

# Status Struggles: Network Centrality and Gender Segregation in Same- and Cross-Gender Aggression

Robert Faris<sup>a</sup> and Diane Felmlee<sup>a</sup>

## Abstract

Literature on aggression often suggests that individual deficiencies, such as social incompetence, psychological difficulties, or troublesome home environments, are responsible for aggressive behavior. In this article, by contrast, we examine aggression from a social network perspective, arguing that social network centrality, our primary measure of peer status, increases the capacity for aggression and that competition to gain or maintain status motivates its use. We test these arguments using a unique longitudinal dataset that enables separate consideration of same- and cross-gender aggression. We find that aggression is generally not a maladjusted reaction typical of the socially marginal; instead, aggression is intrinsic to status and escalates with increases in peer status until the pinnacle of the social hierarchy is attained. Over time, individuals at the very bottom and those at the very top of a hierarchy become the least aggressive youth. We also find that aggression is influenced not so much by individual gender differences as by relationships with the other gender and patterns of gender segregation at school. When cross-gender interactions are plentiful, aggression is diminished. Yet these factors are also jointly implicated in peer status: in schools where cross-gender interactions are rare, cross-gender friendships create status distinctions that magnify the consequences of network centrality.

## Keywords

social networks, aggression, gender, status

Aggression is commonplace in U.S. schools: bullying and other forms of proactive aggression adversely affect 30 percent, or 5.7 million, American youth each school year (Nansel et al. 2001). The National Education Association (1995) estimates that each week-day, 160,000 students skip school to avoid being bullied. This aggression has important consequences. Being victimized by bullies positively relates to a host of mental health problems, including depression (Baldry 2004), anxiety (Sharp, Thompson, and Arora

2000), and suicidal ideation (Carney 2000), as well as physical health problems (Ghandour et al. 2004), social isolation (Nansel et al. 2001), and academic struggles (Berthold and

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<sup>a</sup>University of California-Davis

## Corresponding Author:

Robert Faris, Department of Sociology, University of California-Davis, 2247 Social Sciences and Humanities, One Shields Avenue, Davis, CA 95616  
E-mail: [rwfaris@ucdavis.edu](mailto:rwfaris@ucdavis.edu)

Hoover 2000). Many of these outcomes last well into adulthood (Schäfer et al. 2004). Moreover, it is not only victims who suffer negative consequences; aggressors (compared with bystanders) also experience problems with school adjustment, mental health, and integration (Nansel et al. 2004).

Perhaps because psychologists produce the bulk of the literature on aggression, research tends to focus on the role of the involved individuals' personality traits. With some exceptions (e.g., Hawley 2003; Pelligrini and Long 2002), these traits consist of psychological pathologies or developmental deficiencies, conveying an impression of aggression as a counterproductive response to psychological difficulties or problems in the home. Here, we provide a contrasting view that emphasizes the role of peer status and social context. We argue that the role of personal deficiencies is overstated and that concerns over status drive much aggressive behavior. As peer status increases, so does the capacity for aggression, and competition to gain or maintain status motivates the use of aggression. Aggression wanes only at the highest echelons of status, where its utility is questionable.

Gender receives particular attention in the literature on aggression, with debate centering on whether females bully as frequently and in the same ways as males (for a review, see Espelage and Swearer [2003]). We suggest that, for the most part, gender affects aggression insofar as it relates to peer status. Extending arguments about gender as a status characteristic, we suggest that the effect of gender is primarily relational and contextual: adolescents' aggressive behaviors are influenced not so much by their own gender as by their relationships with the other gender, and by the degree of gender segregation at the school level, which are jointly implicated in peer status. While our primary focus is on the direct effect of peer status—as reflected in social network centrality—we also suggest that the effect of social network centrality on aggression is magnified when youth have

cross-gender friendships in schools where such relationships are rare. Our emphasis on inter-gender relationships is not limited to friendship. Rather than presume aggressive tendencies are insensitive to the characteristics of potential victims, we consider whether same- and cross-gender aggression follow similar patterns.

### *Conceptual Definitions*

Before proceeding, we should clarify our use of the terms aggression, power, status, and centrality. Following Kinney (2007), we define aggression<sup>1</sup> broadly as behavior directed toward harming or causing pain to another, including physical (e.g., hitting, shoving, and kicking), verbal (e.g., name-calling and threats), and indirect aggression (also called social or relational<sup>2</sup> aggression). Indirect aggression is defined as harmful actions perpetrated outside of a victim's immediate purview, such as spreading rumors and ostracism. Here, "peer status" refers to adolescents' position within their informal school prestige hierarchy, based on schoolmates' assessments. We use the term "power" to reflect the capacity to influence others and the ability to resist others' influence. Hypothetically, power and status may not always overlap, but we argue that in the adolescent context, power is rooted in peer status and both are reflected by social network centrality.

## **THEORY**

### *Social Network Centrality and Aggression*

The relationship between aggression and social network centrality depends on (1) whether centrality increases the capacity for aggression and (2) whether status is a primary motivation for aggression. The first question pertains to the relationship between power and network position. The strong argument

is that network position empowers the well-situated to pursue their ends. The weak version is that network position does not create, but merely reflects, underlying power arrangements. Most scholars of networks make the strong argument that networks create power and status (Burt 1982; Freeman 1979; Friedkin 1991). Actors “at the center of the network, on whom the more peripheral actors are dependent, are the most powerful actors in the system” (Marsden and Laumann 1977:217). Individuals who link otherwise disconnected actors—that is, individuals who bridge structural holes—enjoy special advantages in social and economic exchanges (Burt 1982) and exercise control over information flows (Freeman 1979). Power-dependency theory shows that networks create tangible power imbalances by regulating the availability of alternative exchange partners (Cook et al. 1983; Emerson 1972; Molm 1990). Even if network position is initially caused by exogenous personal qualities, central actors likely receive a disproportionate share of new nominations, not because of personal qualities, but by virtue of having already received many nominations (Gould 2002). To accept the weak argument, one would have to assume that no such Matthew Effects occur (or that ties do not matter).

Some scholars may be unaccustomed to talking about power in the context of high schools. However, as media coverage of youth who were “bullied to death” suggests, some adolescents have the power to make their peers’ lives miserable. These same adolescents are also apt to employ more subtle means of persuasion and pressure, backed by threat or reward, to achieve their goals.<sup>3</sup> Youths who hold this power, exercised or latent, are likely found at the busy intersections of social networks rather than at the margins. Youths who bridge structural holes—that is, youths who have many friends who are not friends with each other—have greater access to valued resources like potential romantic partners or social options on the

weekend. Because their social lives do not depend on any single friend or group of friends, they can exclude others more easily than they can be excluded themselves. This gives them greater leverage in each of their friendships (these friendships often involve subtle dominance struggles [Gould 2003]). Because these youths have ties to multiple peer groups, they are also in a position to receive and disseminate information and gossip (accurate or otherwise). In addition, actors in brokerage positions presumably have a large number of allies they can mobilize as needed.

Even if the weak argument is correct and network centrality only reflects some set of underlying qualities, central students likely wield greater influence than do marginal students. The characteristics that make them central—affluence, attractiveness, athleticism, or charisma—should enable them to influence, manipulate, or otherwise dominate their peers. In addition, occupying a central position within a school’s social network, as compared to a more isolated position, directly increases the opportunities to engage in aggressive interactions with one’s peers. Regardless of the causal relationship between power and network position, these arguments agree that network centrality is positively associated with the ability to exploit or otherwise harm others. What they do not explain, however, is when and why harm doing occurs.

With respect to the second question about the motivation for aggression, many adolescents perceive peer status to be an important goal and aggression to be an effective means of attaining it. Alternatively, they view a lack of aggressiveness, and in particular, passivity in the face of another’s harmful behavior, as leading to subsequent losses in social status and power. Little research examines whether aggression is, in fact, an effective way of gaining or maintaining status (although one recent study found that, under certain conditions, aggression led to subsequent status gains [Rodkin and Berger 2008]), but more important for our purposes is whether aggression is *believed* to increase

status. To our knowledge, this question has not been addressed directly, but research has established a correlation between status concerns and aggression. Gould (2003) convincingly argues that social rank is of utmost importance for interaction and that serious, even deadly, conflicts arise when relative social rank is unclear or in dispute.<sup>4</sup> Other scholars maintain that ambiguity with respect to ownership of resources increases conflict and violence (Villareal 2004).

These arguments present aggression as a reaction to status-related affronts, but other research finds a link to proactive aggression as well. Subcultural theories of crime and violence underscore the argument that enhancing peer status and respect are motivations for violent behavior among certain subcultures that prize readiness to fight (Anderson 1994; Cloward and Ohlin 1960; Miller 1958). Recent research finds that violence among males relates positively to peer acceptance in school, particularly for students with poor academic performance (Kreager 2007b). Additionally, proactively aggressive adolescents have strong—and their victims weak—status motivations (Sijtsema et al. 2009). Adolescents who seek status become more aggressive over time; and net of their own individual motivations, youth in friendship groups that emphasize status are also more aggressive (Faris and Ennett forthcoming). If centrality increases the capacity for aggression, and if adolescents view aggression as a means to enhance status (or prevent losses), then greater network centrality likely leads to increases in subsequent aggression.

