A laboratory-based investigation of relations among video lottery terminal (VLT) play, negative mood, and alcohol consumption in regular VLT players

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Abstract

Thirty regular video lottery terminal (VLT) players were randomly assigned to 90 min of VLT play or a control activity (viewing a movie) to examine the impact of VLT play on alcohol use. Ratings of dysphoric mood were taken at baseline, midactivity, and postactivity. Alcoholic and nonalcoholic control beverages were available throughout. As hypothesized, those in the VLT condition were more likely to consume alcoholic than nonalcoholic control beverages (i.e., 73% drank alcohol and 20% drank control beverages), whereas no such preference for alcohol was observed in the movie control condition (i.e., 40% drank alcohol and 47% drank control beverages). Consistent with predictions derived from Steele and Josephs’ [J. Abnorm. Psychol. 97 (1988) 196; Am. Psychol. 45 (1990) 921.] attention allocation model, VLT condition participants who drank alcohol showed increases in dysphoric effect over the course of testing. No such changes in negative mood were observed in VLT participants who did not consume alcohol or in movie control participants regardless of whether they drank alcohol. An observed temporal pattern of greater drinking during the early phase of VLT play indicated that the relation between alcohol use and dysphoric affect among VLT condition participants could not readily be explained by drinking to relieve dysphoria induced by VLT losses. Clinical and policy implications are discussed. © 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Psychiatric comorbidity; Alcohol use disorders; Pathological gambling; Negative mood; Video lottery terminals

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1. Introduction

Video lottery terminals (VLTs) have become a widely available form of gambling activity. For example, VLTs are now available in all Canadian provinces except British Columbia and Ontario. One Canadian survey found that VLT gambling accounted for 54% of the total provincial gambling revenue (Focal Research, 1998). As compared to most other types of gambling, use of VLTs has been described as a “continuous” form of gambling in that the time between wager and payout is relatively short (Diskin & Hodgins, 1999; Griffiths, 1993a). This characteristic may be related to the apparently severe potential for abuse of this form of gambling activity by pathological gamblers (Dickerson, 1990; Fisher & Griffiths, 1995).

Research has shown a high comorbidity between pathological gambling and alcohol use disorders in both clinical and community samples (e.g., Bland, Newman, Orn, & Stebelsky, 1993; Daghestani, Elenz, & Crayton, 1996; Elia & Jacobs, 1993; Lesieur, Blume, & Zoppa, 1986; Smart & Ferris, 1996; see also review by Crockford & el-Guebaly, 1998). Consistent with the belief that many VLT players indulge in alcohol while gambling, a recent survey found that 74% of regular VLT players reported drinking alcohol when playing VLTs (Focal Research, 1998). Of those who reported at least some use of alcohol when playing VLTs, the majority (53%) reported that they did so “always” or “frequently” (half the time or more). However, these statistics have been established using retrospective self-reports, which can be subject to a variety of biases (e.g., memory inaccuracies). It remains to be established whether similarly high rates of alcohol use during VLT play would be obtained when observing regular VLT players’ drinking behavior while they are actually using VLTs.

Lab-based alcohol research methods allow for direct observation, under controlled circumstances, of the factors leading to increased alcohol consumption (Stewart, Samoluk, & MacDonald, 1999). Lab-based ad lib alcohol consumption studies (e.g., Conrod, Stewart, & Pihl, 1997; Gabel, Noel, Keane, & Lisman, 1980; George, Phillips, & Skinner, 1988; Samoluk & Stewart, 1996; Samoluk, Sweet, Stewart, & MacDonald, 1999) provide the opportunity to manipulate and precisely measure variables that are hypothesized to motivate alcohol consumption behavior and complement survey research by controlling for the many limitations inherent in self-report. The validity of the lab-based ad lib alcohol consumption paradigm has been established: Drinking levels in a lab-based barroom situation correlate with self-reported usual drinking levels (George et al., 1988). The ad lib alcohol consumption paradigm thus appears well-suited for examining whether VLT play does indeed selectively prompt alcohol consumption behavior among regular VLT players.

Although survey research suggests that simultaneous use of alcohol and VLT machines is relatively common (e.g., Focal Research, 1998), little research has focused on the potential negative emotional consequences of concurrent alcohol consumption and VLT play. Steele and Josephs (1988, 1990) have developed an attention allocation model to explain alcohol’s variable effects on negative mood. Specifically, this model asserts that alcohol consumption leads to a narrowing of attentional capacity such that attentional resources are focused toward only the most immediate environmental cues (i.e., “alcohol myopia”). Thus, alcohol will lead to a decrease in negative mood only in the presence of a pleasant distractor (with alcohol...
focusing attention toward the pleasant distractor and away from any anxiogenic stimulus). In contrast, alcohol use in the absence of a pleasant distractor will increase negative mood by focusing attention toward the anxiogenic or distressing stimulus. By design, VLTs yield more monetary losses than wins. Thus, the attention allocation model would predict that dysphoria resulting from accumulated financial losses during VLT play should be enhanced when players simultaneously consume alcohol.

