Isolation, cohesion and contingent network effects: the case of school attachment and engagement

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Abstract

Isolation and cohesion are two key network features, often used to predict outcomes like mental health and deviance. More cohesive settings tend to have better outcomes, while isolates tend to fare worse than their more integrated peers. A common assumption of past work is that the effect of cohesion is universal, so that all actors get the same benefits of being in a socially cohesive environment. Here, we suggest that the effect of cohesion is universal only for specific types of outcomes. For other outcomes, experiencing the benefits of cohesion depends on an individual's position in the network, such as whether or not an individual has any social ties. Network processes thus operate at both the individual and contextual level, and we employ hierarchical linear models to analyze these jointly to arrive at a full picture of how networks matter. We explore these ideas using the case of adolescents in schools (using Add Health data), focusing on the effect of isolation and cohesion on two outcomes, school attachment and academic engagement. We find that cohesion has a uniform effect in the case of engagement but not attachment. Only non-isolates experience stronger feelings of attachment as cohesion increases, while all students, both isolates and non-isolates, are more strongly engaged in high cohesion settings. Overall, the results show the importance of taking a systematic, multi-level approach, with important implications for studies of health and deviance.

Keywords

Adolescence, Social networks, Cohesion, Isolation, Attachment, Engagement.

Durkheim's classic work on suicide has inspired generations of scholars (Wray et al., 2011; Tsai and Papachristos, 2015). His fundamental insight was that the social environment can affect individual outcomes in profound ways, even those that we think of as deeply personal (Durkheim, 1897[2006]; McPherson and Smith, 2019). This means examining individual outcomes, such as institutional attachment and engagement, in light of community-level features, such as cohesion. These insights have often been used to understand the experience of adolescents in schools, the case considered here. For example,

youth in more cohesive schools have higher levels of attachment and lower levels of minor deviance (Bryk and Driscoll, 1988; Battistich et al., 1995; Battistich and Hom, 1997; Henry and Slater, 2007; Maimon and Kuhl, 2008; Warrington and Younger, 2011). In a similar way, past work has used a Durkheimian perspective to examine individual level social isolation (Berkman et al., 2000). Past research has found that isolates, or youths with no social ties, feel less attachment to their schools (Mouton et al., 1996; Cheng and Klugman, 2010; Hascher and Hagenauer, 2010).

In this paper, we ask: how do isolated and non-isolated youths fare in different school network contexts on two key outcomes, school attachment and academic engagement (see Johnson et al., 2001)? Academic engagement captures the stake youths have in conforming to institutional norms to achieve conventional success. Engaged youths enact fewer disruptive classroom behaviors and engage in normatively appropriate behaviors that indicate commitment to success within the institution, like completing their homework, getting along with their teachers and coming to class (Johnson et al., 2001). School attachment captures an emotional component, showing the student's sense of belonging in the larger setting. Youths who feel more attached to their schools also feel more accepted by their peers, and they would be sorry to leave the institution.

Our goal is to tease out how cohesion and isolation *combine* to create particular experiences for youths, showing how individual network position intersects with macro-level features of the school network. Specifically, we examine whether cohesive school networks promote attachment and engagement for all students in the school, or only for those who are deeply embedded in the school network. In this way, we extend previous research that has focused on the independent effects of individual level isolation and/or school level cohesion. This is an important problem as efforts to increase cohesion in the friendship network for the sake of individual well-being might not have the desired effect if those who need help the most (isolated adolescents) do not benefit, and are possibly even harmed, by increased school cohesion.

We begin the paper by laying out our theoretical approach, discussing how isolation and cohesion combine to shape school attachment and engagement. We empirically test our framework using data from Add Health, which includes network data across a number of schools as well as individual-level data on engagement and emotional attachment to the school. We end the paper by considering larger questions about social control and emotional attachment.

Background

Individual isolation in schools

Social isolation is an individual-level network feature, describing a youth who has no strong social connections to bind them to their peers at school. We focus on isolation (as opposed to other individual-level network features), because youth who are on the outside of the school friendship network are in a unique position, not shared by others in the school who have at least a few friendship ties. Even having a few friends can change the social dynamic as the youth does not stand out as a 'loner', a peer attribution based on network position (Prinstein and La Greca, 2002).

There is a strong link between being isolated and experiencing negative emotions. Social isolation is related to suicidality, depressive symptoms, and low self-esteem (Bearman and Moody, 2004; Hall-Lande et al., 2007; Cheadle and Goosby, 2012). If one has no friends at school, it may be difficult to feel good about the school as a whole (Newmann, 1981; Brown et al., 2003). Conversely, the experience of positive personal relationships has an established link with mental health and attachment (Oberle, et al., 2011). For example, Moody and White (2003) showed that students who are deeply embedded within the global friendship network structure at school tend to feel more attached to school. In more qualitative work, Mouton et al. (1996) shows that students who are only weakly attached to the school tend to have strong feelings of alienation, feeling lonely and out of place (see also Schulz and Rubel, 2011). Much of the research exploring the connection between negative affect and isolation is cross-sectional; therefore the causal direction of the connection between negative affect and school attachment is somewhat unclear. There is evidence to suggest that social integration is protective of future self-esteem (Pachucki et al., 2015), but there is also evidence that depression could itself lead to social isolation. For example, Schaefer et al. (2011) find that youths who experience depression are less socially active and withdraw from the friendship network. Most likely, the association between affect and isolation is reciprocal, where isolation decreases emotional attachment, while youths with decreased attachment form (and maintain) fewer friendships.

Additional research finds that isolation and attachment vary across demographic groups. For example, Johnson et al. (2001) found racial/ethnic differences in attachment in middle school, with white and Black youths less attached to their schools than Hispanic youths, but these differences disappear by high school. They also find that girls report higher attachment during middle school compared to boys, but that this association too shifts by high school. A later study replicated these findings, also showing that attachment decreases with increasing school size (Crosnoe et al., 2004). Brown et al. (2003) found that males and whites experience greater feelings of alienation, while Hascher and Hagenauer (2010) find that isolation increases across grade levels. Accounting for these relationships, however, previous

work still finds main effects between isolation and school attachment (Cheng and Klugman, 2010; Hascher and Hagenauer, 2010).

