The Embeddedness of Adolescent Friendship Nominations: The Formation of Social Capital in Emergent Network Structures

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Abstract

Although research on social embeddedness and social capital con-firms the value of friendship networks, little has been written about how social relations form and are structured by social institutions. Using data from the Adolescent Health and Academic Achievement study and the National Longitudinal Study of Adolescent Health, the authors show that the odds of a new friendship nomination were 1.77 times greater within clusters of high school students taking courses together than between them. The estimated effect cannot be attributed to exposure to peers in similar grade levels, indirect friendship links, or pair-level course overlap, and the finding is robust to alternative model specifications. The authors also show how tendencies associated with status hierarchy inhering in triadic friendship nominations are neutralized within the clusters. These results have implications for the production and distribution of social capital within social systems such as schools, giving the clusters social salience as "local positions."

Together, theories of social embeddedness and social capital have contributed to a rational analysis of the value of resources that inhere in social relations. Over a quarter of a century ago, Granovetter 1985 forcefully argued that economic transactions cannot be reduced merely to monetary rewards and costs as actors attune their economic exchanges to the social relations in which the exchanges are embedded. Others such as Coleman (1988), Portes (1998), and Lin (1999, 2001) characterized the potential value of resources inhering in social relations as social capital. The flow of resources through social relations can give individuals competitive advantage (e.g., Burt 2000, 2005) and make systems more dynamic, reducing the need to rely on more formal (e.g., legal and market) institutions (Coleman 1990, 1990). Subsequently, social capital has proven a critical factor for individual educational, occupational, and health outcomes Granovetter 1973; Bian 1997; Marsden and Gorman 1998; Uzzi 1999; Berkman and Glass 2000; Burt 2000; Erickson 2001; Frank et al. 2008) as well as systemic performance (Putnam 2000; Bryk and Schneider 2002).

While theories of embeddedness and social capital have contributed to a rational analysis of the value of resources that inhere in networks, less attention has been paid to the rational analysis of the formation of the relationships, such as friendships, over which resources might flow. Certainly, friendships are inclined to follow the principle of homophily—birds of a feather flocking together (e.g., Lazarsfeld and Merton 1954; Blau 1977; McPherson, Smith-Lovin, and Cook 2001). Homophily can be based on background characteristics (e.g., race, gender, or socioeconomic status) or on a broader range of tastes and preferences. These shared characteristics can increase the chances a friendship overture will be reciprocated and therefore reduce the transaction costs of identifying potential friends.

But identifying potential friends is not purely a function of individual action, as opportunities to interact can be constrained by social context. For example, Zeng and Xie (2008) demonstrated how adolescents exercised preference racial homophily given constraints in opportunities for interaction structured by grade levels in school. Similarly, Kossinets and Watts (2009) found effects of homophily based on college students' choices as well as homophily induced by structural constraints in e-mails and courses.

The contrast of agency and constraint harkens to classical tensions in theories of individual and society (e.g., Parsons 1949; Wrong 1961; Durkheim 1964, 1965, 1966; Giddens 1982, 1984; Sewell 1992). In this study, we extend this literature by examining how social relations are embedded within social structures that emerge as individuals participate in events. In particular, we study how adolescent friendship nominations are embedded in social structures that emerge through the pattern of adolescent course-taking in high school. Anticipating our key results, we find first that new friendship nominations are more likely to be made within clusters of students who take sets of courses together than between the clusters. Second, we find the tendency for status hierarchies associated with patterns in triadic friendship nominations to be reduced within coursetaking clusters. These findings, combined with Frank et al.'s (2008) findings that girls conformed to the norms of math coursetaking within their clusters, give the clusters social salience as "local positions."

In the next section, we present theory based on the value and transaction costs of identifying potential friends in adolescence. We then describe the nationally representative National Longitudinal Study of Adolescent Health (Add Health) and Adolescent Health and Academic Achievement (AHAA) data and measures we will use, including information about friendship nominations, coursetaking, local positions, and other factors affecting friendship formation (e.g., race, activity participation). After specifying models that account for complex dependencies in social network data, we present our results, compare the estimated effects of local positions on new friendship nominations against other estimated effects, and estimate the sensitivity of our inferences to model specification. Furthermore, we explore the extent to which local positions reduce effects of triadic patterns of friendship nominations associated with status hierarchy. In the discussion we comment on how social structures can generally emerge through individual participation in events or venues, with implications for the production and distribution of social capital within social systems such as schools.

THE VALUE AND TRANSACTIONS COSTS OF IDENTIFYING POTENTIAL FRIENDS IN ADOLESCENCE

Friendship nominations can serve two key functions related to social capital in adolescence. First, adolescents may conform to the norms of those whom they consider friends (Cook, Deng, and Morgano 2007). For example, female adolescents are especially likely to share a common attitude toward delinquency and academics with those whom they nominate as friends (Crosnoe, Cavanagh, and Elder 2003; Carbonaro and Workman 2013). Adhering to the norms of a network allows one to maintain standing in the network. Second, adolescents may provide resources such as help with homework, knowledge about opportunities, and emotional support to those whom they consider friends (Alfassi 1998; Fuchs, Fuchs, and Kazdan 1999; Way and Chen 2000; Crosnoe et al. 2003; Chu 2005; Stanton-Salazar and Spina 2005; Riegle-Crumb, Farkas, and Muller 2006).

Note that in each of the above examples it is the recipient of the friendship nomination who benefits. Recipients of friendship nominations can exert conformity pressure on others, and recipients of nominations can receive resources from others who consider them friends. As a consequence, the directionality of friendship nominations opens the possibility for opportunism and malfeasance (Granovetter 1985, p. 492; Hawley 1999; Hawley, Little, and Pasupathi 2002) as the provider of the resource may engage in a relaxed accounting (Lawler and Thye 1999, p. 232) without immediate reciprocity (La Ferniere and Charlesworth 1987; Coleman 1990).

Given the advantages of receiving nominations, it is not surprising that adolescents exert large amounts of effort and emotional energy to the pursuit of popularity and social status (e.g., Coleman 1961; Eder 1985). But the process of attracting friendship nominations is not always straightforward. Those who seek high status by joining a high-status group may find themselves exerting extreme effort to conform to norms in a group in which they do not easily fit (e.g., Akerlof and Kranton 2002). And adolescents who seek status by initiating many friendships may find that their overtures are not always reciprocated, making the initiator of friendships vulnerable (we will elaborate on contexts that reduce this vulnerability below). This vulnerability in forming new friends may be especially salient for adolescents who control little else in their everyday lives (e.g., Milner 2006) and for whom identity is just forming (Erikson 1959; Coleman 1961; Douvan and Adelson 1966; Czikszentmihalyi and Larson 1984; Giordano, Cernkovich, and Pugh 1986; Kinney 1993; Crosnoe 2000).

Given the challenges to initiating a friendship, we address how adolescents can draw on shared activities to reduce the transaction costs in identifying potential friends. Such activities attract adolescents who have similar interests and attributes and who may have similar values and preferences (Moody 2001). Furthermore, these shared interests increase the chances of reciprocity (Hartup 1993).

A mutually chosen activity also reduces the vulnerability of initial overtures because the activities provide opportunities to observe and initiate interaction (Leifer 1988, p. 867). Furthermore, an adolescent who is rebuffed can quickly retreat into the experience of a

shared activity (Werner and Parmelee 1979; Berndt 1982; Berndt and Murphy 2002). Friendships may also simply emerge during an activity without specific overtures and reciprocity, as individuals become emotionally attached to interactions during participation in the activity (e.g., Lawler and Yoon 1996, 1998). Thus shared activities establish a setting, or context (Leifer 1988), allowing adolescents to explore pools of potential friends beyond their closest circles (Hartup 1993; Barber, Eccles, and Stone 2001).

While extracurricular activities such as sports or the arts may attract adolescents with common interests (and we will test such effects in our data), each extracurricular activity pertains only to subsets of students for specific periods during the day and specific intervals during the school year. In contrast, academic courses constitute settings that apply to every student throughout the academic year. Consider that the typical adolescent will spend approximately 1,000 hours a year in academic courses, roughly double an intensive extracurricular activity that meets an average of 10 hours a week across the whole year. Thus coursetaking constitutes a potentially profound but understudied force affecting friendship nominations in adolescence (for an exception, see Kubitschek and Hallinan [1998]).

We will focus on effects of coursetaking as part of a complex emergent social organization in adolescence (Hartup and Stevens 1997; Maroulis et al. 2010). The pattern of course participation is epitomized in the academic tracks (e.g., college preparation, general, vocational) that once dominated American high schools (Oakes 1985; Gamoran 1987; Lucas 1999). But contemporary schools have been detracked, as students are less likely than previously to be assigned to a single level across subjects (Stevenson, Schiller, and Schneider 1994; Friedkin and Thomas 1997; Oakes, Wells, and Jones 1997; Lucas 1999), and direct associations between track placement and background may not pertain (Davis 2012). Although considerable vestiges remain from tracking concerning academic effort (Carbonaro 2005) and course choices (Yonezawa, Wells, and Serna 2002; Mickelson and Everett 2008), tracks are insufficient to characterize the social organization of the contemporary American high school.

