%, anti-placebo). Drinks were prepared in a separate room, and were all presented in neutral glasses of 200 ml each.

Procedure

The experiment was always conducted in the afternoon, because most people do not appreciate drinking alcohol in the morning. Per session, up to four participants were tested. To ensure privacy they were seated in individual cubicles and all instructions were printed in a booklet, so they could work individually and at their own pace. First their blood alcohol level was measured using a calibrated breathalyser to ensure that they were sober at the start of the experiment (all participants were). Then the procedure of the study was explained and participants filled out informed consent. Next, they indicated their current thirst, hunger and mood on the affect grid.

After that, they proceeded with the subliminal priming task, which was presented as a gender classification task (as in Winkielman et al., 2005). Neutral male and female faces had to be categorised using two response keys. Unknown to the participants, each face was preceded by a briefly presented other face which was neutral, painful or dead. Every trial started with a 50-ms presentation of a black cross that served as a fixation point and a forward mask. The cross was then replaced by the prime stimulus, which was shown for 16 ms. The prime was backward masked by a neutral face (the target), which was shown for 400 ms. The participant then had to press a 'V' if this was a woman, or an 'M' if it was a man. In total, there were eight priming trials. More trials may cause habituation to the primes (Whalen, Rauch, Etcoff, McInerney, Lee, & Jenike, 1998; Winkielman et al., 2005). After the gender classification task, participants were again asked to indicate their mood (affect grid).

Directly after this, participants were presented with a tray with the four different beverages. They were told that they would get ten minutes to rate the drinks on the accompanying forms. They could choose which drink they wanted to start with, and how much they wanted to drink. They rated the taste of the drinks and answered some filler questions that were included to ensure that the task would take a while, leaving enough time for the participants to drink as much as they wanted. After ten minutes, the experimenter came to pick up the tray and measured the amount of the drinks that was consumed (in another room). Participants then filled in another affect grid, the alcohol use questionnaire and the RSES.

Participants then proceeded to a forced choice recognition task, designed to measure perceptibility of the subliminal primes. They were informed that they had been primed in the first part of the experiment, and were told that the upcoming task would also contain primes. Their task was to pay attention to the primes and pick the prime from two alternative faces. The forced choice task consisted of 20 trials, similar to the gender classification trials (50 ms fixation point, 16 ms prime, 400 ms backward mask). The only difference was that after each trial, two faces appeared on the screen, from which the participant had to choose the face that had been presented as the prime. In the end, all primes used in the experiment were shown once more, this time supraliminally, and participants were to indicate the valence and the amount of arousal that the pictures evoked. Then they were asked what they thought the experiment was about. Once more, participants' breath was measured, to assure that their blood alcohol level was below

legal limit. Participants were then debriefed, thanked and received a small monetary reward as compensation for their time.

Results

Manipulation checks

First it was checked whether there were any differences between the three conditions with respect to age, alcohol use, initial level of thirst and hunger, mood (both valence and arousal), self-esteem and self-esteem through alcohol. No such differences were found, all $ps > .20$. All participants rated the pictures on an affect grid, with valence scores ranging from 0 to 9. The neutral pictures were rated 5.9 on average, the pain pictures 2.5 and the death pictures 1.8. As expected, the neutral pictures differed significantly from the pain pictures, $t(56) = 16.89, p < .001$, and the death pictures, $t(56) = 20.89, p < .001$. However, the difference between the pain pictures and the death pictures was also significant, $t(56) = 2.37, p < .05$. The death pictures were thus rated significantly more negatively than the pain pictures and the neutral pictures. The average percentage correct on the forced choice task was 52.3%, which corresponds to 10.46 correct answers out of 20 trials. This score was found not to differ from chance level (10 items correct), $t(56) = 1.49, p = .142$, confirming the subliminal nature of the priming procedure used (Hypothesis 3).

In previous terror management research, mortality salience manipulations did not influence mood. The same was found for the present study. In repeated measure analysis, neither the effect of time ($F(1,54) = .407, p > .50$), nor the interaction between time and condition ($F(2,54) = .331, p >$

.50) were significant. Thus, there was no effect of priming on conscious mood as measured by the affect grid (Hypothesis 2).

