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RESEARCH REPORT

High- and low-dose alcohol-related expectancies and the differential associations with drinking in male and female adolescents and young adults

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Abstract

A Dutch questionnaire was developed consisting of positive and negative expectancies relating to low and high doses of alcohol. The associations of these four types of expectancies with current alcohol consumption were investigated in three samples: secondary school pupils of 11–15 years old, secondary school pupils of 16 and older, and university undergraduate students (total n = 554). Using restrictive factor analyses, a common factor-model of the expectancies was shown to fit adequately across subgroups. Which expectancies were associated with current alcohol consumption varied substantially across the subgroups. As expected from previous research, inclusion of high dose expectancies did not substantially improve the prediction of drinking in university students. However, positive and negative high-dose expectancies were found to be powerful predictors of current alcohol consumption in secondary school boys of 16 and older, the subgroup with the highest average alcohol consumption on each occasion. Possible implications are discussed for future research and interventions.

Introduction

In the past 15 years, alcohol-related expectancies have emerged as powerful predictors of alcohol consumption. Expectancies have consistently been found to be associated with current alcohol consumption in college students (e.g. Leigh & Stacy, 1993), community samples (e.g. Brown *et al.*, 1980) and adolescents (e.g. Christiansen, Goldman & Inn, 1982). Expectancies have also

been shown to predict future drinking in adolescents after 1 year (Christiansen *et al.*, 1989), 2 years (Smith *et al.*, 1995) and 9 years (Stacy, Newcomb & Bentler, 1991). Furthermore, expectancies have proven to be useful in predicting treatment-outcome in alcoholics (e.g. Jones & McMahon, 1994). Although expectancies are now widely believed to be important in alcohol research, several issues concerning their

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measurement remain (e.g. Leigh, 1989a; Goldman *et al.*, 1991; Leigh & Stacy, 1991, 1993).

It is now well established that people hold both positive and negative alcohol-related expectancies (e.g. Fromme, Stroot & Kaplan, 1993; Leigh & Stacy, 1993; Chen *et al.*, 1994; McMahon, Jones & O'Donnell, 1994). In addition, it has been shown that expectancies vary with the dose of alcohol concerned (Southwick *et al.*, 1981; Connors *et al.*, 1987; Collins *et al.*, 1990; Earleywine & Martin, 1993). With respect to dose and valence, four types of expectancies can be distinguished: positive expectancies for a low dose, positive expectancies for a high dose, negative expectancies for a low dose, and negative expectancies for a high dose.

Previous research first focused on positive expectancies. The first and the most widely used instrument in alcohol-expectancy research (AEQ, Brown *et al.*, 1980) was aimed at: "the domain of humans' expectancies about the reinforcing effects of moderate alcohol consumption" (Brown *et al.*, 1980, p. 424). The authors followed Rotter's definition of expectancies as "the probability held by the individual that a particular reinforcement will occur as a function of a specific behaviour" (*ibid.*, p. 419). The instrument contained items concerning a low dose of alcohol ("a drink or two") as well as items about an unspecified dose of alcohol (e.g. "Drinking relieves boredom"), but no items specifically targeted high doses of alcohol. In the typology defined above, all six factors of the AEQ fall into the category of positive expectancies for a low (to moderate) dose of alcohol.

Negative expectancies were introduced on a small scale in two modified versions of the AEQ: the AEQ-A (AEQ modified for adolescents, Christiansen *et al.*, 1982) contained one negative scale, one mixed scale and five positive scales. In the modified AEQ by Rohsenow (1983) two negative scales were added to the six abridged positive expectancy-scales of the AEQ. In subsequent years, several instruments were developed with an approximately equal number of positive and negative scales (e.g. Young & Knight, 1989; Fromme *et al.*, 1993; Leigh & Stacy, 1993). It was shown with various instruments that negative expectancies significantly improve the prediction of current drinking (Fromme *et al.*, 1993; Leigh & Stacy, 1993; Chen *et al.*, 1994; McMahon *et al.*, 1994). The issue of whether positive or negative expectancies

are better predictors of current drinking is an unresolved issue: the findings of Stacy, Widaman & Marlatt (1990) and of Leigh & Stacy (1993) favour positive expectancies, but those by Grube, Ames & Delaney (1994) and McMahon *et al.* (1994) favour negative expectancies. The comparison between positive and negative expectancies is confounded by the fact that the expected positive effects are more proximal than the expected negative effects. Negative effects are expected to occur later in a drinking session; students expect more positive effects of alcohol for the rising limb of the blood-alcohol curve and expect more negative effects for the descending limb of the blood-alcohol curve, which is in agreement with the actual effects of alcohol (Earleywine & Martin, 1993). Recently, it has been found that still more distal negative expectancies (e.g. feeling sick the day after, or losing one's job with continued drinking), are also strongly associated with current drinking (McMahon *et al.*, 1994).

Even though it has been recognized in the literature that expectancies vary with dose of alcohol (Southwick *et al.*, 1981; Connors *et al.*, 1987; Collins *et al.*, 1990; Earleywine & Martin, 1993), the assessment of dose-related expectancies has received relatively little attention. One reason could be that the AES (Southwick *et al.*, 1981), an early scale which assessed dose-related expectancies, predicted current alcohol consumption less accurately than two questionnaires which did not assess high and low dose effects independently (Leigh, 1989b). The AES was also criticized in an influential review of the expectancy literature for the use of a bipolar response format (Leigh, 1989a). This could well be the main reason for the poor association with current drinking. In a more recent expectancy questionnaire (Fromme *et al.*, 1993), the relation between dose and expectancy was investigated by asking the subjects to indicate the number of drinks they would need to consume in order to experience each of the expected alcohol effects. Positive effects were expected to occur after a significantly lower dose than negative effects. In this way, the two most plausible types of expectancies are measured which correspond to the biphasic response to alcohol (low dose positive and high dose negative expectancies). However, the other two types of expectancies (negative low dose and positive high dose) are not measured by this response format. This might be an adequate

strategy in students but not necessarily in other populations.

