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Peer Influence, Friend Selection, and Gender: How Network Processes Shape Adolescent Smoking, Drinking, And Delinquency

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Abstract

We examine gender differences in the extent to which the social network processes of peer influence and friend selection explain why adolescents tend to exhibit similar risky behaviors as their friends for three problem behaviors (smoking, drinking, and delinquency). Using dynamic Stochastic Actor-Oriented Models (SAOMs), we analyze five waves of data on a large sample of 13,214 adolescents from 51 friendship networks. While both processes explain patterns of risky activities for girls and boys, the delinquent behavior of girls is more susceptible to influence and girls are especially likely to select friends who have similar smoking behaviors to their own.

Keywords

Peer Influence; Friend Selection; Gender Differences; Adolescent Friendship; Problem Behavior

This research examines the degree to which gender differences exist in two crucial peer processes that impinge on several risky adolescent behaviors, including smoking tobacco, drinking alcohol, and delinquency. Harmful actions on the part of adolescents do not occur within a social vacuum. The social ties of both the young and old embed them in a web of potent connections that plays a part in influencing their behavioral choices, health outcomes, and other indicators of well-being (Smith and Christakis, 2008). The friendship network ties of adolescents, in particular, both shape, and are shaped by their participation in problem behaviors (Haas et al., 2010). However, there exists considerable variation among the social networks of adolescents. For instance, previous work finds that the structure and nature of friendship networks often are characterized by notable gender differences (e.g. Benenson, 1990; Stehlé et al., 2013). Girls tend to be situated in smaller networks that consist of emotionally intimate relationships, while boys surround themselves with larger friendship groups that are characterized by joint participation in extracurricular activities (Perry and Pauletti, 2011; Rose and Rudolph, 2006). Through the adoption of a social network perspective, we can develop unique insight into the causes and consequences of risky youth behaviors, as well as how gender moderates these associations.

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Considerable research documents that young people tend to participate in similar risky behaviors as their friends. This homogenous problem behavior is the result of two social processes: peer influence and friend selection. Adolescents may initially select friends who already exhibit similar behaviors as their own or be influenced by friends to adjust their behavior so it is more like that of the group (Kandel, 1978). While previous work considers how peer influence and friend selection operate in the general population of adolescents, significantly fewer studies question whether these processes vary for girls and boys (for exceptions, see Haynie et al., 2014; Kretschmer et al., 2018; Mercken et al., 2010). Gender is a crucial social structure that shapes our lived experiences (Risman, 1998), including the norms, goals, and expectations that adolescents bring to their social relationships (Maccoby, 1998; Rose and Rudolph, 2007). Yet despite the salience of gender, it remains unclear whether the key social network processes of peer influence and friend selection are also gendered processes. Studies that test for gender differences in peer influence and friend selection often uncover mixed findings, likely because they rely on small samples with limited statistical power (e.g., Fortuin et al., 2016; Haynie et al., 2014) or only consider a single behavior type (e.g., Kretschmer et al., 2018; Mercken et al., 2010). Additional work is needed to determine how gender shapes peer influence and friend selection processes so scholars and practitioners can better characterize the complexity of adolescents' social worlds.

The current research seeks to further improve our understanding of gender differences by analyzing data derived from one of the largest studies of its kind, consisting of five waves from 51 school networks. Using Stochastic Actor-Oriented Models (SAOMs) we test whether the perceived relational choices of adolescents, including peer influence and friend selection, are moderated by their gender. Additionally, by considering three separate risky behaviors, this study aims to further our understanding as to whether gendered experiences with influence and selection are consistent or variable across multiple behaviors. Testing for variations across multiple behavior types can improve our understanding as to whether gendered patterns are due to inherent, structural differences between girls' and boys' friendship networks or if they vary according to the behavior of interest.

Background

Friendship Homophily, Influence, and Selection

According to the principle of homophily, individuals prefer to associate with those who share similar characteristics, beliefs, and behaviors to their own (McPherson et al., 2001). While there is evidence for homophily in a variety of different social relationships, it is particularly apparent within adolescent friendship groups. If a pair of adolescents are friends, both parties are likely to share many attributes, including similar participation in problem behaviors (Kandel, 1978).

There are two general mechanisms that help to explain why homophily on risky behavior is commonly observed within adolescent friend groups: peer influence and friend selection. Peer influence occurs when an adolescent's attitudes and behaviors are shaped by those of a friend so that the pair becomes more homogenous than it was prior to the relationship's inception (Kandel, 1978). Friend selection, on the other hand, refers to the tendency for

adolescents to form friendships with peers to whom they are similar. If two adolescents share the same trait or characteristic, it is more likely that a friendship will form between the pair (Kandel, 1978).

Initially, most scholars relied on influence theories to explain homophily in adolescents' risky behavior. Sutherland's (1947) classic differential association theory argues that peers and intimates introduce individuals to "definitions," or behavior patterns that can encourage risky behavior. If individuals' associates overwhelm them with definitions that promote substance use or delinquency, for instance, their odds of participating in these same behaviors increase. Akers's (1973) social learning theory extends Sutherland's work by incorporating behavioral learning theories from psychology. Most notably, Akers argues that individuals learn to commit deviant acts through their interactions in social settings. Individuals' choices to participate in risky behavior are guided by their observations of how these behaviors are punished or reinforced by their peers. Thus, both theories argue that friendship homophily is the result of influence processes.

Alternatively, Gottfredson and Hirschi's (1990) control theory posits that deviant youth seek out friends with similar risky behaviors as their own, suggesting that friend selection mechanisms are responsible for homophily in adolescents' behavior. According to this theoretical framework, adolescent risk behavior is not the result of influence processes. Instead, adolescents' decisions to experiment with delinquency and substance use are shaped by their individual self-control, or impulse regulation. Youth with low self-control are more likely to participate in risky behaviors and tend to seek out friends who exhibit similarly low levels of self-control. Because of these two associations, adolescents often participate in the same problem behaviors as their friends, and thus, the friend selection process, not peer influence, is primarily responsible for behavior homophily observed within adolescent friend groups.

As the growing sophistication of social network analysis has spread to the study of adolescent friendships, research has begun to consider the extent to which peer influence and friendship selection contribute to homophily in adolescents' risky behavior. Thus far, the overwhelming consensus is that influence and selection are not mutually exclusive processes. Indeed, the influence any adolescent receives is determined by which friends he or she initially selects. Much empirical research supports the importance of both processes, finding that influence and selection both notably contribute to homophily for adolescent risky behavior (e.g., Kretschmer et al., 2018; Mercken et al., 2010; Osgood et al., 2013; Pearson et al. 2006; Wang et al., 2016).

Gender Variations in Friendship

While many scholars have studied how influence and selection processes operate in the general population, few consider how gender shapes individuals' experiences with these network processes. However, the existence of gender variations should be anticipated, since previous work highlights the ways in which boys' and girls' friendships differ with regard to both their structure and character (Perry and Pauletti, 2011; Rose and Rudolph, 2006). Boys' friendship networks tend to be more expansive and characterized by greater numbers of heterophilous ties, while girls' networks are smaller and primarily contain best friends

(Benenson, 1990). Female friendship networks often are densely interconnected and characterized by higher degrees of reciprocation and transitivity (Kreager et al., 2011; Ridgeway and Smith-Lovin, 1999). While boys and girls both prefer intimate friendships, they tend to seek out this intimacy through different means. Girls define intimacy as being characterized by high degrees of emotional investment, while boys consider their friendships to be more intimate if they are organized around participation in shared activities (Ko et al., 2014; Rose and Rudolph, 2006).