The evidence for the effect of social isolation on engagement is more mixed. Some evidence suggests that children and adolescents who report social isolation tend to have lower academic engagement. For example, they are more likely to report lower intrinsic motivation at school and lower class participation (Goodenow, 1993; Walton and Cohen, 2007). On the other hand, past work focusing on minor deviance has often found the opposite. Here, more popular adolescents (Ennett et al., 2006; Reynolds and Crea, 2015) and adolescents who feel closer to their peers (Fitzgerald et al., 2016) are more likely to engage in minor deviant behaviors, potentially as a way of maintaining status in the school (Allen et al., 2005; Faris and Ennett, 2012; Andrews et al., 2017; Copeland et al., 2017). It is also possible that disruptive behavior itself leads to social isolation—youths who engage in non-normative behavior may become more socially isolated. Dijkstra and Berger (2018) found that aggressive youths received fewer friendship nominations than their peers, after reporting aggressive behaviors. Finally, other work has found few differences in disruptive behavior between social isolates and their more embedded peers (Kreager, 2004). Therefore, it is an open question as to whether isolates exhibit more or less engagement than non-isolates, although past evidence suggests the differences are likely to be small. Thus, we expect that socially isolated youth will feel less attachment to their schools, but they may or may not report less engagement than their non-isolated peers.

School cohesion

Social network cohesion is a school level feature, produced through the complex aggregation of all interactions taking place in the school (see McFarland et al., 2014 for a discussion of why some schools may be more cohesive than others). Cohesion is itself a multidimensional construct with both ideational and relational components that emerge from the collective life of the community (Durkheim, 1897[2006]; Moody and White, 2003). The relational dimension, which is the focus here, refers to the extent and pattern of social relations that bind individuals (or groups) to each other (Bearman, 1991). A school that is held together by many overlapping relationships (or one with a structurally cohesive pattern of social relations, in network terms) does not depend on a few actors to hold it together but instead forms a holistic whole beyond the presence of any particular person (Moody and White, 2003).

Cohesion has been linked to substantive outcomes through two main mechanisms – integration and regulation. Integration refers to individuals' connections to others and works by defining group boundaries, strengthening identities, and promoting a sense of belonging (Mueller and Abrutyn, 2016). Students in cohesive schools are connected to each other through overlapping friendships. This provides social integration by making in-group/out-group distinctions clearer. We draw on Simmel's (1922)[1955]) classic treatment of conflict to understand how comparative processes can generate in-group solidarity and feelings of belonging. According to the theory, in-group/out-group distinctions serve to create positive attachment for those embedded in the network by allowing people in the group to define themselves against the out-group and to feel positive emotions about their own membership.

In the context of adolescents, this process has been described as essential for maintaining a sense of belonging because knowing one's place in the larger network helps predict how individuals will be treated by others (see Tarrant et al., 2006). For example, qualitative work describes how students are aware of the dangers of being in the out-group—that is, being excluded, avoided, and potentially being treated poorly (Warrington and Younger, 2011). Knowing that these outcomes may be likely for out-group membership thus places great value on in-group membership, increasing attachments to the larger, integrated group (Battistich et al., 1995; Warrington and Younger, 2011).

Regulation refers to the level of control exerted over members (Browning et al., 2015; Pescosolido and Georgianna, 1989). In the school context, regulation works by clarifying norms and enforcing their enactment across the school community (Warrington and Younger, 2011). In a cohesive school, multiple, overlapping friendships facilitate social control (and engagement) because the boundary around the school community is well defined. This makes it easier to sanction in-group members. There is stronger overlap between friendships, and thus more consistent messages and a higher cost of non-adherence. In this way, students may be motivated to follow these norms in order to avoid sanctioning, embarrassment and social ostracism (Newcomb et al., 1993).

It is important to note that our focus is on regulatory processes at the school level, as opposed to smaller peer groups within the school (Haynie, 2001; Burk et al., 2008; de la Haye et al., 2015). That is, though some work examines the effect of peer norms on adolescent delinquency (e.g., Reynolds and Crea, 2015), larger contexts in which these smaller groups are embedded are associated with their own

norms, rules, and regulatory processes that influence behavior (Rees and Pogarsky, 2010). Indeed, research shows that cohesive school networks generate lower rates of disruptive behavior. For example, Bryk and Driscoll (1988) found that students in communally organized schools had fewer negative behavior reports written about them by teachers. Battistich and Hom (1997) found that students in schools characterized by a greater sense of community engaged in fewer delinquent behaviors, like skipping school. Similarly, O'Neill and Vogel (2020) replicated this finding but found a relationship with delinquent behaviors enacted on school grounds. Together, this work shows the importance of considering cohesion for engagement at the school level.

Individual isolation and school cohesion together

How do cohesion and isolation combine to impact individuals ? We argue that a contextual feature may not have the same protective effect for people who are isolated compared to people who are not.

Figure 1 provides a stylized example of two small, hypothetical schools. We offer four ideal types for comparison: an isolate in a high cohesion setting; a non-isolate in a high cohesion setting; an isolate in a low cohesion setting and a non-isolate in a low cohesion setting. The question is how these four different types of actors' experiences vary and lead to outcomes like school attachment and engagement.

Attachment in high and low cohesion settings

Panel A in Figure 1 represents a case of high cohesion, where only a few individuals are isolated and everyone else are integrated into a highly connected community. There are many connections between subgroups, and these are arranged so that removing a single individual would not cause great damage to the network, as all individuals (except a few isolates) would be able to reach each other.

Our baseline expectation is that students at more cohesive schools will have higher levels of attachment because adolescents in tight-knit schools, where interactions are frequent and positive, find it easier to maintain a sense of belonging and form a coherent, stable identity, all contributing to feelings of attachment to the school (Mueller and Abrutyn, 2016; Battistich et al., 1995; Warrington and Younger, 2011). However, this positive effect of cohesion might not operate the same for isolates compared to non-isolates.

