



Short Communication

Social network influences of alcohol and marijuana cognitive associations

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ABSTRACT

Decision-making is a social process whereby behaviors are often driven by social influences and social consequences. Research shows that social context also plays an integral role in decision-making processes. In particular, evidence suggests that implicit or non-conscious cognitions are linked to social information in memory and that implicit attitudes can be communicated and assimilated between people on an unconscious level. This study assesses social contagion of implicit cognitions regarding alcohol and marijuana among high school friend networks. Data are from an evidence-based drug education program delivered by either a health educator or by nominated class leaders over a 3-month period. Implicit attitudes were found to be susceptible to social influences, particularly for alcohol. Surprisingly, social contagion was stronger for cognitions than for behaviors. In addition, results support prior research that has found that implicit attitudes are not entirely stable and may be more susceptible to change than are behaviors. Public health initiatives to engender behavioral change could be facilitated by targeting flexible cognitive associations within existing social network structures.

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1. Introduction

In the last decade, awareness and understanding of the interconnectedness of our behaviors and thoughts have become widespread. It is common to talk about the influence of our friends' behaviors on our own, and the viral spread of attitudes or ideologies. Behavioral research finds that cognitive processes involved with decision-making are indeed driven by social influences and social consequences. Social network analysis is a set of theories and tools that allow us to assess how relationships influence individual decisions from the perspective that behaviors are not self-contained, but rather embedded within networks of social influences and meanings (Burt, 1987; Friedkin, 2004; Valente, 2010). The importance of social network influences in behavioral outcomes has been well documented. Drug use, in particular, is a highly social activity which is often initiated with friends and maintained among groups (Kandel, 1985; Kobus, 2003; Pearson et al., 2006). Alcohol and marijuana use are typically surrounded by rituals and cultural values, which engender cognitive associations and norms around these activities.

Network studies typically focus on contagion of overt behaviors and explicit attitudes. Yet limiting measurements to overt activities implies that social influence occurs entirely through explicit knowledge of others

and entirely at the rational and conscious levels. However, several domains of psychological and cognitive research suggest that social influence may also occur at the unconscious or implicit level. The importance of implicit attitudes is that they can contradict explicit attitudes and, in some cases, correlate with behaviors more so than consciously-held attitudes (Dovidio, Kawakami, & Gaertner, 2002; Greenwald & Banaji, 1995; Kahneman, 2003). Automatic memory pathways have been found to account for up to 30% of variances in health-related decisions, independent of explicit cognitions (McCusker, 2001). For example, Stacy (1997) found that among college students, associative strengths between positive outcomes ('relaxing' or 'feeling good') was a better longitudinal predictor of alcohol and marijuana use than explicit attitudes towards drug use, after controlling for sensation-seeking, acculturation, and gender.

A key feature of implicit pathways is that they are embedded within memories of physical and social settings such that relevant information is more easily accessed in particular contexts. Some studies have also shown that implicit information can be communicated person-to-person. For example, research in non-verbal communication shows that emotion and social status (e.g., empathy, dominance) are communicated through symbolic language. In group-task research, congruent cognitive structures are found to lead to more effective & efficient communication, collaboration, problem-solving and coordination of activities (Levesque, Wilson, & Wholey, 2001; Palazzolo, 2005). Unconscious cognitions appear to be essential to how individuals relate to one another, and may be passively communicated and unconsciously assimilated. At the very least, these kinds of studies support the need to consider social context when investigating implicit cognitive changes.

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Despite a number of studies establishing the relationship between implicit attitudes and substance use (Stacy, 1995; Stacy & Weirs, 2010), as well as between social networks and substance use (Valente, 2010), there has been little attention devoted to dependencies between social interactions and memory processes. The current study investigates whether alcohol and marijuana-related implicit cognitions can spread via social contagion among high school friend networks. Analysis is presented that assesses whether exposure to friends' cognitions and behaviors help explain individual's cognitions after a 3-month long drug education program (hypothesis 1), and whether contagion of cognitions has any influence on corresponding behaviors (hypothesis 2).

2. Materials and methods

Data were collected during an evidence-based drug education program 'Towards No Drug Abuse' (TND) as part of the University of Southern California's Transdisciplinary Drug Abuse Prevention Research Center (Valente et al., 2007). The curriculum includes twelve 1-hour classroom lessons over the course of three months, and incorporates role-playing and reducing misconceptions about drug use (Sussman, 1995; Sussman et al., 2004). The participants attended Continuation high schools in Los Angeles County, which are alternative settings that focus on technical and life skills. Of the 1493 students invited to participate, 980 provided valid consent forms. Of those, complete data was collected from 567 students, representing 74 classrooms within 40 schools. Subjects completed baseline paper-and-pencil surveys in the spring of 2004 and a post-test survey upon completion of the program.