Our argument thus far—that aggression is perceived to be instrumental behavior for gaining status and that centrality is associated with greater capacity for it—stands in contrast to much of the psychological literature on aggression, which views it as a reaction to psychological problems, social insecurities, or troubled home lives. Many studies find that aggressive youth are disliked, unpopular, and experience difficulty maintaining relationships with classmates (e.g., Adler and

Adler 1995; Garandeanu and Cillessen 2006). This perspective suggests that aggressive youth are likely peripheral in a school's social network and, far from enhancing status, acting out likely completes their marginalization. While we suspect that such research overestimates the link between social marginality and aggression due to measurement methods—indirect aggression, for instance, is often ignored—and theoretical emphases on mental health, we acknowledge the capacity of any student to be violent, and that certain socially marginal subcultures can be quite aggressive. We thus anticipate some exceptions to the generally positive association between centrality and aggression, but we argue that the more substantial departure occurs at the top, not the bottom, of the status hierarchy.

There are several reasons to expect individuals at the pinnacle of the status hierarchy to desist in aggression. Fundamentally, if aggression is purely instrumental for status attainment, then individuals at the top will not find it particularly useful or needed; pro-social tactics may achieve their ends more effectively (Hawley 2003). Kindness may be a luxury most easily enjoyed from a secure position at the pinnacle of a hierarchy, or by individuals who have no hope (or desire) to reach such heights. A friendly compliment from the homecoming queen or the star quarterback is likely to cement, not minimize, status differences, while a cutting remark is likely to signal status insecurity rather than dominance. In a similar vein, aggression may expose power arrangements that, once revealed, render further aggression unnecessary. Thus, while we expect that centrality monotonically increases the capacity for aggression, the need for aggression decreases once one attains the upper reaches of social prominence. This leads to our first hypothesis:

*Hypothesis 1:* Network centrality at Time 1 increases aggression at Time 2 until relatively high levels of centrality are reached,

at which point additional increases in centrality decrease subsequent aggression.

### *Cross-Gender Friendships*

That males are more aggressive than females is virtually axiomatic for many researchers, and most empirical studies support this view (e.g., Coie and Dodge 1998), including several meta-analyses (e.g., Archer 2004; Hyde 1984). Gender differences are especially pronounced if the analysis is limited to physical aggression, but they often persist even with broad conceptions of aggression. Proposed explanations for the difference include the Male-Warrior Hypothesis, which emphasizes biological traits (Van Vugt, De Cremer, and Janssen 2007), as well as entrenched cultural beliefs about gender roles and stereotypes (Berger, Cohen, and Zelditch 1972; Ridgeway and Correll 2004). Other scholars note that differences between the genders in interpersonal behavior tend to be exaggerated or essentialized, and that differences in social context and structural location account for large amounts of variance in behavior (Felmlee 1999).

Understanding the magnitude and root causes of these differences is important, but we argue that preoccupation with gender differences obscures other important ways in which gender matters for aggression. With few exceptions (e.g., Rodkin and Berger 2008), scholars have not considered how inter-gender interaction shapes aggression. Therefore, in addition to individual-level gender effects, we consider the consequences of cross-gender friendships and corresponding levels of informal gender segregation at the school level. Our expectations are guided by two propositions in addition to our fundamental assertion that aggression is enabled by, and instrumental for, social climbing. First, social interaction increases opportunities for conflict. Second, favorable interaction with the other gender is a common goal for many adolescents.

Regarding the former, social interaction is a prerequisite for aggression, and the more

time people spend together, the more opportunity there is for conflict to arise. There are additional reasons, however, why aggression may accompany friendship formation, and cross-gender friendship formation in particular. Gould (2003) argues that friendships feature underlying dominance claims that, when challenged, result in dramatic conflicts. This argument encompasses same- and cross-gender friendships alike, but social ties between the two genders include the additional difficulties of higher levels of uncertainty and topic avoidance. Cross-gender friendships thus hold greater potential for misunderstanding and conflict (Afifi and Burgoon 1998; Tannen 1990). Indeed, recent research finds an association between cross-gender friendships and violent or antisocial behavior (Arndorfer and Stormshak 2008; Haynie, Steffensmeier, and Bell 2003). For female youth, studies find a link between a high proportion of cross-gender friendships and crime (McCarthy, Felmlee, and Hagan 2004). Cross-gender friendships also lead to dating activity (Feiring 1999), which may further intensify conflict.<sup>5</sup>

While aggression does transpire between friends, we suspect the bulk occurs within adjacent relations (e.g., when classmates become rivals for the attention of a mutual friend). These relations are both more prevalent than friendship (one invariably has more friends-of-friends than one has friends) and lack incentives to keep conflict in check. Friends, after all, at least *like* each other, whatever their differences. There is no such presumption about friends-of-friends. Cross-gender friendships will entail a certain amount of conflict, but more important, they will bring actors into more frequent contact with cross-gender friends-of-friends. We thus anticipate that cross-gender aggression will increase with the rate of cross-gender friendships, by virtue of increased opportunity and competition. In a similar vein, we expect that high levels of gender segregation at the school level (or a low rate of cross-gender friendships relative to what we would expect

by chance alone [Freeman 1978]) will decrease the opportunity for interaction and conflict between the two genders and therefore produce lower levels of cross-gender aggression over time.

*Hypothesis 2a:* Cross-gender friendships increase cross-gender aggression.

*Hypothesis 2b:* School gender segregation decreases cross-gender aggression.

Our second gender proposition, that cross-gender relationships are an important goal for many adolescents, is unlikely to be controversial and finds support in numerous studies. In the 1960s, for example, Coleman's (1961) ethnography of high school documented the importance of success with the other gender. While young children's relationships are usually completely homogenous with respect to gender (Eder and Hallinan 1978), gender homophily wanes after the onset of puberty, and cross-gender friendships become increasingly common (Shrum, Cheek, and Hunter 1988). Such friendships become tied to peer status as adolescence proceeds (Bukowski, Sippola, and Hoza 1999; Collins 2003), perhaps because they often lead to romantic relationships (Feiring 1999), which also flourish over this period (Laursen and Williams 1997).

If cross-gender friendships are an important goal and aggression is generally instrumental, we might expect youth who form such ties, and reach their goal, to desist from aggression. Additionally, compared with individuals without such friendships, adolescents with multiple cross-gender friends arguably spend less of their free time interacting—and hence, feuding—with peers of their own gender. For the same reason, we anticipate relatively higher rates of same-gender aggression in gender-segregated schools, where there are few cross-gender friendships and arguably less interaction between genders. We therefore test the following hypotheses:

*Hypothesis 3a:* Cross-gender friendships decrease same-gender aggression.

*Hypothesis 3b:* School gender segregation increases same-gender aggression.

### *Gender Bridges*

Our primary interest with respect to gender, and cross-gender friendship specifically, is its relationship to peer status. We suggested that cross-gender friendships are a desirable goal. Goal attainment, however, does not necessarily imply status distinction. Because status is relative, distinctions can only be created when traits or behaviors are uncommon. In the present case, cross-gender friendships may provide their own satisfactions, but they cannot create status distinctions if they are common. Furthermore, the direction of the status distinction—whether non-normative behavior leads to prestige or stigma—depends in part on the status of those engaged in it. In schools where cross-gender friendships are uncommon, the social distinctions created by these friendships are likely to be empowering (e.g., by providing access to the other gender) for central adolescents and stigmatizing (e.g., by violating gender norms) for marginal ones.

Because we believe that aggression is entwined with power and status, we call attention to a unique social position, a “gender bridge.” We define a gender bridge as a student who has cross-gender friendships in schools where such friendships are rare. We argue that the positive effect of centrality on aggression is enhanced for gender bridges, such that socially prominent gender bridges enjoy substantial magnification of their already high levels of peer status. These students are thus likely to be even more aggressive toward other students (compared with comparably central students). For example, consider two hypothetical students attending a gender-segregated school. Students *A* and *B* have high centrality, but *A* has multiple cross-gender friendships while *B* has none. Assuming cross-gender friendships are desirable, *A*'s status is magnified relative to *B*'s by virtue of having these friendships when few of their classmates do. We suggest that

this effect operates primarily through the symbolic value of having rare and valued ties, but these friendships may also provide more tangible advantages such as invitations to parties, access to a wider range of gossip, and exposure to more potential dating partners. Whatever the mechanisms, such magnification in peer status is likely accompanied by increased aggression, for reasons outlined earlier. We therefore test our final hypothesis:

*Hypothesis 4:* The effect of centrality on same- and cross-gender aggression will be magnified for gender bridges.

