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## Good Self-Control Moderates the Effect of Mass Media on Adolescent Tobacco and Alcohol Use: Tests With Studies of Children and Adolescents

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### Abstract

**Objective**—To investigate whether self-control moderates the effect of media influences on tobacco and alcohol use among youth and if so how this effect occurs.

**Design**—In Study 1, a regional sample of 10-year olds ( $N = 290$ ) was interviewed in households; attention to tobacco/alcohol advertising was assessed. In Study 2, a national sample of youth ages 10–14 years ( $N = 6,522$ ) was surveyed by telephone; exposure to tobacco/alcohol use in movies was assessed. Good self-control was measured in both studies.

**Main Outcome Measures**—Willingness to use substances and affiliation with peer substance users (Study 1); involvement in smoking or drinking (Study 2).

**Results**—In Study 1, the effect of tobacco/alcohol advertising on predisposition for substance use was lower among persons scoring higher on good self-control. In Study 2, the effect of movie smoking/alcohol exposure on adolescent tobacco/alcohol use was lower, concurrently and prospectively, among persons scoring higher on good self-control. Moderation occurred primarily through reducing the effect of movie exposure on positive smoking/alcohol expectancies and the effect of expectancies on adolescent use; some evidence for moderation of social processes was also noted. Covariates in the analyses included demographics, sensation seeking, and IQ.

**Conclusion**—Good self-control reduces the effect of adverse media influences on adolescent tobacco and alcohol use. Findings on the processes underlying this effect may be useful for media literacy and primary prevention programs.

### Keywords

adolescent smoking/alcohol use; moderation; self-control; movies; advertising

This research addresses the question of whether self-control moderates the effect of media influences on adolescent health behavior, with a focus on early tobacco and alcohol use. Content analyses have shown that adolescents have substantial exposure to tobacco and alcohol use in movies and that smoking and drinking are generally portrayed in a neutral or positive manner (Dal Cin, Worth, Dalton, & Sargent, 2008; Roberts, Henriksen, & Foehr, 2004; Sargent, Tanski, & Gibson, 2007). Studies with U.S. samples have shown that amount of exposure to tobacco or alcohol cues in movies predicts likelihood of early smoking and drinking among adolescents (e.g., Dalton et al., 2003; Distefan, Pierce, & Gilpin, 2004; Sargent et al., 2005; Wills, Ainette, Stoolmiller, Gibbons, & Shinar, 2008). Moreover, tobacco and alcohol advertising have been linked to adolescent substance use in several studies (e.g., Ellickson, Collins, Hambarsoomians, & McCaffrey, 2005; Pierce, Choi, Gilpin, Farkas, & Berry, 1998; Snyder, Milici, Slater, Sun, & Strizhakova, 2006; Stacy, Zogg, Unger, & Dent, 2004). These main effects have been found concurrently and prospectively, with control for a number of plausible covariates, and across national contexts (Hanewinkel & Sargent, 2008; Hanewinkel, Tanski, & Sargent, 2007; Thrasher, Jackson, Acillo-Santillan, & Sargent, 2008). Accordingly, reviewers have suggested that mass media are an important source of influence on tobacco and alcohol use in early adolescence (Grube & Waiters, 2005; National Cancer Institute, 2008).

In view of the prevalence of media effects on adolescent substance use, it is important to identify factors that can moderate these influences. In the present research we focus on self-control as a moderator. Previous studies have shown that self-control constructs are relevant for the etiology of adolescent substance use (Wiers et al., 2007; Wills & Dishion, 2004). Measures indexing the tendency to control behavior or emotion have been related to adolescent smoking and alcohol use (e.g., Audrain-McGovern et al., 2007; Brody & Ge, 2001; Novak & Clayton, 2001) as well as to combined use (e.g., Simons & Carey, 2006; Sussman, McCuller, & Dent, 2003; Wills & Stoolmiller, 2002). Research with different paradigms has indicated that the tendency to be reflective, planful, and systematic in problem solving (here termed *good self-control*) is inversely related to substance use through several pathways (Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008; Wills & Ainette, 2009).

Good self-control is a set of related abilities that include focusing attention, linking behaviors and consequences over time, and considering alternatives (Barkley, 1997; Metcalfe & Mischel, 1999; Zimbardo & Boyd, 1999). Developmental models posit that indices of good self-control should be correlated because they are based on temperamental characteristics such as attention and memory (Barkley, 1997; Rothbart & Ahadi, 1994; Wills & Dishion, 2004). Confirmatory analyses have supported the posited measurement structure, with several indicators having high loadings on an underlying construct of good self-control. Indicators for good self-control used across studies have included measures of concentration, planning, and persistence; systematic problem solving; delay of gratification; and future time perspective (e.g., Wills, Cleary, Filer, Mariani, & Spera, 2001; Wills, Walker, Mendoza, Ainette, 2006; Wills, Murry et al., 2007). Thus, these various indicators for good self-control all measure a similar underlying construct (Wills, Isasi, Ainette, & Chen, 2009).

## Pathways and Moderation Effects

Although research has shown that media exposures are related to adolescent smoking and alcohol use, the way in which these effects occur is not well understood (Grube & Waiters, 2005; National Cancer Institute, 2008). Several recent papers have used mediation analysis as an approach to understanding how relations between media exposure and substance use occur. Dal Cin et al. (2009) and Wills, Sargent, et al. (2008) have identified expectancies as a pathway: exposure to substance use cues in movies is related to changes in smoking and alcohol expectancies, which in turn are related to increases in use. Peer affiliations are another pathway: media substance exposure is related to increases in affiliation with substance-using peers, which in turn increases smoking or alcohol use (Wills, Sargent, et al., 2007; Dal Cin et al., 2009).

Though studies have examined main effects of self-control, there has been less attention paid to moderation. Some developmental theorists have suggested that self-control processes are implicated in moderation of adverse circumstances in childhood (Masten & Powell, 2003) but there have not been many direct tests of this proposition. Recent prospective studies, though, have shown that good self-control reduces the impact of two types of risk-promoting influences, negative life events and deviant peer affiliations on antisocial behavior and substance use, respectively (Gardner, Dishion, & Connell, 2008; Wills, Ainette, et al., 2008). This suggests an inquiry on whether self-control can moderate the effect of media influences and, if so, how this occurs.

Our theoretical formulation on how media influences are moderated by self-control focuses on two stages. The first stage refers to the way in which information from media exposures is encoded. With regard to a media effect on expectancies, good self-control is posited to be related to more elaborated processing of information, as individuals higher on this dimension would engage in more analytic processing of the situations they see in movies or advertising and make more cognitive reinterpretations of what they view (Gerrard et al., 2008; Wills & Dishion, 2004). For example after viewing a smoker onscreen they could be more likely to think “That person is acting, not really enjoying the cigarette” rather than perceiving the smoker as attractive and the cigarette as enjoyable, so expectancies about smoking would be less affected. This leads to the prediction that good self-control will reduce the effect of media exposure on positive expectancies. Regarding the effect of media exposure on peer affiliations, the prototype-willingness model (Gibbons, Gerrard, & Lane, 2003) suggests that persons higher on good self-control are more likely to see the behavior of smokers and drinkers as inappropriate so they would view these persons as less attractive and be less inclined to affiliate with them (cf. Wills, Murry, et al., 2007). Thus, we predicted that the effect of media exposure on affiliation with peer users would be lower among persons who score higher on good self-control.