Prediction of drinking

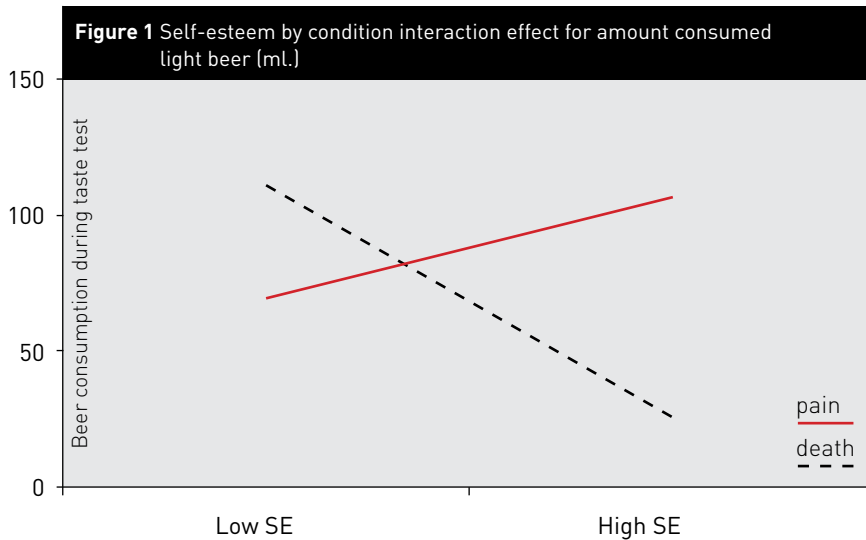
Separate hierarchical regression analyses were conducted for the amount of drinks consumed and for the subjective ratings of the drinks.

Amount consumed of the different drinks

Descriptive statistics for the amount consumed are presented in Table 2. These data were subjected to a mixed multivariate analysis of variance (MANOVA), with drink as within-subjects factor (four levels) and condition as between-subjects factor (3 levels). The amount consumed differed significantly between the drinks, $F(3,52) = 4.1, p = .01$, therefore the drinks were analysed separately. The light alcoholic beer was consumed most, the non-alcoholic beer was consumed the least (the exact means can be found in Table 2). During the debriefing, many participants indicated that they disliked the non-alcoholic beer and immediately tasted that it was a fake. In addition, there were no differences between the soft drink and the soft drink with alcohol. Our initial intention had been to analyse separately for 'think alcohol' and 'get alcohol' conditions (as in a balanced placebo design, cf. Marlatt & Rohsenow, 1980). However, given the fact that the placebo drink did not work for many participants and that our hypotheses are primarily about the effects of alcohol, we report the analyses for the condition in which people thought they drank alcohol and also received alcohol (light beer), and for the 'soft drink' condition, in which people believed they received a non-alcoholic drink, and also received a non-alcoholic drink.

Table 2 Descriptive statistics for amount consumed (in ml., possible values ranging from 0 to 200) and ratings of the drinks

	Amount consumed				Ratings			
	Overall	Neutral	Pain	Death	Overall	Neutral	Pain	Death
Light alcoholic beer								
- Mean	89.12	87.37	91.32	74.47	55.00	47.50	63.42	50.63
- SD	59.05	13.66	13.80	11.70	22.02	4.249	4.2504	5.173
Soft drink								
- Mean	72.84	63.68	53.16	56.84	58.35	61.61	60.474	57.79
- SD	53.77	9.58	7.26	13.66	22.20	2.6864	5.746	5.336
Non-alcoholic beer								
- Mean	63.25	102.63	72.89	49.21	38.04	37.44	41.73	39.00
- SD	52.33	15.16	13.87	9.10	25.21	5.157	6.130	6.356
Soft drink with vodka								
- Mean	76.80	95.00	52.37	59.21	57.17	61.67	57.37	56.68
- SD	59.67	14.38	6.78	12.56	20.92	4.345	5.188	5.272



Prediction of beer consumption

The regression analysis first included an array of covariates (thirst, hunger, mood, alcohol use, etc). If these variables did not significantly explain variance, they were deleted from the analysis. As the pain condition served as a negative emotion control condition, the pain and death conditions were coded into a dummy variable. A hierarchical regression analysis was conducted. One outlier was found, and removed from analysis. In the first step of hierarchical regression analysis, this dummy variable and self-esteem were entered. The resulting model was not significant ($p = .739$). In the second step, the interaction between these two variables was entered. Adding the interaction to the regression produced a significant change in explained variance, $\Delta R \text{ beta} = .255, p = .002$ (Table 3). This model was significant ($p = .014$). The interaction is shown in Figure 1. In the death condition, participants with low self-esteem drank more beer than those with high self-esteem. This confirms the second expectation that mortality salience would increase beer consumption for participants with low self-esteem (Hypothesis 2).

Prediction of soft drink consumption

The same hierarchical regression analysis was performed for the amount of soft drink consumed. The model with self-esteem and the dummy variable was not significant ($p = .239$). Adding the interaction did not produce a significant change in explained variance ($\Delta R \text{ beta} = .090, p = .063$) and the resulting model was not significant ($p = .095$) (Table 4). This is in line with the expectation that mortality salience would not affect the consumption of the soft drink, although it should be noted that a statistical trend was observed in the same direction.