Several theoretical arguments can help explain why gender differences exist in adolescent friendships. First, differences in male and female friendships can be explained by the gendered behaviors and personality traits that individuals begin to acquire during childhood; they are not the result of inherent characteristics (Hollander et al., 2011). Children learn gendered behavior by both intentionally and unconsciously modeling the actions of those around them as well as from reward systems that positively reinforce adherence to gender roles (Bandura, 1977; Chodorow, 1978). While boys are taught to value objectivity and independence, girls are encouraged to be better attuned to social dynamics and cooperation with their friends (Chodorow, 1978). These gendered attitudes are further reinforced through children's interactions with peers as young girls and boys tend to gravitate towards same-gender friendships (Maccoby, 1998).

After gendered expectations are engrained during childhood, gender continues to be socially constructed and is consistently "performed," or displayed, by individuals (West and Zimmerman, 1987). Adolescent friendships represent one context within which "doing gender" occurs. Girls often take on a nurturing role in their relationships and are expected to disclose intimate matters to their friends, whereas boys are encouraged to minimize displays of emotion. Nevertheless, note that girls are not necessarily encouraged to cooperate with or nurture their rivals, enemies, and other actors who may either victimize them, or who they may victimize. Furthermore, adolescents can "perform" gender however they please, but failing to follow societal gender norms can have serious ramifications, including loss of popularity or targeting for aggression (Felmlee and Faris, 2016). To avoid suffering from these consequences, the majority of adolescents enact gender in a way that complements their sex categorization.

Social institutions further shape beliefs about gender differences and pattern our social interactions (Ridgeway and Smith-Lovin, 1999). Gender itself can be understood as a system, or social structure; even when individuals reject gender norms and male dominance, they are often forced to continue making gendered choices because of institutional pressures and social costs (Risman, 1998; Ridgeway and Correll, 2004). Individuals are systematically granted or forbidden access to opportunities on the basis of their gender and these inequalities are reflected in our institutions and relationships (Ridgeway and Smith-Lovin, 1999). For instance, extracurricular athletics geared towards boys tend to reinforce values such as competition and achievement whereas those organized for girls often focus on emotional management (Eder and Parker, 1987). By coming into contact with institutional structures, boys and girls acquire gender-specific resources that differentially effect how they form and maintain friendships.

Gender Variations in Influence and Selection

Due to the existing evidence on gender differences in adolescent friendships, there is reason to believe that, when compared to boys, girls are more influenced by their friends' behaviors and have higher odds of befriending similar peers. First, girls and boys are likely to have different experiences with these network processes since girls are more likely to report emotionally intimate friendships (Ko et al., 2014; Maccoby, 1998; Rose and Rudolph, 2006). Emotionally close friendships are likely to make girls more susceptible to influence from their friends' behaviors (Haynie et al., 2014; Mercken et al., 2010). Parents, teachers, and other trusted adults often emphasize the risky consequences associated with smoking, drinking, and delinquency. For girls, in particular, to forgo these warnings, it may be necessary that other trusted sources, such as emotionally intimate friends, counter this cautionary advice. At the same time, since girls prefer friendships that are emotionally close, they are likely to be more selective in who they initially choose as friends. Girls may especially prefer those who have interests similar to their own since such commonalities can assist in the cultivation of emotionally intimate bonds (Haynie et al., 2014; Kretschmer et al., 2018).

Similarly, past research finds that girls tend to be more concerned about fitting into their social networks (Frank et al., 2008; Kretschmer et al., 2018). Girls also worry more about abandonment and losing friendships with their peers (Maccoby, 1998; Rose and Rudolph, 2006). As a result of these patterns, female adolescents may feel more pressure to adjust their behaviors so that they are more similar to those of their friends (Kretschmer et al., 2018). Girls also could believe that by adopting the behaviors of their friends they can increase their sense of belonging in the friendship group, as well as minimize the risk of social abandonment. At the same time, girls may avoid these social tensions altogether by initially selecting friends who participate in identical behaviors as their own since such similarities will likely foster a greater sense of fitting in with one's social group.

Finally, the differing structures of girls' and boys' social networks are also likely to result in greater tendencies for peer influence and friend selection among girls. The structure of girls' friendship groups, particularly the high prevalence of reciprocated friendships and tendency towards dyadic-level interactions (Kreager et al., 2011; Maccoby, 1998), may foster an environment where individuals are more prone to be influenced by their close ties. In a reciprocated dyad, which are more common among females, both adolescents acknowledge that the relationship exists and are thus, more likely to be both aware of and influenced by each other's participation in behaviors (Engels et al., 2004). Boys' friendships, on the other hand, tend to occur in larger, structurally coherent groups that are centered around joint membership on sports teams or in school clubs (Maccoby, 1998; Rose and Rudolph, 2006). As a result of these differing structures, boys may be less concerned with whether their friends also participate in similar problem behaviors as their own, both when selecting and maintaining their friendships.

Limited previous work considers whether gender moderates peer influence and friend selection and the findings of these studies have been inconsistent. Some empirical evidence suggests girls are more likely to be influenced by their friends' behaviors (e.g., Haynie et al., 2014), whereas others find that girls have greater tendencies to select friends with similar

behaviors to their own (e.g., Burk et al., 2012; Kretschmer et al., 2018). Some studies find no evidence for gender differences (e.g., Fortuin et al., 2016; Urberg et al. 1997). There are several factors that could account for this variation. In addition to considering a broad array of behaviors, previous studies also rely on different types of survey items to measure the behavior of one's friends. Some use respondents' perceptions of their friends' behavior (e.g. Piquero et al., 2005), but these perceptions tend to over-estimate similarity between friends and respondents (Bauman and Ennett, 1994). Because of these biases, others collect complete friendship network data by asking all students in a school or classroom to report both their individual behaviors and nominate their closest friends. However, global network studies are not without their limitations. They often rely on small, non-representative samples from one or two networks (e.g. Haynie et al., 2014; Fortuin et al., 2016), which decreases the statistical power of their analyses and limits the generalizability of their findings. Scholars also apply numerous analytical techniques to test for gender differences in influence and selection. Earlier studies often used lagged regression to piece apart the effects of influence from friend selection, while more recent work employs stochastic actor-oriented models (SAOMs) that take into account the inherent endogeneity of influence and selection in social networks (e.g. Dijkstra et al. 2010; Kretschmer et al. 2018; Osgood et al., 2015; Pearson et al., 2006).

The current study reconsiders whether girls are more influenced by the risky behaviors of their friends by applying SAOMs to a uniquely large data set derived from multiple global networks. Additionally, we aim to further our understanding of how gender moderates the relationship between risky behavior and friend selection by testing whether girls are more likely to select friends who participate in similar risky behaviors as their own. Our study will add considerable evidence to the current debate by analyzing a sample of 51friendship networks for sixth through ninth graders, a period when adolescents are most likely to exhibit risky behaviors similar to their friends (Burk et al., 2012).