With regard to the second stage, which we term enactment, Gibbons et al. (2003) have suggested that relations of cognitions to health behaviors may vary across persons, and studies have shown individual differences in the accessibility of expectancies (Palfai & Wood, 2001). Because individuals with good self-control are inclined to focus attention on conventional activities (e.g., academic achievement) it may be that substance expectancies are less available in this group hence would have less effect on behavior. Thus we predicted that expectancies would have less effect on smoking/ alcohol use for persons higher on good self-control. With regard to the social pathway, aspects of good self-control such as tendency to consider alternatives in problem situations would likely result in a broader response repertoire and greater flexibility in dealing with interpersonal temptations or provocations (Sussman et al., 2003; Wills, Ainette, et al., 2008). This could be relevant for moderating the impact of temptation or pressure situations that otherwise could lead to

substance use. This leads to the prediction that the effect of peer affiliations on adolescent substance use will be lower for persons who score higher on good self-control.

## Present Research

In two studies, we tested whether good self-control moderates the effect of mass media on substance use. Though the measures of media exposure varied somewhat, the self-control measures were similar and our aim was to determine whether moderation effects are comparable in form across the studies. The analyses were based on a regional sample of 10-year-old children (Study 1) and a national sample of 10–14-year-old youth (Study 2). Our aim in both studies was to test the proposition that the effect of media influences will be lower among persons who score higher on good self-control. Study 1 was cross-sectional, testing the basic hypothesis that a moderation effect would be observed. Study 2 was longitudinal and tested for a concurrent moderation effect as well as testing for moderation of changes in use over time. In Study 2, where measures of expectancies and affiliations were available, we tested our two-stage formulation about the locus of moderation effects by examining for moderation of cognitive and social pathways for media effects. In both studies the analyses included control for demographic characteristics and we included two plausible confounders, sensation seeking and IQ, so as to examine the possibility that moderation effects are attributable to these variables rather than to self-control characteristics of the participants.

## Study 1

The data were from a community sample of 10-year-old children, who were interviewed in households. Because of the age of the children there was almost no substance use, so the criterion variables were measures of predisposing risk factors: willingness to smoke or drink and early affiliation with peer experimenters (cf. Wills, Gibbons, Gerrard, & Brody, 2000). The media measure assessed children's attention to tobacco and alcohol advertising and self-control was assessed with multiple indicators.

## Method and Sample

Families were recruited from six communities in the New York metropolitan area, which had census characteristics close to those of the state population (U.S. Department of Commerce, 2002). They were identified through a list-based recruiting method that identified families with a child in the appropriate age range. The study procedure was approved by the Institutional Review Board (IRB) of Albert Einstein College of Medicine. Following initial contacts by letter and telephone, families were recruited by a research staff member who explained the study procedures and answered any questions about the procedure. A visit was then scheduled and two interviewers went to the household. Data from the recruiting procedure indicated the response rate (number of participants/eligible population) was approximately 70%. The child and a parent were interviewed separately in the home by trained research assistants using a computer-based protocol (for detailed description of procedures see Wills, Anette, Mendoza, Gibbons, & Brody, 2007). The parent provided consent for the interview and the child provided assent.

The child participants ( $N = 290$ , 45% male) had a mean age of 10.2 years ( $SD 0.5$ ). Ethnicity was 52% Caucasian, 23% African American, 18% Hispanic, 2% Asian American, and 5% other ethnicity. Data on family structure indicated that 19% of the participants were living in a single-parent family, 75% were with two biological parents, 3% were in a blended family (one biological parent and one stepparent), and 3% were in another family structure; the mean number of persons in the household was 4.1 ( $SD 1.3$ ). The interviewed parents had a

mean age of 40.7 years ( $SD$  6.4) and 78% were born in the United States. Their mean educational level on a 1–6 scale was 4.5 ( $SD$  1.3), indicating at least some college education.

## Measures

**Good self-control**—Good self-control was assessed with items from the Kendall-Wilcox scale, a measure of generalized self-control (Kendall & Wilcox, 1979), supplemented with scales indexing problem solving, delay of gratification, and self-reinforcement (K. Chen et al., 2004; Heiby, 1982; Wills, McNamara, Vaccaro, & Hirky, 1996). The lead-in statement was, “Here are some questions about how you do things. Press a number from 1 to 5 to show what is true for you.” Responses were on 5-point Likert scales with anchor points “Not at all true” and “Very true.” Subscales for this construct were a 5-item scale on planfulness (“You like to plan things ahead of time,”  $\alpha = .76$ ); a 6-item scale on problem solving (“When you have a problem, you think of different ways to take care of the problem,”  $\alpha = .87$ ); a 6-item scale on delay of gratification (“You can control yourself when you have to wait for something important,”  $\alpha = .78$ ); a 6-item scale on positive self-reinforcement (“When you do something right, you take time to enjoy the feeling,”  $\alpha = .87$ ); and a 7-item scale on soothability (e.g., “You can deliberately calm down when you are excited or wound up,”  $\alpha = .83$ ). A composite score based on the five subscales had  $\alpha = .73$ .

**Poor regulation**—Included as a covariate, poor regulation was indexed with subscales derived from similar sources (e.g., Eysenck & Eysenck, 1978; Kendall & Wilcox, 1979). There was a 3-item scale on impatience (e.g., “When you ask a question, you often jump to something else before getting an answer,”  $\alpha = .67$ ); a 5-item scale on distractibility (“You like to switch from one thing to another,”  $\alpha = .77$ ); a 5-item scale on impulsiveness (“You often talk quickly before thinking things out,”  $\alpha = .84$ ); a 5-item scale on angerability (“When you have a problem, you blame and criticize others,”  $\alpha = .85$ ); a 6-item scale on immediate gratification (“It’s difficult for you when you have to wait your turn for a long time,”  $\alpha = .74$ ); a 5-item scale on tension maintenance (“When you have a problem, you keep on worrying about it,”  $\alpha = .90$ ); and a 6-item scale on self-criticism (“You often blame yourself when things go wrong,”  $\alpha = .79$ ). A composite score had  $\alpha = .84$ .

**Advertising attention**—An 8-item inventory based on social-cognitive theory and media research (Gibbons et al., 2003; Wakefield, Flay, Nichter, & Giovino, 2003) assessed orientation to alcohol and tobacco advertising in venues where they were likely to be seen by children. Responses were all on 4-point scales. Items for alcohol asked, “When you see alcohol commercials on TV ...: How much do you pay attention to them?” [anchor points “Don’t pay attention to them at all” and “Pay attention to them very much”]; “Do you think they are funny?” [“I think they’re not at all funny” to “I think they’re very funny”], “Do you wish you were like the people in the commercials?” [“I don’t want to be like them at all” and “I very much want to be like them”]; and “Of the commercials you see on TV, how much do you like the commercials for alcohol?” [“I like the alcohol commercials the least” to “I like the alcohol commercials a lot”]. Scales for smoking had the stem “When you see advertisements for cigarette smoking (like on billboards or at sports events) ...:” and asked similar questions about attention, funniness, liking, and identification. After dropping one low-loading item the inventory was scored for a 7-item composite which had  $\alpha = .77$ . Similar items have been used to assess aspects of reactions to advertising with younger samples and are variously termed affective response, liking, or attention (M. Chen, Grube, Bersamin, Waiters, & Keefe, 2005; Slater, Goodall, & Hayes, 2009; Unger, Schuster, Zogg, & Stacy, 2003); we use the latter term.