The present lab-based study had two purposes: (1) to examine the impact of VLT play on alcohol consumption in a sample of regular VLT players; and (2) to examine the impact of simultaneous VLT play and alcohol use on dysphoric mood. We hypothesized that VLT play would be more likely than a control activity (i.e., watching a nondysphoric action movie) to induce alcohol consumption and that VLT play (but not action-movie watching) would be associated with a preference for drinking alcoholic as opposed to nonalcoholic beverages. We also hypothesized that, consistent with predictions derived from Steele and Josephs’ (1988, 1990) attention allocation model, the consumption of alcohol during VLT play would lead to increased dysphoric mood over the course of testing relative to VLT play alone or to action-movie watching with or without simultaneous alcohol consumption.

2. Method

2.1. Participants

A sample of 30 regular VLT players was recruited via telephone interviews following response to a newspaper advertisement. The newspaper advertisement requested the participation of people who played VLTs regularly (i.e., at least once a month for the last 3 months) for a study on the effects of VLT play on mood. During the telephone interview, potential participants were provided with an outline of the experimental procedure. They were informed that if they were assigned to the VLT condition, they would use their own money for playing VLTs. We did not disclose that the study involved an investigation of alcohol consumption behavior, as participants may have altered their drinking behavior as a result.

Those interested in participating were screened for several inclusion criteria. In addition to being regular VLT players, participants had to be regular, nonproblem drinkers (i.e., report that they usually consume alcohol at least once per month). Potential participants were administered the Brief Michigan Alcoholism Screening Test (Pokorny, Miller, & Kaplan, 1972). Those scoring $\geq 6$ (indicating a possible “problem drinker”) were excluded for ethical reasons, given guidelines recommending that alcohol not be administered to those with alcohol problems in a research context (National Advisory Council on Alcohol Abuse and Alcoholism, 1989). The experimenter also ensured that there were no medical reasons that the potential participant should not consume alcohol, such as current medication use or a medical condition for which alcohol consumption is contraindicated (O’Brien & Chafetz, 1982). At the time of the telephone interview, willing and eligible participants were instructed to fast from food or beverages for 2 h prior to participation and to abstain from alcohol and drugs for 24 h prior to participation.
On average, participants were 35.6 (S.D. = 11.7) years of age and had completed 14.4 (S.D. = 2.5) years of schooling. The average income code on the 1–7 scale was 3.1 (S.D. = 1.7). Twenty-two (73.3%) of the participants were male. Twenty-one (70%) of the sample were either single, divorced, or widowed, and the rest were either married or cohabiting. The large majority were smokers (80%) and reported consuming alcohol when they played VLTs (83.3%). The average South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987) score in the total sample was 3.6 (S.D. = 3.4). SOGS scores indicated that 11 participants (36.7%) could be classified as “probable pathological gamblers” (Lesieur & Blume, 1987). On average, participants played VLTs 2.0 (S.D. = 1.1) times per week and had been engaged in VLT gambling for 5.6 (S.D. = 3.5) years.

2.2. Measures

2.2.1. Demographics questionnaire

An author-compiled demographics questionnaire was used to obtain information on the participant’s age, gender, education level (years of schooling), and annual income (on a seven-point scale with anchors from “up to [Can]$10,000” to “more than [Can]$60,000” per annum).

2.2.2. Addictive behaviors measure

An author-compiled measure was used to assess a variety of addictive behaviors: smoking status (smoker vs. nonsmoker), whether the participant drinks alcohol while playing VLTs, and history of VLT use (i.e., frequency of VLT play per week and number of years playing VLTs). We used methods recommended by Sobell and Sobell (1990) to enhance self-report accuracy (e.g., confidentiality was assured).

2.2.3. SOGS (Lesieur & Blume, 1987)

The SOGS is a 16-item self-report questionnaire that requires respondents to describe their lifetime gambling habits. The SOGS has been shown to possess excellent internal consistency (α = .97), adequate stability (test–retest r = .71 over 1 month in a combined sample of inpatients/outpatients), and convergent validity with counselors’ independent assessment scores, family members’ ratings, and DSM-III-R (American Psychiatric Association, 1987) pathological gambling scores (Lesieur & Blume, 1987). SOGS scores of ≥ 5 are used to identify “probable pathological gamblers” (Lesieur & Blume, 1987).