Variations in Influence and Selection Across Behaviors

Studies of gender differences in influence and selection tend to base their conclusions on the analysis of a single behavior (e.g. Burk et al., 2012; Kretschmer et al., 2018; Mercken et al., 2010), an analytical strategy that could be responsible for the mixed findings discussed previously. In other words, it is unclear whether the variations between girls' and boys' experiences with peer processes are the result of previous studies analyzing substantively different samples or because gender differences vary according to the behavior of interest. To better theorize why gender variations in peer influence and friend selection exist, the current study considers whether these variations manifest similarly across three different behaviors in a constant sample of adolescents. The current study asks whether girls are consistently more prone to influence or more apt to select friends with similar risky behavior to their own, regardless of the behavior of interest. The extent to which similar gender variations are observed across multiple risky behaviors would suggest that individuals' experiences with influence and selection are continuously shaped by their interactions with gendered friendship structures.

On the other hand, girls may be more prone to influence and selection for certain deleterious behaviors, but not others. Such a finding would imply that a particular behavior's characteristics and the norms that surround it are responsible for these gender differences. For example, since a variety of social factors, such as the perceptions of male figures in the media, frame delinquency as being more normative for boys than girls, boys may feel more inclined to act out and participate in deviant behavior, regardless of their friends' involvement in such activities. Girls, on the other hand, are encouraged to avoid "masculine behaviors," such as delinquency, and thus, friend influence may be particularly necessary to pressure girls into delinquency participation (Haynie et al., 2014).

The current gender norms regarding tobacco and alcohol use are not as strict. Although boys historically smoked and drank at higher rates than girls, this gender gap has become nonexistent in recent decades (Center for Disease Control and Prevention, 2014; US Dept. of Health and Human Services, 2012). Because the gender norms surrounding the use of tobacco and alcohol have diminished, there may be less variation in what causes girls and boys to initiate these behaviors; both genders may be similarly affected by factors like peer influence. Thus, the current study seeks to further understand whether gender differences in influence and selection are comparable across three risky behaviors: smoking tobacco, drinking alcohol, and delinquency.

Data and Methods

Sample

For our analysis, we utilize data on 13,214 students who participated in the Promoting School-Community Partnerships to Enhance Resilience (PROSPER) study. All respondents attended school in one of 28 small public school districts during their sixth through ninth grade years. Half of the districts were located in Iowa and the other half were in Pennsylvania. All participating districts were located in rural communities or small cities, with populations ranging from 7,000 to 45,000. Half of the participating districts were randomly selected to receive a substance abuse prevention campaign that consisted of a community-based component in sixth grade and a school-based component in seventh grade.

The data include five waves of panel data for two cohorts of students. One cohort began sixth grade in 2002 and the other started in 2003. Self-administered surveys were distributed at each school during the fall and spring of students' sixth grade years and during the spring of students' seventh through ninth grade years. Both response and retention rates remained relatively high throughout the survey. At each wave, 86 to 90% of eligible students participated and of the students who were present at the first wave of the study, each participated in an average of 4.18 waves.

For the purpose of our analysis, it was necessary to omit students who attended certain schools. One community did not allow for the collection of friendship network data, another experienced a fire that led to reassigning a large proportion of the students to different schools, and one cohort joined the study a year late. After these omissions, our sample includes an average of 9,135 students per wave and all students hail from one of 51 school networks.

Measures

All three dependent variables, smoking, drinking, and delinquency, are based on individuals' responses to survey questions. Individual smoking and drinking are measured from students' responses to the following survey questions: "during the past month, how many times have you smoked any cigarettes?" and "during the past month, how many times have you had beer, wine, wine coolers, or hard liquor?" Students' responses range from 1= *none* to 5 = *more than once per week*. Because initial rates of smoking and drinking were extremely low, we recode students' past month participation into three ordered categorical measures: 0 = *none*, 1= *once in the past month*, and 2 = *more than once in the past month* (following Osgood et al., 2015).

Our measure of delinquency combines student responses from twelve different survey questions related to delinquent activity. Students were asked to report how many times they skipped class, got into physical fights, stole property, vandalized, etc. in the past year. Students' responses for all twelve questions vary from 1= *never* to 5 = *5 or more times*. Using a technique criminologists refer to as variety scoring, we sum the number of delinquent activity types that each adolescent admitted to participating in at least one time in the past year (Sweeten, 2012). This results in a measure ranging from 0 to 12, with 0 indicating no delinquent activity and 12 indicating maximum involvement. To improve the convergence of our models, we recode this measure into four categories: *no delinquency* (delinquency variety score = 0), *minor delinquency* (score = 1), *moderate delinquency* (score = 2–3), and *high delinquency* (score = 4–12) (following Osgood et al., 2015).

Friendship networks were created in each wave of the survey by asking students, "who are your best and closest friends in your grade?" Respondents were allowed to nominate up to seven friends. We consider only within-school and within-grade friendship nominations as this allows us to link each respondent to the individual-level data of all peers he or she nominated. A dummy variable for gender is included in each of the analyses where 1 = *boy*. Additionally, we include several control variables that have been shown to influence either changes in individual risky behavior or changes in friendship structure. Controls include binary measures for race (1 = *white*) and family structure (1 = *lives with both biological parents*) (following Osgood et al., 2013; Osgood et al., 2015). We also include a control that indicates whether the student experienced a school transition during the previous wave (1 = *experienced a transition*) since previous work finds that school transitions tend to be associated with declines in individual social integration (Felmlee et al., 2018). Finally, we create measures for family relations, school bonding/adjustment, and sensation seeking by averaging the subscale responses for related survey questions (following Simons et al., 1991 and Zuckerman, 1994).[1] All measures are coded so that higher values indicate better family relations, greater school bonding/adjustment, and a higher propensity for sensation seeking, or risk taking. For the purpose of our analysis, all covariates have been centered at the mean value in their respective network. This requires us to perform some additional calculations to

[1]The family relation measure averaged four questions ($\alpha = 0.75$), the school bonding/adjustment measure averaged eight ($\alpha = 0.81$), and the sensation seeking measure averaged three ($\alpha = 0.75$).

interpret the interactions included in our analysis, which will be further addressed during the discussion of our analytical plan.

Plan of Analysis

Stochastic Actor-Oriented Models.—For this study, we test our research questions using Stochastic Actor-Oriented Models (SAOMs) estimated with SIENA (Simulation Investigation for Empirical Network Analysis) statistical software (Snijders, 2001; Steglich et al., 2010). SAOMs consist of two components that operate simultaneously: one models changes in friendship and the other models changes in individual behavior. Each component uses data from the first wave as starting values and, for each subsequent step, simulates the evolution of either friendship or behavior by allowing randomly-selected individuals to make forward-looking changes. Within the network evolution model, each randomly-selected student can form a new friendship, dissolve a pre-existing friendship, or make no changes. For analyzing evolution in the behavioral change model, it is necessary that we code the behavior of interest as an ordered categorical variable. Selected individuals can increase their behavior by one unit, decrease their behavior by one unit, or keep their behavior at the same level. Changes in friendship and behavior are guided by the Markov property, meaning that they are only dependent on the current state of the simulation, not those that preceded it (Snijders, 2001).

All decisions are probabilistically governed by a set of user-specified effects included in a parameter vector. A population of simulations are generated according to this vector and are then used to calculate a distribution of predicted changes in friendship patterns and behavior. The bigger the tentative estimate for any process, the more that process influences an actor's choices. After comparing the performance of multiple candidate parameter vectors, one selects the model that best fits the simulated distribution of network statistics to the observed data. The resulting model is used to evaluate estimates of structural and behavioral effects, where estimates are often exponentiated and interpreted as odds ratios (Snijders, 2001; Steglich et al., 2010).[2,3]

Included Effects.—Effects for the network component of the model reflect friendship preferences; some are purely structural in that they depend only on the current pattern of friendships and others are based on individuals' attributes. We include network effects related to our research questions as well as controls for friendship selection and behavior change.