For non-isolates, we expect cohesion to operate in the expected fashion, with in-group/out-group distinctions serving to create positive attachment. In schools characterized by high levels of cohesion, there is agreement amongst the socially connected majority of the school that the people on the fringes are *not* their friends. This process may result in healthy school attachment for the majority of youth who are inside the well-defined group, defining themselves against those on the outskirts of the
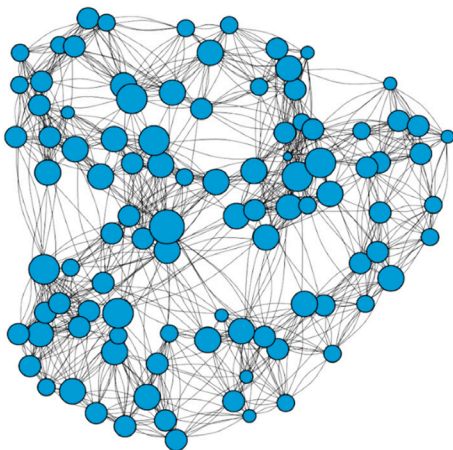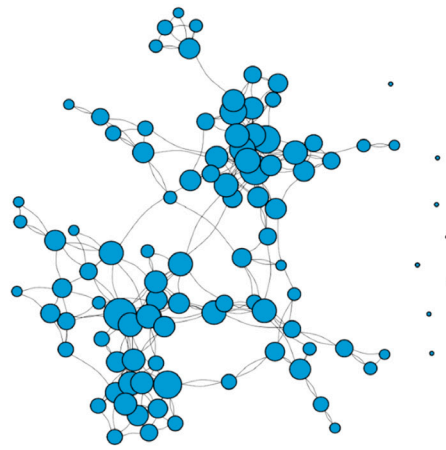

Figure 1: Example school networks with high and low cohesion.

network. Isolated youth, in contrast, face a situation where there is a well-defined social community of which they are not part. Because there is a single, robustly connected network, there is little ambiguity about which individuals are community members and which are not (isolated youths). From the perspective of the social isolate, it is clear that they are missing out on the sense of community that others experience.

Panel B provides a counterexample of low structural cohesion. Here, there is still a densely interconnected core (and some isolates), but the community network is more easily broken up into subgroups by the removal of key individuals. In this context, it is less clear which individuals are in each social group. In low cohesion settings, the distinctions between isolates and non-isolates are likely to be less stark. We can see in Panel B of Figure 1 that there are a number of students on the periphery of the network. Here, the sting of being isolated may not be quite so bad. The lower level of cohesion will constrain the potential for positive emotions to emerge out of the group, reducing attachment among non-isolates and making the experience of being socially isolated less harsh in comparison. In this way, isolates may fare better in low cohesion settings, even if they still have lower levels of attachment than non-isolates.

Engagement in high and low cohesion settings

Should the constraining effect of social cohesion operate differently for isolates and non-isolates ? Our expectations about how cohesion constrains the behavior of isolates (compared to non-isolates) are similar to what we saw with attachment. For example, isolates may be less affected by cohesion because only those embedded in the network are really subject to the larger norms of the school. Isolates standing outside of the social world may feel less pressure to adhere to the normative expectations of the school. They are, perhaps, less prone to being sanctioned by their peers and may be less affected by any such sanctioning because they cannot be threatened with the worst sanction—exclusion. If this is the case, then we would not expect isolates to be terribly affected by increasing cohesion. We might, however, expect isolates to actually be less engaged in high cohesion settings. In such settings, everyone else is conforming to normative expectations; if isolates continue to reject normative expectations, they might experience heightened pressure towards disengagement, as they see themselves as distinctly outsiders.

Summary of expectations

Overall, we expect that socially integrated youth will fare better in more cohesive schools. They will feel more attachment to their institutional settings as their peer networks create a more well-defined community. Likewise, non-isolated youth will have a higher stake in conformity to school rules in more cohesive settings. We expect that the effect of cohesion on attachment among isolated youth will be much weaker, and cohesion may even lead to lower attachment. We have analogous expectations for engagement. If membership in the community is required for regulation, they would be unaffected by changes in cohesion. If isolates define themselves against the in-group, they may be less engaged in high cohesion settings, acting out against the community they are not a part of. Empirically, the key is being able to differentiate between these accounts, teasing out how cohesion shapes emotional school attachment and engagement as well as how this differs (or not) across isolates and non-isolates.

Data

Our data come from the first wave of the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally representative sample of U.S. adolescents. Add Health is a longitudinal stratified study of U.S. schools ranging from the 7th to 12th grades (Bearman et al., 1997; Harris et al., 2009). The first wave of data collection occurred in 1994 and 1995 when students in 144 schools were invited to take an in-school survey ($N = 90,118$). Respondents were asked a wide range of social and demographic items, risk factors, and parental background questions. Respondents were also provided with their school's student roster and were asked to select up to five male and five female friends (10 total friends). Information about school characteristics, including school size, grades earned, and school type, was also collected in Wave I. These data provide contextual-level control variables for the multi-level models.

We follow prior studies (Haas et al., 2010) using data from the 129 schools where at least 50% of the students participated in the network portion of the study ($N = 75,122$). This also aligns with recent recommendations from work on the effect of missing data on network measurement (Smith et al., 2017). The school sample was further reduced to 113 schools, as 16 were excluded because they did not report key contextual-level data including whether the school is located in an urban or rural region, and whether the school is public, private,

or Catholic. Missing data at the individual-level also limited the sample. Responses required to construct the dependent variables were missing in 7237 cases. Of those, 2463 respondents did not report on either school attachment or engagement, 4022 did not report their attachment, and an additional 752 did not report on indicators of engagement. An additional 430 respondents did not report their gender and grade. Thus, the final sample consists of 61,411 students in 113 schools. Finally, our analysis requires variation in cohesion and isolation across schools, so we restrict our analysis to the cross-sectional, in-school survey. Only ten schools provided complete network data over the multiple waves. We return to the problem of using cross-sectional data in the conclusion.