**Substance use willingness**—Measures of willingness for substance use are derived from social-cognitive theory and have been shown in several studies to predict substance

use at later ages (Gerrard et al., 2008; Gibbons et al., 2003), hence they are useful indicators of predisposition for substance use. Items were introduced with the stem “Here are some questions about things that could happen to kids. Suppose you were with a group of kids and there were [some cigarettes/some alcohol/some marijuana] you could have if you wanted. How willing would you be to do the following things?” Options for cigarettes were take one puff, smoke a whole cigarette, and take some cigarettes to try later. Responses were on 4-point scales with anchor points “Not at all willing” and “Very willing.” Similar items and response options were provided for situations involving alcohol and marijuana. The measure was scored for a 9-item composite, which had  $\alpha = .77$ .

**Peer user affiliations**—Measures of peer affiliations obtained in late childhood have been shown to predict substance use at later ages (e.g., Dishion, Patterson, Stoolmiller, & Skinner, 1991). Items on affiliation with peer users asked “How many of your friends have [smoked a cigarette/had a drink of beer/had a drink or wine (or wine coolers)/smoked marijuana].” Responses were on 5-point scales with anchor points “None of my friends” and “Four or more of my friends.” A 4-item composite score had  $\alpha = .77$ .

**Sensation seeking**—A brief version of Zuckerman’s scale, included as a covariate, was derived from a scale used in a previous study (Wills, Vaccaro, & McNamara, 1994). Sample items were “You sometimes like to do things that are a little frightening” and “You would like to explore strange parts of town by yourself.” A 4-item scale had  $\alpha = .60$ .

**WISC-R**—Included as a covariate, the revised Wechsler Intelligence Scale for Children (WISC-R, Wechsler, 1991) was administered by an interviewer who was trained to do this. Subscales included were Block Design, Object Assembly, Picture Arrangement, and Vocabulary. As a psychometric scale, a four-item score for IQ had  $\alpha = .65$ .

## Results

Descriptive statistics for the study variables are presented in Table 1A. For the most part the variables had low to moderate skewness. Good self-control was normally distributed, with skewness = 0.00; scores for poor regulation were somewhat shifted toward lower values but the skewness value was still low (0.40). Two of the criterion variables had more skewed distributions, substance use willingness (skewness = 5.72) and peer user affiliations (skewness = 3.80), so these were log transformed. These and the advertising measure had only a moderate degree of skew (Table 1A).

Tests for moderation were conducted in multiple regression. These analyses were performed with entry of main effect terms for the advertising measure, the good self-control measure, and their cross-product; the criterion variable was willingness or peer affiliations. (Preliminary analyses tested each of the five self-control subscales separately and they all showed moderation for at least one criterion variable so all were included in the analytic score.) Results indicated significant cross-product terms with inverse sign for substance willingness (interaction  $t = -3.04, p < .01$ ) and peer user affiliations ( $t = -2.20, p < .05$ ). Graphing based on estimated values of criterion variables at  $M \pm 1 SD$  on the respective predictors showed the interactions for good self-control were consistent in form with a buffering effect: the effect of advertising on the predisposing factors was lower among persons who scored higher on good self-control (Figure 1, A and B). These moderation effects represented reductions in the effect of the media risk factor of 96% and 74%, respectively.

## Structural Modeling Analysis

For a combined analysis with covariates we utilized a structural equation modeling approach so as to include all the variables in a single model. Data were analyzed in Mplus version 5 (Muthen & Muthen, 2005) with maximum likelihood estimation using the EM algorithm to include missing data. The EM algorithm uses all the data that are available to estimate the model using full information maximum likelihood estimation; it employs an iterative procedure that first computes initial expectations of parameter estimates (E), then maximizes the expected log likelihood (M), and repeats the E and M computations until the estimates converge. All constructs were entered as manifest variables to maintain a desirable cases: parameters ratio. Correlations of the study variables as computed in Mplus, presented in Table 2, were generally consistent with expectation. The main predictor measures, good self-control and advertising attention, showed significant correlations with the criterion variables. Poor regulation was positively correlated with advertising attention and sensation seeking, justifying inclusion as a control variable. Gender and WISC score showed some correlations with predictor or criterion variables and hence were included as covariates.

For the moderation tests, a structural model was specified with centered scores for the measures of good self-control and advertising attention as exogenous, together with their cross-product. Specified as covariates were gender, sensation seeking, the WISC-R score, and the poor regulation measure. Correlations among the covariates and the measures of good self-control and advertising attention were included in the model, and the covariates and predictors were allowed to predict the criterion variables. The criterion variables were substance willingness and peer user affiliations, specified with a covariance of their residual terms. From an initial saturated model, nonsignificant paths were eliminated. The final model had good fit, with chi-square (6 *df*, *N* = 290) = 2.29, comparative fit index (CFI) = 1.00, and root mean square error of approximation (RMSEA) = 0.00 (confidence interval .000 –.035). Results are presented in Figure 2 with standardized coefficients. The predicted moderation effect was observed: there were significant paths with inverse sign from the cross-product term to the criterion variables of willingness ( $p < .01$ ) and peer user affiliations ( $p < .05$ ), indicating less effect of advertising at a higher level of good self-control. A main effect was noted for good self-control, with inverse paths to willingness and peer affiliation, and main effects were noted for advertising, with positive paths to willingness and affiliation.

With regard to control variables, sensation seeking had significant positive paths to willingness and affiliation, net of its correlations with self-control and advertising. Poor regulation was included as a covariate but there were no significant paths for this in the structural model. It was correlated with the criteria at almost the same level as good self-control (in opposite directions) but was also positively correlated with sensation seeking and advertising attention (see Table 2); these correlations served to reduce the multivariate effects for poor regulation in the model to nonsignificance.

## Study 2

Study 2 was based on a representative national sample of younger adolescents, who were interviewed by telephone. Because of the telephone format the study had relatively simple measures for self-control and peer use but had detailed measures of exposure to tobacco and alcohol cues in movies, based on independent content coding. After the baseline interview, participants were followed up (also by telephone) with interviews conducted at 8-month intervals.

## Method

### Sample and Procedure

Participants were recruited through random-digit dialing methods to identify a sample of US families with a youth aged 10–14 years (for detailed description of procedures see Sargent et al., 2005). The response rate (number of completed interviews/eligible population) was 66%. All aspects of the study were approved by the IRBs at Dartmouth Medical School and the survey firm (Wes-tat, Rockville MD). Parental consent and youth assent were obtained prior to the interview. Participants were assessed by telephone with a computer-assisted telephone interviewing (CATI) protocol lasting approximately 20 minutes. Reports for sensitive questions were made on the telephone keypad to insure confidentiality. At the baseline interview the participants ( $N = 6522$ ) had a mean age of 12.1 years ( $SD = 1.4$ ). The sample was 49% female; ethnic distribution was 11% African American, 2% Asian/Pacific Islander, 62% Caucasian, 19% Hispanic, and 7% multiple/other ethnicity. Forty percent of the parents had education through high school graduate, 29% had some college education, and 31% had a bachelor's degree or more education.  $N$ s for the subsequent interviews were 5503, 5019, and 4374 for Waves 2 through 4, respectively.

### Measures

**Movie tobacco and alcohol exposure**—The extent of adolescent exposure to smoking and alcohol cues in movies was assessed using a procedure based on independent coding of movie content (for detailed description see Sargent et al., 2005). Movies were selected for the interview from a pool including the top 100 US box-office hits per year for each of the 5 years preceding the baseline survey (1998–2002,  $N = 500$ ), and 32 movies that earned at least \$15 million in gross U.S. box-office revenues during the first four months of 2003. (Older movies were included because adolescents often watch these movies on videotapes or DVDs.) The CATI survey was programmed to randomly select 50 movie titles from the larger pool of 532 movies for each interview. The individual samples of 50 movies were stratified by Motion Picture Association of America (MPAA) rating such that the distribution of MPAA ratings for movies in each list of 50 reflected the distribution in the full sample of 532 (19% G/PG, 41% PG-13, 40% R). Respondents were simply asked (No/Yes) whether they had seen each movie title on their unique list. Each of the 532 movies in the parent population was subsequently coded by trained research assistants who recorded the number of times smoking occurred in the movie and the number of seconds that alcohol use was portrayed onscreen. Studies have shown that the reporting procedure has a low false positive rate and the coding procedure has good intercoder reliability, with kappas of .81 to .86 (Sargent et al., 2005; Wills, Sargent, et al., 2008). Coding data were used to obtain scores for each participant which indexed the amount of exposure to smoking and alcohol use in the movies that he or she had viewed.