First, we included several structural effects to control for well-established network processes. These effects are included to reduce bias in the friend selection and individual behavior estimates. The *density* effect reflects the costliness of friendship ties and can be

[2]To account for students who joined the study late or left early, we employ the method of joiners and leavers. Also, since the survey limited the number of nominations each ego could make to seven, we request that all simulated networks have a maximum outdegree that is less than or equal to seven.

[3]In preliminary analyses, we calculate the Jaccard index to quantify the degree of tie stability between each set of adjacent waves in our study. The Jaccard value indicates the proportion of ties that remain stable between two waves of network data. Across the 51 networks in our sample, the Jaccard index averaged 0.37 between Waves 1 and 2, 0.25 between Waves 2 and 3, 0.27 between Waves 3 and 4, and 0.28 between waves 4 and 5. Following the recommendation of Snijders, van de Bunt, and Steglich (2010), these Jaccard values enable us to satisfy the assumptions of the SAOM.

interpreted like an intercept in a logistic regression. The estimate for this effect tends to be negative since it is highly unlikely for an individual to be friends with each of his or her peers in all but the smallest networks. The *reciprocity* effect controls for the tendency of individuals to reciprocate friendships nominations and the *transitive triplets* effect controls for the preference to nominate friends of friends. The *transitive reciprocated friendship* effect can be understood as an interaction between the two aforementioned effects; it measures whether transitive nominations tend to be reciprocated.[4] The *indegree popularity* effect and *in-in degree assortativity* effect are often considered concordantly. The former measures individuals' inclinations for preferential attachment, or the tendency for well-liked students to receive more nominations and become increasingly popularity, while the latter measures individual's preferences for friendships with peers who have similar popularity as their own. Finally, we include the *outdegree-trunc* effect which can capture any tendency for actors to make zero friendship nominations.

We also included several attribute-based network effects that capture the propensity for friendships to form on the basis of individuals' attributes. The *ego* effect measures whether a specified individual-level attribute is associated with higher odds of making nominations and the *alter* effect considers whether an attribute is associated with higher odds of receiving more friendship nominations. Either the *similarity* or *same* effect is included to measure the preference for individuals to select friends who have attributes similar to their own. The similarity effect is used to measure this tendency for continuous and ordinal attribute variables, while the same effect is used for categorical variables. In each of the SAOMs, we include the ego and alter attribute-based network effects, as well as either the similarity or same effect, for the problem behavior of interest, gender, and race.

Behavioral effects were included in the models to measure individuals' tendencies to change their level of participation in the outcome of interest. To measure how peer influence shapes individual behavior, we include the *average alter* effect, which considers whether having friends with higher average participation rates increases a respondents' odds of participating in the behavior of interest. We also include several *effect from attribute* variables, which measure how specified attributes (i.e., control variables) relate to problem behavior participation.

Interactions and Centered Variables.—To address our research questions, it is necessary to include two interactions in the SIENA models. We interact the effect of average problem behavior of alters with respondent's gender to test for gender differences in the susceptibility to peer influence. To test for gender differences in selection, we interact the effect for problem behavior similarity with respondent's gender.

The *p* values associated with these interaction estimates indicate whether girls and boys have significantly different experiences with peer influence and friend selection. However, additional calculations are necessary in order to obtain separate coefficients for each gender because the SIENA software centers all individual-level covariates by subtracting their mean

[4]Block (2015) warns that failing to include the transitive reciprocated friendship effect biases the reciprocity and transitive triplet effect by making them artificially low.

at the network level. Thus, in order to substantively interpret our findings, separate calculations of gender specific coefficients and their standard errors must be made for each network, which we then combine through meta-analysis.[5]

Meta-analysis.—For the purpose of our study, we applied SAOMs to all 51 networks in our sample. Because of the large number of total respondents, it was necessary to run SIENA analyses on each network individually. We applied three sets of SAOMs to all 51 networks, each with a different risky behavior (smoking, drinking, or delinquency) as the outcome variable of interest.[6]

Only models that reached convergence and adequate Goodness of Fit were included in the final analysis.[7] Some network models were unable to converge for certain risky behaviors and were therefore omitted from the final analyses. Because of their inability to reach convergence, it was necessary to omit one network from the final analysis for delinquency, three from the drinking analysis, and fifteen from smoking. Previous work that has applied SIENA to multiple networks has taken a similar approach (see Knecht et al. 2011; Osgood et al., 2013; Osgood et al., 2015). In additional analyses (available upon request), we consider how the converged networks differ from those that were unable to reach convergence across the three behaviors. Overall, the networks that did and did not converge were substantively similar. However, networks that reached convergence were statistically significantly more likely to be located in communities with low proportions of the population living in rural areas when compared to those networks that did not reach convergence. The networks that did not converge tended to also include slightly fewer students and lower rates of problem behavior participation, but these differences are not statistically significant.

To aggregate the SAOM findings across the individual networks, we performed a three-level random effects meta-analysis (An, 2015; Snijders & Baerveldt, 2003). The first level represents the individual networks and includes variance terms calculated from the results of the SAOMs. The second level accounts for differences between the experiences of the two cohorts and the third level does so for the school district. In additional meta-analyses (available upon request), we compare SAOM estimates between districts that were randomly assigned to participate in the PROSPER substance abuse prevention program and those that

[5]We calculate the influence and selection estimates for boys for each network by subtracting the proportion of boys in each respective network from 1, multiplying by the interaction estimate, and adding this product to the main effect parameter (e.g., (1-proportion of boys) × interaction + influence). To calculate the estimates for girls, we begin by subtracting the proportion of boys from 0. Standard errors can be calculated for each gender-specific estimate by using the variance sum law for correlated random variables, which states that the variance of two correlated variables is equal to the sum of both variables' variances plus two times the product of their correlations and the standard errors of each variable. Due to the mean centering, the standard errors for the interaction coefficient estimate must be appropriately scaled (e.g., $\sigma^2_{inf} + \sigma^2_{int} \times (\text{1-proportion of boys})^2 + 2 \times \text{corr(influence, interaction)} \times \sigma_{inf} \times \sigma_{int} \times (\text{1-proportion of boys})$).

[6]While SIENA software allows for the user to incorporate multiple behaviors as dependent variables (Steglich et al., 2010), we had difficulty reaching adequate convergence statistics for most networks when we considered smoking, drinking, and delinquency together in single models. This is likely because rates of participation and behavior change were relatively low at the start of the study and all three behaviors were highly correlated (smoking and drinking: $r = 0.45$, smoking and delinquency: $r = 0.38$, delinquency and drinking: $r = 0.42$).

[7]Following the recommendations of Ripley et al. (2016), our criteria for convergence were convergence t-ratios between −0.10 and 0.10, and overall maximum convergence ratios less than 0.25. Goodness of Fit indices were calculated for indegree, outdegree, geodesic distance, and triad censuses. Due to the large number of SAOMs, Goodness of Fit results for individual models are available upon request.

served as controls. For the effects of interest, we find that experiencing the prevention program did not result in substantively different conclusions.[8]

Results

Descriptive Statistics

Girls make up slightly more of the sample than boys and the sample is predominately white (see Table 1). When averaged across all waves of data, 9.81% of students reported past-month smoking and 20.17% reported past-month drinking. Delinquency, however, was reported more frequently, with 43.27% of the sample reporting any past-year delinquency.