Measures

Dependent variables

We examine the relationship between isolation, cohesion and two dependent variables: school attachment and disengagement. Descriptive statistics for dependent, independent, and control variables are presented in Table 1. *School attachment* is a mean score on three items that reflect youths' emotional attachment to their school (Moody and White, 2003). Respondents were asked how much they agreed (strongly agree = 1, agree = 2, neither agree nor disagree = 3, disagree = 4, strongly disagree = 5) with the three following statements: 1) I feel like I am part of this school, 2) I feel close to people at this school, and 3) I feel happy to be at this school. The items were reverse-coded so that a higher score reflects higher subjective attachment to school. On average, respondents reported a high level of school attachment (mean = 3.56). *Disengagement* is a mean score on three items related to non-normative, or disruptive, classroom behaviors. The three items asked students how often (never = 0, just a few times = 1, about once a week = 2, almost every day = 3, every day = 4) they have had trouble: 1) getting along with your teachers, 2) paying attention in school, and 3) getting homework done. The variable is coded such that higher values indicate less engagement, or disengagement. The average on these items was moderate (mean = 1.58). Both the *school attachment* and *disengagement* scales have acceptable internal consistency (Cronbach's alpha = 0.79 and 0.81, respectively). We also used the Pearson correlation coefficient to assess the relationship between the two scales. *School attachment* and *disengagement* are only weakly, negatively, correlated with each other (r=-0.11), suggesting they are capturing different constructs.

Table 1. Descriptive statistics.

	Mean/p	Std. Dev.	Range
School attachment	3.556	0.977	1–5
Disengagement	1.579	1.121	0–4
Isolate	0.037	0.001	
School cohesion	0.895	0.076	0.567–1
Race/ethnicity			
White	0.564	0.002	
Black	0.147	0.001	
Asian	0.047	0.001	
Hispanic	0.146	0.001	
Other	0.095	0.001	
Female	0.513	0.002	
Grade	9.670	1.597	6–13
Log School Size	6.961	0.666	3.258–8.112
School type			
Public	0.933	0.001	
Catholic	0.043	0.001	
Private	0.024	0.001	
N	61,411		

Focal independent variables

Our main independent variables are isolation and cohesion within schools. A youth is in a state of *isolation* if they nominate no schoolmates as friends and if they receive no friendship nomination. In our sample, 3.66% of students are isolated.

School cohesion is a contextual measure of the robustness of a school's friendship network. School cohesion is the proportion of students who are connected to each other through friendship ties by at least two independent paths (Moody and White, 2003). In network literature, this is called the largest connected bicomponent (see Moody, 2004, for example). A path is defined as a unique sequence of actors and ties that connect one actor to another (e.g., i is friends with j who is friends with k, creating a path between i and k: i->j->k). Two paths are independent if they do not depend on the same (third party) actor to connect the actors in question; for example, i->j->k and i->j->m->k are not independent as they both depend on actor j. A network with more

independent paths is robust, as the removal of a small set of actors would not disrupt the larger friendship network. Substantively, a piece of information (like a rule, or a rumor) that originates with anyone in the largest bicomponent can reach any other youth at least twice through a different series of people. This makes school cohesion an ideal measure of the integrative and regulative capacity of the community. A cohesive school will provide youth with a sense of community or knowing that "your friends are my friends." At the same time, redundant communication paths facilitate informal social control (Osgood et al., 2014). On average, the largest bicomponent of schools' friendship networks contained 90% of their students, but school cohesion ranged from a school where only 57% of youth were connected through multiple paths, to schools where all students were connected to each other through different paths. Note that school cohesion is only weakly correlated with school size and has almost no correlation with the proportion isolated in the school.

Control variables

Individual-level controls include race/ethnicity, sex, and grade. Race/ethnicity is an imputed five category measure including white, black, Asian, Hispanic, and other categories (white = REF). Sex is a dichotomous indicator (male = REF). Grade is a continuous indicator ranging from 6 to 13. School type and school size are the two school-level controls included in the models. School type is a three-category variable differentiating schools between public, private, and Catholic. The majority (93%) of schools in the sample are public. School size is included as a logged variable based on the number of students on the school roster.

Methods

We employ multi-level linear models to explore the effect of school cohesion and individual isolation on school attachment and disengagement. The 61,411 students are nested within 113 schools. We run separate models for attachment and disengagement. We run two models in each case, where the outcome is a function of isolation, cohesion, and a series of individual-level and school-level controls. Model 1 includes isolation, cohesion, and all controls at both levels. The intercept is allowed to vary across schools. Model 2 is the same as Model 1, but here we include a cross-level interaction between isolation and cohesion. We allow the coefficient on isolation to vary across schools as a random slope. The models

are the same for both outcomes of interest. Formally, the full model is:

$$Y_{ij} = b0_j + b1_j \left(Isolate_{ij} \right) + b2 \left(Asian_{ij} \right) + b3 \left(Black_{ij} \right)$$
$$+ b4 \left(Hispanic_{ij} \right) + b5 \left(Other_{ij} \right) + b6 \left(Female_{ij} \right)$$
$$+ b7 (Grade_{ij}) + \varepsilon_{ij}$$

$$b0_j = a00 + a01 \left(Cohesion_j \right) + a02 \left(School\ Size_j \right)$$
$$+ a03 \left(Catholic_j \right) + a04 \left(Private_j \right) + u_{0j}$$
$$b1_j = a10 + a11 \left(Cohesion_j \right) + u_{1j}$$

Results

The results focus on the relationship between two network features, isolation and cohesion, and two outcomes of interest, school attachment and disengagement. The question is how social cohesion, at the school level, combines with social isolation, at the individual-level, to produce different patterns of attachment and disengagement across contexts.

Table 2 presents our set of models. We start with the baseline models, Model 1a for attachment and 2a for disengagement. Although we are unable to establish the direction of causality with our cross-sectional data, Model 1a makes clear that social isolates have lower levels of attachment than non-isolates. On average, controlling for other individual variables, estimates show that isolates have attachment scores about .5 lower than non-isolates, a considerable difference on a scale ranging from 1 to 5. We also see that girls, non-white students (particularly those who identify as Black or Other), as well as younger students also tend to report lower levels of attachment.