Before proceeding with a description of the data, three notes are in order. First, some research on cross-gender interaction finds different consequences by gender (Haynie et al. 2003). Such findings suggest it is not cross-gender friendships per se, but friendships with *boys* that influence outcomes. Although we construct our variables in cross-gender and same-gender terms (as opposed to male friends and female friends), we take these results seriously and test for gender interactions in our analyses. Second, much research explores differences in *how* adolescents are aggressive. Some scholars assume that because females have less physical strength,<sup>6</sup> for example, they may rely more on indirect and verbal aggression (Björkqvist, Lagerspetz, and Kaukiainen 1992; Hyde 2005).<sup>7</sup> However, we agree with Espelage and Swearer (2003) and Jackman (1994) that broader—not narrower or more varied— notions of aggression are needed to fully examine the role of gender. If aggression is used tactically, we might expect it to take on a variety of forms depending on the situation. Nonetheless, we test our primary hypotheses separately for physical, verbal, and indirect aggression. Finally, our argument about gender centers on platonic friendships rather than romantic activity. This is partly due to practical reasons (network data on dating partners is unavailable), but we also argue that while cross-gender friendships often lead (directly or indirectly)

to dating relationships, they are important in their own right and likely to outlast transitory romantic relationships (Brown, Feiring, and Furman 1999). Because dating activity is associated (under certain conditions) with delinquency (McCarthy and Casey 2008), we control for dating involvement and test for interactions with key variables.

### *Contributions of This Study*

The literature on aggressive peer interaction is voluminous. Nevertheless, it exhibits a number of limitations. Many studies rely on small, cross-sectional samples, inhibiting investigation of predictors of aggression. Much research also relies solely on self-reported aggression, which may underestimate socially undesirable behavior. Few studies collect detailed sociometric data on friendship ties, and to our knowledge, only two other studies have collected data on networks of aggressive relationships, and these consist mostly of younger children (Rodkin and Berger 2008; Veenstra et al. 2007). We attempt to address these limitations by the following means: We obtain reports from both the respondents and their peers regarding incidents of harmful behavior. We use a relatively large sample of data from 3,722 students gathered from all of the public middle- and high-school students in three counties of one state (19 schools). We undertake a dynamic analysis of aggressive behavior using longitudinal data from each school gathered at two time points. Most important, we use a network measure of aggression that enables investigation of target characteristics. We analyze aggression relationally and consider new questions, in this case, whether cross-gender and same-gender aggression arise from common factors.

### **DATA, MEASURES, AND METHODS**

Data for these analyses come from The Context of Adolescent Substance Use study

(Ennett et al. 2000), a longitudinal in-school survey of adolescents in three counties in North Carolina that began in the spring of 2002 and was administered every six months through Wave 6 (in the fall of 2005), until it concluded with a final survey one year later (such that the oldest cohort was followed through 12th grade). At Wave 1, all public-school students in grades 6 through 8 in each of three counties were eligible, resulting in a study population of 8,201 students, of which 7,173 (88 percent) participated at least once. For each of the seven waves, the response rate was maintained at or above 75 percent. Our sample includes the 4,266 students who participated in Waves 4 (fall 2004) and 5 (spring 2005);<sup>8</sup> after listwise deletion of missing data (544 of 4,266 total cases were dropped), our final sample includes 3,722 students. Models with school clustering and multiple imputation of missing data (with 20 imputations) for the 544 cases produce substantively identical results.

### *Dependent Variables*

To measure aggression, students were asked to nominate up to five schoolmates who “picked on or were mean to” them, and up to five peers whom they “picked on or were mean to.” Students were instructed to disregard playful teasing and focus only on harmful actions. We merge the two networks (i.e., the network according to victims, and the network according to aggressors) such that an aggressive link from *A* to *B* is considered present if *A* nominated *B* as a victim or *B* nominated *A* as an aggressor.<sup>9</sup>

From this combined network, we calculate *aggression outdegree*, or the number of students a respondent harassed or attacked. We then define *cross-gender* and *same-gender aggression* as the number of other- and same-gender peers toward whom a respondent was aggressive. Additionally, for each nomination, students were asked (separately) whether the relationship involved physical attacks, direct verbal harassment, or indirect

aggression. From these reports, we generate networks of *physical* (e.g., links that involved physical attacks such as hitting, shoving, or tripping), *verbal* (e.g., name-calling and other verbal abuse), and *indirect aggression* (e.g., spreading rumors, ostracism, or related forms of behind-the-back harassment). All dependent variables were measured in the spring of 2005 (Wave 5). We control for the prior level of each outcome by including the appropriate aggression measures from the beginning of that same school year (fall 2004, or Wave 4).

### *Independent Variables*

We measure the key independent variables using friendship network data. Students were asked to name up to five of their best friends; from these nominations, we calculate measures of social network centrality. We examine *betweenness centrality*, which is calculated by first determining the shortest paths, or geodesics, between all pairs of actors (using undirected ties), and then calculating the percentage of all these geodesics that include the focal actor. There are multiple centrality measures, each emphasizing different structural properties (Borgatti and Everett 2006; Freeman 1979). We focus on betweenness centrality, as opposed to other popular measures like Bonacich centrality (Bonacich 1987), because it best captures the brokerage position we associate with status in this context and matches our conception of gender bridges.<sup>10</sup>

We also use the friendship nominations to calculate *multiple cross-gender friendships*, a binary indicator of whether a respondent had at least two cross-gender friends. At the school level, we measure *gender segregation* using Freeman’s (1978) segregation index, which compares observed and expected patterns of ties across groups. The measure ranges from  $-1$  to  $1$ , where a  $1$  is perfect segregation or homophily (i.e., all friendships are same-gender), a  $0$  indicates that same- and



cross-gender friendships are equally likely, and a  $-1$  indicates perfect heterophily (i.e., all cross-gender friendships).

### Control Variables

We include a number of conventional control variables, but some bear further discussion. First, one of the strongest predictors of adolescents' behavior in a given domain is the behavior of their friends (Ennett and Bauman 1994; Mercken et al. 2010). Aggression may be particularly susceptible to peer influence processes, because it is often perpetrated by multiple adolescents (Craig and Pepler 1997; Salmivalli et al. 1996) and friends frequently target the same victims (Card and Hodges 2006). Network studies find strong correlations between the aggressive behavior of adolescents and their friends' aggression (Mouttapa et al. 2004). Because central actors have more friends, they may also have more exposure to aggressive peers.<sup>11</sup> To ensure that the relationship between centrality and aggression is not a spurious result of peer influence and diffusion processes, we include *friends' average aggression*, defined as the average aggression level of a respondent's friends, including those who nominate the respondent but do not receive a nomination in return (results do not change when only nominated friends are included).

Romantic involvement and ensuing conflicts may also confound the relationship between status and aggression, so we include a binary indicator of whether a respondent had *ever been on a date*. The survey instrument defines dates as "informal activities like meeting someone at the mall, a park, or at a basketball game as well as more formal activities like going out to eat or to a movie together." Studies find that *pubertal development* is positively related to aggression (Batsche and Knoff 1994; Olweus 1993), and this was measured by asking "compared to most others your age and gender, do you think your physical development is much earlier, somewhat earlier, about the same,

somewhat later, or much later?" along with a series of detailed physical items. Cronbach's alpha for pubertal development is .73 for boys and .68 for girls.

We measure *grade point average (GPA)* on a four-point scale based on a respondent's self-reported grades in English, mathematics, science, and social studies or history. We include a binary indicator of participation in *school sports* because some sports are linked to fighting (Kreager 2007a). We also include conventional demographic and socioeconomic control variables, including race (African American, Latino, other minority; white is the reference category), grade in school (9th or 10th grade; 8th grade is the reference), a binary indicator of a single-parent home, and a binary indicator of low educational attainment (this equals 1 if no parent attended college, 0 otherwise).<sup>12</sup>

### Methods

Because the dependent variables are counts of the number of victims each respondent was aggressive toward (or the number of aggressors who picked on a respondent), we estimate negative binomial models that include a parameter that captures the overdispersion of the dependent variable (Long 1997). Coefficients can be interpreted such that a one-unit increase in  $X_{ij}$  multiplies the expected outcome measure by a factor of  $\exp(B_j)$ .<sup>13</sup> Non-independence of data points is often a concern in analyses of students in schools, so we include school-level random effects in all of our models. We also tested school fixed effects and the results are identical. Moreover, we estimate a dynamic regression model with a lagged dependent variable and lagged covariates to control for potential problems associated with the interpretation of causal order in our models. We measure all covariates (including the lagged dependent variable) in fall 2004 (Time 1) and all dependent variables at a second time point approximately six months later (spring 2005).