The wane of formal tracking has created a vacuum of conceptualizations of the social organization of the school in general and of patterns of coursetaking in particular (see Sorensen's [1970] prescient description of the dimensions of the social organization of schools). Here we suggest that there are still patterns, but they are emergent. These patterns are generated by latent constructs of student interest and are constrained by master schedules that block students on the basis of availability of teachers and classrooms (Riehl, Pallas, and Natriello 1999; Pittinsky 2008).

Local Positions as Pools of Potential Friends

Our challenge then is to characterize how coursetaking patterns are structured within schools to facilitate friendship nominations. Here we turn to Frank et al.'s (2008) local positions, defined as a set of students who attend a set of common courses. To gain an intuitive feel for local positions, consider the sociogram in figure 1 representing local positions in Miller High School, a moderate-sized rural public high school in the Midwest. In this sociogram,

lines indicate courses (the squares) taken by adolescents (the dots) and the boundaries of the local positions are represented by ovals containing both adolescents and courses.[2]

Figure 1 shows nine local positions. For example, local position F contains five sampled students and is focused around English 3, Woodworking, and Desktop Computers. The multiple foci in each local position extend Feld's (1981) concept of focus. In Feld's conceptualization, each group is organized around a single focus, with weaker foci integrating between groups. In contrast, local positions are defined by sets of students who take a *set* of common courses. As such, local positions represent the overlapping social circles that form a basis of identity (Simmel 1955). But these structures are not deterministic, as students also took courses outside of their local position. For example, many members of local position F took U.S. History, a focal course of local position C.

Given that each local position contains, on average, seven sampled students representing 70 students in the school (Frank et al. 2008), local positions are defined roughly at the level of the crowd (e.g., Brown, Eicher, and Petrie 1986; Eckert 1989; Brown 1990; for a review, see Kindermann and Gest [2009]). In this sense, local positions represent a finer-grained characterization of the social organization of the school than academic tracks (Oakes 1985; Gamoran 1987; Lucas 1999). For example, members of local positions E and H might both represent the college prep track (Hallinan and Sorensen 1985; Kubitschek and Hallinan 1998), but focused around Advanced Biology and Calculus (in local position H) and Genetics and Analysis (in local position E).

The multiple foci of the local positions make local positions important pools of potential friends. First, the foci represent multiple shared interests, increasing the probability that friendship overtures will be reciprocated. Second, sets of adolescents participating in multiple common courses are more likely to share transitions between courses during which they make collective sense of their experiences (e.g., Crosnoe 2011). Third, the focal courses contribute to in- versus out-group distinctions that can shape identity and friendship choices (e.g., Tajfel and Turner 1979; Palmonari, Pombeni, and Kirchler 1990; Shayo 2005). For each of these reasons the foci of the local positions can reduce the transaction costs of identifying potential friends.

Although each of the above effects pertains to pairs of adolescents who take courses together, each may be enhanced within local positions that contain *sets* of students who take sets of courses together. When a pair of adolescents who are members of the same local position encounter one another in courses, during transitions between courses, or are differentiated from others in the school, there are third parties who enhance the experience because they are also members of the same local position. These third parties can broker introductions (Burt 2005), enforce norms (e.g., Simmel 1950; Coleman 1990; Raub and

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[2]Each sample adolescent (indicated by a dot) represents approximately 10 students in the school. To protect the identity of the school and thus confidentiality, we have not reported actual numbers of adolescents, although the number of sample adolescents in each local position and the number of courses taken by the members of each local position reflect rough percentages. Only percentages above 9% are represented. Furthermore, the numbers of members of the largest local positions were reduced for aesthetic purposes: A, from 37 to 10; B, from 25 to 10; C, from 16 to 8; and D, from 18 to 9.

Weesie 1990; Bendor and Swistak 2001), or contribute to the perception of an entity distinct from others in the school (Freeman 1992).

Each of the effects of third parties described in the previous paragraph can contribute to the salience of local positions as groups representing more than an aggregate of dyadic phenomena. As such, the local position memberships can serve as an efficient signal to reduce the transaction costs of identifying potential friends. This generates our first hypothesis.

HYPOTHESIS 1.—Adolescents will be more likely to nominate members of their local positions as new friends than to nominate others in their school as new friends.

If hypothesis 1 holds, it would represent a unique contribution of this study by establishing how friendship nominations are embedded in emergent social structures defined by coursetaking. These friendship nominations can then shape the distribution of social capital within schools.

Microfoundations of Status Hierarchies

A second implication of the potential salience of local positions as groups is that members within a local position may have equal potential as friends, regardless of specific microsocial relations in which a pair of adolescents is embedded. One of the strongest tendencies in microsocial relations is for actors to seek transitivity (e.g., Cartwright and Harary 1956; Davis, Holland, and Leinhardt 1971; Granovetter [1973, p. 1377] argues that this is especially true if the relations are strong). These findings suggest that if Lisa nominates Sue as a friend and Sue nominates Ashley (Lisa → Sue → Ashley), then Lisa is more likely to nominate Ashley than others in the social system (as shown on the left side of fig. 2).

An actor such as Lisa may seek to complete transitivity for two reasons. First, Lisa may contribute to her psychological well-being by balancing her own nominations and those of her friend Sue (e.g., Heider 1946). Second, Lisa may reduce the transaction costs of identifying a new friend by relying on the interests of someone she likes; Lisa reasons that she may like someone (Ashley) who is liked by someone she likes (Sue).

Note that the arguments for transitivity may not apply to the reverse flow: Ashley → Sue → Lisa (as shown on the right side of fig. 2). In this reverse flow Ashley is not liked by someone Lisa likes. Therefore, Lisa does not necessarily achieve balance or reduce transaction costs by nominating Ashley. Furthermore, if resources and conformity flow in the direction of the nominations, then Lisa might seek to preserve her indirect status over Ashley by resisting friendship overtures from Ashley. In graphical terms, we expect Lisa to avoid completing the cycle that would be fulfilled if Lisa nominated Ashley on the right side of figure 2.

Together, the tendency to seek to complete transitivity and avoid cycles suggests a second hypothesis:

H<small>YPOTHESIS</small> 2.—The greater the potential to complete transitivity versus cycles, the more likely one adolescent will nominate another as a friend.

If hypothesis 2 holds, it would support previous hypotheses about the microfoundations of friendship nominations. Critically, these patterns are consistent with status hierarchies at the microlevel and can accumulate to generate status hierarchies between groups based on aggregate tendencies to receive versus make nominations (Cartwright and Harary 1956; Davis 1970; Holland and Leinhardt 1981).

We now consider that if local positions are salient as groups, then the effects associated with transitivity and cycles may be neutralized within local positions (Davis 1970, p. 844). On the left side of figure 2, if Lisa identifies with members of her local position as a group, she does not need to rely on Sue to identify potential friends such as Ashley. Mere membership in the group is enough to indicate compatibility and potential af-finity. Similarly, Ashley should not rebuff a friendship overture that would complete a cycle as on the right side of figure 2 because any friend from within the group should hold equal status. We apply this logic to generate a third hypothesis:

H<small>YPOTHESIS</small> 3.—Any tendency to complete transitivity versus cycles will be reduced within local positions.

If hypothesis 3 holds, it would be consistent with membership in the local position functioning as a quasi tie (Frank 2009) because can override tendencies inhering in direct social relations (transitivity and cycles) even though membership in a local position is not a direct social relation. That is, membership in the local position can neutralize any tendency to favor particular others embedded in specific social relations over any general member of the group. We now describe the Add Health and AHAA data and network models we used to test our hypotheses.

DATA AND MEASURES

Sample

The data we use to test our hypotheses come from Add Health, a representative study of American grades 7–12 in 1994 (see Bearman, Jones, and Udry 1997). Using a stratified sampling design, we selected 80 high schools, most containing grades 9–12 but some containing grades 7 or 8, too, from a list of U.S. high schools on the basis of region, urbanicity, sector, racial composition, and size. Nearly all students in these schools (approximately 90,000) completed the in-school survey in the 1994–95 school year. Of these, 20,745 students, selected randomly (within strata) across high school (and their feeder school pairs), participated in the wave 1 in-home interview in the spring of 1995. In the spring of 1996, a total of 14,738 adolescents (excluding the wave 1 seniors) were followed up in the wave 2 in-home interview, and in 2000–2001, 15,197 wave 1 adolescents were surveyed in the wave 3 in-home interview.

Add Health has two key advantages for our analysis. First, it contains extensive network information regarding specific friendship nominations. Second, the AHAA study provides educational data for the Add Health sample (Muller et al. 2007*a*, 2007*b*). Conducted in

2001, AHAA collected the complete high school transcripts for over 12,000 members of the wave 3 sample from the approximately 1,200 high schools they last attended. In particular, we use the AHAA data to measure local positions as well as pair-level course overlap.