2.2.4. Revised Multiple Affect Adjective Check List (MAACL-R; Zuckerman & Lubin, 1985)

On the MAACL-R, respondents report on their current mood state by checking all of the 132 affect-related adjectives that currently apply. The MAACL-R was completed at three time points: baseline, midactivity, and postactivity. Of the two MAACL-R summary scales, only the “Dysphoria” summary scale (i.e., Anxiety, Depression, and Hostility scales combined) was used in the present study. This scale possesses good psychometric properties (see review by Zuckerman & Lubin, 1985). It shows good-to-excellent internal consistency (i.e., α’s ranging from .83 to .95 across eight samples). As a measure of a transitory mood state, it shows expected moderate stability levels (test–retest r = .30 over 4 days). It also displays convergent
and discriminant validity with self- and peer-ratings of specific affects (i.e., tense, sad, angry, elated, and excited) and with Profile of Mood States subscale scores (McNair, Lorr, & Droppelman, 1971). Following the recommendations of Zuckerman and Lubin (1985), Dysphoria scale scores were analyzed as \( t \) scores given our repeated-measures design. Conversion of raw scores to \( t \) scores was accomplished using Zuckerman and Lubin’s (1985) tables.

2.3. Procedure

All participants were tested individually in the gambling laboratory of the Psychology Department at Dalhousie University. The laboratory has been modified to resemble a bar (i.e., a typical location for playing VLTs in the province of Nova Scotia; Focal Research, 1998). Specifically, the walls have been painted red and a number of posters advertising alcohol appear on the walls. This “bar-lab” contains a bar, two bar stools, and two VLTs. Both VLTs can be used for playing either a video poker or a spinning reel game. The VLTs are identical in all respects (including particular games offered and odds of winning) to commercial VLTs appearing in licensed establishments across the province of Nova Scotia. The bar-lab also contains a television monitor and videocassette player for presentation of movies (see Stewart, Blackburn, & Klein, 2000 for further description).

Upon arrival at the lab on the day of testing, participants’ adherence to the fasting and abstinence criteria were verified verbally. Given potential damage to a fetus from alcohol ingestion by a pregnant woman (National Advisory Council on Alcohol Abuse and Alcoholism, 1989), all females were screened for possible pregnancy. Participants gave written informed consent and were provided Can$50.00 as compensation for their time. A digital scale was used to determine participant body weight. Participants then completed the demographic questionnaire, the addictive behaviors measure, and the SOGS (Lesieur & Blume, 1987). In order to obtain a baseline measure of mood, the first MAACL-R (Zuckerman & Lubin, 1985) was administered.

Participants were then introduced to the gambling laboratory. Participants were randomly assigned to either the experimental condition (playing the VLTs) or the control condition (watching an action movie; \( n = 15 \) per activity condition). In the VLT condition, participants were invited to use their own money to play one or both of the standard VLTs for up to 90 min. In the control condition, participants were invited to watch an action movie for up to 90 min. They were given the choice of one of the four following movies: The Saint (Noyce et al., 1998), The Fugitive (Davis, Barish, Huggins, & MacGregor-Scott, 1993), Breakdown (Mostow, DeLaurentiis, & DeLaurentiis, 1997), or Conspiracy Theory (Donner, Van Wyck, Craccholo, Goodloe, & Solomon, 1997). Participants were requested to select a movie that was unfamiliar to them. Each of the movies was chosen to be decidedly nondysphoric in affective content. Participants assigned to the action-movie condition were instructed that they were serving in a control condition for a study on VLT play; they were made to understand that they would not be given any opportunity to play the VLTs during the study. The movie was also presented in the bar context (just as movies may appear on the screens of televisions situated in real-world bars) to enhance participants’ perception that alcohol consumption was an acceptable response during movie watching. Participants in both conditions were instructed...
to remain in the laboratory for at least 90 min but were permitted to discontinue their assigned activity at any point.

Participants in both activity conditions were invited to use their own money to purchase alcoholic or nonalcoholic beverages at any point throughout their assigned activity. They were not informed that their drinking behavior would be monitored. Alcoholic beverages included two brands of beer (12 oz bottles), vodka and orange juice, and rum and cola. The alcoholic mixed drinks were comprised of 1 oz of either vodka or rum (40% alcohol) and 5 oz of mix. All of the alcoholic beverages were priced for purchase at Can$3.50. For nonalcoholic control beverages, orange juice (Can$1.75), cola (Can$1.75), and coffee (Can$1.00) were also available for purchase. The pricing of these beverages was designed to reflect the local cost of such beverages at relatively less-expensive pubs and taverns, which are popular locations for playing VLTs in the province of Nova Scotia.

