Effect of a Drinker Identity on Smoking-Related Information Processing and Behavior

Summary of Project Aims

The current project extended self-schema theory (Markus, 1977) and built upon our previous research showing that among adolescents, a future-oriented self-schema related to drinking not only predicted alcohol use, but also predicted tobacco use one year later (Lee et al., 2015). Self-schemas are knowledge structures about the self in various behavioral domains, that guide the processing of information and direct the behavioral actions that are congruent with them. The current STTI supported project included two studies with the overarching purpose to determine the effects of a drinker self-schema on: 1) processing of smoking-related stimuli, and, 2) smoking behaviors. In addition, factors contribute to the presence of a drinker self-schema in memory were determined. We identified college-enrolled undergraduate students who engaged in drinking and smoking, but did not define themselves as smokers to address the following specific aims.

Aim 1: Determine the effect of a drinker self-schema on the processing of drinking- and smoking-related information.

H1: Higher drinker self-schema scores will enhance processing (more positive endorsements, faster response latency times, greater incidental recall) of positively valenced drinking- and smoking-related attributes.

Aim 2: Determine the effect of a drinker self-schema on drinking and smoking behaviors.

H2: Drinker self-schema scores will positively predict alcohol and tobacco use.

Aim 3: Determine relationships between early experiences with alcohol on the drinker self-schema.

H3: Higher parental alcohol problems, earlier initiation of alcohol use, higher levels of alcohol use, higher levels of alcohol problems, and higher percentage of friends’ alcohol use during high school will predict higher drinker self-schema scores.
Conceptual Framework

The current study was based on the schema model of self-concept (Markus, 1977) and the related hypothesis that cross-substance facilitation of information processing (Doebrick & Todman, 2003) influences co-occurring drinking and smoking behaviors. Given that cross-substance facilitation of information processing due to underlying self-cognitions may be the explanatory mechanism that accounts for co-occurring drinking and smoking behaviors, we directly examined whether the drinker self-schema biases the processing of smoking-related information (Aim 1). Then, we examined cross-substance facilitated effects on behavior by testing whether the drinker self-schema predicts smoking behaviors (Aim 2). Finally, considering that the individual’s experience is likely to serve as the context for the development of self-schemas, this study extended the schema model of self-concept to explore factors that contribute to the development of the drinker self-schema, including personal experience with alcohol (age of initiation, high school alcohol use and problems), parental alcohol problems, and friends’ alcohol use during high school (Aim 3).

Methods

Research design

A two-phase design was used to determine the effects of the drinker self-schema on processing smoking-related stimuli and smoking behaviors, and to explore factors that contribute to the development of the drinker self-schema. Phase 1 consisted of internet administered self-report measures, including a well-validated measure of self-schemas and measures of determinants of the drinker self-schema. Phase 2 was a follow-up study with a subset of participants who completed phase 1. It consisted of an in-person session that included measures of information processing and alcohol- and tobacco-use behaviors.

Participants and setting
We recruited a convenience sample of 329 undergraduate students from universities and colleges in Western New York. Eligibility criteria included: (1) self-reported alcohol and tobacco use in the past month (at any level), (2) do not identify as a “smoker”, (3) current enrollment in 4-year college/university as a full-time student, (4) English speaking, and (5) 18 to 24 years old.

Exclusion criteria included: (1) self-reported pregnancy (current or past year), and (2) psychotherapy or medication for treatment of alcohol and tobacco use at the time enrollment. Face-to-face announcements, flyer, and e-mail or electronic advertisements were used for recruitment and target multiple college/university and community settings to reach a diverse population of undergraduates.

Measures

**Drinker self-schema:** A five-item scale that has been modified from the Smoker Self-Schema Scale (Shadel, Mermelstein, & Borrelli, 1996) was used. Participants rated on an 11-point Likert scale to which they agreed or disagreed with items (e.g. “drinking is part of who I am”). Mean scores (range 1–11) were used with higher scores indicating stronger agreement that “drinker” is self-defining. Strong psychometric properties have been supported in the literature for drinker self-schema measure (Corte & Becherer, 2007; Lindgren, Foster, Westgate, & Neighbors, 2013).