Because the course-level data were obtained with permissions to collect high school transcripts gathered in wave 3 of Add Health, our analytic sample was considerably reduced from the original wave 1 sample. Preliminary analyses indicate that there were few differences between the samples on a set of background characteristics.[3] The adolescents in our analytic sample may have been slightly more advantaged than the full wave 1 cohort, with reduced-form Add Health Peabody Picture Vocabulary Test (AH-PPVT) scores of 102.84 (vs. 100.72 for the full wave 1 sample) and 56% coming from two-parent families (vs. 53% for the full wave 1 sample). But demographically, the weighted wave 3 sample we used in our analysis was almost identical to the wave 1 sample, containing 12% Hispanic (in the wave 1 and wave 3 samples), 17% black in the wave 3 sample versus 16% in the wave 1 sample, and mean parental education of 2.89 in the wave 3 sample versus 2.80 in the wave 1 sample (range from 0 representing no formal schooling through 5 representing graduate training or degrees; see the technical appendix for details). Thus, the small differences in the AH-PPVT and in two-parent families were not likely large enough to make our analyses substantially misrepresent the Add Health sample, which was itself nationally representative.

Dependent Variable

New friendship nominations—Our dependent variable was dichotomous, taking a value of one if a new friendship nomination occurred in the wave 2 survey (time 2) and zero otherwise. We defined the nominations as new by removing those pairs of adolescents in which at least one nominated the other in the in-school or wave 1 surveys (time 1).[4] In this sense, we lever-age the longitudinal data in Add Health (e.g., Flashman 2012) to control for many of the factors manifest at time 1 (e.g., common neighborhood) associated with the transaction costs of identifying potential friends. This allowed us to estimate the effects of social contexts manifest within schools on friendship nominations.

To evaluate the robustness of our inferences to our definition of friendship nomination, we estimated alternative models. First, we estimated models separately for pairs in which both adolescents nominated each other and in which only one adolescent nominated the other. Second, we included pairs of adolescents who made friendship nominations at time 1, and we included in our model an indicator of the presence of at least one friendship nomination at time 1 in the model.

To test our second and third hypotheses we estimated models of directed nominations associated with potential status differences. In these models, we analyzed only pairs in which nominations were not reciprocated and therefore could be indicative of status

[3]Comparisons were made using wave 1 sample weights for the wave 1 sample and transcriptweights (from wave 3) for the study sample because transcript data were collected at wave 3.
[4]By assuming that friendships pertained if either adolescent nominated the other, the number of friendships in which an adolescent was involved was not limited by the 10 nominations available in the Add Health survey (see Moody 2001, p. 690 n. 8).

differences.[5] To be consistent with our theoretical focus on new friendship nominations, we still removed those pairs of adolescents in which there was at least one nomination at time 1.

Independent Variables

Because we wanted to capture the conditions characterizing the transaction costs of identifying potential friends in high school, the measures below were from the in-school or wave 1 surveys (time 1) in Add Health unless otherwise specified.

Local positions—We used the local positions identified by Field et al.(2006) as provided in Muller et al. (2007*a*, 2007*b*). The raw data used to identify the local positions were indicators from the AHAA high school transcripts of the courses each student took, weighted inversely proportional to course size. Field et al.'s (2006) algorithm identified local positions by iteratively reassigning adolescents and courses to maximize the increase in odds that an adolescent participated in a course within the same local position versus participating in a course outside the local position. This created local positions in which coursetaking was concentrated. Ultimately, there were 1,173 local positions nested in 78 schools. Membership in the same local position was assigned a value of one if two adolescents were assigned to the same local position in the 1995–96 school year and zero otherwise.

Homophily—It could be that local positions merely aligned with preexisting background characteristics shown to be the basis of homophily (e.g., Blau 1977; McPherson et al. 2001). To control for racial homophily, we constructed two indicators based on ethnicity (there is considerable evidence that racial effects operate differently for minorities than for whites: Hamm 2000; Zeng and Xie 2008; Kossinets and Watts 2009; Wimmer and Lewis 2010). The first indicator took a value of one if the pair of adolescents were the same race or ethnicity and neither one was white and zero otherwise. The second indicator took a value of one if both adolescents were white and zero otherwise.

To control for gender homophily, we constructed two indicators. The first indicated whether both adolescents were boys, and the second indicated whether both were girls. The null group was a pair that included one boy and one girl.

Homophily of parental education, age, and grade point average (GPA) was defined as the absolute value of the difference between the pair of adolescents. We then multiplied by negative one so that the variable represented the extent of *similarity* on the attribute. For example, the measure of similarity of parental education between Lisa and Ashley was

$$-|\text{parental education}_{Lisa} - \text{parental education}_{Ashley}|.$$

Structural constraint: formal (grade level)—Because local positions are defined by courses, they may simply represent differences in grade levels (Zeng and Xie 2008). Therefore, we controlled for the absolute value of the difference in the grade levels between the pair of adolescents. For example, if Lisa was in grade 9 and Ashley was in grade 10, the

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[5]Analytically, reciprocated nominations would offset because status difference$_{Lisa,Ashley}$ = −status difference$_{Ashley, Lisa}$.

absolute value of the difference would be one. As above, we multiplied by negative one so that the variable represented the extent of similarity in the characteristic. Note that for similarity of grade level, Zeng and Xie used an offset factor of 6, representing the number of potential courses two students in the same grade might share. We did not control for the offset term because we separately controlled for the number of common courses taken using the AHAA transcript data (see below).

Structural constraint: informal (number of indirect friendship links)—As we noted in the hypothesis development, friendships may form as a result of preexisting triadic friendship patterns. To test our first hypothesis, we followed the definition of our dependent variable to define an indirect friendship link between two adolescents as existing if the adolescents shared other friends, regardless of the direction of nominations. For example, there was an indirect friendship link between Lisa and Ashley if each nominated Sue: Lisa → Sue ← Ashley. Each of the following patterns also contributed to the number of indirect friendship links: Lisa → Sue → Ashley; Lisa ← Sue ← Ashley; Lisa ← Sue → Ashley. In alternative models of directed friendship nominations, we estimated separate effects for each of the triadic patterns above.

For hypotheses 2 and 3 we defined a directional term on the basis of the difference between potential to complete transitivity Lisa → Sue → Ashley) versus cycles Lisa ← Sue ← Ashley). We also controlled for the other two terms representing the third party as the focal point—Lisa → Sue ← Ashley (Newcomb 1961)—and as the one who joins—Lisa ← Sue → Ashley (Simmel 1950; Obstfeld 2005). We emphasize here that these shared friendship nominations were based on patterns in the time 1 data, allowing us to estimate the effect of time 1 friendship nomination patterns on new friendship nominations at time 2.

Shared activities—Although local positions are focused around courses as activities, it could be that adolescents identified new potential friends through participation in extracurricular or other activities such as sports and academic or art clubs (e.g., Schaefer et al. 2011). To measure shared participation in activities, we drew on the in-school portion of Add Health, which included information about specific activities in which adolescents participated (data regarding similar activities were not available in the wave 1 or wave 2 surveys). Following Schaefer et al., we created separate measures for shared participation in sports, academic clubs, and art clubs (see the technical appendix for details).

Course overlap—Any estimated effect of local positions on friendship nominations may be due to course overlap between pairs of adolescents. That is, an adolescent may have made a new nomination on the basis of how many courses she shared with another adolescent, regardless of whether the adolescents were members of the same local position. Our measure of pair-level course overlap was based on the number of common courses the adolescents took in 1995–96 (as provided in Muller et al. [2007*a*], 2007[*b*]). Paralleling the construction of the local positions, we used the term that weighted the courses inversely proportional to their enrollments: smaller courses counted more because they indicated a narrow interest and increased the probability of exposure (see the technical appendix for details). For alternative specifications, we also considered a measure that did not weight for course size but was simply the raw number of courses shared by a pair of adolescents.