For ethical reasons (i.e., participant safety), a ceiling was placed on the number of alcoholic beverages that could be purchased by each participant based on their gender and body weight. Otherwise, participants were allowed to purchase and consume as many alcoholic and/or nonalcoholic beverages as they desired throughout their assigned activity. Body weight and the participant’s gender were used in conjunction with tables provided by O’Brien and Chafetz (1982) to determine a ceiling for each participant. The ceiling represented the maximum number of drinks that could be consumed while remaining under the legal blood alcohol limit for driving in the province of Nova Scotia [i.e., blood alcohol concentration (BAC) < 0.08%]. For example, a male weighing 190 lb was limited to three alcoholic beverages during his assigned activity. Whether any alcoholic beverages and/or nonalcoholic beverages were purchased/consumed and the time at which each beverage was purchased was unobtrusively recorded by the experimenter (“bartender”). Finally, the experimenter monitored and recorded the total amount of time each participant spent in his/her assigned activity (maximum 90 min).

For participants in both activity conditions, the study was divided into two periods (Period 1: first 45 min; Period 2: last 45 min). At the end of each period, participants were requested to discontinue their assigned activity to complete the mood rating measure (i.e., midactivity and postactivity MAACL-R’s). Because many regular VLT players smoke (Focal Research, 1998; Smart & Ferris, 1996), smokers were permitted to smoke during the break between Periods 1 and 2, if they so desired. At completion of the study, participants were fully debriefed regarding the purposes of the study and were informed that their drinking behavior was of additional interest to the experimenters. BACs were taken only at experiment completion, rather than throughout testing, to reduce the likelihood that participants would suspect that the experimenter was interested in their drinking behavior. Those who had consumed alcohol were required to remain at the laboratory until their BACs had reached half of the legal limit (i.e., 0.04% as determined by an AlcoSensor III, Intoximeters Inc.). Participants who had consumed alcohol were not permitted to drive home and were provided with taxi chits.

After VLT play condition participants had left, the experimenter printed out the total amount of money inserted into each machine and the total paid out from each VLT. These variables were used to calculate the total amount of money lost (or won) by each participant in the VLT condition across the two VLT machines. More detailed information on particular wins or losses occurring throughout the course of the play session was not available.
3. Results

We first ensured that continuous study variables were normally distributed within the current sample. All continuous variables, save one, were within acceptable skew limits, suggesting that the distributions were approximately normal. The only continuous variable showing unacceptable skew was the “activity time” variable (i.e., the amount of time participants engaged in their assigned activity; maximum = 90 min). This variable showed strong negative skew (skew value = −3.24).

3.1. Control variables

One-way (activity condition: VLT Play vs. Movie Control) analyses of variance (ANOVA) and $\chi^2$ analyses performed on the demographic and addictive behavior variables revealed no significant between-condition differences, confirming that random assignment to conditions was effective in balancing the two activity conditions on potentially confounding variables. We then compared our sample with a larger sample of 711 regular VLT players from across the province of Nova Scotia (Focal Research, 1998) on all of the demographic and addictive behavior variables. This comparison revealed that our use of newspaper advertisements for recruitment appears to have resulted in a fairly representative sample of regular VLT players. The only exception was that a larger percentage of participants in the present study were single, divorced, or widowed than in the larger community sample (see Focal Research, 1998).

The large majority in each activity condition engaged in their assigned activity for the full 90 min (i.e., all 15 of those in the movie control condition and 10 of those in the VLT play condition). Due to the negative skew evident in the distribution of this variable, between-activity condition differences were evaluated using a Mann–Whitney $U$-test, which indicated no significant difference in the median amount of time spent in the assigned activity across the two activity conditions (i.e., medians of 90 min in each case). Moreover, there was no relation observed between continued VLT play and alcohol consumption in the present study [$\chi^2(1)=0.17, \text{n.s.}$]. Of the five participants in the VLT condition who discontinued play prior to the 90-min limit, four (80%) consumed alcohol during play. Similarly, of the 10 participants in the VLT play condition who continued play for the full 90-min limit, 7 (70%) consumed alcohol during play. Thus, data for all VLT condition participants were combined for all subsequent analyses regardless of total length of VLT play.

On average, participants assigned to the VLT condition lost Can$20.95 during VLT play (S.D. = Can$32.31; range = Can$21.00 in winnings to Can$106.25 in losses).

3.2. Impact of activity condition on drinking

Although all participants were given the option of purchasing/consuming both alcoholic and nonalcoholic beverages throughout their assigned activity, none of the participants chose both alcoholic and nonalcoholic beverages. In other words, of those who chose to drink, all
chose either one or more alcoholic beverages or one or more nonalcoholic beverages. Only three participants (one VLT play participant and two movie control participants) chose not to purchase any beverages during the study.