**Early experiences with alcohol:** Age of initiation of drinking was measured by asking “At what age did you first have more than a sip or two of alcohol?” Level of alcohol use during high school was measured with three questions that include frequency of drinking, number of drinks on typical drinking day, and frequency of binge drinking (National Institute on Alcohol Abuse and Alcoholism, 2003). Level of alcohol problems during high school was measured by the 23-item Rutgers Alcohol Problem Index to assess problems either while drinking alcohol or as a result of their drinking that occurred over a one-year period, ranging from 0 (never) to 4 (more than 10 times; H. R. White & Labouvie, 1989). Parental alcohol problems were measured with the short form of the Children of Alcoholics Screening Test with 6 yes/no format items (Hodgins, Maticka-Tyndale, El-Guebaly, &
“Yes” responses were summed to obtain a total score (range 0–6). Friends’ alcohol use was measured by the number of friends who consumed alcohol during high school and among those, who had “gotten drunk” regularly. The percentages of their friends who used alcohol and who had been drunk regularly among all friends during high school were computed separately (Windle, 2000).

**Socio-demographic factors:** Data on gender, racial/ethnicity, age, years in college, and residence on/off campus were collected.

**Current alcohol and tobacco use:** The frequency of alcohol and cigarette use was measured by the questions of “During the past 30 days, how often did you have any kind of drink containing alcohol?” and “During the past 30 days, how often did you smoke a cigarette?” The responses were rated on a 7-point rating scale (from once a month to everyday) was used for alcohol and cigarette use separately. In addition, the Timeline Followback (TLFB) was used to obtain quantity of alcohol and cigarette use for 90-day interval prior to the interview day (Sobell & Sobell, 1992). Memory aids (e.g. daily calendar, standard drink conversion, upper and lower amounts of use, key dates, and specific events) were used to stimulate and enhance recall.

**Procedures**

Undergraduates who are interested in participating were asked to complete a brief eligibility-screening online when they visited the survey study website. After completion, message popped up indicating whether the individual is eligible or ineligible for the survey study.

**Phase 1: An on-line survey study.** Undergraduates who were eligible were directed to complete an online consent form followed by the anonymous survey that included measures about early experiences of alcohol use and self-schemas. Self-schema measures were administered first to prevent priming. The survey took approximately 15 minutes to complete. At the completion of the survey, a message was displayed to invite the participants to participate in Phase 2 study. A $10 e-gift card was provided as compensation for completing Phase 1.
Phase 2: An in-person session. Eligible students who agreed to participate in Phase 2 were individually scheduled for the laboratory session (1 week after Phase 1 study). Upon arrival the laboratory, they received a brief explanation about the study and completed a second consent form. The session contained two parts and took approximately 40 minutes to complete. First, participants were asked to complete three cognitive tasks on a computer. Instructions for the tasks were presented on the computer screen and explained orally by the data collector.

1) Attributes rating task. Participants were told that sentence stems reflecting different activities would appear upon the screen, followed by a series of attributes. Each stem appeared on the screen for 2 seconds, followed by a blank screen for 1 second. Three stems were: “For me, cigarette smoking is...” and “For me, alcohol use is...” and “For me, newspaper reading is...” Then, related attributes were presented individually on the screen with a 300-millisecond inter-stimulus interval. Each stem was associated with a total of 30 attributes (15 positive and 15 negative; Choi, Choi, & Rifon, 2010; Doebrick & Todman, 2003; Friestad, Rise, & Røysamb, 1999; Gibbons & Eggleston, 1996). The newspaper reading block was used as control condition to account for individual differences in speed of processing, including both positive and negative attributes. Each attribute appeared with one of three sentence stems. Participants were required to indicate agreement or disagreement for each attribute with its corresponding stem before the next stimulus appeared on the screen. Three-minute resting period was given before moving on to next block. The responses were entered by pressing one of two letters on the keyboard (i.e. F and J; dominant hand was used for agreement). Response and response latency (measured in milliseconds) were automatically recorded. The order of stimuli was randomized for each participant and the order of three blocks was counterbalanced across groups and across participants.