## RESULTS

### *Descriptive Statistics*

The average student was aggressive toward just .63 schoolmates and, consistent with national prevalence estimates (Nansel et al. 2001), the majority (67 percent) of students were not aggressive toward anyone at Time 2 (see Table 1). Average aggression, like all other aggression measures, declined from fall 2004 to spring 2005. Between-wave correlations of all aggression measures range from .25 to .36, indicating substantial individual variability across time. Females were significantly more aggressive than males at the start of the school year (although not at the end), but as might be expected, males were more physically aggressive. Males were also more aggressive toward females than females were toward males, and females were more aggressive toward other females than males were toward other males. Compared to boys, girls occupy significantly more central network positions, are more physically developed, and earn higher grades, but they are less likely to participate in sports. Roughly two-thirds of all students had been on a date.

We plot the friendship and aggression networks of two typical high schools, “Washington” and “Jefferson” (see Figure 1). The nodes are shaded and shaped according to gender. We established their positions in the graphs by applying a springer-embedder routine in the Netdraw component of UCINET (Borgatti, Everett, and Freeman 2002) to the friendship network such that node positions are based on friendship relations and do not change when the friendship relations are replaced with aggression (the bottom half of the figures). We exclude adolescents who had no friendly or aggressive links with their peers. Relatively isolated individuals are located on the periphery, while central students fall in the dense regions of the graph. Washington High is highly segregated with respect to gender (Freeman segregation = .84); cross-gender

friendships are more common in Jefferson High (Freeman segregation = .53).

Both aggression networks are substantially less dense than their corresponding friendship networks, but aggressive relationships roughly follow a similar pattern as friendship—the most dense regions of the aggression network are also the most dense in the friendship network. Additionally, most aggressive links are of modest length, with few aggressive acts stretching from one side of the graph to the other. This suggests a tendency to target victims within, rather than across, social circles. Finally, cross-gender aggression appears to be less common than same-gender aggression, but it seems relatively more likely to occur in the school with lower gender segregation. We turn to multivariate analyses to determine whether this is in fact the case.

### *Centrality and Aggression*

We begin multivariate analysis by estimating models of overall aggression as well as the three subtypes of aggression, controlling for prior aggression levels (see Table 2). Our purpose in these initial models is to test whether centrality has the hypothesized effect on aggression, and whether it has the same effect on each subtype. As hypothesized, we find that centrality has a curvilinear effect on change in aggression (Model 1). Initially, increases in centrality are accompanied by increases in the rate of aggression (see Figure 2). When betweenness centrality reaches approximately 4 (i.e., a student is included in 4 percent of all geodesics), aggression plateaus and then begins to decline. Note that the distribution of centrality is highly skewed and approximately 86 percent of students have scores less than 2. Increases in centrality would thus result in decreasing aggression for only a small percentage of very high-status adolescents. For the vast majority of students, additional centrality increases lead to increased aggression. We also find the hypothesized curvilinear

**Table 1.** Descriptive Statistics

	Females	Males	Overall	SE	Min.	Max.
Overall aggression, spring 2005	.65	.62	.63	1.18	.00	7.00
Overall aggression, fall 2004	<b>.86</b>	<b>.77</b>	.82	1.36	.00	9.00
Physical aggression, spring 2005	<b>.23</b>	<b>.28</b>	.25	.69	.00	6.00
Physical aggression, fall 2004	<b>.24</b>	<b>.33</b>	.28	.72	.00	8.00
Verbal aggression, spring 2005	.45	.49	.47	1.00	.00	7.00
Verbal aggression, fall 2004	.55	.60	.58	1.10	.00	9.00
Indirect aggression, spring 2005	<b>.42</b>	<b>.32</b>	.37	.86	.00	7.00
Indirect aggression, fall 2004	<b>.55</b>	<b>.41</b>	.48	.99	.00	7.00
Cross-gender aggression, spring 2005	<b>.19</b>	<b>.24</b>	.21	.60	.00	7.00
Cross-gender aggression, fall 2004	.27	.29	.28	.67	.00	6.00
Same-gender aggression, spring 2005	<b>.46</b>	<b>.38</b>	.42	.91	.00	7.00
Same-gender aggression, fall 2004	<b>.59</b>	<b>.48</b>	.54	1.02	.00	7.00
Betweenness centrality	<b>1.00</b>	<b>.84</b>	.93	1.26	.00	12.69
Has multiple cross-gender friendships	.16	.18	.17	.37	.00	1.00
School gender segregation	.62	.62	.62	.06	.41	.98
Friends' average aggression	.80	.78	.79	.69	.00	6.00
Has been on a date	.64	.61	.63	.48	.00	1.00
GPA	<b>2.95</b>	<b>2.77</b>	2.86	.86	1.00	4.00
Sports	<b>.52</b>	<b>.62</b>	.57	.50	.00	1.00
Pubertal development	<b>2.88</b>	<b>2.72</b>	2.81	.52	.75	4.00
School size	598.23	601.59	599.79	310.82	36.00	1005.00
Female			.54	.50	.00	1.00
Male			.46	.50	.00	1.00
African American	.33	.27	.31	.46	.00	1.00
Latino	.03	.05	.04	.19	.00	1.00
Other minority	.07	5.00	.06	.24	.00	1.00
White	.56	.60	.58	.49	.00	1.00
Grade 8	.35	.34	.34	.48	.00	1.00
Grade 9	.34	.33	.33	.47	.00	1.00
Grade 10	.31	.33	.32	.47	.00	1.00
Single-parent home	.34	.32	.33	.47	.00	1.00
No parent attended college	.34	.34	.34	.47	.00	1.00

Note:  $N = 3,722$ . Bold = statistically significant gender difference ( $p < .05$ ).

effect of centrality on change in physical, indirect, and verbal aggression (Models 2 to 4), although we only find this effect for physical and indirect aggression after removing five outliers.<sup>14</sup> As with overall aggression, all three subtypes plateau when centrality approaches 3 to 4 percent and then decline at the upper echelons (see Figure 2).

We find no evidence of gender differences in overall, physical, or verbal aggression, although models of physical aggression that exclude physical aggression at Time 1 (not

shown) do find that females are less physically aggressive than males. Expected rates of indirect aggression, however, are 22 percent higher for females than for males. For all outcomes, we tested for interactions between gender and both centrality parameters (not shown), but none are statistically significant. Because centrality has nearly identical effects on each subtype, and because the majority of aggressive relationships involve more than one form of aggression, we adopt the composite measure of aggression in subsequent models.



**Figure 1.** Networks of Friendship (Top) and Aggression (Bottom) in Washington and Jefferson High Schools, by Gender

Note: Dark circle = male; light triangle = female.

Before proceeding to models of gendered aggression, some control variables are noteworthy. As might be expected, we find evidence of peer influence: a one-unit increase in the measure of friends' average aggression is associated with increases in aggression, ranging (across the outcomes) from 9 (verbal aggression) to 16 percent (physical aggression). Adolescents who play sports became more aggressive, but this appears to mostly take the form of verbal aggression. Youth involved in dating activities are between 22 and 30 percent more aggressive than their peers who have never been on a date. High school sophomores are 69 percent less physically aggressive than 8th graders, but there are no other age or cohort effects. Perhaps because it is more difficult to spread rumors in very large settings, small schools have higher rates of indirect aggression. With the exception of low parent education (which decreases rates of overall and verbal aggression), race and family background

factors have no effect on aggressive behavior.

### *Same-Gender Aggression*

Next, we turn to models of same-gender aggression, where we grand-mean center betweenness centrality and school gender segregation to ease interpretation of interaction effects (see Table 3). Contrary to expectations, we find that centrality does not have a significant effect on change in same-gender aggression, even after removing five outliers (Model 1). However, when we add cross-gender friends and school gender segregation to the model (Model 2), we find the hypothesized positive main effect of centrality (one-tail test), although the quadratic term is not significant. School gender segregation has no effect on same-gender aggression, but we find that cross-gender friendships decrease aggression, as hypothesized. Adolescents who have multiple cross-gender

**Table 2.** Random Effects Negative Binomial Regression of Overall, Physical, Indirect, and Verbal Aggression, with School Intercepts, Spring 2005 (Time 2)