**Good self-control**—Self-control was assessed with four items from the Kendall-Wilcox Scale (Kendall & Wilcox, 1979) that reflected delay of gratification and behavioral control (e.g., “I get my homework done first so I can have fun later,” “I am good at waiting my turn”). Responses were on 4-point scales (“Not at all true” to “Very true”). The items were scored for a composite measure indexing good self-control, which had relatively low internal consistency ( $\alpha = .46$ ).

**Sensation seeking**—The measure of sensation seeking was based on previous methodological research which indicated appropriate brief scales (Stephenson, Hoyle, Slater, & Palmgreen, 2003). We used a 4-item scale with items such as “I like to do scary things” and “I like loud music” ( $\alpha = .59$ ). Responses were on 4-point scales with anchor points “Not like you” and “Just like you.”



**Positive smoking/alcohol expectancies**—Items for smoking expectancies were “I think I would enjoy smoking” and “I think smoking would be relaxing.” The correlation of these items was  $r = .45$ . The expectancy item for alcohol was “I think I would enjoy drinking alcohol.” For all items, responses were on 4-point scales (“Strongly disagree” to “Strongly agree”). Smoking was scored for a 2-item composite and alcohol expectancy was analyzed as a single item.

**Peer affiliations**—Questions about peers asked “How many of your friends [smoke cigarettes/drink alcohol].” Responses were on 3-point scales (“None of them” to “Most of them”).

**Participant’s substance use**—Questions about smoking asked “Have you ever tried smoking a cigarette (even a puff)?” (No/Yes) and for those answering affirmatively, “How many cigarettes have you smoked in your life?” (“A few puffs,” “1–19 cigarettes,” “20–100 cigarettes,” or “more than 100 cigarettes”). These two items were combined to provide a 0–4 scale for cigarette smoking, where the lowest score indicated never smoked and the highest score indicated more than 100 lifetime cigarettes. Questions about alcohol asked “Have you ever drunk alcohol (beer, wine, wine coolers, or liquor like vodka or gin) that your parents didn’t know about?” (No/Yes); “Have you ever had 5 or more drinks of alcohol in a row, that is, within a couple hours” (No/Yes); and “Did you have 5 or more drinks of alcohol in a row during the past month?” (No/Yes). These items were combined to provide a 0–3 score for alcohol use, where the lowest score indicated never drank and the highest indicated previous alcohol use and lifetime heavy drinking plus heavy drinking in the past month.

## Results

Descriptive statistics for the study variables are presented in Table 1B. Good self-control and sensation seeking had minimal skew; the other predictor variables (movie smoking or alcohol exposure, affiliation with peer smokers/drinkers, and smoking/ alcohol expectancies) had only moderate skew. The criterion variables for smoking and alcohol were more skewed; in their original metrics the smoking score had skewnesses of 4.34 and 3.54 at Waves 1 and 2, respectively, and skewness values for the alcohol score were 3.86 and 2.95. These variables were log transformed (adding a constant of 1 to prevent zeroes) and values for the transformed scores are in Table 1B.

### Multiple Regression Analyses

The basic hypothesis, that self-control moderates the effect of media exposure, was tested in multiple regression analyses with baseline data in order to maximize power for detecting moderation. We entered main effect terms for good self-control and movie exposure together with their cross-product. Covariates included in the regression were participant age (5 levels), gender (binary), race/ethnicity (three binary codes, with Caucasians as the reference group: African American, Hispanic, and Other); parental education (3 levels), household income (3 levels), home ownership (binary), and sensation seeking (continuous). The criterion variables were the smoking score for the regression model with movie smoking exposure and the alcohol score for the regression model with movie alcohol exposure; analytic  $N$ s with controls were 5,900–5,950.

Results showed significant interaction effects of good self-control with movie smoking exposure (cross-product  $t = -6.76$ ,  $p < .0001$ ) and with movie alcohol exposure ( $t = -8.42$ ,  $p < .0001$ ) for predicting adolescent smoking or alcohol use. Graphing of data based on estimated values of the criterion variable at  $M \pm 1 SD$  on the respective predictors indicated interactions consistent in form with a buffering effect: the effect of movie

exposure on adolescent smoking and alcohol use was lower among persons with a higher level of good self-control (Figure 3, A and B). These moderation effects represented reductions of 47% and 45%, respectively, in the effect of the media exposure on concurrent adolescent smoking and alcohol use.

To test for buffering of peer influences, we conducted separate analyses entering the cross-product of self-control and a peer affiliation measure in similar regression models. These indicated that self-control moderated the effect of friends smoking on adolescent smoking (interaction  $t = -13.40$ ,  $p < .0001$ ) and the effect of friends alcohol use on adolescent drinking ( $t = -7.49$ ,  $p < .0001$ ), replicating findings from Wills et al. (2008). Predicted values of smoking/alcohol use at  $M \pm 1$  *SD* on the respective predictors indicated these interactions were buffering effects: the effect of affiliation with peer users was lower at a higher level of good self-control (results not pictured).

Prospective analyses in multiple regression entered Wave 1 values for self-control and media exposure, their cross-product, and all the previously described controls plus the Wave 1 score for smoking/alcohol use, with the Wave 2 score for smoking or alcohol use as criterion; analytic *N*s were 4,900–5,000. In these analyses, sensation seeking had main effects on smoking and alcohol use concurrently (betas = .13–.16,  $p < .0001$ ) and prospectively ( $\beta = .09$ –.16, all  $p < .0001$ ). Prospective tests for moderation indicated a W1-W2 moderation effect for good self-control for movie smoking exposure, cross-product  $t = -2.22$ ,  $p < .05$ , and for movie alcohol exposure,  $t = -3.77$ ,  $p < .001$ . Increases in smoking/alcohol use over time as a consequence of movie exposure were reduced among persons with a higher level of good self-control. Prospective tests for other lags using similar regression models indicated the  $t$  for the cross-product of W1 self-control and W1 movie smoking exposure was  $-3.39$  ( $p < .001$ ) for Wave 1-Wave 3 and was  $-3.16$  ( $p < .01$ ) for Wave 1-Wave 4; analytic *N*s were 4,600 and 4,200, respectively. For alcohol, with similar *N*s, the  $t$  for the cross-product of W1 self-control and alcohol exposure was  $-4.55$  ( $p < .0001$ ) for Wave 1-Wave 3 and was  $-4.10$  ( $p < .0001$ ) for Wave 1-Wave 4. These moderation effects represented reductions of 29%–46% in the effect of the media exposure, with a mean reduction of 35%.

### Multiple-Group Analyses

For testing our theoretical formulation about the locus of moderation effects, we analyzed a structural model with baseline data to maximize power for detecting interactions. Movie exposure was specified as exogenous, expectancies and peer affiliations were endogenous (with a covariance of their residual terms), and a score for smoking or alcohol use was the criterion. This tests the theory that movie exposure could be related to smoking or alcohol use through two pathways, one involving expectancies about use and one involving affiliation with peer users. Moderation was evaluated in multiple-group analyses by testing whether each of the four mediation pathways in the above-specified model (plus a direct effect) differed for persons low versus high on good self-control.