At the school level, more cohesive schools tend to have higher levels of attachment (the coefficient is positive), but the effect is not significant at traditional levels of significance. Thus, just looking at the baseline model, we would arrive at similar conclusions as past work: cohesion, measured at the contextual-level, does not have a clear effect on attachment, controlling for individual-level network integration (here measured as isolation) (Flaherty and Brown, 2010). If we stopped there, we would end up declaring that cohesion does not really matter and that network effects are a purely local matter.

Model 2a presents the baseline model for disengagement, and we can see that cohesion, but not isolation, is the main network process shaping behavior. Here, isolates are not any more likely to be disengaged than non-isolates. There is a positive coefficient, but the magnitude is small and not

Table 2. Multilevel regression models predicting school attachment and disengagement from school cohesion and individual isolation.

	Model 1a School Attachment; No interaction		Model 1b School Attachment; interaction		Model 2a Disengagement; no interaction		Model 2b Disengagement; interaction	
	Coefficient	z-statistic	Coefficient	z-statistic	Coefficient	z-statistic	Coefficient	z-statistic
Isolate	-0.478***	(-19.55)	0.154	(0.80)	0.029	(1.12)	-0.231	(-0.97)
School Cohesion	0.327	(1.87)	0.350*	(2.00)	-0.602***	(-6.91)	-0.575***	(-4.02)
Isolate X School Cohesion			-0.740**	(-3.25)			-0.231	(-0.97)
Race/ethnicity								
Black	-0.194***	(-14.12)	-0.194***	(-14.10)	0.180***	(13.24)	0.181***	(11.53)
Asian	-0.060**	(-2.92)	-0.059**	(-2.90)	0.148***	(5.46)	0.148***	(6.27)
Hispanic	-0.120***	(-8.91)	-0.119***	(-8.87)	0.203***	(11.46)	0.203***	(13.08)
Other	-0.221***	(-15.93)	-0.220***	(-15.92)	0.165***	(11.31)	0.166***	(10.29)
Female	-0.078***	(-10.01)	-0.078***	(-10.03)	-0.169***	(-17.70)	-0.169***	(-18.65)
Grade	-0.082***	(-24.16)	-0.082***	(-24.14)	-0.034***	(-9.01)	-0.0346***	(-9.10)
School Size (log)	0.006	(0.32)	0.006	(0.34)	-0.033**	(-2.73)	-0.0323*	(-2.05)
School type								
Catholic	0.061	(0.92)	0.0581	(0.87)	-0.165***	(-6.12)	-0.165**	(-3.07)
Private	0.216**	(2.98)	0.218**	(3.02)	-0.173***	(-4.46)	-0.170**	(-2.79)
Intercept	4.132***	(18.54)	4.107***	(18.40)	2.704***	(21.18)	2.672***	(14.52)
Slope Variance	0.009***		0.004***	(-3.57)	0.0001***	(-32.99)	0.00008	(-1.23)
Intercept Variance	0.017***		0.018***	(-25.43)	0.010***	(-35.10)	.010***	(-23.60)
Cov(Slope, Intercept)	0.001		-0.001	(-0.20)	-0.001***	(-39.08)	-0.001	(-0.26)
Residual Variance	0.905***		0.905***	(-17.55)	1.226***	(50.35)	1.226***	(35.69)
N	61411		61411		61411		61411	
AIC	168415.9		168408.3		186999.9		187001.0	
BIC	168560.3		168561.7		187144.3		187154.4	

Notes: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

significant for most model specifications, including the one presented in Table 2 (i.e., including a full set of controls). This is in keeping with past work on isolation, where isolates are vulnerable to feelings of alienation, but are not more disruptive (Kreager, 2004).

At the school level, cohesion is associated with lower levels of disengagement. This effect is significant, net of controls at the school level, including school size and type of school. For example, we would expect a high cohesion school (with all youths in one bicomponent) to have 0.30 lower values on disengagement than a low cohesion school (where only 0.5 of the students are in the largest bicomponent). This effect is larger than with any of the individual level variables: gender, race, grade, or social isolation. For example, boys are less engaged than girls, but the difference is less than that expected between low and high cohesion schools.

We now move on to the second set of models (Models 1b and 2b) which include interactions between isolation and cohesion, allowing us to see how these processes play out across scenarios with different combinations of individual network position and contextual features of the school (cohesion). In particular, the models make it possible to differentiate between cases with universal effects, where all

students get the benefit (or at the least the effect) of higher cohesion, from more contingent cases, where students only get the benefit of cohesion if they are socially integrated into the school.

Model 1b presents the results for attachment. There is a significant coefficient for the interaction between isolation and social cohesion across all model specifications. This suggests that the benefits of cohesion are contingent on being socially integrated. Figure 2 offers a clear picture of how these two network features, isolation and cohesion, come together to shape school attachment. The figure presents the predicted values for school attachment for isolates and non-isolates at different levels of cohesion (ranging from 0.5 to 1)[1]. The predicted values are calculated at the means for the other variables.