ANALYTIC STRATEGY

Main Model

We begin by reporting descriptive statistics for all of our variables at the level of the pair of actors. The first model we estimated was[6]

$$log \left[\frac{p(\text{new friendship nomination}_{ii'})}{1-p(\text{new friendship nomination}_{ii'})} \right] = \theta_0$$

$$\text{local position} \quad (\text{primary hypothesis})$$
$$+\theta_1 \text{ membership in same local position}_{ii'}$$
$$\text{homophily}$$
$$+\theta_2 \text{ same race} \quad (\text{not white})_{ii'} +\theta_4 \text{ both white}_{ii'}$$
$$+\theta_4 \text{ both girls}_{ii'} +\theta_5 \text{both boys}_{ii'}$$
$$+\theta_6 \left(-|\text{parental education}_i - \text{parental education}_{i'}|\right)$$
$$+\theta_7 \left(-|age_i - age_{i'}| +\theta_8 - |GPA_i - GPA_{i'}|\right)$$
$$\text{structural}$$
$$+\theta_0 \left(-|\text{grade level}_i - \text{grade level}_{i'}|\right)$$
$$\text{structural constraint:informal micro}$$
$$+\theta_{10} \text{ indirect friendship links}_{ii'}$$
$$\text{shared activities}$$
$$+\theta_{11} \text{ sports}_{ii'} +\theta_{12} \text{ academic}_{ii'} +\theta_{13} \text{ arts}_{ii'}$$
$$\text{course overlap}$$
$$+\theta_{14} \text{ extent of course overlap}_{ii'},$$

where new friendship nomination$_{ii'}$ took a value of one if either i nominated i' or i' nominated i as a friend at time 2 (spring 1996) and zero otherwise. Note that we interpret our estimates as odds ratios instead of as probabilities because the probabilities were very small (about four in a thousand friendship nominations that could occur between pairs of adolescents did occur; see table 1 below).

As shown in figure 3, our model leveraged the longitudinal data in Add Health and AHAA. New friendship nominations were defined as those reported in the spring of 1996 (time 2) that were not reported in the spring of 1995 (time 1). These are posited as a function of conditions that pertained in the spring of 1995 (bases for homophily, indirect friendship links, and shared activities) as well as academic experiences during the 1995–96 school year (local position membership, grade level, and pair-level course overlap).

Accounting for Dependencies in Network Data

In estimating model (1) we recognized the potential for dependencies in net work data to compromise standard estimation approaches. Indeed there is a long history and recent developments in the specification and estimation of models of network relations (e.g., Holland and Leinhardt 1981; Robins et al. 2006, 2007; Snijders et al. 2006). At the baseline, our model accounts for differential representation of characteristics of adolescents in each school because the data consist of all possible pairs, including those who were and were not

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[6]In the model outlined below, we did not model both friend$_{ii}$, and friend$_{i'i}$, as there was only one observation for each pair of actors. We selected half of the data for which the identification number of i was greater than that of i.

friends (Zeng and Xie 2008). Furthermore, we included fixed-effects controls for schools to account for general tendencies for friendship nominations to increase or decrease in each school.

The remaining aspects of our estimation approach hinged on our control for degree distribution by including fixed effects for the number of friendship nominations in which each adolescent participated Quillian and Campbell 2003). That is, we included an indicator for whether an adolescent engaged in (nominations sent or received) one friendship nomination, another for two friendships, and so forth. We were able to implement this nonparametric control for degree distribution because of the limited range of degree in our sample (the maximum value in our sample was 18), although some of the estimates of the particular degree effects may have been misleading or degenerate because of collinearities.

Specific to Add Health, Goodreau (2006, p. 247) stated that "to capture most of the global structure for these friendships, one needed only relatively local phenomena—attribute mixing and patterns of shared partners or k-triangles." The attribute mixing Goodreau referred to is based on race and grade level, which we included in our model, and we captured the patterns of shared partners with the term representing the number of indirect friendship links. Not surprisingly, our estimated effects of same race and grade level largely confirmed those in Goodreau (2006) and Zeng and Xie (2008). Nonetheless, we are cautious in interpreting statistical significance, interpreting only estimated effects that were at least two and half times their naive standard errors, and we estimated models with alternative specifications.

Implications of the Model Specification for the Sample

Our dependent variable (new friendship nominations in time 2 from wave 2 in Add Health) and key independent variable (membership in the same local position from AHAA for the wave 3 Add Health sample) affected the sample we analyzed. Initially there were 5,706,944 (unweighted) pairs in all schools in 1994–95 in Add Health. This was reduced to 624,254 when we restricted the sample to those for which each adolescent had been assigned to a local position (eliminating those for whom we did not have transcript data or who were no longer in high school in 1995–96).

We then focused our analysis on those who experienced local positions in the tenth and eleventh grades in 1994–95 and then eleventh and twelfth grades in 1995–96 because there are fewer requirements in these grades allowing for greater differentiation of the local positions. This reduced the sample to 316,701, which we used to test hypotheses 2 and 3.

To test hypothesis 1 we analyzed the presence or absence of any nomination in the pair, regardless of the directionality of the nomination. This reduced the sample in half to 158,350. Furthermore, because hypothesis 1 concerns the transaction costs of identifying new friends, we tested it among adolescents who were unlikely to have exposure through common third parties. In particular, we removed from our data those pairs of adolescents who were members of the same small friendship cliques. These cliques were determined by applying Frank's (1995 KliqueFinder clustering algorithm to the network data of friendship nominations from the Add Health in-school and wave 1 data. The algorithm identified

roughly 3,883 groups containing an average of three to four people, with some as large as 21. Thus these were immediate friendship groups in which any pair of actors likely had exposure to one another through common friends regardless of shared courses. Ultimately, our sample for testing hypothesis 1 was 157,722.

In estimating our models we employed the weights in the Add Health data to adjust for the considerable oversampling of certain populations (Tourangeau and Shin 1999).[7] In particular, the weights reduced the leverage of data from the two largest Add Health schools, which accounted for 84% of the unweighted cases but 35% of the weighted cases.[8] Given the sampling design in Add Health and the use of the weights, our data should be representative of pairs of adolescents who were in the tenth and eleventh grades in 1994–95 and then in the eleventh and twelfth grades in 1995–96 in U.S. schools.

Alternative Specications

To evaluate the sensitivity of our inferences to model specification, we estimated the following models. Each was identical to our main model except for the changes specified (italics indicate the choice for the main model):

1. *exclusion of pairs in same friendship clique* versus inclusion of those in same friendship clique,

2. *control for degree distribution with fixed effects* versus controlling for the degree distribution using geometrically weighted degree count for alternating signed k-stars (Snijders et al. 2006),

3. *weighted for sample weights* versus unweighted,

4. controlling for the prior friendship state by removing cases with preexisting friendships versus no control for prior versus controlling for the prior as a covariate,

5. weighting pair-level course overlap for course size versus using un-weighted pair-level course overlap,

6. *friendship counted for any nomination* versus friendship nomination counted only if the nomination transcended the school boundary—indicating the potential for resource flows (e.g., emotional support) that do not necessarily pertain to school matters,[9]

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[7]We weighted by the log of the product of the weights for each member of the pair (Chantala 2001). We took the log because the distribution of weights was highly skewed, with some weights in the original product more than 13,000 times the modal weight. Such skewed weights would give extreme leverage to a small number of observations, reducing confidence in estimates. We normalized the weights to have a mean of one to preserve the original sample size.
[8]We examined whether the effects of local positions interacted with membership in either of these schools. The coefficient for school 58 was 2.268 naive SE .286 and for school 77 was .694 (naive SE .364). Neither was statistically significantly different from the baseline value for the rest of the schools (tested with interaction terms, $P > :1$). Therefore, we report results across all schools in our main results.
[9]We defined a friendship nomination as transcending the school boundary if the respondent indicated a positive response to three or more of the following conditions (see Carbonaro and Workman 2013): in the week prior to completing the survey, the respondent had been to the friend's house, met with the friend to hang out, spent time with the friend on the weekend, had talked with the friend about a problem, or had spoken with the friend on the telephone (see the technical appendix for details).

7. *friendship either reciprocated or directed* versus only directed nominations versus only reciprocated nominations.

We report the estimated effect of local positions on friendship nominations for each alternative specification, holding all other conditions constant. Furthermore, it is not clear how the alternative specifications might interact with one another. Therefore, we created an ensemble estimate from all possible combinations of alternative specifications ($3 \times 3 \times 2^5 = 288$). We synthesized the results using the HLM V-Known procedure that incorporates information about the precision of each estimate (Bryk, Raudenbush, and Congdon 2002). We also estimated a separate model that excluded local positions to ascertain the extent to which estimated effects of the covariates were reduced by adding local positions.

Microfoundations of Status Hierarchies

Following the sensitivity analyses, we evaluated hypotheses 2 and 3 on the basis of the triadic friendship patterns. To evaluate hypothesis 2 we estimated a model for directed nominations (see the description under the dependent variable for hypotheses 2 and 3). To evaluate hypothesis 3 we included an interaction between membership in the same local position and potential to complete transitivity versus cycles. As a basis for comparison we estimated similar interactions between potential to complete transitivity and dyadic course overlap, and similarities of grade level.

RESULTS

Descriptive statistics are reported in table 1. Friendship nominations were present in only 0.4% of all possible pairs in our sample. Bear in mind that the data included pairs across grades (allowing us to estimate the effects of local positions and grade level). About 14% of all possible pairs were members of the same local position.

Regarding background homophily, about 12% of pairs were the same race (not white) and about 58% of pairs were both white. Because about half the sample in each school was female (with small deviations based on our sample filters and school attrition), about one-quarter (27%) of pairs were both and about one-quarter (23%) were both boys; the remaining 50% included one boy and one girl. Parental education differed on average by slightly more than one level and age differed by a little less than one year. The mean difference in GPAs was a little less than one unit (.9), and the typical pair of students were about half a grade apart.