2) Incidental recall task. After exposure to the cigarette smoking stimuli, participants were asked to recall as many attributes related to cigarette smoking from the rating task as possible, in any order, and enter them on a blank Word file. A period of 5 minutes was allowed for recall.
3) Brief distraction task. After completing the attributes rating and incidental recall tasks, participants were asked to complete a brief distraction task in order to minimize priming effects on responses in next measure. Participants were asked to write a brief essay describing campus life on a blank Word file. A period of 5 minutes was allowed.

Next, the Timeline Followback interview was conducted. Participants were asked to consider each date and recall the number of alcohol drinks, number of cigarettes smoked, and occasions of e-cigarette smoked they used in the past 90 days and enter those numbers into an excel file. A $20 e-gift card was compensated for participating of Phase 2 study.

Data analysis

Aim 1: Negative binominal regression was used to determine the information processing effects of the drinker self-schema on number of attribute endorsements and number of recall for smoking-related attributes. Median regression was used to determine the levels of drinker self-schema on response latency times with the parallel responses to newspaper “control” words as a covariate.

Aim 2: The effect of a drinker self-schema on the levels of drinking and smoking with the covariates of socio-demographic factors (gender, years in college, residence) was examined by negative binominal regression.

Aim 3: To explore the association of personal alcohol-use experience, parental alcohol problems, and friends’ alcohol use with the drinker self-schema, structural equation modeling (SEM) was used to predict the levels of the drinker self-schema.

Summary of Findings

Participant characteristics

Of the 329 undergraduates enrolled in the study (Mean age=20.3 years, SD=1.6 years), 54.3% were male and 71.3 % were White. More than one-third of the sample (35.4%) were senior level students followed by 28.7% were sophomore, and 18.0% were freshman and 18.0% were junior.
Approximately two-third of the sample (65.2%) lived on campus. Of the total 329 participants who completed the online phase of the study, a total of 104 undergraduates also completed the Phase 2 study.

**Current drinking and smoking behaviors**

Almost all participants (95.7%) reported drinking regularly (at least 1 or 2 times/month) with 38.9% reporting drinking 1 to 2 times a week and 31.9% reporting drinking 3 to 4 times a week in the past 30 days. Moreover, for the frequency of smoking in the past 30 days, 43.8% reported tobacco use once a month, followed by 2 to 3 times a month (24.3%) and 1 to 2 times a week (18.2%). The frequency of drinking in the past 30 days varied by gender (male>female, t(326)=-1.99, p=.048), current residence (off campus>on campus, t(326)=-2.47, p=.014), and years in college (senior>junior>sophomore>freshman, F(3,324)=3.96, p=.009), but did not differ across racial/ethnic groups.

**Determinants of the drinker self-schema**

In this sample, the mean scores of the drinker self-schema was 3.6 (SD=2.5, range 1–11). Over two-third of participants (72.3%) reported their parents or caregivers/guardian consumed alcohol with the mean scores 1.05 (SD=1.8, range 0–6) of parental alcohol problems. On average, participants reported that 59% of their friends drank alcohol and 33% got drunk regularly during high school. Alcohol initialed age was 15.4 (SD=2.8, range 2–21) years with 31.7% having initiated alcohol use at age 14 years and younger. Approximately 80% of the undergraduates reported drinking during high school with 27.0% reporting drinking 3 or 11 times in a year, followed by 1 or 2 times in a year (21.9%), 2 to 3 times a month (19.9%), and once a month (14.8%). In terms of quantity of alcohol use on a typical drinking day during high school, 33.1% reported drinking 3 to 4 drinks on a typical day, followed by 1 drinks (19.9%), 5 to 6 drinks (17.3%), and 2 drinks (16.5%). Moreover, among those undergraduates who drank during high school, 27.4% of them reported 1 or 2 days in a year of binge drinking (male≥5drinks; female≥4 drinks). The mean score of high
school alcohol problems was 0.3 (SD=0.5, range 0–3).