Most striking in Figure 2 is that the cohesion-attachment relationship is flipped for isolates and non-isolates: the effect of cohesion on attachment is positive for non-isolates and negative for isolates. The

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[1]Note that it is technically impossible for an actor to be isolated in the extreme case of cohesion equal to 1, as all actors would be in the main bicomponent, and thus not isolated.
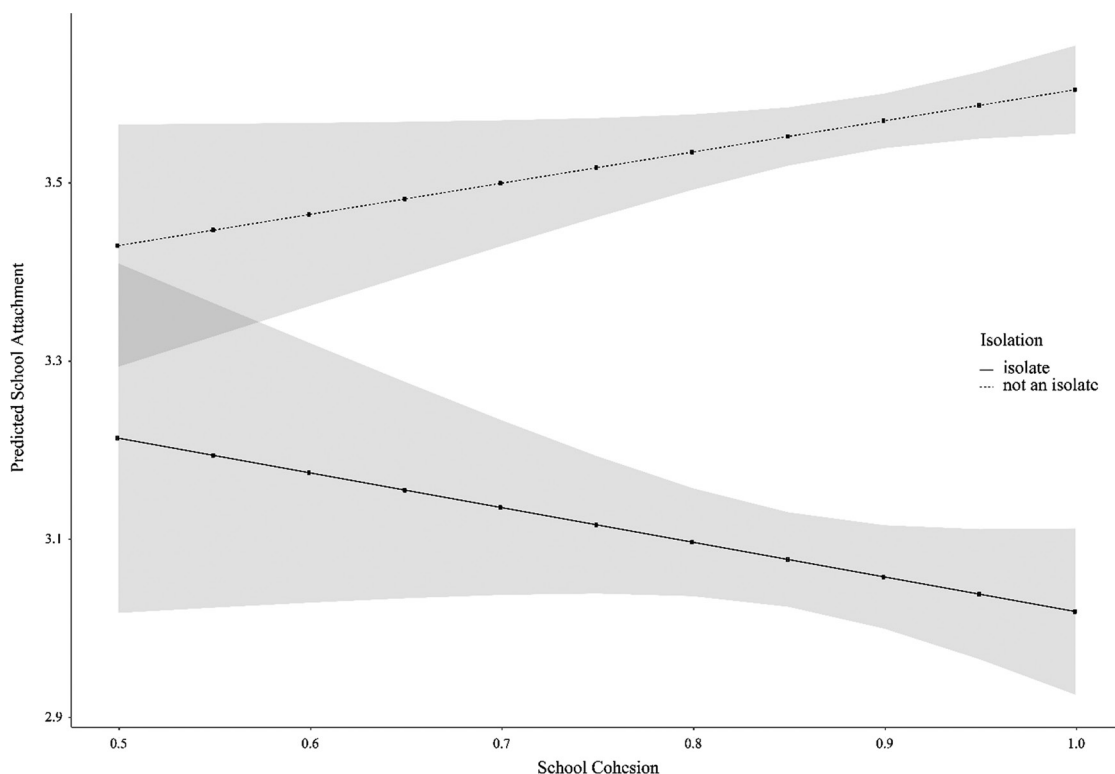

Figure 2: Predicted school attachment; Isolation by school cohesion interaction.

coefficients for cohesion are significant for both groups, in contrast to the baseline model (with no interaction), where the cohesion coefficient is not a significant predictor of attachment (see Model 1a). The effect of cohesion is, at least in part, suppressed in the baseline model: the estimated coefficient appears weaker than the true effect (within each group) and suppressed by the effect of cohesion running in opposite directions for isolates and non-isolates.

In short, non-isolates, but not isolates, get the benefit of higher cohesion, in terms of higher levels of emotional attachment to school. Isolates, in fact, actually fare worse in cohesive settings, as they are likely punished for not being socially part of the school. Using predicted values discussed further below, the difference on attachment across the two is statistically significant (using a formal test on the marginal difference). In this way, isolates likely feel the pinch of being socially isolated (at least in terms of attachment) when everyone else around them is part of a larger social group. When the school itself is not cohesive, one's own isolation may not feel so stark, as one is likely not missing out anything.

The model for disengagement is simpler. Here, the main effect of cohesion on reducing disengagement is consistent across isolates and non-isolates. There is no significant interaction between isolation and cohesion (and this holds across all specifications). This is demonstrated in Figure 3, where higher cohesion leads to lower levels of disengagement and this effect is very similar between isolates and non-isolates. The baseline effect for school cohesion (corresponding to non-isolates) is significant and similar to the coefficient seen in Model 2a. Contrary to our expectations, both isolates *and* non-isolates are more engaged, or regulated, in environments with higher social cohesion. Regulatory processes are not dependent on one being socially integrated into the network. Our results suggest that regulation does not occur through in-group/out-group social comparison processes. We discuss this further in the conclusion.

Table 3 puts the results for school attachment and disengagement together. The table is a 2 × 2, with isolation/non-isolation on the rows and cohesion on the columns. Cohesion is measured as low or high, with low cohesion set at 0.6 and high cohesion set at 0.95 (so that 95% of the people in the network are in the largest bicomponent). Each cell presents the predicted values for attachment and disengagement for that combination of individuals' network position and contextual, network-level of cohesion (setting all other values at their means).
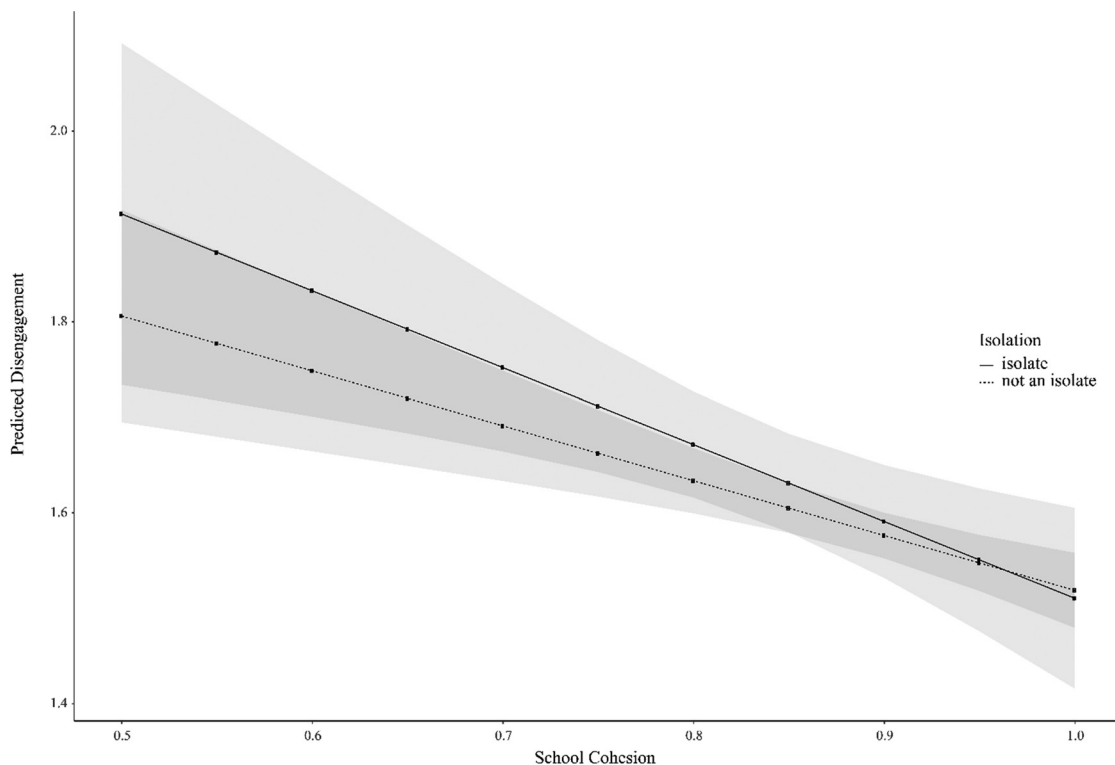