What exactly constitutes a "positive" or a "negative" expectancy? One person's positive expectancy might be another person's negative expectancy. Aggression, for example, has been reported both as a positive expectancy (Brown *et al.*, 1980) and as a negative expectancy (e.g. Leigh & Stacy, 1993). Some researchers have argued that the valence (or "value" or "evaluation") of the expected effect should be measured on an individual basis (e.g. Fromme *et al.*, 1993; Grube *et al.*, 1995). However, as observed by Grube (1995), the usually applied strategy in expectancy research is not to include valence on an individual basis. In this study value was not measured on an individual basis, but this approach holds promise for future expectancy research and clinical applications (e.g. Mooney & Corcoran, 1989).

The expectancy questionnaire used in this study contains items stated in the general format concerning the expected effects of alcohol on "an average person". This strategy has several advantages: one questionnaire may be used irrespective of the alcohol experience of the (young) subject, which makes a direct comparison of the expectancies of drinking and non-drinking subjects in the youngest subject-group possible. A second advantage is that it will allow for future comparisons with a different subject-group that our research group is studying (children of alcoholics, see Wiers, Sergeant & Gunning, 1994). The third advantage is that the results can more easily be compared with the most widely used expectancy questionnaire for adolescents which also contains items in the general format (the AEQ-A; e.g. Christiansen *et al.*, 1982, 1989; Smith *et al.*, 1995). It has been argued, however, that the general format is not optimal with drinkers (Leigh, 1989a; Young & Knight, 1989). In direct comparisons it has been found that subjects expect stronger effects for others than for themselves (Rohsenow, 1983; Leigh, 1987). It is not clear, however, which format results in a better prediction of current drinking. In the only reported study known to the authors in which both personal and general expectancies were included, the correlations of personal expectancies and general expectancies with current drinking were judged to be so similar that the latter were left out of the report (Wood, Nagoshi & Dennis, 1992). Hence, this paper reports a

study which measured expectancies about the effects of a high or a low dose of alcohol on an average person and the associations of these expectancies with current drinking patterns in adolescents and adults.

Method

Measures

Expectancies. A Dutch expectancy questionnaire was developed to measure the four types of expectancies described in the introduction. It consisted of a primary section of 42 items concerning the response of an average person to a low dose of alcohol, followed by a smaller secondary (exploratory) section of 14 items regarding the response of an average person to a high dose of alcohol. An unipolar Likert scale was used as the response format as in recent expectancy questionnaires, with a five-point scale from "don't agree" to "strongly agree". Several specific scales from the AEQ and AEQ-A served as models for our a priori positive scales. The general positive scale of these measures was not included. General positive expectancies are accounted for using the method of fitting a second order factor model, as in Leigh & Stacy (1993). Most negative items were constructed by changing positive items into the opposite meaning. For example, the item "after a few drinks people say clever things" (cognitive/motor enhancement) became "after a few drinks people say stupid things" (cognitive/motor impairment). Some items were translated from the AEQ and the AEQ-A, others from a questionnaire developed by Sher *et al.* (1991). The remaining items were generated by the authors with the help of several regular bar visitors.

Alcohol consumption. A self-report measure of alcohol-consumption was used. Self-report measures have generally been found valid when used in research settings with sober subjects who are given assurances of confidentiality (Sobell & Sobell, 1978, 1990; Sobell *et al.*, 1988; Knight & Godfrey, 1993). These requirements were fulfilled here.

Subjects were asked to indicate on a checklist of alcoholic beverages how many they would typically drink of each beverage on an average weekday (Monday–Thursday). All alcoholic consumptions were transformed into "standard drinks" (a standard drink contains

approximately 15 ml of pure ethanol). In addition to the amount consumed on an average weekday, subjects were asked to estimate the number of weekdays in a month that they would drink this quantity (range: 0–16). The same response format was used to ascertain the number of standard drinks consumed during weekend-days (Friday–Sunday; range: 0–12). Subjects were also asked to indicate on how many days they drank five or more standard drinks during the past month. At the end of the questionnaire, the subject was asked to give an estimate of the number of standard drinks he or she consumed during an average week (“one guess”). From these data, an estimate of the subject’s weekly alcohol consumption was calculated (abridged as “QF”, indicating quantity $\times$ frequency¹), as well as the number of days a subject had consumed five or more alcoholic consumptions (“D”, indicating number of days intoxicated).

Subjects

Subjects were 554 secondary school pupils and university students. The secondary school pupils were drawn from four secondary education levels: low level professional training, medium general education, medium level professional education and high-level general education. The secondary school pupils were divided into two groups with respect to age: 11–15-year-olds

($n = 216$; 104 boys and 112 girls, mean age = 13.3 years) and secondary school pupils of 16 and older ($n = 163$; 101 boys and 62 girls, mean age = 17.0 years). The third group (“university students”) consisted of introductory psychology students ($n = 175$; 73 men and 102 women, mean age = 21.7 years). The second and third subject-groups showed some overlap in age: university students were 18 years or older, and the age of some of the 16+ group of secondary school pupils extended into the range of the university students. The overlap is not large: when 18 years is used as an overlapping border, the age of 8% (13/163) of the subjects of group 2 had an age in the range of group 3 (nine subjects were 19, three subjects were 20, and one subject was 21 years old). The reason why the subject-groups were differentiated with respect to current education level rather than age was that the subcultures of the subject-groups is rather different: university students generally live on their own, in student houses or in private rooms, whereas the secondary school pupils generally live with their parents. In addition, the university students were selected for school ability: they must have finished the highest level of education in secondary school. The secondary school pupils, in contrast, are of different levels of education: only about 25% of them would eventually qualify for university. Further details concerning the subgroups can be found in Table 1.