Ratings of the drinks

Descriptive statistics for the ratings of the drinks are shown in Table 2. Taste data from one participant in the neutral condition were lacking. The data were subjected to a mixed MANOVA, with drink as within-subjects factor (four levels) and condition as between-subjects factor (3 levels). The taste ratings differed significantly between the drinks, $F(3,51) = 6.9, p < .001$. The alcoholic beer and both soft drinks were rated about equally positively, while the non-alcoholic beer was rated less positively (the exact means can be found in Table 2).

In keeping with the analyses of the amount consumed, we analysed the rating of the alcoholic beer and the soft drink, using the same hierarchical regression analyses as for the analyses of the amount consumed. The rating of

Table 3 Summary of hierarchical regression analysis for amount of beer consumed

Variable	B	SE B	t	p
Step 1				
RSES	-2.443	17.205	-.025	.888
Dummy	-14.945	19.122	-.136	.440
Step 2				
RSES	33.212	18.328	.336	.079
Dummy	-14.842	16.704	-.135	.381
Interaction	-108.865	32.026	-.620	.002

$F(2, 34) = .306, p = .739, R^2 = .018$ for step 1, $F \text{change}(1, 33) = 11.555, p = .002$, $R^2 \text{change} = .255$ for step 2, RSES = Rosenberg Self-Esteem Scale.

Table 4 Summary of hierarchical regression analysis for amount of soft drink consumed

Variable	B	SE B	t	p
Step 1				
RSES	13.751	14.103	.164	.336
Dummy	-19.342	17.184	-.189	.268
Step 2				
RSES	36.993	18.203	.441	.050
Dummy	-20.250	16.568	-.198	.230
Interaction	-52.529	27.365	-.410	.063

$F(2, 35) = 1.493, p = .239, R^2 = .079$ for step 1, $F \text{change}(1, 34) = 3.685, p = .063$, $R^2 \text{change} = .090$ for step 2, RSES = Rosenberg Self-Esteem Scale.

the alcoholic beer was not predicted significantly by the independent variables or by the interaction between these variables, nor was the rating of the soft drink. These results do not support the expectation that mortality salience would increase the ratings of the beer for participants that have low self-esteem (Hypothesis 2).

Discussion

The main results of the present study were that the Terror Management Theory for Alcohol was partially supported. Specifically, the main hypothesis of the study was that the subliminal presentation of faces of dead people would increase both consumption and positive ratings of alcohol, in comparison with subliminally presented neutral faces or painful faces, but only for people with low self-esteem. The results for the consumption of the drinks indeed supported this hypothesis. It was found that participants with low self-esteem drank more beer in the death condition than participants with high self-esteem. This was not found for soft drinks (although it should be noted that a trend in the same direction was observed). The results for the ratings of the drinks did not support the main hypothesis. No effects of condition, self-esteem or interaction were found for the ratings of beer and soft drinks.

Together these findings indicate that the subliminally presented faces did have some effect, even though they did not reach awareness, as was established both with a subjective criterion (asking the participants whether they had seen anything) and an objective criterion (the forced choice task). Also, it was shown that the priming procedure did not alter conscious affect, as in other terror management studies (Hypothesis 3).

The results of this study only partially support the Terror Management Theory of Alcohol. This might be explained by the fact that the student participants in this study may not have been heavy drinkers in the sense that their worldviews are alcohol related. When students graduate, their heavy drinking pattern often changes, parallel to the way their personal life changes at that moment. Because their heavy drinking pattern is temporary, it might be that their worldview does not centre on alcohol. Non-student heavy drinkers might differ from students in that their drinking pattern is permanent; their whole life is centred around drinking, as is their worldview.

The present study has several limitations. First of all, the balanced placebo design did not work as expected, which led us to discard the results of the non-alcoholic beer and the soft drink with

vodka. Second, the pictures used as death primes were evaluated more negatively than the pictures used as pain primes, which might have influenced the priming effects. And third, the experiment had to be conducted in a laboratory because of the priming method. The laboratory setting might have caused participants to enter a rational state of mind, which stands in the way of mortality effects (Simon et al., 1997).

As the results of this study only partially support the Terror Management Theory of Alcohol, future research is needed to examine the value of this theory. Clear results on this topic could have implications for treatment of alcohol abuse. Treatments could focus on establishing another, healthier worldview and on increasing self-esteem regarding that worldview, making alcohol redundant as a defence against death terror. This could be related to humanistic worldviews or to existing religions, such as Christianity as in Alcoholics Anonymous or Buddhism as in some recent interventions (Marlatt, 2002).

Author's note

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