The average number of indirect friendship links was about 0.26 (88% had no indirect friendship links, 5% had one indirect friendship link, and 4% had two, with most of the remainder between four and 16 indirect friendship links). Regarding shared activities, the number of common sports played was about 0.11 (about 8% of pairs played one common sport and 1.1% played two common sports), about 3% shared academic activities, and about 3% shared art activities.

Average course overlap not weighted for size was about 1.22 (39% shared no courses), with adolescents in the same local position sharing about two courses and those in different local positions sharing about one course. Weighted for the sizes of the courses (see the technical

appendix for details), the average overlap was about .346 units (.76 within local positions, .28 between local positions).

As a preliminary result, the odds of a friendship nomination existing at time 2 were roughly 2.6 times greater within local positions than between local positions (this would be associated with a conventional *P*-value of less than .001). This supports the idea that local positions structure a clustering of friendship nominations. But much of the alignment between local positions and friendship nominations could be due to other factors (e.g., structural constraints) or previous friendship nominations confounded with membership in the same local position. Therefore, in table 2 we present our estimated effect of local positions on the new friendship nominations between time 1 and time 2 controlling for the covariates we outlined in the previous section.

Concerning our first hypothesis, the estimated effect of membership in the same local position on new friendship nominations was .571 (the estimate was more than four times its naive SE of .118). Correspondingly, the odds of a new friendship nomination between members of the same local position were 1.77 greater than the odds of a new nomination between members of different local positions (controlling for other factors in the model).

Consistent with previous results (e.g., Goodreau 2006; Flashman 2012; Zeng and Xie 2008), there was evidence of homophily for members of the same race (but not white), similarity of parental education, and similarity of GPA. Consistent with Zeng and Xie (2008), similarity in grade level was a strong predictor of friendship nominations (coefficient of 1.380), with a one-unit (or one grade level) increase in similarity roughly tripling the odds of a new nomination. Similarly, the number of indirect friendship links was a strong predictor of new friendship nominations. The coefficient of .224 implies that each indirect friendship link increased the odds of a new nomination by about 25%.

There was little support for the effect of participating in common activities on new friendship nominations. The coefficient for common sports played was essentially zero, and the coefficients for shared academic activities (.223) and shared art activities (.244) were nontrivial but less than twice their naive standard errors. We note, however, that the measures of shared activities were obtained from the in-school survey, and as such their effects may have been manifest and controlled for by removing friendship nominations that had already expressed at time 1. In fact, in the model in which we did not remove friendship nominations present at time 1 estimated under alternative specifications), the coefficient for common sports activities was .230, more than two and a half times its naive SE of .062.

The estimate of pair-level course overlap was about two and a half times its naive standard error, and we note that a measure of pair-level course overlap that did not weight for course sizes had a stronger effect (see the interpretation of table 3 below). Furthermore, without controlling for co-variates or prior friendship nominations, the estimated effect of pair-level course overlap was .216 (with naive SE .013).

Membership in the same local position had)a greater estimated effect on a new friendship nomination than a 1-SD increase in each of the covariates (the standardized coefficients for the continuous predictors are reported in table 2). For example, the .303 increase in log odds

of a new friendship nomination associated with a 1-SD increase in similarity of GPA is less than the estimated effect of .571 associated with membership in the same versus different local positions. The effect of the local positions is about equivalent to that of a 1-SD increase in similarity of grade level (coefficient of .569). Given the extensive controls in the model including the removal of pairs in which there was a nomination at time 1, we infer that local positions had an effect on new friendship nominations. The inference is consistent with our conceptualization of local positions as salient social entities in adolescence, above and beyond the effects of pair-level course overlap as well as many other bases of homophily among adolescents.

Alternative Model Specications

Estimates for alternative specifications are shown in table 3. For the models that used only one observation per pair, most of the estimates of the effect of membership in a common local position on new friendship nominations were comparable to, or greater than, the estimate of .571 reported in table 2. Most support our inference of an effect of local positions on new friendship nominations (based on the estimate being more than two and a half timesits naive standard error). Of particular interest, the estimated effect of local positions was especially strong in predicting new friendship nominations that transcended the school boundary (coefficient of .806, naive SE .234).

Interestingly, when we controlled for the raw count of shared courses (unweighted pair-level course overlap), the estimated effect of local positions was .335. Although this is a reduction of 40%, the estimate was still more than two and a half times its naive standard error. In this model, the coefficient for unweighted pair-level course overlap was .308 (naive SE .036). These results suggest that some of the effect of local positions may be due to the raw count of shared courses, although we do not have a theoretical explanation for why the raw count of shared courses is more potent than the count that weights inversely proportional to course size, which reflects the increased likelihood of exposure in small courses.

The estimated effect of local positions was weakest (coefficient of .240) when we controlled for the presence of prior friendship nominations rather than eliminating those pairs in which nominations were made at time 1. But the estimated effect of local positions in this model included the effect of local positions on friendship nominations that dissolved from time 1 to time 2, which may have been a function of different mechanisms (e.g., the psychological cost of a loss) than those we presented in our theory on the basis of the transaction costs for the formation of new friendship nominations. In results not reported in table 3, the estimated effect of local positions on the loss of friendship nominations for those 2,759 pairs in which a nomination was made at time 1 was –2.437 (with naive SE .188). Although less than two and a half times its naive standard error, the result suggests that the local position effect was weaker in sustaining existing friendship nominations than in facilitating new ones.

The estimated effect of local positions for only those pairs in which only one nomination was made was .611 (more than three times its naive SE of .124), and the estimated effect of local positions on reciprocated nominations was .092 (naive SE .486). Consistent with our attention to the trans-costs of identifying potential friends, the bulk of our evidence for the

effect of local positions comes from pairs in which the friendship had not necessarily matured to reciprocity.

The ensemble estimate across all 288 possible combinations of alternative specifications (weighting for precision using the HLM V-Known program) was .420.[10] This is slightly smaller than the effect we report in our analysis in table 2 (.571), but the two are not statistically different (using an SE of .120 as reported in table 2). Moreover, many of the smaller estimates pertain to questions slightly different from our focal question. For example, consistent with the results in table 3, when we controlled for the prior friendship state as a covariate, we got smaller estimates average estimate of about .26).

Micro Foundations of Status Differences (Hypotheses 2 and 3)

Results of the models of directed nominations related to hypotheses 2 and 3 are reported in table 4. Model 2 in table 4 supports hypothesis 2. The greater the potential to complete transitivity versus cycles, the more likely the adolescent was to make a new friendship nomination. For each unit increase in potential completion of transitivity versus cycles, the odds an adolescent made a new nomination increased by about 1.3 (coefficient of .289, naive SE .045).

Regarding hypothesis 3, the potential to complete transitivity versus cycles was strikingly neutralized within local positions. For pairs in different local positions the estimated tendency to complete transitivity versus cycles was .392 (naive SE .055). But for those in the same local positions the estimated effect was .392 − .318 = .074, a reduction of more than 80% (and reducing the coefficient below its naive standard error). This suggests that triadic nomination patterns were reduced within local positions, with each member of the local position equally valuable as a potential friend.[11] There was no interaction between same race (not white and the potential to complete transitivity versus cycles. But grade level worked similarly to local positions, with a 1-SD increase in similarity of grade level reducing the effect of potential to complete transitivity versus cycles by about .27 (−.547 × .500 = −.27). Thus, in their capacity to simultaneously increase likelihood of a new friendship nomination and neutralize tendencies in triadic patterns of nominations, grade levels have more of the features of groups than race. This supports attention to grade levels in shaping friendships in high school (e.g., Zeng and Xie 2008). Nonetheless, grade levels are cross-cut and subdivided by emergent local positions whose effects are comparable to those of grade levels.

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[10]The estimated effects of local positions were small and the naive SEs large when modeling only reciprocated ties, which were fairly rare in our data (only about 368 of all pairs had reciprocated nominations, 25% of those in which at least one tie occurred).
[11]The interaction between pair-level course overlap and status difference was in the same direction as that for local positions. In comparing the estimated interactions, we note that the effect of local positions was considerably stronger than the standardized coefficient for pair-level course overlap (a 1-SD increase in course overlap translated to a .074 drop in the effect of status differences). When the interaction between status difference and local position was entered into the model along with the interaction between status difference and pair-level course overlap, the naive standard errors increased by more than 5%. Therefore, we could not differentiate the effects of the two interaction terms. At the very least we infer that the value of seeking status can be neutralized when transaction costs are low as within common courses or local positions.

DISCUSSION

A fundamental task for adolescents is to develop friendships from which they can draw social capital while in high school and in which later economic transactions can become embedded (Granovetter 1985). But adolescents' opportunities to meet friends are structured by social institutions, such as schools. In particular, the courses a student attends attract others with common interests, provide opportunities to identify with a group of similar-minded others, and provide opportunities to observe others and initiate interactions. Each of these features potentially reduces the transaction costs of identifying potential friends.