Table 1. *Characteristics of the six subgroups defined by cohort and gender*

Subgroup	Gender	<i>n</i>	Mean age ($\pm$ SD)	% abstainers	Mean standard drinks/week QF ¹ ($\pm$ SD)	Mean standard drinks/occasion Q ¹ ($\pm$ SD)	Number of intoxications past month D ¹ ($\pm$ SD)
15 or younger	boys	104	13.4 ($\pm$ 1.0)	46	2.0 ($\pm$ 4.0)	2.1 ($\pm$ 2.8)	0.8 ($\pm$ 2.6)
	girls	112	13.3 ($\pm$ 1.0)	60	1.5 ($\pm$ 3.6)	1.3 ($\pm$ 1.9)	0.5 ($\pm$ 1.6)
Adolescents							
16 or older	boys	101	17.1 ($\pm$ 1.1)	6	15.3 ($\pm$ 13.8)	6.5 ($\pm$ 4.0)	4.7 ($\pm$ 4.5)
	girls	62	16.8 ($\pm$ 0.8)	15	6.5 ($\pm$ 7.0)	3.8 ($\pm$ 2.7)	2.3 ($\pm$ 3.4)
Students	men	73	22.2 ($\pm$ 5.0)	3	15.9 ($\pm$ 11.7)	5.3 ($\pm$ 3.5)	5.8 ($\pm$ 6.7)
	women	102	21.4 ($\pm$ 3.8)	10	9.5 ($\pm$ 9.6)	3.5 ($\pm$ 2.4)	3.2 ($\pm$ 4.5)

¹The formulae of the drinking variables are given in Note 1.

After a few drinks ... (low dose expectancies)

After many drinks ... (high dose expectancies)

Figure 1. Restrictive factor analysis model with first-order factors as fit to all subgroups. The rectangles contain the items of the latent factors. Small ellipses contain the error components, the numbers above the arrows are the common factor scores obtained in the multi-group analyses (see Appendix).

Procedure

In a pilot study (Hoogveen, 1994), two versions of the expectancy questionnaire were compared in a university student sample ($n = 370$). One version contained positive and negative expectancies, as described above. The other version consisted of only positive a priori scales for a low and for a high dose of alcohol. The version which included negative expectancies resulted in a better prediction of current drinking. It was then decided to continue the research with adolescents with the version that included negative items. The general instruction and the wording of some items were changed to make them more suitable for secondary school pupils. The items

in the final common factor model presented in Fig. 1 were identical across all subjects. All questionnaires were completed in a surveyed assembly setting (the secondary school pupils in a regular classroom, and the university students as part of a questionnaire battery for freshmen). Confidentiality was assured verbally and in writing.

Statistical analyses

The main aim of the statistical analyses was to compare the endorsement of the different expectancies and the prediction of current drinking across the three subject-groups and gender.

Before these comparisons could be done in meaningful way, it had to be shown first that one measurement model could be used across the subject-groups. Because the present study used a new expectancy instrument, the analyses were started with two exploratory factor analyses (PCAs), to get a rough idea of the factor structure in the secondary school pupils and in the university students. Then a series of multi-group restrictive factor analyses were conducted to test whether one common factor model held up across the subgroups. This procedure is not strictly confirmatory (the exploratory analyses were performed on the same sample, see Jöreskog, 1993), but not trivial because it is explicitly tested that one common model can be used to compare the subject groups. This test is more stringent than the standard Box test, because the covariances of two groups can be of the same order of magnitude while the same factor structure does not hold across groups.

After it was shown that one measurement model could indeed be used across the subgroups, regression analyses were performed for each subgroup in which it was investigated which expectancies predicted current drinking. Finally, the endorsement of the different expectancies across subgroups was analysed using multivariate analyses of variance (MANOVA).

Results

Drinking variables

The two measures of the average number of standard drinks consumed in a week, QF (QF is quantity $\times$ frequency¹) were highly correlated (0.85). In all three subject groups the "one guess" measure was significantly lower than the estimate based upon an average weekday and an average day at the weekend (paired *t*-tests: group 1 $t(215 \text{ df}) = 2.9$, $p < 0.01$, group 2 $t(162 \text{ df}) = 8.4$, $p < 0.01$, group 3 $t(174 \text{ df}) = 6.7$, $p < 0.01$). In subject-group 3 (university students), QF could be compared with a detailed measure of drinking during the past week. QF correlated 0.77 with the number of standard drinks consumed during the past week, but was again significantly lower (12.3 vs. 14.6; $t(183 \text{ df}) = 2.70$, $p < 0.01$).

The second drinking variable which was assessed in the entire subject-group was the number of days in the past month on which five or more alcoholic standard drinks were consumed

(D). This drinking-variable correlated 0.75 with QF. For each of the subject groups further subdivided with respect to gender, means and standard deviations of the variables concerning self-reported drinking can be found in Table 1.

A MANOVA of the drinking variables showed a significant main effect for gender $F(2,547 \text{ df}) = 22.5$, $p < 0.001$) and subject group ($F = 22.5$; 4,1094 *df*, $p < 0.001$), and a significant interaction between subject group and gender $F(4,1094 \text{ df}) = 5.8$, $p < 0.001$). Follow-up univariate tests showed that the two main effects and the interaction were significant for both drinking variables (both $p < 0.01$). Pairwise comparisons of the harmonic means (adjusted for unequal group sizes, Stevens, 1992, p. 204) with the Student–Newman–Keuls method ($\alpha = 0.05$) showed that males in groups 2 and 3 drink significantly more standard drinks each week than girls of the same groups. The youngest boys and girls consumed significantly less than the older subjects. On the number of drinks on each occasion (Q), the pattern of results showed one difference: boys of group 2 drink significantly more on each occasion than male university students (and all other subgroups).