In all statistical analyses, we used dichotomized drinking variables as opposed to continuous scores (i.e., number of beverages of each type consumed) because, for ethical reasons, an artificial ceiling had been placed on the number of alcoholic beverages that could be consumed by each participant. One-tailed \( \chi^2 \) tests were used because directional effects had been made a priori. In the experimental (VLT Play) condition, 11 of 15 participants consumed at least one alcoholic beverage, whereas only 6 of 15 did so in the control (movie) condition. In the experimental (VLT play) condition, three participants consumed at least one nonalcoholic beverage, whereas seven did so in the control (movie) condition. These effects are illustrated as percentages in Fig. 1. A \( 2 \times 2 \) (Activity condition \times Beverage type) \( \chi^2 \) analysis on beverage consumption was significant \( \chi^2(1) = 3.10, P < .05 \). Within the VLT play condition, participants were significantly more likely to choose at least one alcoholic beverage as opposed to at least one nonalcoholic beverage \( \chi^2(1) = 4.57, P < .05 \). This beverage type effect did not prove significant in the control condition \( \chi^2(1) = 0.08, n.s. \), showing that there was not a preference for one type of beverage over another in the control (movie) condition. Fig. 1 also shows that those in the VLT play condition were more likely to choose an alcoholic beverage than those in the movie-watching control condition. Conversely, those in the VLT condition were less likely to choose a nonalcoholic beverage than those in the movie-watching condition.

Further examination of the beverage consumption data revealed that most drinks were consumed during Period 1 (i.e., first 45 min) of the assigned activity. Twenty-three of the total of 28 alcoholic beverages were consumed during Period 1. Ten of the total of 12 nonalcoholic

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**Fig. 1.** Percentage of participants in each activity condition choosing to consume at least one alcoholic beverage (striped bars) or at least one nonalcoholic beverage (open bars) during their assigned activity.
beverages was consumed during Period 1. Eight of the 30 participants reached their predetermined ceiling for alcohol consumption and were not permitted to purchase additional alcoholic beverages if they requested to do so.

3.3. Effects of activity condition and alcohol consumption on negative mood

Since the majority of drinking occurred toward the beginning of the activity sessions, it was possible to examine the effects of combined VLT play and alcohol use on change in dysphoric mood over the course of the experiment. Initially, participants were divided into two beverage conditions based on whether they consumed any alcoholic beverages during their assigned activity (VLT or movie). This resulted in four groups: Movie-No Alcohol ($n = 9$); Movie-Alcohol ($n = 6$); VLT Play-No Alcohol ($n = 4$); and VLT Play-Alcohol ($n = 11$). Dysphoria $t$ scores are shown as a function of activity condition, alcohol group, and time (baseline, midactivity, postactivity) in Fig. 2. The pattern of Dysphoria $t$ scores was consistent with predictions derived from Steele and Josephs’ (1988, 1990) attention allocation model, with the greatest increase from baseline occurring in the VLT Play-Alcohol condition (see Fig. 2). We first conducted a $2 \times 2$ (Activity condition × Alcohol group) ANOVA on Dysphoria $t$ scores at baseline. This ANOVA revealed no significant effects, suggesting no significant difference between the four groups in dysphoric affect at study onset. Thus, we proceeded to hypothesis testing with planned comparisons (Howell, 1992). One-tailed tests were used when directional effects had been made a priori. We first examined the effects of time separately in each of the four groups. A significant effect of time was observed only among those in the VLT Play-Alcohol group [$F(2,20) = 3.58, P < .05$]. Dependent-sample $t$
tests revealed higher Dysphoria t scores at the midactivity \([t(10)=2.07, P<.05]\) and postactivity \([t(10)=1.95, P<.05]\) test times relative to baseline (see Fig. 2). Thus, consistent with hypothesis, significant increases in negative affect over the course of the experiment were only observed among those participants randomized to the VLT play condition who simultaneously drank alcohol.

We also conducted a series of planned comparisons on the midactivity and postactivity Dysphoria t scores of those who did vs. those who did not consume alcohol, separately within each activity condition. Independent-sample t tests of the Dysphoria t scores were performed that corrected for the greater variance in the alcohol as compared to no-alcohol groups in the VLT play condition. Consistent with hypothesis, those in the VLT activity condition who had consumed alcohol reported greater negative affect than those who did not consume alcohol at both midactivity \([t(12.32)=1.58, P=.07]\) and postactivity \([t(12.75)=2.16, P<.05];\) see Fig. 2. The greater negative affect reported by those who had consumed alcohol relative to those who had not consumed alcohol was specific to those assigned to VLT play as opposed to those assigned to movie watching (see Fig. 2).