Figure 3: Predicted disengagement; Isolation by school cohesion interaction.

Table 3. Predicted values for different combinations of isolation and cohesion.

	Low cohesion		High cohesion	
	School attachment	Disengagement	School attachment	Disengagement
Not an Isolate	3.465	1.749	3.587	1.547
Isolate	3.175	1.832	3.038	1.551

We use Table 3 to explore the profiles, or experiences, of individuals occupying different positions in different schools. For example, non-isolates in low cohesion settings represent a kind of moderate case, with fairly high school attachment but also high disengagement (3.465 and 1.749). As we move across the columns to a high cohesion setting, our non-isolates increase their emotional attachment to school (3.587) and have lower disengagement (1.547). Non-isolates are thus much more committed in high cohesion schools: they are emotionally attached and more likely to engage with the behavioral norms of the school itself. And, in fact, non-isolates in high cohesion schools have the lowest levels of disengagement and the highest levels of attachment of all profiles in the table.

Isolates offer a different, more complex version of this story. An isolate in a low cohesion school represents an archetypical case of non-integration. They have relatively low school attachment and high levels of disengagement, with expected values of 3.175 for emotional attachment and 1.832 for disengagement; compare this to 3.587 (higher attachment) and 1.547 (less disengagement) for the non-isolate in the high cohesion setting. As cohesion increases, isolates become emotionally less attached, yet they behave in ways that conform more strongly to the norms of the school. This leads to an extreme combination: isolates in high cohesion settings have the lowest levels of attachment in the entire table (3.038) *and* engage more strongly with the norms of the school (1.551), they are virtually identical to non-isolates in high cohesive settings.

Table 3, therefore, captures distinct profiles, with different combinations of isolation and cohesion yielding different types of experiences. For example, youths in the low cohesion setting represent cases of low regulation, with both isolates and non-isolates experiencing high levels of disengagement. Non-isolates in high cohesion settings are the archetypical case of total integration, as they are emotionally attached to the school and follow the rules. Isolates,

in contrast, are the most 'in-line', with the lowest disengagement, in settings where they are the least attached. This is perhaps an undesirable combination from an individual's point of view, engendering alienation and possible resentment. More generally, this would suggest that social control is not simply a byproduct of being socially integrated and internalizing the group identity; integration into the school can, but need not, be useful in maintaining behavioral regularity.

Conclusion

Isolation and cohesion are two key network features that are often used to predict important outcomes. At the contextual-level, higher cohesion is associated with lower rates of depression and suicide (Ivory, et al., 2011; Aminzadeh et al., 2013). At the individual-level, isolates tend to have worse outcomes than their non-isolate counterparts (Hall-Lande et al., 2007; Cheadle and Goosby, 2012). These findings mask a common (but generally unstated) assumption of network studies: that the effect of cohesion is universal, so that all youths, regardless of position, get the same expected benefits of being in a socially cohesive environment. We examine this assumption carefully here, suggesting that network effects are universal only for specific types of outcomes. More importantly, we are able to pinpoint the conditions where the effect of cohesion is universal, and where it is more contingent. In the more contingent case, a student must possess a certain resource, like not being isolated, to benefit from the cohesiveness of the larger setting.

Empirically, we find that cohesion works very differently for isolates and non-isolates, depending on the outcome of interest. We find that non-isolates become more attached to the school as cohesion increases, while isolates actually feel less attached in high cohesion settings. Alternatively, all students, regardless of isolation status, are 'better behaved' when cohesion is higher. For example, in high cohesion schools, non-isolates are completely integrated, with

high school attachment and low disengagement. Isolates in high cohesion schools also experience less disengagement, but they are much more likely to be alienated. In this way, isolates in high cohesion schools 'toe the line' but feel like they do not belong. Or, we see that individuals can be regulated without the necessary condition of being integrated. Isolates and non-isolates in less cohesive schools are more similar to one another, both experiencing low regulation with moderate attachment.

The results, in sum, are starkly different for different types of outcomes, those based on emotional attachment compared to norms of behavior. Why would we find different types of processes for attachment and engagement ? One possibility is that the mechanism that drives the association between isolation, cohesion and attachment is different than the mechanism that drives the association between isolation, cohesion and engagement. In the case of school attachment, we suggest comparison processes are key: where youths compare their experience to those around them (am I part of a group that everyone else is part of?), with isolates faring worse in more cohesive settings. With engagement, we suggest that another mechanism, diffusion, might be more important.

With diffusion processes, a piece of information (like normative expectations for behavior) is passed along the social network, and this information flow facilitates the regulation of behavior (Newcomb et al., 1993; Warrington and Younger, 2011). In a cohesive school, information would be able to flow more easily between students, because there are fewer distinct subgroups. Here, it is easier to sanction members, as reports of any non-normative behavior could be quickly spread throughout the whole network (Veenstra et al., 2013). The normative climate of such a community may impinge on its members regardless of their individual position. Even without friendship ties, children are within the school setting most of their waking lives and their actions are visible to everyone; isolates and non-isolates alike might be subject to the regulatory influence of the whole school.