	(1) Overall Aggression		(2) Physical Aggression		(3) Indirect Aggression		(4) Verbal Aggression	
	$\beta$	SE	$\beta$	SE	$\beta$	SE	$\beta$	SE
Female	-.05	.06	-.11	.08	.20**	.07	-.08	.06
Centrality	.13**	.04	.22**	.07	.10*	.05	.12*	.05
Centrality squared	-.01*	.01	-.04**	.01	-.02*	.01	-.01^	.01
Friends' average aggression	.10**	.04	.15**	.05	.11*	.05	.09*	.04
Has been on a date	.20***	.06	.23*	.09	.26***	.08	.14*	.07
GPA	-.01	.03	-.08	.05	-.01	.04	-.06	.04
Sports	.12*	.06	.09	.09	.12	.07	.16*	.07
Pubertal development	-.07	.05	-.07	.08	-.05	.07	-.08	.06
Dependent variable in fall 2004 (Time 1)	.28***	.01	.38***	.03	.35***	.02	.33***	.02
African American	.10	.06	.08	.10	.01	.08	.08	.07
Latino	.21	.13	.22	.19	.19	.17	.28	.15
Other minority	-.18	.12	-.22	.19	-.02	.14	-.26	.14
Grade 9	-.10	.12	-.25	.18	.06	.11	-.12	.13
Grade 10	-.11	.12	-.37*	.19	.00	.12	-.19	.13
Single-parent home	-.03	.06	.10	.09	.09	.07	-.01	.07
No parent attended college	-.13*	.06	-.13	.09	-.10	.08	-.14*	.07
School size (hundreds)	-.01	.02	.00	.03	-.04*	.02	-.01	.02
Constant	-.70***	.20	-1.09***	.31	-1.22***	.25	-.76***	.23
Ln <i>R</i>	5.27	1.02	4.04	.67	8.30	18.89	5.51	1.37
Ln <i>S</i>	5.21	1.03	3.61	.69	8.12	18.90	5.43	1.38
Log likelihood	-3763.60		-2152.37		-2754.22		-3179.05	
Wald Chisq(17)	608.08***		278.15***		373.83***		7550.45***	
<i>N</i>	3,722		3,717		3,717		3,722	

^  $p < .05$  (one-tail test); \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$  (two-tail test).

friends are 16 percent less aggressive toward their same-gender peers, on average.

Finally, we test our gender bridge hypothesis (Final Model). After including the hypothesized three-way and all possible two-way interaction terms, the main and quadratic effects of centrality become significant (and in the expected directions). The main effect of cross-gender friends is essentially unchanged. We also find the hypothesized positive three-way interaction between centrality, cross-gender friends, and school gender segregation, net of all possible two-way interactions (none of which are statistically significant). To ease interpretation, we plot the joint predicted effect of centrality, cross-gender friendships, and school gender segregation in Figures 3a to 3c.<sup>15</sup> We advise caution in interpreting

these results, and we emphasize that a relatively small number of students qualify as gender bridges (approximately 8 percent of our sample); of these, roughly half have above-average centrality scores, and one-eighth (or 1 percent of the full sample) have scores above 2.

Nonetheless, we find that, at average levels of school gender segregation (see Figure 3a), centrality exerts a modest positive effect on same-gender aggression for students who have multiple cross-gender friendships and those who do not. Moving from  $-1$  to  $2$  on centrality increases the predicted same-gender aggression of both groups by  $.13$  and  $.19$ , respectively (see Stolzenberg [2004] for a discussion of using partial derivatives to measure effects in polynomial regressions). However,

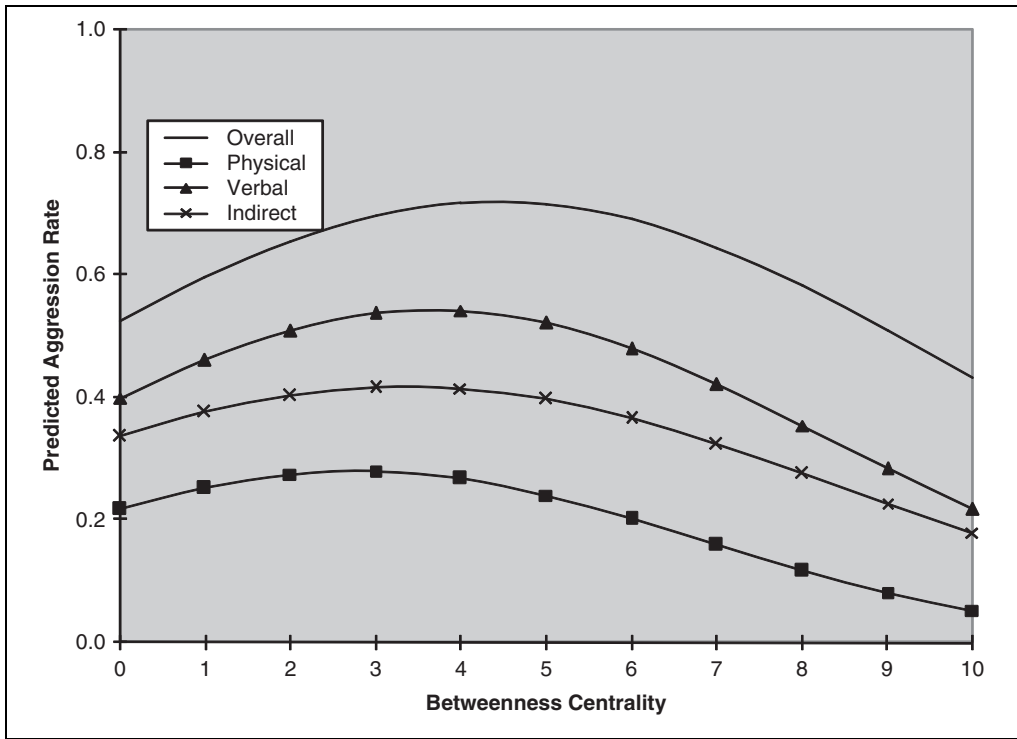


Figure 2. Predicted Aggression Rate by Social Network Centrality

as school gender segregation increases (see Figures 3b and 3c), the slope of centrality increases for youth with multiple cross-gender friendships. In highly gender-segregated schools (see Figure 3c), increases in centrality are associated with sharp increases in same-gender aggression for students who have more than one cross-gender friendship. For other students, centrality has a negligible or negative effect on same-gender aggression. Note, however, that the effect of having cross-gender friendships strongly depends on centrality, and it is associated with reduced aggression among the socially marginal students—only at relatively high levels of centrality (above 2) does it increase rates of aggression. As we anticipated, the effect of centrality on aggression is greatly magnified for gender bridges. However, even these youth ultimately desist from same-gender aggression when centrality reaches the upper extremes (beyond those shown in the figures),

as suggested by the significant negative coefficient for centrality squared.

Some control variables are noteworthy. First, despite the significant bivariate gender difference in same-gender aggression, females are not significantly different from males when other variables are controlled. Consistent with earlier models, having aggressive friends increases—and having parents who never attended college significantly decreases—the rate of same-gender aggression. Youth involved in dating are also more aggressive toward classmates of the same gender. Compared with whites and African American students, Latino students are more aggressive toward same-gender peers.

### Cross-Gender Aggression

Next, we estimate models of cross-gender aggression (see Table 4). We again find the

**Table 3.** Random Effects Negative Binomial Regression of Same-Gender Aggression, with School Intercepts, Spring 2005 (Time 2)

	Model 1		Model 2		Final Model	
	$\beta$	<i>SE</i>	$\beta$	<i>SE</i>	$\beta$	<i>SE</i>
Female	.09	.07	.09	.07	.09	.07
Centrality	.05	.04	.06 <sup>^</sup>	.04	.10*	.04
Centrality squared	-.01	.01	-.01	.01	-.02*	.01
Multiple cross-gender friendships			-.17*	.09	-.20*	.10
School gender segregation			.63	.70	.94	.75
Multiple cross-gender friendships $\times$ centrality					-.01	.06
Gender segregation $\times$ centrality					-.52	.36
Multiple cross-gender friendships $\times$ gender segregation					-1.66	1.91
Multiple cross-gender friendships $\times$ gender segregation $\times$ centrality					1.79**	.69
Friends' average aggression	.11*	.04	.11**	.04	.11*	.04
Has been on a date	.20**	.07	.21**	.07	.21**	.07
GPA	-.06	.04	-.06	.04	-.06	.04
Sports	.11	.07	.10	.07	.10	.07
Pubertal development	-.04	.07	-.03	.07	-.04	.07
Same-gender aggression, fall 2004 (Time 1)	.36***	.02	.36***	.02	.36***	.02
African American	.11	.08	.10	.08	.10	.08
Latino	.43**	.15	.42**	.15	.41**	.15
Other minority	-.09	.14	-.08	.14	-.12	.14
Grade 9	-.19	.16	-.17	.16	-.16	.16
Grade 10	-.32	.17	-.30	.16	-.30	.16
Single-parent home	-.06	.07	-.06	.07	-.05	.07
No parent attended college	-.20**	.07	-.19**	.07	-.20**	.07
School size (hundreds)	.00	.03	.01	.03	.00	.03
Constant	-.82***	.24	-.83***	.24	-.78***	.25
Ln <i>R</i>	4.22	.71	4.33	.73	4.34	.73
Ln <i>S</i>	3.89	.73	4.00	.75	4.00	.74
Log likelihood	-2938.43		-2935.94		-2932.27	
Wald Chi Square ( <i>df</i> )	476.72***	(17)	482.45***	(19)	490.86***	(23)

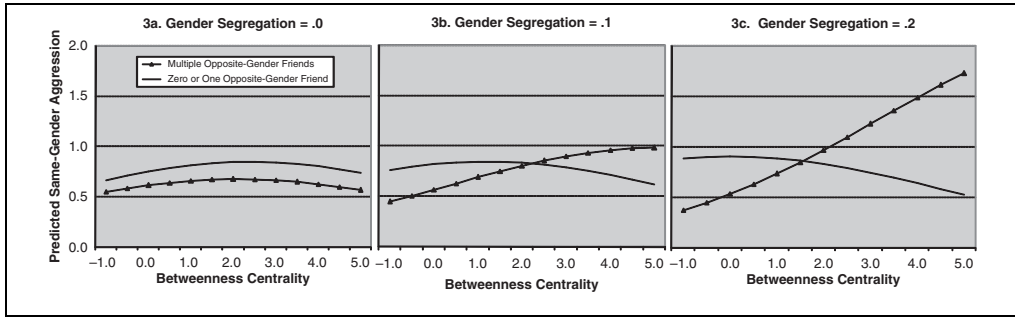
Note:  $N = 3,717$ .