Expectancies: analyses of the measurement model

Preliminary expectancy scales were constructed separately for the university students (group 3) and the secondary school pupils (groups 1 and 2) by using exploratory factor analysis with oblimin rotation. Items measuring low and high dose expectancies were analysed separately. The factor structures in the students and secondary school pupils appeared to be quite similar. To enable a test of a common factor model for the different subject groups (multi-group restrictive analysis), a second exploratory factor analysis was done excluding those items which had been slightly changed in wording for the adolescents. The first six exploratory factors on this reduced item set explained 54% of the variance. These factors were used to construct six preliminary scales concerning a low dose of alcohol. Three scales concerned positive effects of a low dose of alcohol and three concerned negative effects of a low dose of alcohol. Following the same procedure, two preliminary common scales were constructed concerning a high dose of alcohol: high-dose positive and high-dose negative.

Unfortunately, the small number of the high-dose items did not allow for specific subscales. Restrictive factor analyses were used to investigate whether the preliminary common factor structure fitted the expectancy data for each of the subject groups and across gender (with LISREL VIII, Jöreskog & Sörbom, 1993). In all structural equation models that follow, maximum likelihood estimation was used.

The covariance matrix of the latent factors of the preliminary model (Φ see Appendix) was not positive definite in every subgroup. As a solution to this problem, the model was reduced to seven factors. The aggression scale was removed because a preliminary multiple regression analysis showed that it did not correlate significantly with alcohol consumption in any of the subgroups. The final model consisted of three low-dose positive expectancy scales (cognitive-motor enhancement, sexual enhancement, celebration-group acceptance), two low-dose negative expectancy scales (sexual-social inhibition and cognitive-motor impairment), a scale of high-dose positive expectancies and a scale of high-dose negative expectancies. The final model with all remaining items is shown in Fig. 1. The fit of this model was adequate in the adolescent sample: χ^2 (278 df) = 531 (n = 379), with fit indices: RMSEA = 0.049, AGFI = 0.88, NNFI = 0.82 (for an explanation of the fit indices see note [2]). The fit for the student sample was reasonable: χ^2 (278 df) = 421 (n = 175), RMSEA = 0.054, AGFI = 0.81, NNFI = 0.80.

Does one common factor model hold across subgroups? The question addressed in this section is whether the same factor structure for the expectancies holds in the six subgroups (details concerning the multi-group model may be found in the Appendix). Fitting the common model to all six subgroups in one restrictive multi-group analysis was not possible, because this would have required a larger number of subjects in each subgroup. The first multi-group analysis concerned the question whether the same factor structure held for students and adolescents. The fit was reasonable: χ^2 (575 df) = 991 (n_1 = 175, n_2 = 379), with fit indices: RMSEA = 0.051, GFI = 0.84, NNFI = 0.81. Within the adolescent group, the comparison between subject group 1 (maximum age 15) and subject group 2 (secondary school pupils 16+) also resulted in a moderate fit, χ^2 (575 df) = 901, (n_1 = 163,

n_2 = 216), RMSEA = 0.055, GFI = 0.83, NNFI = 0.77. This is interesting, because in the youngest age-group the majority did not drink alcohol (see Table 1). When comparing all male and female subjects the fit was also found to be reasonable: χ^2 (575 df) = 999 (n_1 = 278, n_2 = 276), RMSEA = 0.052, GFI = 0.88, NNFI = 0.81. Note that for all the multi-group results, the informal fit indices indicated a moderate to adequate fit (RMSEA between 0.050 and 0.055²), suggesting that a common factor model was acceptable for further comparisons across groups.

Second-order factors. Restrictive factor analysis was performed on a model consisting of the four types of expectancies as second order factors (see Fig. 2). This resulted in a reasonable fit in adolescents, χ^2 (288 df) = 587 (n = 379), with fit indices RMSEA = 0.052, AGFI = 0.87, NNFI = 0.80 and again a modest fit for students: χ^2 (288 df) = 472 (n = 175) RMSEA = 0.061, AGFI = 0.79, NNFI = 0.75. The fit indices of the model with second-order factors indicated a somewhat poorer fit to the data than the model with only first-order factors. Nevertheless, the model containing second-order factors was used to predict drinking in addition to the model containing only the first-order factors. The reason is that under certain circumstances, second-order factors may predict drinking better than first-order factors. The reason for this difference is that the first-order factors contain a residual error component that the second-order factors do not contain (see Fig. 2). The presence of the residual variance of the first-order factors has the same effect as error in the predictors: it results in a (downward) bias of the estimates of the regression coefficients and a reduction of explained variance. This is not the case when the residual error is fixed to zero, in the case of second-order factors with only one first-order indicator (here the two high-dose expectancies and age). A similar model (with two higher-order factors: low-dose positive and low-dose negative) was used in students in a study by Leigh & Stacy (1993). An advantage of this procedure is that no general scale is introduced at the level of the first-order factors (which correlate highly with other predictors) while the general effect of a type of expectancy can still be investigated (Leigh, 1989; Leigh & Stacy, 1993).

Figure 2. Regression model with second-order latent factors as predictors. The small ellipses in the left column contain the error components. The bigger ellipses in the second column depict the first-order expectancy factors (as in Fig. 1) and age within group. The five ellipses in the third column are the second-order factors used to predict drinking. Note that the high-dose factors and age are equivalent at the first- and second-order levels. The result is that prediction of drinking is not improved for these predictors due to the introduction of the higher-order factors. The prediction of drinking can be improved by the introduction of the second-order factors of the low-dose expectancies (see Appendix).

Prediction of alcohol consumption

The prediction of current alcohol consumption with the latent expectancy variables was also performed within the framework of structural equation modelling (LISREL VIII, Jöreskog & Sörbom, 1993). The regression with first-order factors only is equivalent to a conventional regression analysis. In this procedure non-normality of the dependent variables is undesir-

able. Therefore, both indices of alcohol consumption used (QF and D) were log transformed.¹ Prediction of the number of standard drinks consumed in an average week (QF) by the first-order expectancy scales and within-group age were conducted for each of the six subgroups separately. In all analyses the same procedure was followed. All regression analyses were carried out using the scores on the scales

derived from the common factor model. First, all expectancies and age were entered as predictors and QF as dependent variable. The estimates of the regression coefficients were judged against their standard errors to determine their significance. On the basis of these results, significant predictors were identified and retained in a second regression analysis. The effect of removing the non-significant predictors was evaluated by inspecting the χ^2 goodness-of-fit indices. Using first-order factors as predictors, removal of the non-significant predictors did not result in a significant decrease in goodness-of-fit in any instance. None of the analyses were substantially influenced by outliers; regression without the outliers resulted in virtually identical results. Regression analyses for all six subgroups with first-order latent factors are displayed in Fig. 3a–f.