Over the course of the study, average levels of risky behavior participation increase for both girls and boys (see Table 2). Boys continuously report significantly higher mean levels of delinquency than girls, as confirmed by a paired *t*-test. However, delinquency participation increases more rapidly for girls than it does for boys. Across all waves, the percent of girls reporting any past-year delinquency increases from 24.73% in the fall of sixth grade to 48.06% in the spring of ninth grade. The rate of boys participating in any type of delinquent behavior increases from 45.37% at the start of sixth grade to 54.14% in ninth grade.

Gender variations in drinking and smoking are slightly different. In the first two waves, collected during students' sixth grade years, boys report significantly higher mean levels of drinking, but after seventh grade this pattern reverses and girls drink at higher rates than boys. There is no statistically significant difference in mean levels of smoking for boys and girls in the early waves of the study, but in later waves, girls start smoking at significantly higher rates. Both girls and boys increase their drinking and smoking substantially between sixth and ninth grade. The proportion of girls reporting any past month drinking increases by roughly 30% and the proportion of boys increases by around 25%. With regards to past month smoking, the proportion of girls increases by roughly 17% and the proportion of boys increases by around 12%.[9]

Stochastic Actor-Oriented Models: Influence and Selection

The results of our first set of SAOM estimations suggest that, as a whole, youth in our sample are influenced by their friends' smoking, drinking, and delinquency and prefer to select friends whose participation in risky behaviors is similar to their own. The coefficients of the friends' average behavior effects are positive and significant for smoking ($b = 0.930$, $p < 0.001$), drinking ($b = 0.827$, $p < 0.001$), and delinquency ($b = 0.287$, $p < 0.001$), giving evidence for peer influence (see Table 2). These findings suggest that, even after controlling for friendship selection processes, adolescents tend to adjust their risky behavior participation so that it better corresponds to that of their friends. For example, if the average

[8]Note that for one of the twelve effects of interest (behavior similarity for delinquency) we did find a statistically significant difference between our control and treatment samples. Both students in the prevention program and the control networks are more likely to prefer friends with similar levels of delinquency as their own, but for those in the control networks, this tendency is slightly weaker (analyses available upon request).

[9]The descriptive statistics include respondents from all 51 networks in our sample. However, substantive patterns regarding gender differences across the five waves are similar when we only focus on those networks where SAOMs achieved convergence (analyses available upon request).

drinking level of an adolescent's friends increases by one, the adolescent is 2.29 times more likely to increasing his or her drinking, all else being equal.

The behavior similarity effect, which measures the tendency for adolescents to select friends whose risky behaviors are similar to their own, is also positive and significant for smoking ($b = 0.405$, $p < 0.001$), drinking ($b = 0.278$, $p < 0.001$), and delinquency ($b = 0.216$ $p < 0.001$). In other words, all adolescents prefer to select friends who participate in the same risky behaviors as they do; peer influence does not account for all of the observed behavior homophily. When interpreting the behavior similarity effect, odds ratios correspond to one's likelihood of choosing a friend with risky behavior identical to one's own versus a friend whose behavior is different. From analyzing the ego-alter tables presented in the Supplemental Materials, we find that an adolescent with high delinquency is 1.48 times more likely to befriend a highly delinquent peer than a peer with no reported delinquency. Though not reported in Table 3, all of the models presented include the network and behavioral controls that were previously mentioned. Tables including the observed coefficients for all network and behavioral controls are presented in the supplemental materials.

Stochastic Actor-Oriented Models: Gender Interactions

According to the interaction terms in the second set of models, girls are more likely to experience influence and selection processes for some risky behaviors, but not others (see Table 3). For delinquency, the interaction between the effect of friends' average delinquency and the effect of being male is both negative and significant ($b = -0.183$, $p < 0.001$), suggesting that girls and boys are differently influenced by their friends' delinquent behavior. While the delinquent behavior of all adolescents in the sample was affected by the average delinquency of friends, boys are significantly less influenced by their friends' average delinquent behavior, all else being equal. For every one unit increase in friends' average delinquency, girls have 42.09% higher odds of increasing their delinquency ($p < 0.001$), while boys' odds only rise by 22.23% ($p < 0.001$) (see Figure 1).[10] Coefficients for the interactions between the effect of friends' average behavior and the effect of being male are not significant in the drinking and smoking models, however, suggesting that gender did not moderate the relationship between peer influence and individual smoking or drinking to any meaningful degree.

To assess gender differences in selection, the second model includes an interaction term between the behavior similarity and male ego effects. For smoking, the coefficient for the interaction is both negative and significant ($b = -0.080$, $p < 0.05$), indicating that girls and boys differ in the strength of their preferences for friends with similar smoking behavior as their own. After accounting for the mean-centering of variables, it is possible to calculate gender-specific estimates for the smoking similarity effect. Net of all other controls, a girl's odds of forming a friendship tie are 55.96% higher if she shares similar smoking habits with

[10]After accounting for the mean centering, it is possible to calculate influence estimates for girls and boys, respectively, by summing together the scaled interaction estimates and influence estimates for each individual network. Through consulting the covariance matrices that the SIENA software outputs, we also calculate standard errors for each of the gender-specific influence estimates to ensure that they are significantly different from zero.

the peer ($p < 0.001$), while shared smoking behavior only increases a boy's odds of forming a friendship tie with a peer by 42.39% ($p < 0.001$) (see Figure 2).[11] On the other hand, the interactions between the behavior similarity and male ego effects are not statistically significant for drinking or delinquency. Instead, the drinking and delinquency homophily observed within girls' and boys' friendships are similarly shaped by selection processes.[12]

Discussion

Smoking, drinking, and delinquency all portend serious negative outcomes for young people, and scholars have long debated the origins of these activities. This study points to the salience of young people's social networks in the production of these troublesome behaviors, highlighting the social embeddedness surrounding adolescents' actions. In an application of dynamic network models, our results demonstrate that peer influence, as well as friendship selection, contribute to the homophily observed on all three activities, and they do so for both girls and boys. In addition, our findings are relatively robust as they are based on data from one of the largest, longitudinal studies of U.S. adolescents' friendship networks, utilizing a sample with an average of over 9,000 students per wave in a panel study of 51 school networks.

Furthermore, the present study gives evidence that gender moderates influence and selection processes for certain problem behaviors, but not for others. For delinquency, the effect of peer influence is significantly greater for girls' behaviors than it is for boys'. Gender did not significantly moderate the relationship between peer influence and smoking or drinking, however. Additionally, girls and boys both tend to form friendships with peers who participate in similar levels of smoking, drinking, and delinquency to their own, yet when compared to boys, girls are even more likely to prefer friends with similar smoking habits.

Our findings prompt us to further ask why gender variations are not consistent across all problem behaviors. Throughout the duration of our study, boys consistently report higher levels of delinquency and these gender differences are not as pronounced for smoking or drinking. Because delinquent behavior is more normative for boys than girls, influence from friends may have been particularly necessary for girls to get involved in these activities. Furthermore, since peer influence is less critical in explaining boys' delinquency, we speculate that boys are often drawn into delinquent behavior by other means. For instance, they may involve themselves in delinquent behavior as a way to cope with internal stressors, since boys are more likely to express mental health problems through externalized behaviors (Rosenfield et al., 2005).