Amount of money lost during VLT play was significantly positively correlated with mid- and postactivity negative affect ratings \((r’s=.84\) and .90, respectively; \(P’s<.001)\) and with alcohol consumption \((r=.52, P<.05)\). Thus, we also examined the Dysphoria t scores of those in the VLT activity condition as a function of alcohol consumption after controlling for amount of money lost or won during VLT play. The purpose of this additional analysis was to determine whether the effects of alcohol consumption on negative affect were indirect (i.e., explained by the greater financial loss associated with alcohol consumption). In a set of one-way (alcohol condition) analyses of covariance (ANCOVAs) on Dysphoria t scores, the effects of alcohol condition were no longer significant at either midactivity \([F(1,12)=1.34, n.s.]\) or postactivity \([F(1,12)=1.32, n.s.]\). Covariate (monetary loss)-adjusted mean Dysphoria t scores were 76.40 (no alcohol) and 60.76 (alcohol) for midactivity Dysphoria and 69.04 (no alcohol) and 56.84 (alcohol) for postactivity Dysphoria, indicating no tendency for alcohol consumption to be associated with increased negative affect once VLT monetary losses were accounted for statistically.

3.4. Predictors of alcohol consumption

Since participants were not randomly assigned to alcohol vs. no-alcohol beverage conditions in the present study, we tested for beverage condition differences in each of the demographic and addictive behavior “control” variables in a series of one-way ANOVA and \(\chi^2\) tests. As shown in Table 1, regular gamblers who chose to drink alcohol differed from those who chose not to drink alcohol in gender, SOGS total score, years playing VLTs, and frequency of VLT use per week. Moreover, for participants in the VLT play condition, those who chose to drink alcohol also differed from those who chose not to drink alcohol in amount of money lost/won during VLT play (see Table 1). The two beverage groups did not differ from one another on any other control variable measured. The fact that the participants in the two beverage conditions did not differ in age shows that the greater number of years spent playing VLTs and greater SOGS scores (lifetime gambling
problems) among those choosing to drink alcohol during the experiment were not secondary to age differences.

4. Discussion

As hypothesized, VLT play (but not movie watching) was associated with greater alcoholic relative to nonalcoholic beverage consumption. Also, as hypothesized, a higher proportion of those in the VLT condition chose to drink at least one alcoholic beverage relative to those in the movie control condition. Our finding that 73% of those assigned to the VLT condition chose to drink alcohol during VLT play validates survey research findings that the large majority of regular VLT players report drinking alcohol while playing VLTs (Focal Research, 1998). The current pattern of findings is particularly impressive given that two factors were operative, which may have minimized between-activity condition differences in alcohol consumption behavior. First, those in the movie “control” condition effectively had more money to spend on beverages (i.e., their potential “costs” involved only buying beverages) than those in the VLT condition whose potential “costs” involved both buying beverages and using money in VLT play. Second, both conditions were run in the same “bar-lab” environment, where the presence of common environmental cues (e.g., presence of VLTs, bar, and alcohol-related posters) may have served to prime alcohol consumption behavior in both activity conditions.

We also examined the consequences of alcohol use on negative mood. As expected, VLT condition participants who drank alcohol showed increases in dysphoric affect over the course of testing. This finding is consistent with the results of observational studies of sustained drinking among social and problem drinkers alike, which have shown that alcohol consumption leads to increased dysphoric mood over time (e.g., Mendelson, LaDou, & Solomon, 1964; Steffen, Nathan, & Taylor, 1974; Williams, 1966). However, consistent with predictions derived from Steele and Josephs’ (1988, 1990) attention allocation model, the increases in dysphoric affect associated with alcohol consumption were specific to those in

<table>
<thead>
<tr>
<th>Variables distinguishing alcohol drinkers from nondrinkers</th>
<th>No alcohol (n = 13)</th>
<th>Alcohol (n = 17)</th>
<th>$F[\chi^2]$</th>
<th>P-level</th>
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<tbody>
<tr>
<td>Gender</td>
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<tr>
<td>Male</td>
<td>7</td>
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<tr>
<td>Female</td>
<td>6</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>Frequency of VLT play (per week)</td>
<td>1.42 (0.76)</td>
<td>2.40 (1.16)</td>
<td>6.91</td>
<td>.014</td>
</tr>
<tr>
<td>SOGS total score</td>
<td>2.00 (1.96)</td>
<td>4.76 (3.73)</td>
<td>5.86</td>
<td>.022</td>
</tr>
<tr>
<td>Years playing VLTs</td>
<td>3.50 (2.12)</td>
<td>7.15 (3.63)</td>
<td>10.36</td>
<td>.003</td>
</tr>
<tr>
<td>Money lost/won on VLT$^a$</td>
<td>6.21 (12.32)</td>
<td>–30.82 (31.84)</td>
<td>4.94</td>
<td>.045</td>
</tr>
</tbody>
</table>

$^a$ Applicable only to those in the VLT condition (n = 4 no alcohol, n = 11 alcohol). Positive value indicates win; negative value indicates loss. Values are cumulative wins/losses over entire VLT play session (in Canadian dollars).
the VLT condition. No significant changes in negative affect over the course of testing were observed in the VLT play condition participants who did not consume alcohol or in the movie-watching condition participants regardless of whether they drank alcohol. Thus, alcohol appears to have narrowed the focus of attention of those playing VLTs towards the “stressor” (i.e., financial losses occurring from VLT play) and thus indirectly contributed to increased dysphoric affect over the course of play. Consistent with this interpretation, the greater negative affect reported by those who chose to drink during VLT play relative to those who chose not to drink alcohol while VLT play was eliminated when financial losses during VLT play were statistically controlled. No increases in dysphoric mood were observed among participants consuming alcohol in the control (movie watching) condition, presumably because no stressor (e.g., financial loss) was present in this condition.