The question then turns to how schools organize opportunities on the basis of coursetaking. Here we drew on Frank et al.'s (2008) conceptualization of coursetaking patterns in terms of local positions that consist of clusters of students who take sets of courses together. From analysis of the Add Health and AHAA data, local positions had significant and relatively important estimated effects on new friendship nominations in high school. This held even after the effects of background homophily and other structural constraints and shared activities were taken into account.

New friendship nominations were neither oversocialized by grade level or race nor undersocialized, merely a function of individual choice. Instead the new friendship nominations were embedded in mesolevel structures, local positions, which emerged through individual choices of courses from among those offered by the school. In this sense local positions reduced the breadth of landscapes that adolescents must have searched to find new friends by creating opportunities for interaction among those with shared interests.

Not only did local positions reduce the size of the broad landscape adolescents needed to search for friends, but local positions also neutralized the effects of the micro structure of triadic nominations measured as the potential to complete transitivity vs. cycles). Of course adolescents may compete for status within groups such as local positions (Eder 1985). But the fact that adolescents compete for status is indicative that nominations are not primarily guided by triadic patterns of nominations. Between local positions there is less to counteract the tendencies to complete transitivity versus cycles, thus contributing to status differences between groups.

Given the salience of local positions to contain new friendship nominations as well as to neutralize tendencies in the pattern of triadic nominations, local positions are likely to contain an even and dense distribution of friendship nominations that sustain the norms and resource flows of social capital (Coleman 1988). Thus we conceptualize social capital in adolescence not as stamped out uniformly in grade levels, nor determined by tightly bound cliques, nor in micro pecking orders (Berndt 1982; Eder 1985; McFarland 2004). Although social capital is no doubt shaped by grade level, cliques, and pecking orders, schools also concentrate social capital within emergent clusters of coursetaking—local positions. As members of different local positions have different resources and attributes, the social capital on which any adolescent can draw will be a function of the local position in which she finds herself by virtue of her coursetaking.

Macro Structure and Individual Agency

The salience of emergent local positions offers important insight into the classic micro-macro tensions of agency and structural constraint (e.g., Parsons 1949; Wrong 1961; Durkheim 1964, 1965, 1966; Sewell 1992). These tensions are typically described in terms of the ability of the individual to exert agency given structural and institutional constraints (e.g., Parsons 1949). The challenge then is to describe how individuals contribute to the formation of the institutions and structures that ultimately constrain (or enable) them (Giddens 1979, 1982, 1984).

To synthesize the dynamic of agency and constraint developed in the context of this study, consider a tenth grader who finds herself sharing four courses and a lunch hour with about 20 other students (Field et al. 2006). She establishes interaction patterns and even identifies one or two potential friends among the subset of students taking similar courses (the first finding from this study). She feels a part of the group of the students with whom she shares courses, and thus she is less likely to judge them on visible characteristics such as race or gender or their status relative to third parties (the second finding from this study). At the end of the academic year as she considers what courses to take in the next year, she observes that many girls in her coursetaking set are advanced in math. Responding to the norm, she chooses to advance to a higher-level math course in the next academic year (the central finding of Frank et al. [2008]). As emergent mesolevel structures, local positions mediate between macro forces (e.g., concerning gender and mathematics) and individual choices such as concerning friendships and math coursetaking.

While the previous description relies on hypothetical group properties of local positions, consider Crosnoe's (2011, p. 25) description:

The morning is a grind for Chris, with all of his pre-AP [advanced placement] classes lined up in a row. He is pulling As, but it is tough work. Most of his closest friends—a group of nine guys and five girls he has known since elementary school—take the same classes. Because they all need to be on (or their parents keep them on) the AP track and because there are only so many pre-AP and AP classes at Lamar, they typically get to move from class to class more or less en masse. This is a good thing because they help each other get by —talking to each other about homework, translating what teachers say for each other. Perhaps more importantly, they harass each other when one of them gets a bad grade, their taunts of being ACC [Austin Community College] bound providing enough motivation to ensure that the next grade will be better.

Note how the common courses and transitions lead to an emergent group as the students travel from class to class "en masse," as the AP courses are taken "in a row." There is support in the group as they "help each other get by" and normative sanctions—harassment associated with a bad grade. These contribute to a group milieu among like-minded adolescents with extensive opportunity to interact (Simmel 1950). Critically, the milieu is embedded in a social structure that emerges through individual choices of courses offered by the school (e.g., AP courses). It is these courses, and the transitions between them, that create and constrain opportunities to interact during the school day. Furthermore, the milieu can filter more macro-societal forces, such as concerning expectations to go to college.

The phenomenon of emergent social structures is not unique to adolescents and schools. For example, social structures can emerge in scientific communities through scientists' participation in policy documents (Frank et al. 2012), in towns and cities through citizens' choices to affiliate with variouscivic organizations (e.g., Laumann, Galaskiewicz, and Marsden 1978), or in child care settings through parents' participation in activities such as fund-raising, field trips, and parties (Small 2009). Critically, the venues around which social structures emerge in each setting can be manipulated by outside agents. Federal governments can shape which policy documents are written and which scientists are invited to coauthor, community governments can shape venues for citizens to interact, child care providers can create opportunities for parents to interact, and schools can affect course offerings and participation of their students.

Emergent Social Structures and the Reproduction of Status

While emergent social structures have implications for how macrosocietal norms play out in daily life, they also may accentuate or moderate status effects and stratification. In schools, local positions may accentuate status hierarchies because those who start in high-status positions have more opportunity to make high-status friends. But local positions can also moderate existing status differences. Just as Epstein (1983) found that the structure of the classroom could reduce socioeconomic homophily (see also Bourdieu 1984, 1986), so membership in the same local position could counteract the estimated effect of two adolescents being about three levels apart in parental education (e.g., the difference between a parent completing high school and more than college).[12] Similarly, the effects of membership in the same local position can mitigate about half the effect of being the same minority on new friendship nominations.

Change agents outside of a system can affect whether emergent social structures accentuate or moderate existing status differences. In schools, school administrators and staff can alter course offerings and influence course participation, which can then affect the emergent pattern of course-taking and thus the production of social capital (Moody 2001; Yonezawa et al. 2002). For example, Catholic schools earned much of their academic reputation by encouraging most students to take more academic courses (Coleman and Hoffer 1987; Bryk, Lee, and Holland 1993). This had implications not only for curricular exposure but for friendship opportunities, which in turn could shape the structure of adolescent society, particularly the relative status of different groups in the school.

Limitations

Endogeneity of local positions—Local positions may have salience as a basis of friendship nominations even if they are merely the endogenous locations in which adolescents with similar preferences convene. That is, local positions may exert their effects only through the structural arrangements that catalyze some background tastes and interests in friendship nomination (Stone, Barber, and Eccles 2008). Or it may be that local positions are structural arrangements that render tastes and preferences more homogeneous, as

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[12]A three-unit change on similarity of parental education= $3 \times .130 = .390$, which is less than the estimated local position effect of .571.

adolescents adapt their preferences on the basis of their social contexts (Bourdieu 1986). For example, woodworking may become more important to each adolescent in a local position focused around woodworking. In turn one could say that it is the commonality of woodworking within the context of the local position that organizes friendship nomination as much as the local position itself as a separate entity.[13]

Nonetheless, it is only through the courses defining the local positions that potential foci of common interests are manifest. Furthermore, without the local position, there are limited conceptualizations of the complex social spaces in schools in which adolescents convene, make new friendship nominations, and influence each other. Therefore, the courses and the pattern of coursetaking defining local positions have practical significance, even if the courses are partly proxies for underlying preferences and tastes.

Local positions as emergent structures relative to pair-level course overlap—
No doubt some of the local position effect is due to pair-level course overlap. But, even when we controlled for unweighted pair-level course overlap, more than half of the estimated effect of local positions pertained. Thus we see the value of local positions as twofold. First, local positions conceptually organize the high dimensionality of shared courses among pairs of adolescents. This applies not only to the social scientist but to the adolescent who may be able to draw on clustering in coursetaking to reduce the transaction costs of identifying potential friends. Second, there is evidence of an aggregate phenomenon associated with local positions that is not captured in effects of pair-level overlap. As such, local positions can capture processes such as a group milieu that cannot be defined dyadically. Nonetheless, it is always important to evaluate the effects of emergent social structures relative to their dyadic components.

Alternative forums for interaction—We have given primacy to face-to-face experiences within courses because such experiences provide opportunities for interaction and exposure to others and have third parties present, all of which are critical to friendship formation. Other forums for interaction (e.g., virtual) may afford similar opportunities (e.g., Wellman and Haythornthwaite 2002; Wimmer and Lewis 2010), especially in contemporary times. However, we note that the data we analyzed and the experiences they represent pertain to people who are now in their adult prime. As such the social capital the Add Health subjects cultivated in high school may be quite salient for pursuing their current behaviors, positions, and stores of various forms of capital. We leave it to further research to examine the extent to which other forums for interaction (especially virtual) replace, compete with, or complement face-to-face exposure in classrooms.