**Endorsements, response latency, and incidental recall**

Among the subset of 104 undergraduates who completed the Phase 2 study, six identified themselves as a smoker on the survey question used to verify the absence of a smoker self-schema. Because it is not possible to determine the effects of the drinker self-schema on smoking behaviors when a smoker self-schema is present, these 6 participants were excluded from the analyses, leaving a total of 98 undergraduates included in the analyses. An additional five participants had missing data for cognitive task 1 (endorsements & response latency) due to computer system errors. Thus, data for the endorsements & response latency tasks were available for 93 undergraduates.

For the endorsement patterns, we expected to find that a higher drinker self-schema score was associated with more endorsements for positive attributes and fewer endorsements for negative attributes for both alcohol use and cigarette smoking. The results showed that participants with higher scores on the drinker self-schema measure endorsed more positive alcohol-use-related attributes ($IRR=1.06$, $SE=0.01$, $p<.001$) and more positive cigarette-smoke-related attributes ($IRR=1.15$, $SE=0.03$, $p<.001$) and fewer endorsements of negative cigarette-smoke-related attributes ($IRR=0.97$, $SE=0.01$, $p<.05$). Higher drinker self-schema scores were also associated with fewer endorsements of negative alcohol-use-related attributes, but did not reach statistical significance ($p=.16$). As expected, the drinker self-schema score was not associated with the number of endorsements for positive and negative newspaper-reading-related attributes (control block; $p=.74$ and $p=.33$).

In terms of the response latency patterns for the attribute endorsements, we expected that a higher drinker self-schema score would be associated with faster processing of *agreements to positive* drinking- and smoking-related attributes. For the *negative* stimuli, we expected that higher drinker self-schema score would be associated with slower processing of *agreements to negative*
drinking- and smoking-related attributes. After controlling for the corresponding response latency of newspaper reading and the order of three blocks (alcohol use, cigarette smoke, and newspaper reading), the only significant finding was that higher drinker self-schema scores were associated with faster processing of agreements with positive alcohol-use-related attributes.

In addition, we expected that higher drinker self-schema scores would be associated with greater recall of cigarette-smoke-related attributes. However, in our sample, the drinker self-schema score was not associated with the number of cigarette-smoke-related attributes recalled.

**Drinker self-schema on drinking and smoking behaviors**

Overall, 98 undergraduates reported an average of 10.1 (SD=8.0) drinks per week and 2.4 (SD=5.0) cigarettes per week. After controlling for gender, years in college, and residence, higher drinker self-schema scores predicted a higher number of drinks in the past 90 days (IRR=1.17, SE=0.04, p<.001), higher number of days drinking (IRR=1.09, SE=0.03, p=.001), higher number of average drinks per day (IRR=1.09, SE=0.04, p=.019), higher number of heavy drinking days (IRR=1.16, SE=0.05, p<.001), and higher maximum number of drinks in one day (IRR=1.05, SE=0.02, p=.015). However, the drinker self-schema scores did not significantly predict smoking behaviors in the past 90 days.

**Early experiences with alcohol on the drinker self-schema and behaviors**

Figure 1 shows the SEM with the standardized regression coefficients for each path. The model fit statistics were acceptable (GFI, IFI, & CFI: >.94; RMSEA=.06). Three latent variables were constructed, including high school drinking behaviors, high school alcohol problems, and high school friends’ drinking. Frequency of drinking, quantity of drinking on a typical day, and frequency of binge drinking were indicators of high school drinking behaviors. Four subscales of Rutgers Alcohol Problem Index were identified by factor analysis based on factor loadings of ≥0.6 and used as indicators of high school alcohol problems. Percentage of friends who drank alcohol and friends who got drunk regularly during high school were two indicators of high school friends’ drinking.
The results revealed that parental alcohol problems predicted early alcohol initiation, and early alcohol initiation predicted high school friends’ drinking. High school drinking behaviors were predicted by early alcohol initiation and friends’ drinking; which in turn predicted more high school alcohol problems as well as higher frequency of drinking and smoking in college. Subsequently, more alcohol problems during high school predicted higher drinker self-schema scores in the college years which predicted higher frequency of drinking and smoking in college.