Boys 11–15 years (Fig. 3a). Significant predictors were two low-dose positive expectancies (sexual enhancement and cognitive–motor enhancement), the low-dose negative expectancy of sexual and social inhibition, the high-dose negative scale and age. Together these predictors accounted for 27% of the variance in current drinking. Expectancies alone (without age) accounted for 23% of the variance. Because of the large percentage of non-drinkers in the youngest subject group, drinking boys were analysed separately ($n = 56$). Interestingly, apart from age, only positive expectancies significantly explained drinking for this group: cognitive–motor enhancement, celebration–tension reduction and the high-dose positive scale. Including age as predictor 41% of the variance was accounted for, and without age 29%.

Girls 11–15 years (Fig. 3b). Significant predictors were one low-dose negative expectancy scale (sexual and social inhibition) and age, accounting for 26% of the variance in current drinking. Expectancy alone (without age) accounted for 14% of the variance. The analysis of the subgroup of drinking girls ($n = 45$) showed that, besides age, one expectancy scale significantly predicted drinking: cognitive–motor enhancement. It is noteworthy that the regression coefficient of this positive expectancy was negative in this subgroup.

Adolescent boys 16+ (Fig. 3c). High-dose

expectancies in this group appeared to be of primary importance in the prediction of current drinking; all other predictors were not significant (including age). Positive and negative high-dose expectancies together accounted for 24% of the variance in current drinking.

Adolescent girls 16+ (Fig. 3d). Significant predictors were the two negative expectancies for a low dose of alcohol (sexual and social inhibition and cognitive–motor impairment), one positive scale (sexual enhancement) and age. Together these variables accounted for 29% of the variance in current drinking. Expectancies alone (without age) accounted for 23% of the variance.

Male students (Fig. 3e). Significant predictors were cognitive–motor enhancement, cognitive–motor impairment and the high-dose negative expectancies, together accounting for 25% of the variance in current drinking.

Female students (Fig. 3f). Significant predictors were sexual enhancement, cognitive–motor impairment and the high-dose negative scale, together accounting for 22% of the variance in current drinking.

Prediction of the second drinking variable, the number of times subjects drank more than five alcoholic beverages on one occasion during the past month (D), was analysed in the same way as QF. The results were very similar in most subgroups. Only those subgroups where different predictors were found in comparison with the prediction of QF are reported. D was explained by other expectancies for boys in the youngest subject group. Significant predictors were high-dose positive expectancies and high-dose negative expectancies. In the subgroup of drinking young boys, high-dose positive expectancies and the low-dose expectancy of celebration–tension reduction significantly predicted drinking. In girls in the youngest subject group, D was significantly predicted by the expectancy of sexual enhancement (like QF in the other female subgroups). For the boys in the second subject group, D was not only significantly explained by the two high-dose expectancies (like QF), but also by the low-dose expectancy of cognitive–motor enhancement. In the other subgroups the significant predictors of D were the same as those for QF.

Finally, the second-order factors were used to

Figure 3a-f. Regression models for each of the six subgroups as defined by gender and subject group (see Table 1). In each of the six figures, the small ellipses in the left column denote the residuals. The bigger ellipses in the second column depict the first-order expectancy factors and age (within the subgroup). Legend for the expectancies (as in Fig. 1): sex + = sexual enhancement for a low dose of alcohol; cm + = cognitive-motor enhancement for a low dose of alcohol, cel + = celebration-group acceptance for a low dose of alcohol; cm - = cognitive-motor impairment for a low dose of alcohol, cel - = sexual and social inhibition for a low dose of alcohol, inh - = sexual and social inhibition for a low dose of alcohol, hd + = positive expectancies for a high dose of alcohol, hd - = negative expectancies for a high dose of alcohol. The dependent variable is QF: the number of standard alcoholic consumptions consumed per week (log-transformed¹), with the small ellipse depicting the residual. Only significant predictors of QF are depicted with the arrows from the expectancies and age. Details of the analyses are given in the text and in the Appendix.

predict drinking (QF) in all subgroups. In the regression of the second-order factors upon QF, the same scale scores were used as above, but the second-order factors were defined as predictors in the LISREL model (see Fig. 2). Note that there is a 1:1 relationship between three first-order factors and their second-order equivalents: the two high-dose expectancies and age. As indicated above, the explained variance will not be increased for these variables by using the second-order factors. The results were difficult to compare across the different subgroups for two reasons. First, in the smallest subgroup (girls of subject group 2), the model did not converge. Secondly, the fit indices indicated an inadequate fit of this model to the data in some subgroups. As a solution, group-specific alterations to the model had to be introduced. These alterations will be explained.