On the other hand, gender variations in rates of smoking and drinking are less prominent and when such differences are observed, as occurred in the later waves of the study, girls report

[11]We further examined gender differences in friend selection through the construction of ego-alter tables. Overall, gender differences are most pronounced for respondents who abstain from smoking. For a more detailed discussion of the gender differences observed in the ego-alter tables, we refer the reader to the supplemental material.

[12]To ensure that our results about differences between behaviors were not an artifact of the varying samples across the three problem behaviors, we also performed a sensitivity check where we restricted our meta-analyses to only include the 35 networks that reached convergence across all three behaviors. The same effects of interest for influence, selection, and the gender interactions were significant in the sensitivity check and the final analyses (see Supplemental Materials).

higher participation rates than their male peers. Gender gaps in substance use have converged in recent decades, and girls and boys often experiment with these substances for similar reasons. Smoking tends to be associated with social status seeking for girls and boys (Moody et al., 2011) and adolescents of both genders admit to drinking alcohol as a means to increase their sociability (Holmila and Raitasalo, 2005). The fact that boys and girls associate smoking and drinking with similar social benefits and consequences can help explain why no significant gender differences in peer influence are observed for the two behaviors.

We also find that girls are more likely to select similar smoking friends, although there are no gender differences in friend selection related to similar drinking or delinquency. Part of the reason may be that smoking is a more visible risky behavior, particularly on school campuses. Smoking is more likely to occur on school grounds than other forms of substance use, and is, thus, more likely to be reprimanded by school administrators (McLeod et al., 2012; McNeely et al., 2002). Since girls are socialized from young ages to prefer more selective, emotionally intimate friendships (Haynie et al., 2014; Kretschmer et al. 2018), it may be the case that they are more likely to select friends with similar smoking behavior simply because smoking is the most visible risky behavior of the three studied. Even though boys are equally aware of their peers' smoking behavior, this information is less likely to shape their friendship choices since boys tend to structure their friendship groups around other factors, such as co-participation in extracurricular activities (Maccoby, 1998; Rose and Rudolph, 2007).

Previous studies on gender differences in peer influence and friend selection tend to only consider a single type of behavior and often uncover inconsistent findings on gender differences (e.g. Burk et al., 2012; Kretschmer et al., 2018; Mercken et al., 2010). However, it is unclear whether these variations are the result of analyzing different samples or the gendered context surrounding the specific behavior of interest. The current study further explores this issue by rigorously testing for gender differences in peer processes across three separate behaviors in a large, constant sample of adolescents. We find that for certain risky behaviors, but not others, girls are more prone to either peer influence or friend selection. This finding is noteworthy because it suggests that sample differences alone are not responsible for the varying results of earlier work. Furthermore, we believe that our results have important theoretical implications for how we understand the social worlds of adolescent girls and boys. Our findings suggest that the specific characteristics of girls' and boys' friendships cannot entirely account for gender differences in peer influence and friend selection. For example, even though previous work notes that girls tend to put a higher value on their social relationships (Maccoby, 1998; Rose and Rudolph, 2006), such patterns are unlikely to solely account for gender differences in the peer processes studied here. To fully explain gender differences in influence and selection, we also must consider the social context surrounding the behavior of interest, such as the social norms regarding its acceptance and visibility within the wider school culture.

There are important limitations to this research that should be addressed. First, the PROSPER study only allowed for students to nominate friends who were in their same grade and attended their same school. The study did not collect behavioral data on out-of-school

and out-of-grade friends, so we do not know how these friendship ties relate to risky behavior processes. Second, students could nominate no more than seven friends, which may have prevented a small minority of students from reporting all of their social ties.[13] Therefore, the results reported herein might underestimate the effects of friend influence and/or selection, given the potential for an underrepresentation of network ties. Third, since large urban communities were not well represented in our sample of school networks, our findings may not represent the experiences of all adolescents in the US. However, we believe that research on rural and small-city settings is important in its own right since, even though a substantial portion of the US population lives in these areas, they tend to the receive limited attention in scholarly work (White and Corbett 2014). Fourth, some of the networks in our sample were unable to reach convergence and were therefore excluded from our analytic sample, which has the potential to bias our results. However, we expect these biases to be minimal. Other than being located in communities with larger proportions of students living in rural areas, those networks that did not achieve convergence were substantively similar to those networks included in our analytic samples. Finally, teasing apart the effect of peer influence from friend selection is difficult, and since we cannot account for the selection of friends on a variety of latent variables, we do not argue that our results imply causation (Shalizi and Thomas, 2011). Nevertheless, when compared to alternative modeling strategies, SAOMs are a superior approach to addressing the biases that affect estimates of influence and selection.

Furthermore, it remains important not to exaggerate observed differences between males and females in their social behavior (Felmlee et al., 2012; Giordano, 2003). We note here that even when gender variations in influence and selection are statistically significant, these differences are a matter of degree, not direction. For example, even though girls are significantly more likely to be influenced by the delinquent behavior of their friends, this does not imply that boys' delinquency is resistant to that influence. Like girls, boys are also susceptible to peer influence; the effect of average friends' delinquency is simply not as influential in inflating boys' odds as it is for girls'. Previous work that relies on smaller samples than what we use in the current study has argued that boys are immune to processes of peer influence or friend selection (e.g., Haynie et al. 2014; Kretschmer et al. 2018). However, we believe that these conclusions may be the result of limited statistical power. Using a uniquely large sample of U.S. adolescents, we show that while the strength of influence and selection processes significantly differs for girls and boys, the experiences of both genders are still shaped by these two fundamental social processes.

The current study provides convincing evidence regarding the social network contributions to risky problem behaviors. By aggregating the separate analyses of 51 adolescent friendship networks, our findings are relatively robust and precise. The positions of adolescents in a social network can both influence and be shaped by their participation in risky behaviors.

[13]Among female respondents, 14% nominated the maximum possible number of within-grade and within-school friends, compared to only 8% of male respondents. Therefore, the cap placed on nominations is likely to have underestimated girls' social ties more so than boys' and, as a result, estimates for girls' experiences with selection and influence may be biased. However, we expect that this bias would make the interpretation of our results *more* conservative. For instance, if fewer female respondents were able to nominate all of their friends, we may have underestimated the effect of peer influence on their problem behaviors and the gender gap may be even larger than we conclude here.

Furthermore, by applying SAOMs to three unique problem behaviors, this study suggests that gender differences in influence and selection network processes are more complex than scholars have previously assumed. Differences in influence and selection are not similarly gendered across all risky behaviors; instead, they vary based on the particular behavior of interest.

We believe that our results can further inform theories of peer processes as well as highlight the importance of applying a social network perspective to study adolescent problem behavior. Our findings add to the overwhelming evidence that both peer influence and friend selection account for the behavior homophily observed in the friend groups of both girls and boys. While individual experiences and demographic characteristics can help identify which adolescents are at the highest risk of experimenting with problem behaviors (Engels et al., 2004; Cooper et al., 1994), it is important to note that adolescents do not make decisions in social isolation (Akers, 1973). As well as exhibiting different individual traits, adolescents also have unique relational ties that tend to shape their choices and behaviors. Furthermore, there is increasing evidence that peer processes do not operate identically for all individuals (e.g. Leszczensky et al., 2016; Veenstra et al., 2013; Wang et al., 2015), highlighting the importance for future work to further consider how and why these differences exist. Our study begins to consider these questions by uncovering that, for certain problem behaviors, there are gender differences in adolescents' experiences with peer influence and friend selection. While the magnitude of these differences should not be exaggerated, their existence presumes that gendered norms and socialization processes can result in different consequences for girls' and boys' problem behavior participation. Scholars should continue to utilize social network analysis to study how gender is intertwined with peer influence and friend selection. Through the adoption of a social network perspective, we are able to further our understanding of the gendered nature of peer influence and friend selection processes.