We first estimated models for the total sample using maximum likelihood estimation with all paths specified from movie exposure to model constructs and with all significant paths ( $p < .01$ ) from the control variables to the model constructs. The model for smoking had chi-square (32 *df*;  $N = 6,522$ ) of 88.89, CFI of .99, and RMSEA = .017 (CI = .013–.021) and the model for alcohol had chi-square (21 *df*;  $N = 6,522$ ) of 45.65, CFI of 1.00, and RMSEA = .014 (CI = .008–.019), all parameters representing good fit to the data. In the interest of brevity we do not report all the zero-order correlations among demographic, predictor, mediator, and criterion variables. (Complete data are available from the first author.) We note that the correlations of good self-control with movie smoking exposure, smoking expectancies, peer smoker affiliations, and the smoking score were  $-.15$ ,  $-.21$ ,  $-.21$ , and  $-.21$ .

21, respectively (all  $p < .0001$ ). The comparable correlations for self-control for alcohol variables were  $-.13$  with movie alcohol exposure,  $-.20$  with alcohol expectancy,  $-.20$  with peer drinker affiliations, and  $-.18$  with the alcohol score (all  $p < .0001$ ). The correlation of self-control with sensation-seeking (included as a covariate in all the analyses) was  $-.35$  ( $p < .0001$ ).

We performed multiple-group analyses for subgroups defined by a median split of the good self-control score. In these analyses there were 3,803 cases in the lower self-control group and 2,717 cases in the higher group; because of the distribution of the scores for good self-control it was not possible to have equal numbers of cases in both groups. (The analyses were repeated with alternative subgroupings—terciles and quartiles—and the results were similar.) A base model was analyzed in both groups simultaneously with all parameters freely estimated. In successive analyses an equality constraint was imposed on each of five specific paths in the model and a nested chi-square test with 1 *df* was conducted to determine if constraining this path to be equal across groups resulted in significantly worse fit of the model, indicating that the path differed significantly across the self-control subgroups.

Figure 4 presents nonstandardized coefficients from the two base models. The base model for smoking had chi-square (64 *df*,  $N = 6522$ ) of 144.68, CFI = .99, and RMSEA = .020 (CI .015–.024). Results from constraints imposed in the multiple-group analysis (Figure 4A) indicated the path from movie smoking exposure to smoking expectancies was lower among persons who scored higher on good self-control, difference chi-square = 13.28,  $p < .001$ ; the path from movie exposure to peer smoking did not differ significantly across groups. The path from expectancies to adolescent smoking was lower for persons who scored higher on good self-control, difference chi-square = 7.22,  $p < .01$ . Also, the path from peer smoking to adolescent smoking was lower among persons who scored higher on good self-control, difference chi-square = 31.70,  $p < .0001$ . The direct effect from movie exposure to smoking did not differ across groups. These results were generally consistent with prediction in that there was evidence for moderation at three places in the model, taken to represent both encoding processes (exposure  $\rightarrow$  expectancies) and enactment processes (expectancies  $\rightarrow$  smoking and peer use  $\rightarrow$  smoking).

The base model for alcohol had chi-square (42 *df*,  $N = 6,522$ ) of 68.54, CFI = .99, and RMSEA = .014 (CI .008–.020). Results from the multiple-group analysis (Figure 4B) showed that the path from movie alcohol exposure to alcohol expectancies was significantly lower for persons scoring higher on good self-control, difference chi-square = 13.84,  $p < .001$ ; the path from movie exposure to affiliation with peer drinkers did not differ significantly across subgroups. The path from alcohol expectancies to adolescent alcohol use was lower for persons scoring higher on good self-control, difference chi-square = 35.80,  $p < .0001$ , as was the path from peer drinking to adolescent alcohol use, difference chi-square = 8.18,  $p < .01$ . In this model the direct effect from movie alcohol exposure to adolescent alcohol use was significantly lower among persons who scored higher on good self-control, difference chi-square = 5.40,  $p < .05$ . These results were again consistent with prediction, showing moderation for paths representing both encoding and enactment processes. In addition there was evidence for moderation of a direct effect from movie alcohol exposure to adolescent alcohol use behavior.

## Discussion

In two different studies we tested the hypothesis that self-control characteristics affect susceptibility to influences from mass media. The hypothesis was tested in both cross-sectional and longitudinal analyses and the results were generally consistent with prediction.

The findings indicated that good self-control moderated the effect of media on substance predispositions (Study 1) and on substance use behavior (Study 2). The form of the moderation effects was consistent across studies although the media measures differed, indexing self-reported attention to tobacco and alcohol advertising in Study 1 and independently coded exposure to movie tobacco/ alcohol use in Study 2. In both studies the analyses controlled for sensation seeking as well as for relevant demographic characteristics such as gender and age. In addition to the moderation effects we think it is noteworthy that main effects were found for advertising with 10-year old children, consistent with the suggestion that the effect of mass media on predisposition for substance use begins at early ages (Austin & Knaus, 2000; Unger & Chen, 1999).

We found consistent evidence for a buffering process: the effect of media influences on substance predispositions or substance use was lower among persons who scored higher on good self-control. Here buffering effects were observed for two types of media (advertising and movies) and in other studies buffering effects have been observed as well for other risk factors (Gardner et al., 2008; Wills, Ainette, et al., 2008). Because the self-control measures had several aspects, one could ask whether moderation is attributable to only one aspect or whether the observed moderation effects involve all aspects of the abilities that comprise a broadly useful construct of good self-control. Because self-control is indexed by subscales that are correlated, in our view the central question is why different indicators load together empirically and how different facets of good self-control (e.g., focusing attention, delaying immediate responses in favor of long-term goals, gathering information, and solving problems) may work together to moderate external influences. With regard to media, aspects of good self-control that are involved in moderation may represent what Gibbons et al. (2003) have termed the *reasoned pathway* to health-related behaviors; this would include more systematic, analytic processing of media information together with considering alternative behaviors in response to media or peer influences. These aspects of self-control could come into operation during encoding of media information as well as during enactment of behavior. Moderation of a direct effect, found for movie alcohol exposure, may represent a different type of process, which Gibbons et al. (2003) have termed heuristic processing or the *reactive pathway*. Further research on moderation may give consideration to both conceptions.

In Study 2 we replicated a finding that good self-control reduces the impact of peer influences (Gardner et al., 2008; Wills, Ainette, et al., 2008). The fact that self-control buffered the effect of two types of influences that are both social in nature is consistent with the concept that mass media may function as a type of “superpeer” through providing models of attractive persons engaging in behavior that may not be available in or condoned by the current peer group of an individual (Brown et al., 2006; Wakefield et al., 2003). The basic idea is that actors influence adolescent behavior in a manner that is more subtle and indirect than that associated with peer influence, but is nonetheless similar in terms of process. This suggests studies with research designs that use concepts derived from peer group research (e.g., modeling, identification, consensus) to derive hypotheses about commonalities in how mass media and peer groups influence adolescent health behavior (Austin, Chen, & Grube, 2006; Dal Cin, Gibson, Zanna, Shumate, & Fong, 2007; Hoffman, Unger, & Valente, 2006; Shadel, Tharp-Taylor, & Fryer, 2009).

It should be noted that moderation effects were found both for tobacco/alcohol advertising, a media venue where there is an overt attempt to influence, and for movies, a venue where in principle there is no explicit agenda to influence. (However, product placement in movies is legal for alcohol and the alcohol industry spends considerable amounts of money to place alcohol in films commonly viewed by teenagers, Roberts et al., 2004.) The question of

whether advertising and movies are perceived differently by children and adolescents in terms of their intent is a question that could be clarified in further media research.