The fact that dysphoric mood did not decrease over the course of testing among those in the VLT condition (regardless of beverage consumption) directly conflicts with results of retrospective self-report studies. Such studies suggest that depression decreases during VLT play (Griffiths, 1993b) and that many problem gamblers use VLTs to alleviate dysphoria (Beaudoin & Cox, 1999). It is possible that when completing retrospective surveys, regular gamblers selectively remember the affect associated with wins as opposed to more typical losses. Alternatively, on such retrospective surveys, they may report using VLTs to alleviate dysphoria in attempts to legitimize or rationalize their gambling behavior.

A further possibility that may reconcile these discrepant findings is that chronic, generalized negative affect (as in depressive or anxiety disorders) might be qualitatively distinct from the negative affect produced by financial losses. In other words, gamblers may accurately report on retrospective surveys that gambling reduces certain types of negative affect (e.g., the dysphoria associated with painful self-awareness; Hull, 1987), while at the same time, gambling might increase the dysphoria associated with financial losses. It is possible that gamblers find the latter type of negative affect more tolerable than the former at least in the short-term. This highlights another potential problem with self-reports of negative affect such as the MAACL-R (Zuckerman & Lubin, 1985): they fail to consider the source of the dysphoric mood. It is also possible that expectations for the alleviation of dysphoria rather than actual experiences of such mood changes might be involved in the maintenance of gambling behavior. Just as expectancies for tension reduction from drinking alcohol have been shown to predict increased drinking levels and drinking problems (see review by Goldman, Brown, & Christiansen, 1987), so might expectancies for dysphoria reduction from VLT play predict increased VLT use and problems.

The finding that significant increases in dysphoria during VLT play only occurred among those who chose to drink alcohol while playing VLTs is consistent not only with predictions derived from Steele and Josephs’ (1988, 1990) model but also consistent with predictions derived from the tension reduction hypothesis (TRH; see review by Cappell & Greeley, 1987). The TRH would predict that VLT play should lead to increases in negative emotional arousal (e.g., due to financial losses incurred during VLT play) and that alcohol consumption would be used to achieve dysphoria reduction. However, the temporal pattern of greater alcohol consumption during the early phase of VLT play is inconsistent with TRH predictions that increased alcohol consumption should follow the increases in
dysphoric mood induced by VLT losses. Additionally, Dysphoria \( t \) scores remained high at the postactivity testing time among those who chose to drink alcohol in the VLT play condition, providing no support for the TRH prediction that alcohol consumption should result in the alleviation of dysphoric mood.

It should be noted however that the purchase and consumption of beverages was limited to during the activity period of the present experiment. Thus, we were unable to evaluate the possibility that the negative affect experienced by those randomized to the VLT play condition might have led to increased drinking behavior to cope with their resultant negative affect following the VLT play period (cf. Pihl & Smith, 1983). Moreover, an artificial limit was placed on the number of alcoholic drinks participants were allowed to purchase, which resulted in some participants reaching ceiling in the early phases of VLT play. For these reasons, the present study was limited in its ability to fully test TRH predictions, and our interpretations of the temporal sequencing of alcohol intake, VLT play, and increases in dysphoric mood should be treated cautiously. Future research should also consider the possibility that there may be subtypes of VLT players who display differences in the temporal patterning of these variables (e.g., one subtype where alcohol intake follows negative affect increases and another where alcohol intake precedes negative affect increases; cf. Conrod, Pihl, Stewart, & Dongier, 2000).

Our test of attention allocation model predictions was conducted using quasiexperimental data: those who consumed alcohol during the study were compared with those who did not consume alcohol rather than randomly assigning VLT and movie condition participants to alcohol and placebo beverage groups. Thus, it cannot be definitively concluded that alcohol consumption causes increased negative mood during VLT play. Instead, certain types of individuals (e.g., highly impulsive individuals; Murray, 1993; or highly neurotic individuals; Martin & Sher, 1994) may be more likely than others both to consume alcohol and to experience negative emotional arousal during VLT play, creating apparent associations between alcohol consumption and negative mood. In fact, those who chose to consume alcohol in the present experiment were found to differ significantly from those who did not on several demographic and addictive behavior variables. Thus, highly controlled research is the next necessary step in further evaluating attention allocation model predictions as to the effects of alcohol on negative mood during the course of VLT play.