The results of the current study also can further inform prevention and intervention campaigns to address unhealthy adolescent risk behaviors. For instance, since both boys and girls are susceptible to peer influence with regards to smoking, drinking, and delinquency, campaigns to encourage young people to resist peer pressure should continue to be relevant for all adolescents. Since girls tend to be more influenced by their friends' participation in delinquency than boys, such campaigns should make an effort to utilize examples of girls resisting peer pressure to participate in delinquent acts and stress the advantages to girls of choosing non-delinquent friends. Our findings regarding friendship selection effects also suggest that group-based intervention programs may be useful in educating both girls and boys regarding the negative consequences of these risky behaviors. Such interventions may be particularly influential in shaping girls' smoking, because female smokers are even more likely than boys to select friends who also use tobacco. Note, too, that adolescents can be influenced by friends to decrease their involvement in deleterious activities and that adolescents who abstain from risky behaviors prefer friends who are also abstainers. Prevention campaigns can be tailored to exploit these existing network phenomena to help encourage the adoption of positive health behaviors (Smith and Christakis, 2008), and such manipulations are likely to provide more benefits to adolescent girls. By better understanding how girls' and boys' experiences are shaped by social network ties, in

general, prevention and intervention campaigns can be improved to help reduce the adverse health consequences associated with adolescent risky behavior.

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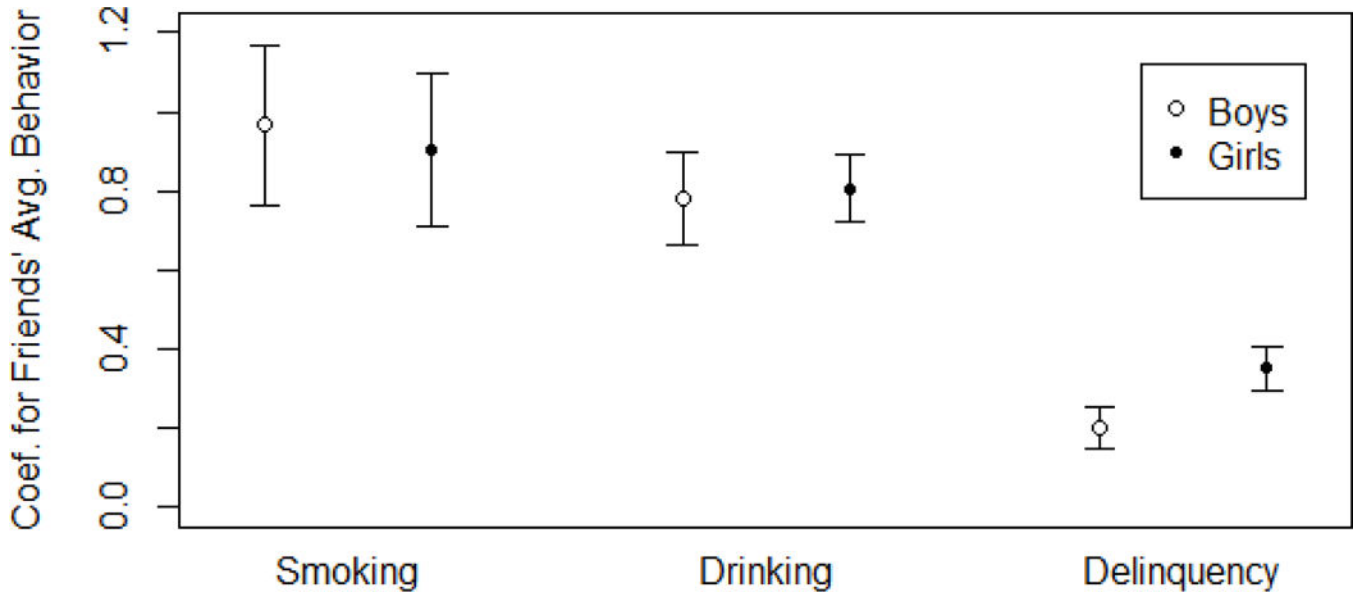

Figure 1.
Gender-specific estimates for friends' average behavior effect with 95% confidence intervals for smoking, drinking, and delinquency

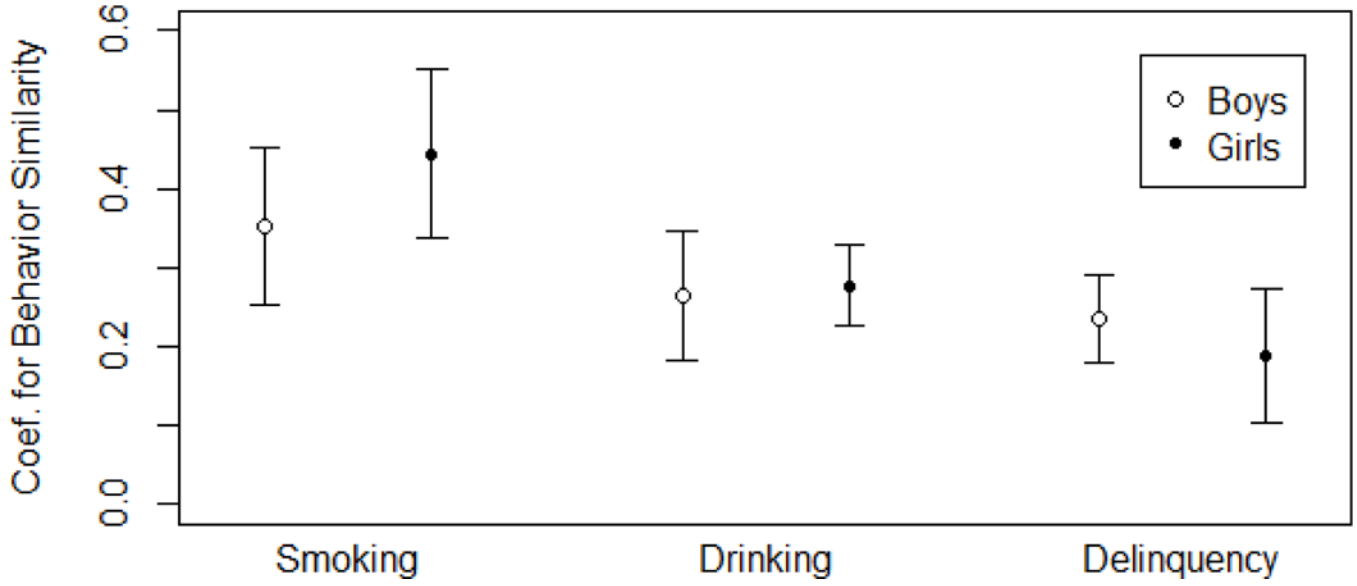

Figure 2.
Gender-specific estimates for behavior similarity effect with 95% confidence intervals for smoking, drinking, and delinquency

Table 1:

Descriptive Statistics Across all Waves

	Mean/%	S.D.	Min.	Max.
Indegree	3.725	(2.788)	0	20
Family Relations	−0.009	(0.502)	−2.997	1.188
School Bonding	3.788	(0.766)	1	5
Risk Taking	2.138	(1.002)	1	5
Smoking Tobacco	0.166	(0.523)	0	2
None	89.76%			
Once in Last Month	3.08%			
More than Once	6.73%			
Missing	0.42%			
Drinking Alcohol	0.302	(0.639)	0	2
None	79.33%			
Once in Last Month	10.31%			
More than Once	9.86%			
Missing	0.50%			
Delinquency	1.830	(1.091)	1	4
None	56.19%			
Minor	16.84%			
Moderate	13.53%			
High	12.90%			
Missing	0.54%			
Boys	48.54%			
White	81.09%			
Lives with Both Bio. Parents	60.09%			

Note: For each wave, average $n = 9{,}151$.