In the youngest male subject group, 48% of the variance in current drinking was accounted for by two significant second-order predictors: low-dose positive and low-dose negative expectancies; model fit: χ^2 (18 df) = 20, p = NS. Note that a significant p denotes a failure of the model to fit the data (see Jöreskog, 1993). In girls of the youngest subject group 29% of the variance in current drinking was accounted for by the second-order low-dose negative expectancies and age, model fit: χ^2 (19 df) = 30.6, p = 0.045. The LISREL VIII output indicated ("Modification Indices", Jöreskog & Sörbom, 1993) that the specific alteration to the model required in this subgroup was a direct path from the residual of sexual-social inhibition to QF (a similar alteration as described in Leigh & Stacy, 1993). For boys in the second subject group, prediction of current drinking was increased to 30%. Two predictors were significant: high-dose positive expectancies and the second-order low-dose negative expectancies (adequate fit: χ^2 [19 df] = 29.9, p = NS). In male students the fit of the second-order model was inadequate (χ^2 [19 df] = 41.1, p < 0.01). Modification indices indicated that the residual errors of two first-order factors (sexual enhancement and sexual-social inhibition) should be allowed to correlate. When the model was modified in this way, the fit was adequate (χ^2 [18 df] = 25.4, p = NS) and the variance in current drinking accounted for was 32% with low-dose positive and low-dose negative expectancies as significant predictors. In female students the original second-order model

also indicated an inadequate fit (χ^2 [16 df] = 32.6, p < 0.01). Modification indices indicated that in this subgroup the residual error of age was correlated with the residual errors of sexual enhancement, sexual-social inhibition and cognitive-motor impairment. When the model was modified in this way, the fit was good (χ^2 [15 df] = 15.7, p = NS). Low-dose positive, low-dose negative and high-dose negative expectancies were the significant second-order predictors that together accounted for 42% of the variance in current drinking.

Differences in the endorsement of the four types of expectancies between subject groups

Given that a common factor model fitted adequately across subgroups and that different types of expectancies associated with drinking in these groups, the next issue concerned differences between subject groups in the endorsement of the expectancy scales. Multivariate analyses of variance were performed on the four types of expectancies (the second-order factors) for the three groups by gender (3×2 MANOVA). Both main effects were significant: the expectancies differed between males and females $F(4, 545 \text{ df}) = 6.8$, p < 0.001, and between the groups $F(8, 1090) = 20.2$, p < 0.001, with a significant interaction $F(8, 1090) = 3.6$, p < 0.001. Pairwise comparisons of the harmonic means were conducted with the Student-Newman-Keuls method (α = 0.05).

Low-dose positive expectancies. No significant gender differences were found on low-dose positive expectancies in the youngest group, nor in university students. In contrast, boys of group 2 more often endorsed low-dose positive expectancies than girls of the same group. These expectancies were mostly endorsed by university students and boys of group 2, followed by girls of the second group. The youngest group showed the lowest endorsement of positive expectancies for low dose of alcohol.

Low-dose negative expectancies. The opposite pattern was found for low-dose negative expectancies: they were most endorsed by boys and girls of group 1 (no gender difference), followed by girls of group 2. The lowest level of endorsement was found in boys of group 2 and university students (male and female).

High-dose positive expectancies. Boys of group 2 endorsed high-dose positive expectancies significantly more than females of group 2 and 3. No further significant differences were found.

High-dose negative expectancies. Boys and girls of group 2 endorsed high-dose negative expectancies significantly less in comparison with all other subgroups. No further significant differences were found.

High-dose expectancies of boys of group 2. The pattern of results suggested that boys of the second subject group showed an extreme pattern of expectancy endorsement, with the negative expectancies endorsed least and positive expectancies most in comparison with other groups. This suggestion was tested with a contrast comparing boys of group 2 with the other three subgroups with somewhat overlapping age-ranges: girls of the same group, male and female university students. It was found that boys of group 2 showed the highest level of endorsement of positive expectancies for a high-dose and the lowest level of endorsement of negative expectancies for a high dose ($p < 0.001$). This is illustrated in Fig. 4. The same contrast was also significant for low-dose positive expectancies ($p = 0.020$), but not for low-dose negative expectancies. The extreme endorsement of the high-dose expectancies in boys of group 2 paralleled their high average number of drinks on each drinking occasion (Q in Table 1), which was also significantly higher for boys of the second subject group in comparison with these other three subgroups (same contrast, $p < 0.001$).

Differences with alcohol consumption as a covariate. The general pattern of results was that a group with a higher alcohol consumption more endorsed positive expectancies and less endorsed negative expectancies in comparison with groups with a lower alcohol consumption. Further analyses showed, however, that not all differences in expectancies between the subgroups could be explained by current drinking pattern. When current weekly alcohol consumption was introduced as a covariate, the main effect for subject group was still significant $F(8,1088 \text{ df}) = 14.6$, $p < 0.001$, the main effect for gender was no longer significant $F(4,544) = 2.2$, $p = \text{NS}$, and the interaction between gender and subject group was still significant $F(1088) = 2.3$,

$p = 0.019$. The pattern of results remained the same when average alcohol consumption on each occasion (Q) was introduced as a covariate.

Differences in the endorsement of expectancies of young drinkers and non-drinkers. Because approximately half the subjects in the youngest subject group reported experience with alcohol ($n = 115$) and the other half did not ($n = 101$), the differences in the endorsement of the four types of expectancies between drinkers and non-drinkers in the youngest group was tested. Because the non-drinkers were found to be significantly younger, $t(214 \text{ df}) = 3.4$, $p < 0.01$, age was introduced as a covariate in the analysis (2×2 MANCOVA). The main effect for gender was not significant $F(4,208 \text{ df}) = 0.14$, $p = \text{NS}$, nor was the interaction between gender and drinking status $F(4,208 \text{ df}) = 1.4$, $p = \text{NS}$. The main effect for drinking status was significant, $F(4,208 \text{ df}) = 6.8$, $p < 0.001$. Univariate follow-up tests indicated that the non-drinkers significantly more endorsed negative expectancies for a low dose of alcohol, $F(1,211 \text{ df}) = 21.1$, $p < 0.001$, and negative expectancies for a high dose of alcohol $F(1,211 \text{ df}) = 5.2$, $p = 0.023$.

Discussion

The first important finding of this study was that the factor structure of the alcohol-related expectancies was similar across different subject groups and gender. With multi-group restrictive factor analyses, it was shown that one model with seven first-order factors fitted reasonably well across subgroups. A second model with four second-order expectancy factors also fitted across subgroups. These second-order factors were the four types of expectancies, distinguished by valence (positive or negative) and dose of alcohol (a few drinks or many drinks). This allowed for further comparisons of the prediction of current alcohol consumption and of the differential endorsement of the four types of expectancies across subgroups.