We note that the studies had some limitations. The media measure in Study 1 contained a subjective element and the criterion variables were proxies for substance use, but the fact that moderation effects of similar form were observed in Study 2 with an objective measure of media exposure and indices of actual substance use showed that the results are similar with different types of measures. In Study 2 the expectancy measures tapped a limited range of content and the peer measures indexed perceived attributes and behaviors of friends. Additional research is needed that includes more elaborated measures of positive and negative expectancies and, where feasible, reports about peer substance use obtained from other sources. The self-control measure in Study 2 had relatively low internal consistency and further research is indicated with different types of self-control measures to explore how media are related to substance use. Finally, the studies were conducted in early adolescence and the criterion variables for the most part indexed relatively low levels of use. Though experimental use in early adolescence is not without significant risk (Chassin, Presson, Sherman, & Edwards, 1990), further research could examine substance use at later ages and test moderation effects for progression of use as well as transitions to tobacco/alcohol abuse and dependence.

### How Do Moderation Effects Occur?

Our theoretical perspective suggested that moderation effects might occur at the stage of encoding information from media. This prediction was supported for expectancies, as persons higher on good self-control showed less effect on expectancies at a given level of movie smoking and alcohol exposure. This suggests these persons process and encode movie information differently, but the exact nature of the cognitive processes involved in these differences is not established from the present data. For example, it is possible that high and low subgroups attend to different types of information or that they interpret this information in a different manner (Slater et al., 2009). Laboratory studies with manipulation of variables may be useful for explicating the mechanism of moderation effects for cognitive processes.

We found no evidence of moderation for the media effect on peer affiliations. While there may be no moderation for this aspect of media influence, the peer measures in Study 2 were relatively simple ones whereas peer-group processes are complex, involving the frequency and context of affiliation over time (Hoffman et al., 2006; Wills, Sargent, et al., 2007). Other types of study designs, such as longitudinal studies with detailed social network assessments, may be useful for clarifying the nature of media influences on peer affiliations and their consequences for behavior.

We did find that paths from expectancies to substance use and from peer characteristics to substance use were both moderated by good self-control. We interpret this as indicating that persons scoring higher on good self-control are less susceptible to temptations from both internal influences (i.e., stored representations of tobacco/alcohol effects) and from external influences (i.e., peer modeling or pressure to use). These could represent different types of processes, and further research is indicated using both field studies and laboratory paradigms to further explicate the mechanism of moderation for both internal and external influences.

Regarding implications for substance use prevention, we note research has shown that cognitive and social aspects of self-control can be taught, with effects on both achievement and interpersonal outcomes (e.g., Diamond, Barrett, Thomas, & Munro, 2007; Finkle, Dewart, Slotter, Oaten, & Foshay, 2009; Oaten & Cheng, 2006). Such findings may be included in prevention programs that focus on general skills enhancement for prevention of

early tobacco and alcohol use. With regard to the present findings about mass media effects, some of the observed moderation effects were of modest magnitude but we think they have theoretical significance: They suggest that obtaining a better understanding of the cognitive processes involved in moderation effects (e.g., differential attention, encoding, or recall) and the social processes involved in these effects (e.g., differential affiliation, resistance, or some combination of cognitive and social processes) can be used to inform media literacy programs that specifically teach young persons how to deal with influences from media (e.g., Austin, Chen, Pinkleton, & Johnson, 2006; Brown, 2006). The moderation findings may also be used in combination programs that include media components together with other prevention material (Slater et al., 2006). Thus findings from both basic and applied research may be used to enhance existing substance prevention programs.