This explanation is consistent with our results: as cohesion increases, disengagement decreases for both isolated and non-isolated actors. Of course, it is possible that other mechanisms might also explain the results, and we do not offer a formal test of the diffusion hypothesis here. We look forward to future work along these lines, that would be able to empirically tease out why isolation/cohesion might operate differently across different types of outcomes (attachment versus engagement).

Though our results are important, the study does have a number of limitations that are worth mention.

First, the data are dated, going back almost 25 years. There is then a worry that the results would not necessarily still apply to today's youth. Our own take is that the fundamental processes explored in this paper, isolation and integration, likely operate in similar ways today as in the 1990s. Individuals are still affected by being socially isolated, while social control is still maintained through interactions taking place in school. These fundamental social facts are unlikely to change in 25 years. Still, important societal shifts have happened since the data were collected. For example, adolescents going to school today are living through exceptionally turbulent, uncertain times (with school shootings, the COVID-19 pandemic, etc.). In such difficult times, the need for attachment and belonging is likely to be amplified. Similarly, the development of social media over the last 25 years might amplify the effects of cohesion and isolation, as it becomes more difficult to 'escape' the school environment, even at home. Thus, if anything, we might expect that the effects of cohesion at the school level to be stronger and the consequences of being isolated in a cohesive school to be particularly sharp. In general, then, we expect that the core findings to hold today, while specific effects (differences between isolates and non-isolates in cohesive schools) to be somewhat stronger than in the past.

A second important limitation is that the data are cross-sectional. We were able to capture variation in cohesion and isolation across schools, but not how shifts in isolation, within a context, is related to our outcomes of interest. Substantively, this means that we cannot establish the direction of the causal link between attachment and isolation. Less attached youths may be more inclined towards social isolation. We found no association between normative disengagement and isolation, and the causal directionality is less concerning here. Longitudinal data are, of course, useful in trying to tease out causal ordering and problems of selection. However, students do not have the opportunity to select into low or high cohesion schools. This means that individuals who are prone to be isolates cannot choose to be in a low cohesion school (even though this would be advantageous for them), while non-isolates cannot (by themselves) make a school more cohesive. Longitudinal data would also be useful in ruling out the possibility that attachment/engagement (our outcomes) actually affected school-level cohesion, rather than the opposite, as generally argued here. For example, if students felt really attached to the school, they might be happier to be there and thus form more friendships, thus making the school more cohesive.

Finally, it could be the case that personal relationships between youths and adults in the school (staff,

teachers, coaches, etc.), also contribute to regulating youths' behavior alongside peer relationships. Having positive relationships with a teacher or coach may also give the youth a reason to have a stake in the institution, and engage with its behavioral expectations. In this way, a school that fosters these relationships may enhance engagement without strong peer effects. This is an interesting possibility that lays outside the scope of this paper, which focuses on the effects of peer-to-peer relationships. An area for future investigation includes alternative integrative mechanisms beyond structural features of the peer community.

Putting these limitations aside, our results have clear implications for future work on isolation and cohesion. At a very broad level, our findings suggest that it is important to systematically capture the context in which isolates are embedded. The effect of isolation depends on the cohesion of the setting, while cohesion depends on the friendships formed between other students in the school. This means that studies interested in isolation should seriously consider the interactions happening around the isolate, and not just the lack of ties for the focal individual.

Our framework could also be applied to a number of more specific substantive problems. For example, our framework may be useful in understanding collective action problems, where individuals participate (or not) in collective action depending on the position they hold in the network, the characteristics of the network and the kind of collective action. We can imagine applying similar logic to questions of voting, volunteering, trust in institutions and the like. In a similar way, it may be fruitful to consider problems of suicide and suicide ideation in the context of the proposed framework. Our study begins with Durkheim's classic work on suicide (Durkheim, 1897[2006]), reworking his topology in the case of multiple network levels and multiple outcomes (see also Bearman, 1991; Maimon and Kuhl, 2008). Future work could build on this, using the proposed framework to return to the question of suicide across groups and contexts. For example, our model makes it possible to explicitly differentiate between integration and regulation, as we explore different kinds of outcomes and network processes at multiple levels.

Our results suggest something about the cost of using sampled, ego network survey data to study network processes. With ego network data, respondents are randomly sampled from the population of interest, answering questions about themselves and the people they are close to. Sampled data are easy to collect and analyze but make it difficult to capture global network measures of cohesion, as the focus is on the local network around the respondent (Smith, 2015). A researcher would know if a given respondent is isolated but would have more difficulty measuring network cohesion; clearly a problem given the results presented here. This is the case as network measures of cohesion are based on the pattern of ties between all actors in the setting, and thus, traditionally at least, require full census information (unlike with other measures of cohesion, such as perceived social support, which are based on simple means over individual-level survey items). One possible solution is to draw on recent developments in network sampling (Smith, 2012; Smith and Gauthier, 2020). Here, a researcher would infer the larger network features from the sampled data, using the inferred features to characterize the context in which each respondent is embedded. This is a promising route forward but would require analyses well beyond what is typically done.

There are also more practical implications for schools. We have shown that, on one hand, disengagement is reduced in settings with higher levels of cohesion and that this holds for all actors. On the other hand, isolates are likely to feel particularly resentful and alienated in such settings, despite behaving themselves. Given this, schools cannot assume that 'all is well' just because there is engagement with the school norms and most people feel that they belong.

Overall, the results clearly show the importance of taking a systematic, multi-level approach. Network processes operate at both the individual and contextual-level (i.e., isolation and cohesion), and it is fruitful to analyze them together, offering a rich picture of how networks matter (Lomi et al., 2016). In this way, it is useful to think of contextual-level features, like cohesion, less as variables and more as the relational backdrop in which activities, interactions, and so on take place. It is with these larger relational features in mind that we can begin to interpret why certain actors are depressed, why certain actors act out and why isolates fare worse (or not) than their more connected peers.

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