The main finding of this study was that different expectancies predicted current drinking across the subgroups. Positive expectancies for a high dose of alcohol, for example, did not significantly predict current drinking in students, which is in agreement with several studies (e.g. Fromme *et al.*, 1993; Leigh & Stacy, 1993).

Figure 4. Differences in (a) high-dose positive and (b) high-dose negative expectancies between subject-groups and gender ($\diamond$ males; $\square$ females).

However, it was found that these “least plausible” expectancies were the strongest predictor of drinking in secondary school boys of 16 and older. In addition, these expectancies

significantly predicted drinking in secondary school boys of the youngest subject-group who had initiated drinking. A comparison between the older secondary school pupils and students

suggested that male and female university students and secondary school girls of 16 and older maintained a pattern of social drinking due to their relatively strong negative expectancies for a high dose and their relatively weak positive expectancies for a high-dose of alcohol. The boys in the second subject group, on the other hand, showed the reverse pattern of high-dose expectancy endorsement (highest on positive expectancies for a high dose and lowest on negative expectancies for a high dose of alcohol). This paralleled their current drinking pattern: they reported the highest average alcohol consumption on each occasion (6.5 standard drinks).

The comparison of the expectancies of drinkers and non-drinkers in the youngest subject group showed that non-drinkers scored significantly higher on negative expectancies (for a low and a high dose), but not on positive expectancies. Interestingly, in those boys of the youngest group who had initiated drinking, *positive* expectancies predicted the amount of alcohol they consumed. This pattern of results suggested that the relevant positive expectancies were acquired before alcohol consumption actually commenced, which is in agreement with the findings of Christiansen *et al.*, (1989) and Miller, Smith and Goldman (1990). Negative expectancies appeared to be moderated as a result of drinking experience. A similar pattern was found for the comparison between the younger boys in secondary education and the older boys in secondary education: the younger boys held stronger negative expectancies than the older boys, both for a high and for a low dose of alcohol. In contrast, no significant difference was found between these two subgroups on the positive high dose expectancies that most strongly predicted drinking in boys of group 2. Again, the pattern of results suggested that the most relevant positive expectancies did not alter much as a result of increased drinking, but the negative expectancies did.

There are several limitations in the present study. First, high-dose expectancies were introduced on an exploratory basis. Therefore, it was not possible to construct specific high dose scales beyond "positive" and "negative" high-dose expectancies. The introduction of more specific scales is important for two reasons: to arrive at a more precise understanding of these expectancies in those groups where they are important predictors of current risky drinking patterns. In

addition, the introduction of specific high-dose scales would make the second-order factor structure more powerful and would enable a more accurate comparison of the predictive power of high- and low-dose expectancies in different samples.

A second limitation of the present study concerns the format of the expectancy questionnaire, which measures the effects of alcohol on an average person. It has been argued that this may not be the most appropriate way to measure expectancies in subgroups primarily consisting of experienced drinkers (here the older secondary school pupils and the university students). However, in a direct comparison between the two formats in college students no difference was found (Wood *et al.*, 1992). The advantage of the general format was that (young) non-drinkers could be included in the study and that, therefore, the results could be compared across subgroups, as well as with results obtained with the widely used AEQ-A (Christiansen *et al.*, 1982). Nevertheless, a replication study with a questionnaire measuring the four types of expectancies in a personal format would be desirable. This especially concerns the findings on the importance of high-dose expectancies for predicting "weekend-bingeing" in secondary school boys of 16 and older. Another possible extension of the present questionnaire is to measure separately expected effects and the desirability of the effects. This might be an interesting way to proceed. However, in the present set-up subjects would have to fill in some items four times: for a low dose and for a high dose of alcohol, concerning expectancy and desirability. This might be a rather taxing procedure for younger subjects.

The results of this study have implications for the prevention of problem drinking in adolescents. Challenging positive expectancies would seem a better prevention strategy than further strengthening negative expectancies which appear to be already unrealistically high before drinking has started. Darkes & Goldman (1993) showed that an experimental challenge of (low-dose) positive expectancies in male problem drinkers (students) was effective. Present results suggest that the prevention of problem drinking in adolescent boys could be improved by challenging their positive *high-dose* expectancies. The more established strategy of enhancing negative (high-dose) expectancies could also be of

relevance in adolescents at risk. These expectancies appear to moderate drinking successfully in students and are relatively weak in adolescent boys with a high alcohol consumption on each drinking occasion. Learning to distinguish for dose effects could be a helpful strategy in prevention of problem drinking. An application of the "extended balanced placebo design" in a challenge could be helpful in this respect (Lapp *et al.*, 1994).

The results for the older adolescent boys obtained in this study can be related to models of risks for alcoholism (Zucker, 1987). The development of an individual's high dose expectancies could be an important factor in determining the outcome of a period of high alcohol consumption in late adolescence: returning to moderate levels of consumption without professional help (a "developmentally limited" alcohol problem, Zucker, 1987) or developing a more serious alcohol problem. The interaction of expectancies with other risk factors seems to be of great importance in understanding vulnerability for alcoholism (Sher, 1991), and constitutes a main goal in our ongoing study with young children of alcoholics (Wiers *et al.*, 1994). In this line of research the recent findings of Deckel, Hesselbrock & Bauer (1995) are particularly interesting: neuropsychological measures of frontal cortex functioning predicted positive expectancies in young-adult children of alcoholics. Impaired functioning of the frontal cortex has been related to the genetic vulnerability for alcoholism (e.g. Pihl, Petersen & Finn, 1990), and might influence the development of high-dose expectancies. Another important risk factor that could be related to the development of (high-dose) expectancies concerns the subjective response to an alcohol challenge in early adulthood which was found to be a strong predictor of future alcoholism (Schuckit & Smith 1996). Longitudinal evidence for the reciprocal influence of alcohol experience and expectancies has been found (Smith *et al.*, 1995).