Table 2.

Descriptive Statistics by Wave and Gender

	Smoking		Drinking			Delinquency	
	Girls	**Boys**	**Girls**	**Boys**		**Girls**	**Boys**
6th Grade	0.045	0.051	0.089	**0.124**	**6th Grade**	1.394	**1.781**
(Fall)	(0.266)	(0.281)	(0.343)	(0.417)	**(Fall)**	(0.776)	(1.005)
None	96.58%	96.08%	92.57%	90.65%	None	74.91%	54.33%
Once	1.69%	2.14%	5.28%	5.80%	One	13.77%	22.21%
More	1.39%	1.49%	1.81%	3.27%	2–3	7.39%	13.86%
					More	3.57%	9.30%
6th Grade	0.070	0.078	0.131	**0.172**	**6th Grade**	1.463	**1.863**
(Spr)	(0.338)	(0.359)	(0.418)	(0.487)	**(Spr)**	(0.859)	(1.069)
None	95.32%	94.76%	89.68%	87.29%	None	72.53%	52.65%
Once	2.09%	2.20%	7.00%	7.72%	One	13.39%	19.92%
More	2.46%	2.81%	3.03%	4.71%	2–3	8.39%	15.07%
					More	5.34%	11.99%
7th Grade	0.155	**0.131**	0.240	0.254	**7th Grade**	1.650	**1.985**
	(0.503)	(0.465)	(0.568)	(0.588)		(1.006)	(1.122)
None	90.30%	91.51%	82.81%	82.01%	None	64.56%	48.14%
Once	3.29%	2.82%	9.91%	9.71%	One	14.70%	19.97%
More	6.09%	5.11%	6.99%	7.76%	2–3	10.96%	16.10%
					More	9.35%	15.27%
8th Grade	0.251	**0.183**	0.406	**0.376**	**8th Grade**	1.848	**2.128**
	(0.628)	(0.549)	(0.712)	(0.699)		(1.110)	(1.187)
None	84.75%	88.76%	72.16%	74.48%	None	56.25%	44.33%
Once	4.49%	3.02%	13.87%	12.10%	One	15.37%	17.59%
More	10.26%	7.56%	13.21%	12.60%	2–3	14.13%	17.23%
					More	13.53%	19.89%
9th Grade	0.355	**0.279**	0.583	**0.550**	**9th Grade**	1.959	**2.156**
	(0.733)	(0.665)	(0.812)	(0.817)		(1.146)	(1.221)
None	79.66%	83.58%	62.22%	65.55%	None	51.53%	45.15%
Once	4.58%	3.85%	16.60%	12.85%	One	16.54%	15.95%
More	15.37%	11.95%	20.68%	20.85%	2–3	15.55%	15.80%
					More	15.97%	22.39%
All Waves	0.185	**0.154**	0.300	0.304	**All Waves**	1.676	**1.992**
	(0.549)	(0.505)	(0.634)	(0.645)		(1.021)	(1.138)
None	88.94%	90.67%	79.23%	79.45%	None	63.39%	48.64%
Once	3.31%	2.84%	10.79%	9.82%	One	14.82%	18.99%
More	7.41%	6.00%	9.53%	10.19%	2–3	11.48%	15.69%
					More	9.85%	16.09%

Notes: Bolded means indicate a $p < 0.05$ significant difference in means between girls and boys, according to a paired *t*-test.

Table 3.

SAOMs for Gender Variations in Influence and Selection for Smoking, Delinquency, and Drinking

	Smoking Tobacco				Drinking Alcohol				Delinquency			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
Behavior Change Effects:												
Friends' average behavior (influence)	0.930	***	0.928	***	0.827	***	0.846	***	0.287	***	0.286	***
	(0.079)		(0.073)		(0.047)		(0.047)		(0.017)		(0.019)	
Effect from male	−0.170	***	−0.180	***	−0.140	***	−0.122	***	0.042	**	0.068	***
	(0.024)		(0.033)		(0.013)		(0.027)		(0.010)		(0.011)	
Friends' behavior x effect from male			0.035				−0.058				−0.183	***
			(0.179)				(0.066)				(0.041)	
Effect from race	−0.031		−0.039		−0.004		−−0.006		−0.076	***	−0.077	***
	(0.019)		(0.020)		(0.027)		(0.027)		(0.022)		(0.022)	
Effect from living with both parents	−0.221	***	−0.216	***	−0.030		−0.030		−0.127	***	−0.128	***
	(0.032)		(0.031)		(0.020)		(0.019)		(0.016)		(0.016)	
Effect from family relations	−0.156	***	−0.174	***	−0.144	***	−0.151	***	−0.202	***	−0.202	***
	(0.029)		(0.029)		(0.020)		(0.021)		(0.016)		(0.022)	
Effect from school bonding	−0.233	***	−0.245	***	−0.183	***	−0.187	***	−0.132	***	−0.130	***
	(0.016)		(0.017)		(0.012)		(0.013)		(0.012)		(0.010)	
Effect from sensation/risk seeking	0.136	***	0.148	***	0.150	***	0.156	***	0.097	***	0.097	***
	(0.013)		(0.011)		(0.010)		(0.011)		(0.007)		(0.007)	
Network Evolution Effects:												
Male alter	0.111	***	0.109	***	0.102	***	0.105	***	0.093	***	0.094	***
	(0.011)		(0.011)		(0.010)		(0.010)		(0.010)		(0.010)	
Male ego	−0.223	***	−0.233	***	−0.198	***	−0.202	***	−0.195	***	−0.194	***
	(0.015)		(0.015)		(0.014)		(0.014)		(0.013)		(0.014)	
Same gender	0.657	***	0.662	***	0.661	***	0.664	***	0.657	***	0.661	***
	(0.028)		(0.026)		(0.025)		(0.025)		(0.025)		(0.025)	
Behavior alter	0.164	***	0.174	***	0.136	***	0.138	***	0.059	***	0.058	***
	(0.020)		(0.021)		(0.010)		(0.010)		(0.006)		(0.006)	
Behavior ego	0.027		0.023		0.028		0.034	*	−0.010		−0.008	

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	Smoking Tobacco				Drinking Alcohol				Delinquency			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	(0.025)		(0.022)		(0.015)		(0.016)		(0.008)		(0.007)	
Behavior similarity (selection)	0.405	***	0.422	***	0.278	***	0.278	***	0.216	***	0.215	***
	(0.046)		(0.030)		(0.022)		(0.025)		(0.028)		(0.028)	
Behavior similarity x male ego			−0.080	*			−0.017				0.042	
			(0.030)				(0.055)				(0.046)	

Notes: Estimates are presented as *b*-coefficients. Standard errors are in parentheticals. Models also include rate, shape, structural, and attribute-based selection effects that are not shown. Delinquency models include 50 networks, drinking include 48, and smoking include 36.

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$