A classroom randomized controlled trial design was implemented to compare two forms of the curriculum: (1) standard condition, where students received TND in a typical classroom format delivered by health educators, and (2) TND experimental (networked) condition, where students work in groups lead by nominated peer leaders. The control condition received no intervention and acts as the reference for the analyses.

2.1. Survey instruments

Data collected includes: demographic information (gender is coded '1' for male, and '2' for female; for ethnicity, '1' = Latin American and '2' for all other ethnicities; socio-economic status represents parents' education and profession, ranging from 0 to 2); social networks (egocentric, "list your 5 best friends" and sociometric "list your 5 best friends in the class"); self-reports of drug behaviors (30-day recall of alcohol and marijuana use); and drug cognitions (free word associations). Word association scores were generated from continuous cue-behavior tasks, which ask participants to write the first behavior or action that comes to mind given a phrase stimulus (see Stacy & Weirs, 2010). Responses to each cue word were coded by two judges (average Kappa = 0.82) with a third judge making the tie-breaking decisions when discrepancies occurred (Ames et al., 2005). At baseline, students were given one of three tasks, randomized within class: (1) *outcome cues* (e.g., "feeling relaxed", "having fun"), (2) *location cues* (e.g., "my bedroom"; "parking lot"), and (3) *compound cues* (e.g., "having fun, in my bedroom"; "feeling good, in my yard"). At post-test, all students received the same outcome cues task.

From the surveyed data, alter and ego variables were calculated. *Ego effects* refer to the influence of the individual's own characteristics and *alter effects* refers to the influence of friends. Ego variables include: (1) *in-school best friends*, the proportion of best friends who attend the same school; (2) *popularity*, in-degree centrality or the number of friend nominations a person receives divided by the total number of students in the class. Alter variables include: (1) *friends' drug behaviors*, the number of friends who report alcohol or marijuana behaviors divided by total number of friends nominated; (2) *friends' drug cognitions*, the number of friends who elicit word association

responses related to alcohol or marijuana divided by total number of friends nominated.

2.2. Analytic procedure

Four models are presented to evaluate post-intervention outcomes: alcohol use, alcohol cognitions, marijuana use, and marijuana cognitions. For brevity, alcohol and marijuana will be labeled together as "drugs." Alter effect scores were calculated from available friend data — if there was no data on a nominee for a specific attribute, their nomination was not counted. Multilevel mixed-effects analysis was conducted using STATA software, version 10.0 (StataCorp, 2007). The random-effects portion of the model accounts for variances across schools. Lagged analysis approach is used, where baseline effects are controlled for in order to detect change in variables over time. Odds ratios and standard errors are reported.

3. Results

Students were mostly Hispanic/Latino (68%) and male (57%). On average, 62% of students reported using alcohol in the last month, and 49% reported using marijuana. In response to the word association cues, 20% generated alcohol responses, and 28% gave marijuana responses. The demographic and behavioral characteristics are typical of California Continuation high school population.

Tables 1 and 2 show results predicting behaviors and cognitions, respectively. Parsimonious models are the result of an unconstrained stepwise elimination process, and include variables that were significant at the 0.05 level, representing the best predictive model with the fewest number of variables.

3.1. Control variables

Popular students were somewhat more likely to be marijuana users compared to those with fewer friends. Non-Latino students were more likely to generate alcohol associations than were Latinos, and boys were about 50% more likely than girls generate marijuana cognitions.

3.2. Ego-effects

As expected, past drug using behaviors are the best predictors of future behaviors. However, contrary to expectations, baseline alcohol cognitions are not associated with cognitions at follow-up and are relatively low for marijuana. Analysis of cognition-behavioral cross-effects showed that individual's cognitions was associated to future behaviors, and baseline behaviors are associated with follow-up cognitions. Effects were greater for alcohol than for marijuana, and greater for cognitions than for behaviors.

3.3. Alter effects

Friends' behaviors and cognitions were found to be associated with ego's corresponding activities, particularly for alcohol. Surprisingly, the influence of friends' cognitions on ego's cognitions was considerably stronger than their influence on behaviors. There were no significant cognitive-to-behavioral or behavioral-to-cognitive alter influences.

Notably, 95% confidence intervals for cognition variable estimates are quite large, particularly in alcohol use models. In the alcohol model, the cognition OR equals 9.4 indicating that the value ranges from -0.44 to 19.24 for 95% of the population. Large variances are often due to insufficient power. Thus, while associations between behavior and cognitions are statistically suggestive they are not conclusive.

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