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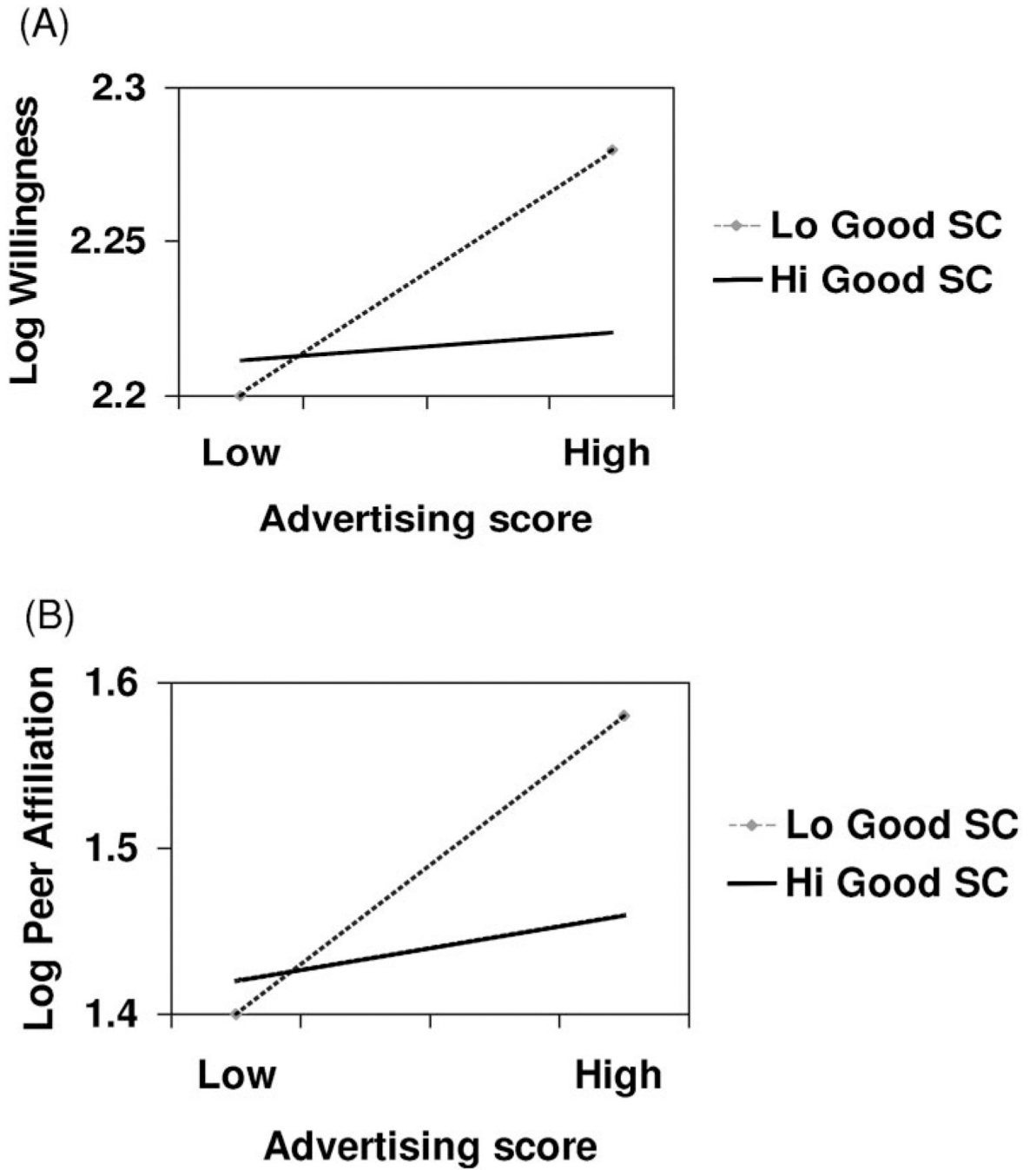
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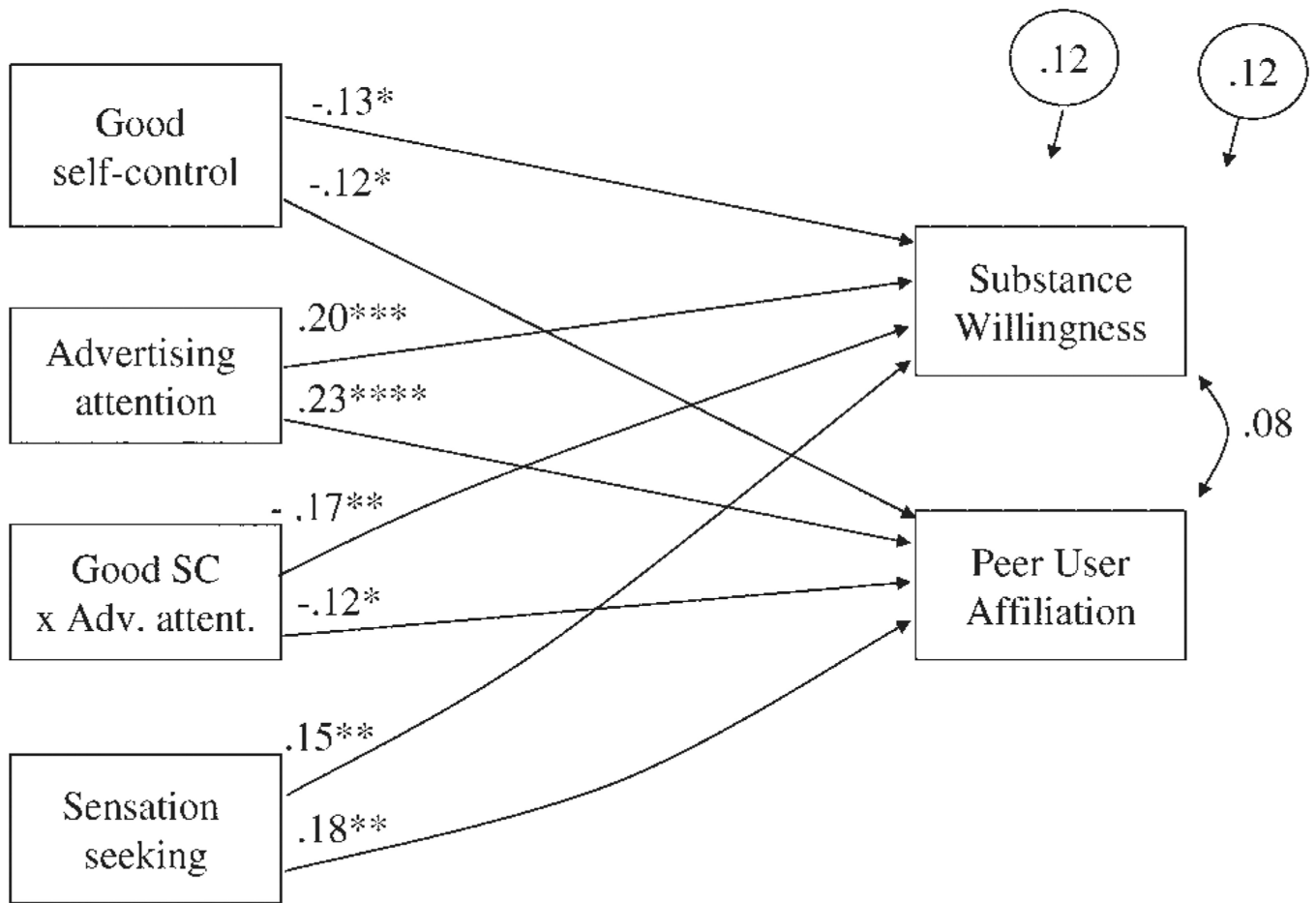
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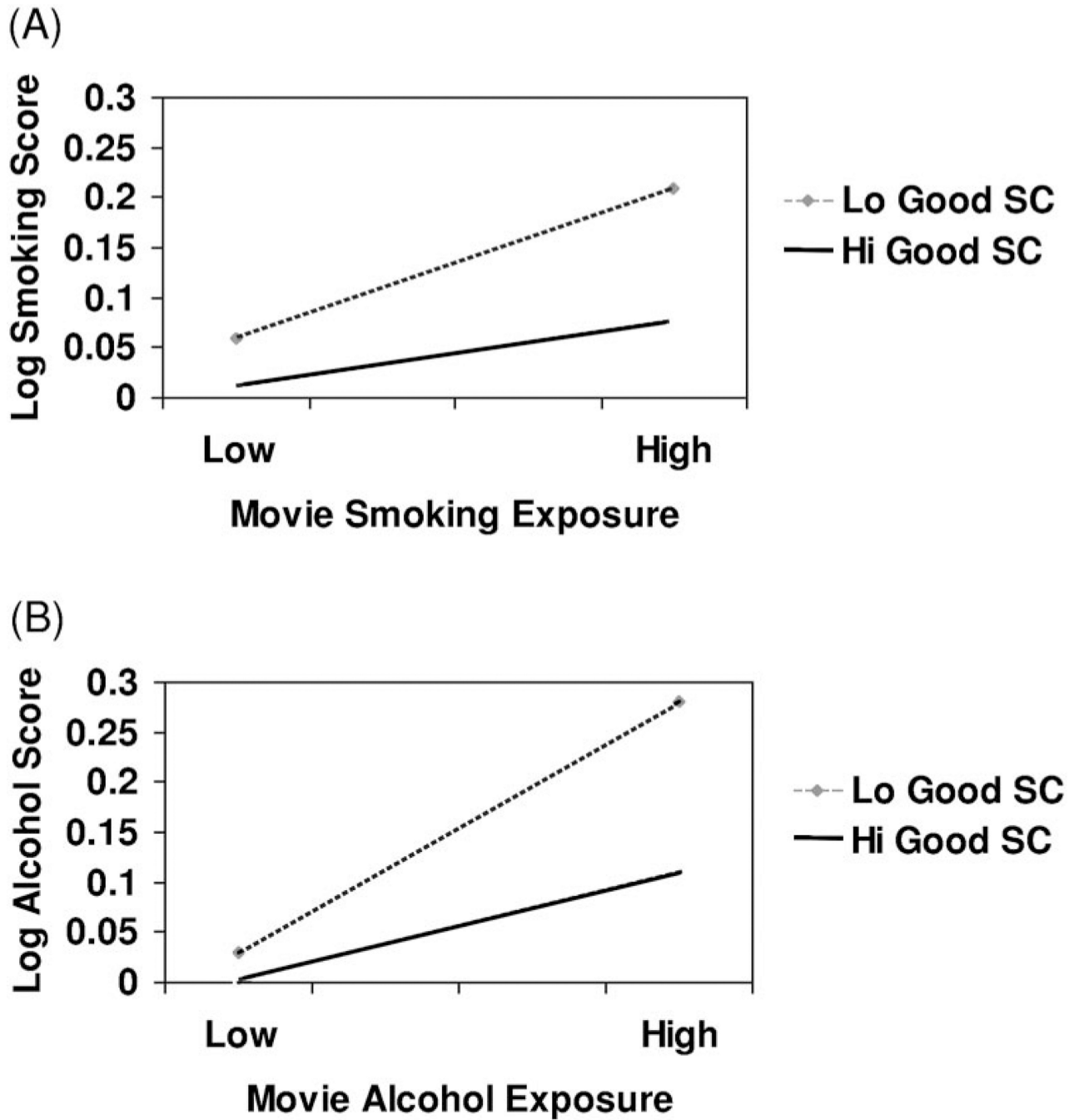
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**Figure 1.** For Study 1, estimated values of criterion variables by levels of good self-control and advertising attention with regard to (A) substance use willingness, (B) affiliation with peer users.