**Figure 1.** Structural equation model for early experience with alcohol on the drinker self-schema and behaviors

*Note:* All paths were showed with standardized regression coefficients. **p < .001

**Recommendations**

Although the findings of this study are mixed, results provide some converging evidence to support the cross-substance facilitation hypothesis that the drinker self-schema influences processing of smoking-related information and smoking behaviors. The pattern of more endorsements of positive cigarette-smoke attributes and fewer endorsements of negative cigarette-smoke attributes provides evidence of cross-substance facilitation of information processing, which was consistent with the findings of Doebrick and Todman (2003). In addition, findings from the SEM are consistent with the hypothesis that parents and friends influence individual drinking behaviors in high school and the pattern of high school drinking contributes to formation of drinker self-schema. Furthermore, once formed in memory, the drinker self-schema predicted the
level of drinking and smoking in undergraduate students. Due to the cross-sectional design, early alcohol experiences were measured retrospectively. Nevertheless, the results are consistent with our theoretical perspective and support the developmental model that earlier onset and early alcohol experience leads to the formation of a drinker self-schema – a stable and enduring self-cognition that predicts both alcohol and tobacco use in college years. Future longitudinal studies are needed to confirm these findings and clarify the developmental process of the drinker self-schema.

Results for the response latency time and incidental recall did not support the cross-facilitation hypothesis. The non-significant effects of the drinker self-schema on response latency time and incidental recall may due to the stimulus words used in this study. Although attributes those used in previous alcohol and tobacco studies, they were completed more than a decade ago. It is possible that the attributes used to describe the drinker and the smoker are outdated and not used by contemporary college undergraduates. Therefore, it is possible that the outdated attributes slowed down the processing judgments and recall.

It is also possible that students’ drinking behaviors themselves influenced memory/cognitive function, particularly for those who have had previous experiences of blackout (Wetherill & Fromme, 2011; Aaron M White, 2003; Aaron M. White & Swartzwelder, 2005). A blackout is a complete inability to remember critical elements of events, or even entire events, which transpired while intoxicated (Aaron M White, Jamieson-Drake, & Swartzwelder, 2002). Blackouts may influence cognitive processing, i.e. slow responding and greater difficulty in recall. As such, future studies should take in to account amount of alcohol intake and other drug use within 24 hours of data collection incorporating cognitive processing tasks.

Although the study provided only partial support for the cross-facilitation model, the implications for substance-use prevention and treatment are significant. Results of this study provide preliminary evidence that early drinking patterns contribute to the formation of a drinking
self-schema that motivates both alcohol and tobacco use. Early intervention to delay drinking onset, and reduce level of alcohol intake may also serve to prevent smoking behaviors. Furthermore, future development of intervention strategies to treat problematic alcohol and tobacco may be more effective if they address multiple behaviors at the same time. Future research is need to continue to test the cross-substance facilitation hypothesis with validated measures, and more diverse patterns of correlated risk behaviors.

**Financial Summary**

All funding from Sigma Theta Tau International ($5,000) has been used to complete this project. Expenses covered include payment for research assistants, including the recruitment (phase 1 study), scheduling the appointments for in-person session (phase 2 study), conducting data collection activities (phase 2 study), and data coding. There are no unused funds.

**Testimonial**

The grant fund from Sigma Theta Tau International provided financial support essential to the completion of this project. Given the large sample size and difficulties in recruitment and enrollment in phase 2, the study could not have been completed without the help of research assistants. Research assistants (paid hourly) assisted me by posting recruitment flyers, scheduling participants, making reminder calls and conducting data collection for the in-person session. Findings of this project provide the preliminary evidence to support future research with larger samples to test different possibility of cognitive structures and mechanism of correlated risk behaviors.

**REFERENCES**