<sup>^</sup> $p < .05$  (one-tail test); \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$  (two-tail test).

hypothesized curvilinear, inverted-U effect of network centrality (Model 1). Contrary to our hypotheses, however, cross-gender friendships have no significant effect on cross-gender aggression. Also contrary to our expectations, school gender segregation significantly increases cross-gender aggression. Compared with students in an average school, students in a school that is .1 points higher on gender-segregation are approximately 17

percent more aggressive toward the other gender (Model 2).

Finally, we test the three-way interaction between centrality, cross-gender friendships, and gender segregation (along with all possible two-way interactions). Again, we note that caution is in order due to the relatively small number of cases involved. However, we again find support for the gender bridge hypothesis: the positive effect of centrality



**Figure 3.** Predicted Rate of Same-Gender Aggression, by Centrality, Gender Segregation, and Cross-Gender Friendships

on cross-gender aggression is significantly magnified for gender bridges (Final Model). The joint effects are plotted in Figures 4a to 4c and are quite similar to those shown in Figures 3a to 3c (although predicted rates of cross-gender aggression are substantially lower).

In schools with average levels of gender segregation (see Figure 4a), the effect of centrality is virtually identical for adolescents regardless of the number of cross-gender friendships they have. For both groups, cross-gender aggression is predicted to be more than two times as high for students near the pinnacle of the social hierarchy, compared with those at the bottom. As school gender segregation increases (see Figures 4b and 4c), however, centrality begins to have a strong positive effect on the aggressive behavior of youth with multiple cross-gender friendships, while having a diminishing—and ultimately negligible—effect on their schoolmates. Gender bridges have predicted rates of cross-gender aggression that are several times greater than comparably central students. For example, when gender segregation equals .2 and centrality equals 3.0, predicted cross-gender aggression for youth with multiple cross-gender friends is 1.79, compared with .55 for equally central classmates without friends of the other gender. Our results are strikingly similar for same- and cross-gender aggression—network centrality generally increases aggression, especially for gender

bridges, until the very highest levels of centrality are attained.

A few control variables merit attention, particularly gender. In contrast to same-gender aggression, females are just 73 percent as aggressive toward males as males are toward females. Other results are consistent across both outcomes: youth who are involved in dating are 23 percent more aggressive toward the other gender, compared with students who had never been on a date. We also find higher rates of cross-gender aggression among youth whose friends are aggressive. However, we find no significant differences based on family background or other control variables.

We illustrate the actual aggressive and friendly relations of gender bridges (see Figure 5) using friendship and aggression relations (both from the fall) in a highly gender-segregated network of 8th graders (Freeman segregation index = .83). Although there are some cross-gender friendships, students are strongly clustered according to gender. The gray nodes represent students with cross-gender friendships and high centrality scores. As the dark lines suggest, these gender bridges are deeply embedded in the aggression network.

### MODEL ROBUSTNESS

For each of the preceding analyses, we had a number of methodological concerns



**Table 4.** Random Effects Negative Binomial Regression of Opposite-Gender Aggression, with School Intercepts, Spring 2005 (Time 2)

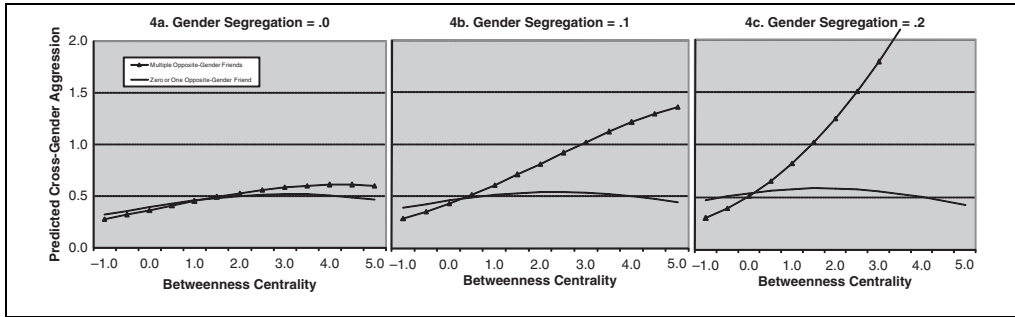
	Model 1		Model 2		Final Model	
	$\beta$	SE	$\beta$	SE	$\beta$	SE
Female	-.32***	.09	-.31***	.09	-.31***	.09
Centrality	.16***	.05	.16***	.05	.18***	.05
Centrality squared	-.02*	.01	-.02*	.01	-.03**	.01
Multiple cross-gender friendships			-.02	.11	-.08	.12
School gender segregation			1.56*	.65	1.58*	.72
Multiple cross-gender friendships $\times$ centrality					.07	.07
Gender segregation $\times$ centrality					-.40	.43
Multiple cross-gender friendships $\times$ gender segregation					.16	2.37
Multiple cross-gender friendships $\times$ gender segregation $\times$ centrality					1.70*	.79
Friends' average aggression	.13*	.06	.13*	.06	.13*	.06
Has been on a date	.20*	.09	.21*	.09	.21*	.09
GPA	.06	.05	.05	.05	.06	.05
Sports	.12	.09	.11	.09	.11	.09
Pubertal development	-.12	.08	-.12	.08	-.13	.08
Cross-gender aggression, fall 2004 (Time 1)	.47***	.04	.47***	.04	.47***	.04
African American	.15	.10	.14	.10	.14	.10
Latino	-.19	.22	-.23	.23	-.20	.23
Other minority	-.17	.19	-.17	.19	-.23	.19
Grade 9	-.11	.14	-.11	.14	-.12	.14
Grade 10	.04	.14	.05	.14	.05	.14
Single-parent home	.06	.09	.07	.09	.07	.09
No parent attended college	-.06	.09	-.06	.09	-.06	.09
School size (hundreds)	-.03	.02	-.03	.02	-.03	.02
Constant	-.80**	.30	-.80***	.30	-.77*	.30
Ln <i>R</i>	18.68	320.4	19.16	352.0	18.2	578.4
Ln <i>S</i>	17.95	320.4	18.43	352.0	17.4	578.4
Log likelihood	-1960.42		-1957.62		-1954.04	
Wald Chi Square ( <i>df</i> )	306.61***	(17)	312.52***	(19)	320.08***	(23)

Note:  $N = 3,722$ .

$\hat{p} < .05$  (one-tail test); \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$  (two-tail test).

regarding our measures, their empirical distributions, and the causal relationships among them. We were concerned that the effects of our variables might differ by gender, age, grade, or dating involvement, so we tested for interactions between these and our key independent variables. None are significant. Additionally, while we believe that betweenness centrality best fits our conception of social status in this context, we also

tested Bonacich centrality and friendship indegree (i.e., the number of friendship nominations received). We find the same curvilinear effect for Bonacich centrality for same- and cross-gender aggression, and (likely because of its more limited distribution) a linear but positive effect of indegree for both forms of aggression (see Table S1 in the online supplement [<http://asr.sagepub.com/supplemental>]). Our most important



**Figure 4.** Predicted Rate of Cross-Gender Aggression, by Centrality, Gender Segregation, and Cross-Gender Friendships

results are relatively robust to the choice of centrality measures.