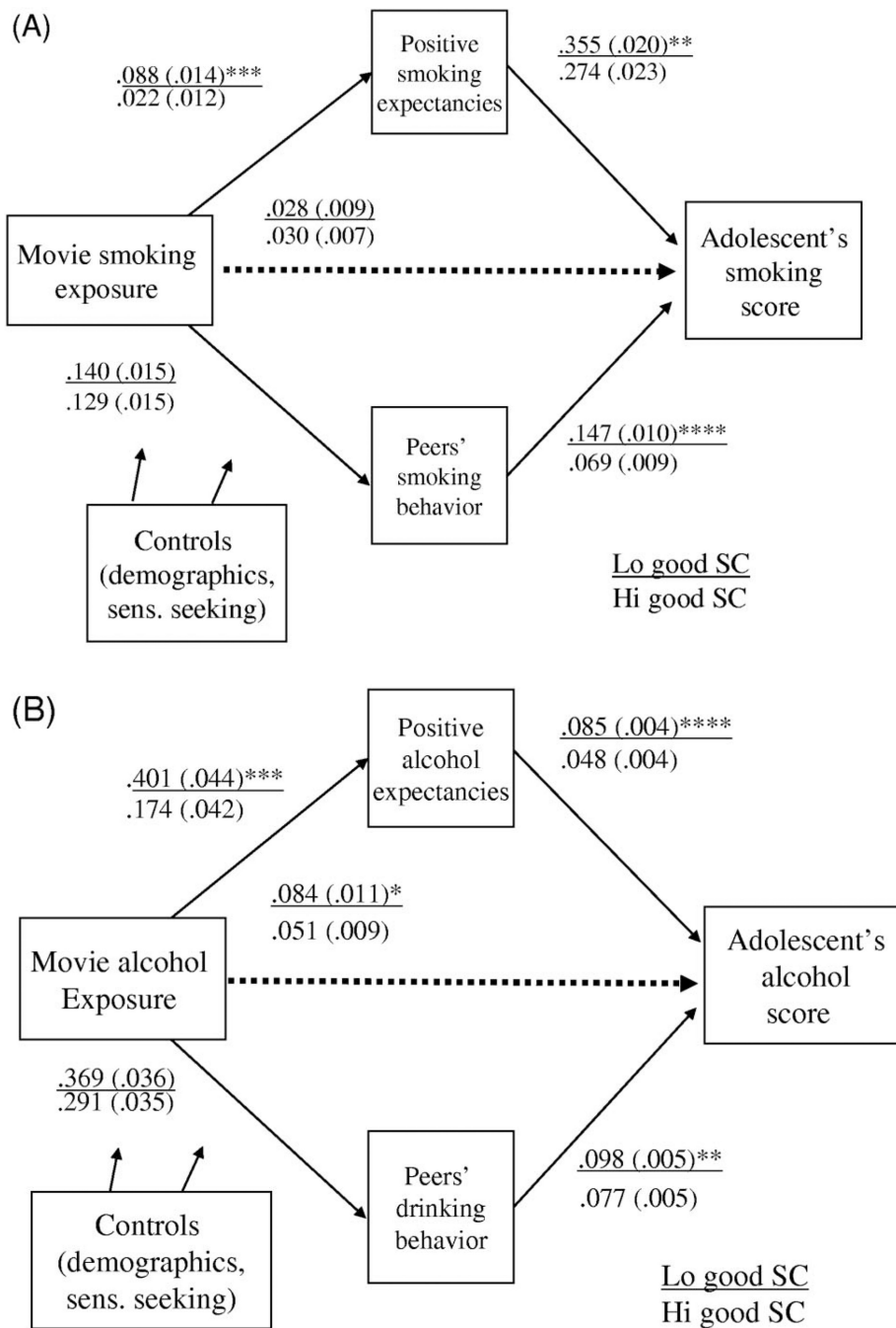


**Figure 2.** Structural model for Study 1. Straight single-headed arrows indicate path effects, curved double-headed arrows indicate covariances. Values are standardized coefficients. Values in circles at top of figure are squared multiple correlations, the variance accounted for in a given construct (to which the arrow points) by the exogenous variables. Model includes poor self-regulation, gender, and IQ (not pictured). For the correlations among the exogenous variables, included in the model but excluded from the figure for graphical simplicity, see Table 2. \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ . \*\*\*\*  $p < .0001$ .



**Figure 3.**

For Study 2, estimated values of substance use by levels of good self-control and movie exposure. (A) Movie smoking exposure and adolescent smoking, (B) Movie alcohol exposure and adolescent alcohol use.



**Figure 4.** For Study 2, unstandardized coefficients (*SE* in parentheses) from multiple-group analysis with adolescent smoking or alcohol use as criterion. Coefficients for persons low on good self-control are above line, coefficients for persons high on good self-control are below line. (A) Model for smoking, (B) Model for alcohol. The following indicate coefficients differ significantly: \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ . \*\*\*\*  $p < .0001$ .

**Table 1**

Descriptive Statistics for Study Variables, for Two Studies

Variable	Range	<i>M</i>	<i>SD</i>	Skew
A. Descriptives for Study 1				
Good self-control	40–150	105.77	17.77	–0.00
Poor regulation	30–130	70.75	20.35	0.40
Advertising attention	7–21	8.15	2.28	2.27
Sensation seeking	4–20	12.13	4.06	–0.05
WISC-R	7–70	42.99	9.43	–0.20
Substance use willingness <sup>a</sup>	2.20–2.77	2.23	0.10	3.24
Peer user affiliations <sup>a</sup>	1.39–2.48	1.46	0.21	2.90
B. Descriptives for Study 2				
Movie smoking exposure <sup>b</sup>	0–410	61.68	55.61	1.44
Movie alcohol exposure <sup>c</sup>	0–166	31.07	25.29	1.21
Self-control	4–16	12.00	1.98	–0.36
Peer smoker affiliation	1–3	1.25	0.50	1.86
Peer drinker affiliation	1–3	1.26	0.52	1.86
Smoking expectancies	2–8	2.36	0.83	2.87
Alcohol expectancies	1–4	1.32	0.60	1.95
Sensation seeking	4–16	7.95	2.47	0.61
Smoking score W1 <sup>a</sup>	0–4	0.15	0.51	3.15
Smoking score W2 <sup>a</sup>	0–4	0.22	0.63	2.59
Alcohol score W1 <sup>a</sup>	0–3	0.14	0.46	2.03
Alcohol score W2 <sup>a</sup>	0–3	0.22	0.59	2.38

<sup>a</sup>Log transform.<sup>b</sup>Number of occurrences.<sup>c</sup>Minutes of use on screen.

Table 2

Correlations of Model Variables for Study 1

	1	2	3	4	5	6	7	8
1. Good self-control	—							
2. Poor regulation	-.13	—						
3. Advertising attention	.01	.17	—					
4. Sensation seeking	.04	.22	.09	—				
5. Male	-.04	.07	.06	.20	—			
6. WISC	-.01	-.10	-.11	.04	-.01	—		
7. Sub. use willingness	-.12	.15	.20	.19	.07	-.01	—	
8. Peer user affiliations	-.11	.11	.24	.21	.12	-.01	.19	—

Note.  $N = 290$ . Approximate significance levels are  $r = .11$ ,  $p < .05$

$r = .15$ ,  $p < .01$ .

$r = .19$ ,  $p < .001$ .