Friendships outside the school—Friendships that form outside the school may be highly salient for some adolescents for some outcomes (e.g., Eder and Kinney 1995; Moody 2001; Milner 2006). But we had limited ability to test such effects in Add Health, which does not contain data about those outside the school who are nominated as friends.

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[13]We are indebted to an anonymous reviewer for this observation and the language we use.

Therefore, we leave it to further research to study friendships formed outside the school as well as in children before they enter high school.

Nonreciprocated nominations—We recognize that some may define a friendship only once it is reciprocated (e.g., Hartup and Stevens 1997). Reciprocated nominations are critical for emotional support, which requires actors to trust one another and understand each other's contexts and emotional language. Although reciprocated nominations were rare in our data, in analyses not previously reported we estimated that the odds a new reciprocated friendship emerged at time 2 were 78 times greater if there was a unilateral nomination at time 1 (and the effect was pronounced if the adolescents were members of the same local position). Thus the unilateral friendship nominations we used to define our dependent variable may be important precursors to reciprocated nominations defining deeper friendship relations. Even as they stand, unilateral nominations can convey important resources such as information or conformity to norms. Nonetheless, it would be valuable to explore the effect of emergent social structures on the formation of reciprocated adolescent friendship nominations that can convey a wealth of resources (e.g., Eder and Kinney 1995; Moody 2001).

Conclusion

Even given these limitations, our results point to the powerful role of the American high school in organizing the everyday life of its youth. While the social world of adolescence has often been cast as a domain of a youth's indiscretion where adult sensibilities are lacking, our results illustrate the tight linkage between academic and social opportunities and transaction costs structured by schools as social institutions—in this case local positions that emerge through shared coursetaking—and the informal world adolescents negotiate.

Acknowledgments

TECHNICAL APPENDIX

Ethnic category (Add Health: H1GI6A–H1GI6E: race; and H1GI4: Hispanic ethnicity).— Race and ethnicity are coded using five mutually exclusive categories, where 1 = Hispanic, all races; 2 = black, non-Hispanic; 3 = Asian, non-Hispanic; 4 = Native American or other race, Non-Hispanic; 5 = white, non-Hispanic.

Parental education (Add Health).—Maximum of mother's and father's self-reported education (PA12 and PB8); in cases in which parents' self-reported education is missing, the maximum of the adolescents' report of their parents' education is used (H1RM1 and H1RF1), where 0 = no formal education, 1 = no high school diploma, 2 = high school

diploma but no college, 3 = some college but did not graduate, 4 = college degree, 5 = more than college (graduate training or degrees).

Age (Add Health: Age2).—Variable constructed by Add Health.

Grades for 1994–95 (AHAA: EAOGPA1–EAOGPA6).—This measure is taken from students' transcripts from the 1994–95 school year and includes all graded courses that year, including noncore and nonacademic courses. Range is 0–4. See Muller et al. (2008).

Shared Activities

Sports (Add Health: s44a14, s44a18, s44a19, s44a20, s44a21, s44a22, s44a23, s44a24, s44a25, s44a26, s44a27, s44a28).—Student participation in cheerleading, baseball, basketball, field hockey, football, ice hockey, soccer, swim team, tennis, running, volleyball, or wrestling was used.

Academic (S44a1–s44a7, s44a30–s44a33).—French club, German club, Latin club, Spanish club, book club, computer club, debate team, newspaper, Honor Society, Student Council, yearbook.

Arts (S44a8, s44a13, s44a15, s44a16).—Drama club, band, chorus or choir, orchestra.

Grade level in fall of 1994 AHAA: ELGLV945).—Students' grade level in the 1994–95 school year (the year of the in-school survey of Add Health). Because each course a student took in a given year is assigned a grade level on his or her transcript, this variable was calculated as the mean grade level of all courses taken in that year. For most students, all the courses taken in a given school year had the same grade level, giving them a whole number for grade level. Some students, however, had courses marked with multiple grade levels in a single school year, and so they do not have a whole number value for grade level. The overall range is from 9 to 12, although for our analyses we included only those between 8.5 and 10.5 (see the main text).

Transcending the school boundary.—Based on

h2mf11a: Did you go to fNAMEg's house in the past seven days?

h2mf12a: Did you meet with fNAMEg after school to hang out or go somewhere during the past seven days?

h2mf13a: Did you spend time with fNAMEg during the past weekend?

h2mf14a: Did you talk to fNAMEg about a problem during the past seven days?

h2mf15a: Did you talk to fNAMEg on the telephone during the past seven days?

Following Carbonaro and Workman (2013), we defined a friendship as transcending the school boundary if the respondent responded yes to three or more of the questions.

Pair-level course overlap (*Encow5 in the AHAA data*).—To account for courses of different sizes, we used the weighted data under the assumption that interaction and exposure would likely have been reduced in those courses with the highest rates of participation. In particular,

$$\text{expected exposure} = \frac{\#\ \text{Carnegie units for which a student took a given course}}{\#\text{classes for the course}}.$$

As in Muller et al. (2007*a*, 2007*b*), the number of classes per course was calculated by dividing the number of people who took a course (estimated from the AHAA data given the sampling rate and the size of the school) by 30 (representing an average class size).[14] For example, a student would have a probability of one-half of being exposed to another student in a course of size 60. We then factor in the Carnegie units to reflect the duration of a student's participation in a course (one Carnegie unit represents roughly one hour per school day). If a student took a course of size 60 for one Carnegie unit, the expected exposure would be one-half, whereas if the student took the same course for three Carnegie units, the expected unit of exposure would equal three-halves, indicating a one-half probability of interacting with any given other in the course for approximately three hours per day.

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[14]The National Center for Education Statistics (1998) reports that the average class size for secondary schools in 1993–94 was approximately 24,)but this includes only teachers in departmental courses, which tend to be smaller than general courses that might appear on a transcript such as physical education and driver's education. Even if our estimate of class size of 30 is variable, our measure still weights small courses more heavily to reflect the likely rates of interaction.

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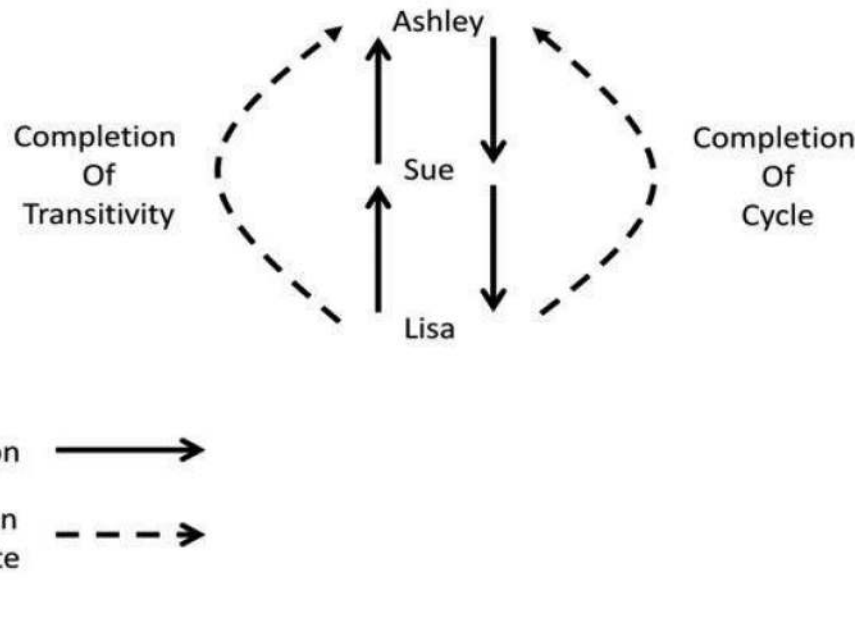Granovetter, Mark. The Strength of Weak Ties. American Journal of Sociology. 1973; 78(6):1360–80.