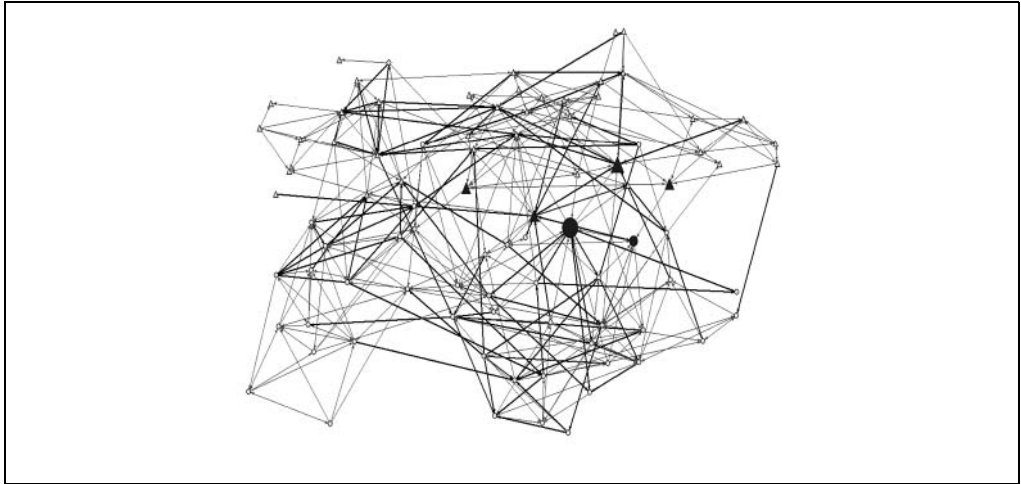
Furthermore, it is possible that aggression and friendship coincide (at least within the three-month period the measures reference), and moreover, that such aggression may differ in meaningful ways from non-friend aggression. We find that a small percentage of aggressive behavior (less than 7 percent) occurred within friendships, and we find no substantive differences if we exclude these joint friend–aggression relationships.

It is also possible that the curvilinear effects in our models are an artifact of the highly skewed centrality distribution.<sup>16</sup> We examine that possibility by excluding all cases in which centered betweenness is greater than 2 (the top 7 percent of the distribution) and reanalyzing the data. We continue to find significant negative coefficients for the quadratic terms for all three aggression outcomes (i.e., same-gender, other-gender, and overall aggression). Again, we find the same inverse-U result if we use Bonacich centrality, which is substantially less skewed. We do truncate the range of centrality in our figures (cutting off at 5 on the mean-centered score, when the maximum observed is 12), because the data are so sparse at the upper extreme.<sup>17</sup>

In a similar vein, we were concerned about influential outliers. As mentioned earlier, we did find at least five influential cases that, if included in the model of

same-gender aggression, reduce the three-way gender bridge interaction as well as the squared term of centrality to nonsignificant levels. These five cases are predominantly female (four of five), minority (four of five), and athletes (all five), and are highly aggressive (on average, 10 times the sample mean) and highly central (at the 97th percentile or above). These cases represent substantively interesting exceptions to our argument regarding desistance at the pinnacle of the social hierarchy. Additionally, one of the schools is an outlier with respect to gender segregation, with a value of .98 on a scale of  $-1$  to  $1$ , indicating that cross-gender friendships were nearly nonexistent. Dropping this school does not affect the results for cross-gender aggression, and it only marginally affects the results for same-gender aggression (the three-way interaction term’s significance falls to  $p < .05$  with a one-tail test).

Fundamentally, we were also concerned with the complexity of estimating a three-way interaction effect (along with the corresponding set of two-way interactions), so we tested our gender bridge hypothesis by stratifying the sample based on school gender segregation. We initially divided the sample into three categories—high (approximately the top 15 percent of the gender-segregation distribution), medium (the middle 70 percent of gender segregation), and low (the bottom 15 percent)—but the results



**Figure 5.** Gender Bridges, 8th Grade Network

Note: Circles = males; triangles = females; black lines = aggression; gray lines = friendship; gray nodes = gender bridges (three-way interaction > 1).

are identical for the latter two groups, which we merged. We find that the two-way interaction between centrality and having multiple cross-gender friendships is significant and positive in the high-segregation schools for both forms of aggression, as we hypothesized (see Table S2 in the online supplement). This instills greater confidence in our results for the three-way interaction in the full sample.

We originally used the percentage of other-gender friends for our measure of cross-gender friendships, but because the results are substantively similar we switched to the binary measure to simplify interpretation of the interaction effects. The binary measure, however, does not entirely resolve an additional concern: arguably, a student who exclusively nominates other-gender friends may cease to act as a gender *bridge*. Very few individuals ( $n = 22$ ) exclusively nominated other-gender friends, and our results do not change if we drop these cases or replace our current indicator variable with one for having between two and four cross-gender friendships. However, a model with an indicator for having at least one (instead of multiple) cross-gender friendship is not significant.

This confirms that having multiple cross-gender friendships is central to the concept of a gender bridge.

Although the sample we use is relatively large, it is not sufficiently large or diverse enough to instill complete confidence in the three-way interaction. We tested the gender bridge interaction in multiple ways, but future research is necessary to determine if the finding is idiosyncratic. In the meantime, we observe that the scarcity of socially prominent gender bridges, who likely comprise a tiny fraction of any sample of youth, belies their potential substantive importance—it is possible for a small number of aggressive youth to wreak havoc on the lives of their peers.

Finally, although our lagged models alleviate concerns about causal direction, it is possible that omitting contemporaneous centrality (e.g., centrality in the spring, or Time 2) biased our results. However, controlling for centrality and centrality squared in the spring (which are statistically significant coefficients, in the same curvilinear fashion) does not substantively change the effect of centrality or centrality squared in the fall. To further investigate the possibility of reverse causal order

with respect to our main hypothesis, we estimated a Seemingly Unrelated Regression (SUR) of two equations (Felmlee and Hargens 1988), one for change in aggression and one for change in network centrality (see Table S3 in the online supplement). We find no evidence of reverse causality, that is, there is no significant effect of overall aggression at Time 1 on centrality at Time 2.<sup>18</sup> Additionally, allowing the errors of the dependent variables to correlate does not influence the results.<sup>19</sup>

## DISCUSSION AND CONCLUSIONS

Peer status among adolescents tends to relate to a variety of positive outcomes involving school (Parker and Asher 1987), social adjustment (Gest, Graham-Bermann, and Hartup 2001), and physical and mental health (Almquist 2009). There are some exceptions, however, such as disadvantaged, high-status boys in violent groups, who are at elevated risk for dropping out of school (Staff and Kreager 2008). Here we document a link between relatively high levels of peer status, as reflected by network centrality, and another negative result—aggressive behavior. Our findings contribute to a small body of work that documents the problems associated with peer status among youth. Our results underscore the argument that attaining and maintaining group status likely involves some degree of antagonistic behavior, perhaps enacted in combination, or in a cyclical fashion (Adler and Adler 1995), with more cooperative and prosocial actions.

Our findings stand in contrast to prevailing themes in the literature on bullying and aggression, and suggest that aggression is not primarily a maladjusted reaction from socially marginal or psychologically troubled adolescents. Rather, aggression is intrinsic to status but in a nonlinear fashion. Individuals at the bottom of the status hierarchy do not have as much capacity for aggression, while those at the very top do not have as much

cause to use it. But for the vast majority of adolescents, increases in status are, over time, accompanied by increases in aggression toward their peers. While we differentiate aggression victims according to their gender in relation to their attackers, we find very few differences. For the vast majority of youth who are somewhere below the pinnacle of a school's social hierarchy, centrality increases adolescents' aggression toward peers of their own and the other gender.

In general, increases in centrality are met with decreases in aggression only for individuals who already occupy the core of a school's social system, that is, students who arguably have less need for aggression as an instrument for social climbing. The question of whether aggression *works*—whether and how it increases status—is beyond the scope of this article (it is the subject of ongoing research), but we suggest that for status to influence aggression, it is sufficient that youth *believe* it does. We also note that our theoretical model does not apply without exception. For same-gender aggression especially, a few highly central youth maintain unexpectedly high levels of aggression. It is conceivable that for these youth, aggression is less of a means to an end than an end in itself, providing entertainment at others' expense.

Much research on aggression focuses on the role of gender, generally on whether girls and boys are aggressive at different rates, or in different ways, but also occasionally on whether predictors of aggression operate differently by gender. We find some expected gender differences: compared to boys, girls are less often physically aggressive (in the cross-section) and more frequently indirectly aggressive. Girls are also less likely to aggress against boys than boys are to aggress against girls. However, most of these differences are modest, and overall rates of aggression are equivalent by gender. Furthermore, we find no evidence that the factors predicting aggression operate differently for girls versus boys.

Instead, we find that gender relationships, and the gender environment, strongly influence

aggression. This underlines arguments that stress the social relational and contextual nature of gender (e.g., Felmlee 1999; Ridgeway and Correll 2004). In particular, cross-gender friendships—at either the school or the individual level—decrease aggression. However, in schools where cross-gender friendships are rare—and arguably, status markers—these relationships magnify the link between peer status and aggression. Our results suggest that gender bridges—that is, youth with multiple cross-gender friendships in schools where such ties are scarce—who are also socially prominent are particularly aggressive toward classmates of their own and the other gender. Romantic interests likely play a role in this process, and dating involvement increases aggression. Status and gender context effects hold, however, regardless of whether a student had ever dated and are not moderated by dating status.