Nonetheless, the present study does provide information on the type of regular VLT player who is most likely to consume alcohol while engaged in VLT play. The finding that male gender was associated with an increased likelihood of consuming alcohol during the experiment is consistent with previous research showing that male (but not female) video gamblers are more likely than gender-matched controls to report alcohol problems (Ettles, 1999). Gambling history variables (i.e., increased frequency of VLT use, greater years playing VLTs, and greater gambling problems) were also associated with an increased likelihood of consuming alcohol during the experiment. Those who play more frequently and those who have been playing VLTs for a longer period of time may have had a greater opportunity to learn gambling–alcohol associations. With repeated pairings, alcohol consumption and VLT use may become associated through classical conditioning, such that the affective state induced by one addictive behavior serves as a cue for eliciting craving for the other. This
learning perspective has already been offered to account for the comorbidity of other addictive behaviors such nicotine and ethanol abuse (e.g., Clements, Glautier, Stolerman, White, & Taylor, 1996).

Another possible explanation for the association of gambling history variables with alcohol consumption is that those who typically drink alcohol during VLT play may have a greater chance of developing problems with their gambling behavior (e.g., increased financial difficulties due to greater VLT spending). In fact, among those in the VLT play condition, alcohol consumption was associated with greater money lost. If this association reflects a causal relation between alcohol consumption and monetary loss during VLT play, it could be that alcohol consumption causes greater financial loss (e.g., through alcohol-induced disinhibition; Peterson, Rothfleisch, Zelazo, & Pihl, 1990) or that greater financial loss causes greater alcohol consumption. Again, the temporal pattern of greater drinking during the early phase of VLT play is most consistent with the former interpretation. The findings of a recent survey of regular VLT players (Focal Research, 1998) are also consistent with the alcohol-induced disinhibition hypothesis. Among those who reported that drinking influences their VLT play, typical complaints involved spending more money than planned or desired, placing higher bets and taking more risks, and not worrying about expenditures when drinking during VLT play. However, only 1% of regular players reported avoiding alcohol while playing VLTs for these reasons (Focal Research, 1998). Since the causal effects of drinking on monetary losses cannot be established with the present design, a future placebo-controlled alcohol challenge study could be used to explore the effects of alcohol on risk-taking during VLT gambling.

Several potential limitations of the current study should be noted that pertain to sample composition and experimental design, respectively. With respect to sample issues, the overall sample size ($N = 30$) resulted in relatively small cell sizes for some of the comparisons, creating a need for replication of the present results to determine their stability. More complex models involving potential reciprocal relations between alcohol consumption and negative mood during VLT play could be evaluated in future research by employing a larger sample size. Additionally, the heterogeneity of the relatively small sample (including both genders, a range of incomes, education levels, gambling severity, and experience with VLTs) makes it difficult to know precisely to whom the results generalize. Moreover, those regular VLT players with possible alcoholism (as defined by high scores on the Brief MAST; Pokorny et al., 1972) were excluded from participation for ethical reasons. This exclusion may limit the representative nature of our sample and thus the generalizability of the results to comorbid clients.

With respect to experimental design, although care was taken to enhance the likelihood that participants remained unaware that their alcohol consumption was being monitored, it remains possible that participants may have surmised this disguised purpose and altered their drinking behavior as a result. Although care was taken to make the bar-lab environment as realistic as possible, certain differences from a real-world bar context (e.g., smoking only permitted during intermission period rather than during VLT play; participants tested individually with no other gamblers present) might impact on the external validity of the findings. Finally, our use of movie watching as a control may have impacted upon the results. Rather than representing a control condition that would reflect “baseline” alcohol
craving and approach behavior, movie watching might have served as a distraction from urges to drink.

Both clinical and policy implications emerge from the present findings. The very high frequency of alcohol consumption during VLT play observed in the present study (73%) should highlight for clinicians the importance of assessing for comorbid alcohol problems among their pathological gambling clients. The relations between alcohol consumption and both financial loss and negative mood seen among our VLT play condition participants suggest that clinicians should assess for potential functional relations between alcohol use and gambling behavior among comorbid clients to assist in treatment planning. Clinicians may also wish to make use of the present findings regarding relations between combined VLT play and alcohol use with increased negative mood to assist problem gamblers in challenging their beliefs that VLT play and drinking leads to decreased dysphoria. Finally, our findings that alcohol consumption was associated with greater money being lost during VLT play and with greater negative emotional arousal should be considered by policymakers when making decisions on relevant public policy issues (e.g., casino requests to make alcohol freely available to patrons).

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