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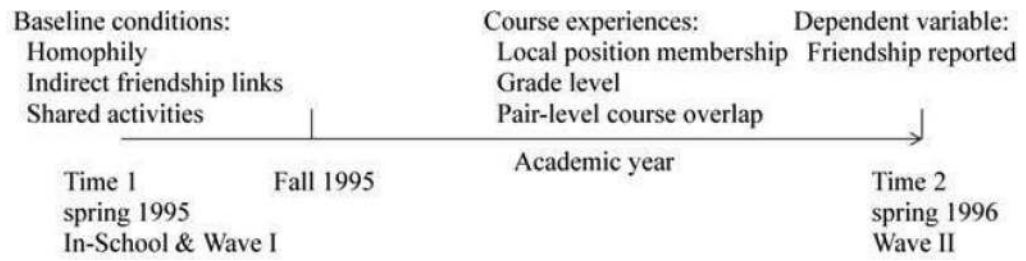
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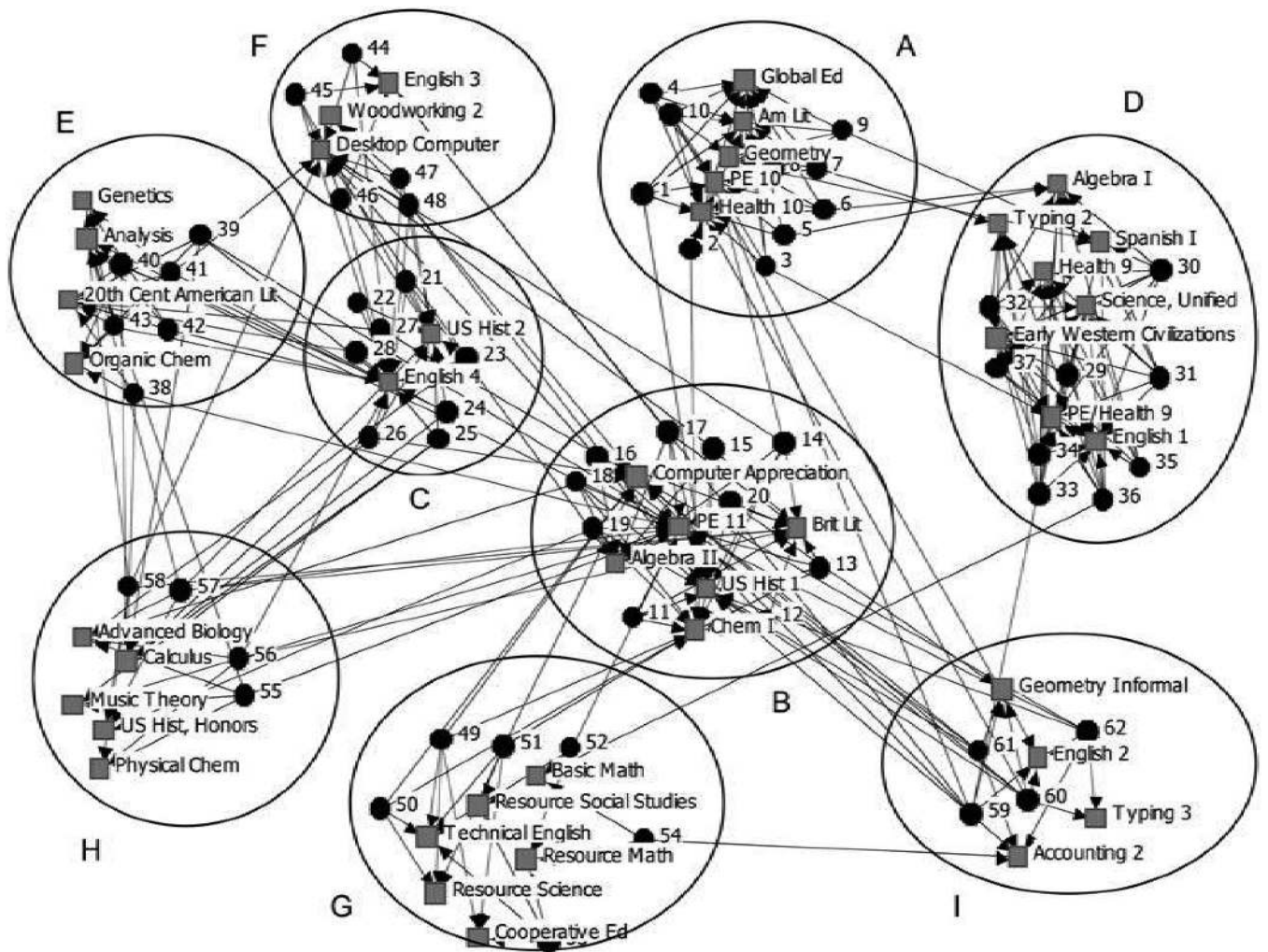
Fig. 1.
Local positions focused around courses in Miller High School. Reprinted from Frank et al. (2008), p. 1655.

Fig. 2.
Triadic structural effects on friendship formation

Baseline conditions: Course experiences: Dependent variable:
  Homophily   Local position membership Friendship reported
  Indirect friendship links   Grade level
  Shared activities   Pair-level course overlap

                                      Academic year

Time 1   Fall 1995   Time 2
spring 1995   spring 1996
In-School & Wave I   Wave II

Fig. 3.
Time line relating academic experiences to friendship nomination

TABLE 1

Descriptive Statistics for Factors Affecting Friendship Nominations between Adolescents

Variable	Mean	SD
Dependent variable:		
Presence of friendship	.004	.061
Local positions:		
Membership in same local position	.137	.344
Background homophily:		
Same race (not white)	.124	.330
Both white	.581	.493
Both girls	.265	.441
Both boys	.230	.421
Similarity of parental education	−1.241	1.052
Similarity of age	−.817	.638
Similarity of GPA	−.896	.687
Structural constraint:		
Formal (similarity of grade level)	−.514	.500
Informal (number of indirect friendship links)	.259	.956
Shared activities:		
Sports	.109	.360
Academic	.034	.196
Arts	.030	.180
Course overlap:[*]		
Unweighted	1.219	1.348
Weighted	.346	.956

NOTE.—Pair-level, listwise data; *N* = 157,722.

[*] Extent of pair-level course overlap.

TABLE 2

Logistic Regression of New Friendship Nominations, Spring 1996: Main Effects

Independent Variable	Unstandardized	Standardized	SE
Same local position	.571[*]		.120
Background homophily:			
Same race (not white)	1.063[*]		.210
Both white	.175		.159
Both girls	−.050		.104
Both boys	−.298		.120
Similarity of parental education	.130[*]	.130	.046
Similarity of age	−.059	−.036	.083
Similarity of GPA in 1994–95	.431[*]	.303	.077
Structural constraint:			
Formal (similarity of grade level)	1.380[*]	.569	.111
Informal (indirect friendship links)	.224[*]	.173	.016
Shared activities:			
Sports	.074	.022	.094
Academic	.223	.039	.155
Arts	.244	.028	.157
Course overlap:			
Pair-level course overlap	.050[*]	.044	.020

NOTE.—Intercept is −11.398; N = 157,722.

[*] Estimate more than two and a half times the naive SE.

TABLE 3

Estimated Effect of Local Positions on Friendship Nominations at Time 2 (Wave 2): Alternative Model Specifications

Specification	Estimate	Naive SE	N
Final model as in table 2	.571[*]	.120	157,722
Inclusion of those in same friendship clique	.507[*]	.118	158,425
Control for degree distribution using alternating signed *k*-stars	.565[*]	.118	157,722
Unweighted	.588[*]	.123	157,722
No control for prior	.385[*]	.091	160,481
Friendship nomination counted only if combined with three or more indicators of transcending the school boundary	.806[*]	.236	157,722
Using unweighted pair-level course overlap as a control . . .	.335[*]	.122	157,722
Controlling for prior (instead of eliminating friendships at time 1)	.240	.100	160,481
Only directed nominations (reciprocated nominations eliminated)[†]	.611[*]	.124	157,648
Only reciprocated nominations (for all pairs)	.092	.486	157,722
Only reciprocated nominations (for those pairs in which there was at least one nomination)[‡]	2.528	1.380	593

[*]Estimate more than two and a half times the naive SE.

[†]Controlled for indirect friendship links using four directed terms.

[‡]Modeled only for those pairs in which there was at least one nomination. Controlled for degree distribution using alternating signed *k*-stars because of the reduced degrees of freedom.

TABLE 4

Logistic Regression of New Friendship Nominations Reported in Spring 1996 for Directed Nominations

Independent Variable	Model 2	Model 3	Model 4	Model 5	Model 6
Same local position	.388[*] (.121)	.453[*] (.122)	.435[*] (.122)	.386[*] (.121)	.410[*] (.120)
Potential to complete transitivity vs. cycles	.289[*] (.045)	.392[*] (.055)	.565[*] (.059)	.274[*] (.046)	.184[*] (.049)
Course overlap	.022 (.016)	.024 (.015)	.005 (.021)	.022 (.016)	.025 (.016)
Same race (not white)	1.048[*] (.206)	1.049[*] (.209)	1.041[*] (.206)	1.012[*] (.209)	1.049[*] (.206)
Similarity of grade level	.946[*] (.112)	.946[*] (.112)	.971[*] (.113)	.943[*] (.112)	1.106[*] (.120)
Potential to complete transitivity vs. cycles:					
× same local position		−.318[*] (.096)			
× course overlap			−.089[*] (.013)		
× same race (not white)				.303 (.191)	
× similarity of grade level					−.547[*] (.099)

NOTE.—Pairs in which friendship nominations were reciprocated were eliminated. *N* = 316,701. Estimates for baseline covariates are not shown. Numbers in parentheses are naive SEs.

[*] Estimate more than two and a half times the naive SE.