Almost as noteworthy as these core findings are the findings that did not emerge. Youth from single-parent households are no more aggressive than others. Students whose parents have low levels of education are significantly less aggressive. While Latino students are more aggressive toward their same-gender classmates, there are no differences between whites, African Americans, and other minority students. Grade in school matters only for physical aggression. Academic achievement and sports participation—the competing purposes of high schools, according to Coleman (1961)—also have little effect on aggression, with the latter modestly increasing overall and verbal aggression. Pubertal development, generally thought to increase aggression, has no effect.

From a practical standpoint, our results have several implications for bullying prevention efforts, which currently fail to show substantial or lasting improvements (Merrell et al. 2008). Such interventions should adopt an expanded view of aggression that includes more subtle and insidious forms of harassment. Fundamentally, these programs should consider how aggressive behaviors are rooted

in status processes. Status is the culmination of patterns of relationships and evaluations of peers, and intervention strategies might succeed by focusing not on bullies or victims, but on the audience for aggression. Interventions may have a better chance of success if bystanders scorn aggression instead of being impressed or entertained by it.

Among the strengths of this study is its use of a broad, relational measure of aggression, which allows consideration of new questions as to who targets whom. We also take advantage of a longitudinal data framework, and we tested our findings under a variety of specifications. Nonetheless, there are substantial limitations. This study is based on a sample of small-town and rural North Carolina students and may not be generalizable to other populations. We consider the consequences of status over the course of just one academic year, and we do not consider long-term status trajectories. On the flip side, our study does not examine shorter-term events that may have substantial consequences—one week in a teenager's life can bring dramatic social successes and failures. We take up the former question in ongoing research, but our data do not allow consideration of the latter.

In summary, we focus on aggression as the outcome of social interactions in which individuals routinely vie for status, influence, and power. Our findings call into question several traditional assumptions, including the argument that isolated individuals on a group's fringes are the most likely to behave aggressively. Instead, aggression remains most common among centrally located students, with the exception of the few at the very top of the hierarchy. Moreover, we find that social factors at the dyad, group, and school level all powerfully shape harmful behavior in a school setting; these factors include the aggressive behavior of an adolescent's friends, location in the friendship hierarchy, and patterns of relationships between the genders in a school. Our results suggest that future research would benefit from further investigation of the social context of

aggression, with particular attention to the link between status and violence.

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## Notes

1. We avoid the term “bullying” for two reasons. First, there is considerable confusion concerning the definition of bullying (Espelage and Swearer 2003). Second, the most commonly used definition restricts bullying to repeated harmful behavior directed toward another person who is less powerful (Olweus 1993). This is problematic for our purposes because it prevents empirical examination of the relationship between aggression and power by including the latter in the definition of the former. Additionally, it unnecessarily excludes actions like spreading a single, devastating rumor.
2. Definitions of these three terms vary; for example, indirect aggression has been defined as social manipulation, whereas relational aggression has been defined as behavior intended to harm a person’s friendships or social standing (Crick and Grotpeter 1995). Empirically, however, there is insufficient difference to justify distinctions between them (Archer and Coyne 2005).
3. This power is attributable to the students’ individual positions and characteristics, but it is also due in part to context: the “caged environment” (Martin 2009) of school prevents the weak from escaping. Whatever the source, few adults are similarly circumstanced—how many adults would be able to drive a colleague to suicide?—leading to the counterintuitive conclusion that adolescents may have more power than adults.
4. Compared with asymmetric role relationships (e.g., bosses and workers), Gould (2003) finds that homicide is more common in symmetric or ambiguous role relationships (e.g., friends, or a worker who is older than her boss) because they provide mixed or no indications as to relative status, leaving participants to sort it out for themselves. In such relationships, seemingly trivial disputes hold great significance because they signal lasting—and intolerable—claims of dominance.
5. For instance, recent research shows that heterosexual romantic relationships are characterized by significantly more negative interactions than are same-gender friendships (Kuttler and La Greca 2004), that girls often face ostracism as a result of gender double standards (Kreager and Staff 2009), and that boys experience significant insecurity in dating relationships (Giordano, Longmore, and Manning 2006).
6. Research on heterosexual dating violence, however, often finds that females physically attack their partners more frequently than do males, although males do more serious damage (Foshee 1996; Malik, Sorenson, and Aneshensel 1997).
7. Direct observation shows that females are more likely than males to engage in indirect aggression (Archer 2004), but gender stereotypes may bias such results (Giles and Heyman 2005). When studies use peer- or self-reports, gender effect sizes are much smaller (Card et al. 2008; Espelage and Swearer 2003; Rhys and Bear 1997) or reversed (Tomada and Schneider 1997).
8. We do not use data from subsequent waves because one school district dropped out of the study (due to events unrelated to the project) and because of complications associated with changes occurring between school years (especially 8th graders moving into high schools).
9. This decision rule is appropriate not only because of underreporting concerns, but because one party’s failure to agree on the nature of the relationship is not necessarily a denial. With a restriction on the number of possible aggressors and victims a respondent can nominate (i.e., five each), the number six victim would not be nominated by the aggressor, but the aggressor might nonetheless be the primary aggressor for victim six.
10. The advantage of betweenness over Bonacich for our purposes is made clear in the case of hangers-on, or unpopular students who have one friend (perhaps aspirational and unreciprocated) who is highly popular. Such a person would receive a substantial boost in Bonacich centrality. Because hangers-on do not create a bridge between any given pair of their peers, their betweenness centrality is zero, a score we contend is appropriate for their vulnerable and low-status positions in the hierarchy. The primary scenario where betweenness centrality might not conform to general understandings of status occurs when an actor has two ties that connect large, dense, and otherwise disconnected groups. However, all school friendship networks in these data consist of a single, large component, with

- a small number of isolated individuals and dyads, so this scenario does not apply here.
11. We do not control for the number of friends because this is already implicated in the measure of centrality, and it would complicate interpretation. When added to our models, number of friends does not have a significant effect on any outcome, nor does it substantively change our results.
  12. In analyses not shown here, we controlled for measures of anxiety, depression, and anger. Only one of these variables is significant in just one model (i.e., anxiety has a marginally positive effect on same-gender aggression), and their inclusion does not affect the size or statistical significance of the substantive variables. We do not include them, however, because of their relatively high rate of missingness.
  13. We also estimated zero-inflated negative binomial models. Convergence occurs only in models with basic demographic information in the zero equation, and few of these variables increase the likelihood of a zero score. No substantive changes occur in the other independent variables.
  14. These five outliers are highly aggressive (approximately 10 times the sample mean for both measures of aggression) and highly central (all at the 97th percentile or above). Including these five influential cases decreases the effect of centrality squared on physical and indirect aggression to non-statistically significant levels.
  15. We generate predicted same-gender aggression levels for the modal/mean values (8th grade white females with two parents, at least one of whom attended college, and who play sports and date and are otherwise average for continuous variables). We do not include the extremes of centrality and school gender segregation in the figures—the observed maxima of which are 11.8 and .38, respectively (with grand-mean centering)—because observations are relatively sparse at those levels.
  16. Although we did not anticipate that the squared term for centrality would vary based on patterns of friendship across gender lines, we nonetheless tested for interactions between centrality squared and the other variables implicated in the gender bridge hypothesis. None are significant; they generate multicollinearity problems, so we dropped them from the analysis.
  17. At the other extreme of centrality, less than 2 percent of the 4,266 adolescents (who participated in both waves of the survey) were isolates. Because these cases are missing data on other independent variables, we exclude them from the analysis. However, substantive results do not change if missing data for all eligible cases are imputed and isolates are included in the analysis (along with a binary indicator for isolate, which is not significant).

18. The effect of aggression on centrality is the subject of ongoing research and beyond the scope of this article, but preliminary results suggest that the effect depends in great degree on target characteristics.
19. In the SUR, none of the aggression measures at Time 1 (i.e., overall aggression, same-gender aggression [SG], or cross-gender aggression [OG]) have a significant effect on centrality at Time 2. At the same time, the centrality measures continue to have the expected relationships to change in aggression, although the statistical significance of three of the six substantive variables (i.e., the three-way interaction in models of OG aggression, and centrality and centrality-squared in SG aggression) drops to  $p < .05$  levels in one-tail tests. However, the drop in significance is exclusively because SUR treats these outcomes as continuous rather than count variables, and not because of bias caused by error correlation. Compared with independent OLS regressions, the results are identical when the errors are allowed to correlate in SUR. Ongoing research suggests that aggression does enhance social status under certain conditions; its effect depends on target characteristics that are beyond the scope of this article.

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- Robert Faris** is Assistant Professor of Sociology at the University of California-Davis. His current research focuses on networks of aggression and violence and their relationship to geography, racial segregation, and other dimensions of social structure.
- Diane Felmlee** is Professor of Sociology at the University of California-Davis. Her current research focuses on the role of the social network environment in interpersonal relationships and on the study of dyads as evolving, interdependent, dynamic systems.