The main conclusion of this study is that the measurement of dose-related alcohol expectancies is a promising addition in future research with alcohol-related expectancies, especially when other populations than university students are studied. Including the "implausible" positive expectancies for a high dose of alcohol could be important in relation to the prevention of alcohol problems. Further longitudinal studies are re-

quired including the four types of expectancies and other individual risk factors.

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Notes

[1] The following variables are defined:

- NWD = the number of weekdays per month (Monday–Thursday) on which alcohol is consumed (0–16).
- DRINKSWD = the number of standard drinks on an average weekday on which alcohol is consumed (as summed from the beverage checklist).
- NWND = the number of weekend-days per month (Friday–Sunday) on which alcohol is consumed (0–12).
- DRINWND = the number of standard drinks on an average weekend-day on which alcohol is consumed (as summed from the beverage checklist).
- WEEKGSS = the number of standard drinks a subject reports to drink in an average week.
- NDDrunk2w = the number of days in the past 2 weeks on which the subject drank five or more standard alcoholic drinks on one occasion

The estimate of weekly alcohol consumption (QF, or quantity $\times$ frequency) was calculated as follows:

$$(1) \text{ QF} = \{[(\text{NWD} \cdot \text{DRINKSWD}) + (\text{NWND} \cdot \text{DRINWND})/4] + \text{WEEKGSS}\}/2.$$

The estimate of the average number of drinks per drinking occasion was calculated as follows:

$$(2) \text{ Q} = \text{QF}/\text{F}$$

where F denotes the frequency of drinking:

$$(3) \text{ F} = \{(\text{NWD} + \text{NWND})/4\}/2.$$

For non-drinkers (F = 0), Q was set to zero.

The number of days intoxicated in the past month was calculated as follows:

$$(4) \text{ D} = 2 \cdot \text{NDDrunk2w}.$$

All alcohol consumption variables were log transformed in the following way:

(5) $\ln(\text{DrinkVar}) = \ln(\text{DrinkVar} + 1)$, where one is added to make the inclusion of non-drinkers possible.

A problematic aspect of a transformation is that it might obscure the interpretation of the outcomes (Stevens, 1992). Here, however, the interpretation is fairly straightforward: $\ln(\text{drinks} + 1)$ equals zero indicates non-drinkers, $\ln(\text{drinks} + 1)$ equals one indicates about three drinks a week, $\ln(\text{drinks} + 1)$ equals about seven drinks a week, $\ln(\text{drinks} + 1)$ equals about 19 drinks a week, and $\ln(\text{drinks} + 1)$ equals about 50 drinks a week, or seven drinks a day.

- [2] To assess the model-fit, several indices can be used. However, it is known that "statistical goodness-of-fit tests are often more a reflection on the size of the sample than on the adequacy of the model" (Browne & Cudeck, 1993, p. 137). It is therefore recommended to concentrate on errors of approximation such as the root mean square error of approximation, or RMSEA (Browne & Cudeck, 1993; Jöreskog, 1993). A RMSEA of below 0.05 indicates a close fit of the model in relation to the degrees of freedom, which is "no less subjective than the choice of 5% as a significance level" (Browne & Cudeck, 1993, p. 144–147). To facilitate comparison with other structural equation models of expectancy, the adjusted goodness of fit index (AGFI, as in Fromme *et al.*, 1993) is given and the NNFI (non-normed fit index, as in Leigh & Stacy, 1993). In multi-group analyses the GFI is given instead of the AGFI. In the multi-group analyses the corrected RMSEA is given, which is equal to the RMSEA given by LISREL 8.12 times the square root of the number of groups (S. Gregorich, personal communication on SMNET <SEMNET@UA1VM.UA.EDU>, February 13, 1997).

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Appendix

A. Multi-group restrictive first order factor analyses in LISREL

In the multi-group restrictive first order factor analysis, the following model was specified in each of the subject-groups used in that analysis:

$$\Sigma_i = \Sigma \quad \Lambda_i \Gamma_i + \Theta_i \quad (1)$$

Here Σ is a matrix of factor loadings, Σ is the covariance matrix of the (zero mean) factors, and Θ_i is the diagonal covariance matrix of the (zero mean) errors, with the subscript i indicating the subject-group. The structure of Σ was specified a priori, because each item was assigned to a predetermined factor (in contrast to exploratory factor analysis) Note that Σ has no group-indicator because it was constrained to be invariant across groups. For reasons of identification, one indi-

cator of each factor was fixed to 1 in all subgroups. The errors in Θ_i were allowed to vary across subject-groups, as was the covariance matrix Ψ_i . All free parameters in Ψ , Ψ_i and Θ_i were estimated using the LISREL program.

B. Second-order (multi-group) factor analysis in LISREL

The object of second order factor analysis is to explain the covariance of the first order factors by postulating a smaller number of second order factors. The model used to this end is:

$$\Psi_i = \Psi (\Psi_i \Psi^t + \Psi_i) \Psi^t + \Theta_i \quad (2)$$

Here Ψ contains factor loadings on first order factors, Ψ contains factor loadings of first order factors on

second order factors, Ψ_i is the covariance matrix of the second order factors, Ψ_i is the diagonal covariance matrix containing the residual variances, i.e. variances of the first order factors that are not explained by the second order factors, and Θ_i is again the diagonal covariance matrix of the errors. The covariance matrix of the first order factors is now modelled as $(\Psi_i \Psi^t + \Psi_i)$. Note that in this analysis both the first and second order factor loadings (Ψ and Ψ) were estimated under the restriction that these parameters were invariant across the subject-groups. The parameters in Ψ_i , Ψ_i and Θ_i were allowed to vary over the subject-groups. For reasons of identification, again one indicator of each first order factor was fixed to 1 in all subgroups, and Ψ_i and Ψ_i were standardized in one subject-group.