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A behavior genetic analysis of the tendency for youth to associate according to GPA

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ABSTRACT

Behavior genetic research has revealed that many "environmental" variables are partially influenced by genetic factors. Known as gene–environment correlation (*r*GE), this line of scholarship provides insight on how and why individuals select into certain environments. Juxtaposing this body of evidence with research on peer group homophily—the tendency for peers to resemble one another on certain traits such as academic ability—raised two research hypotheses: (1) youth will associate with peers who receive grades similar to themselves (i.e., homophily for GPA); and (2) a portion of the variance in peer group GPA (i.e., the peer network average GPA) will be explained by individuals' genetic self-selection into the peer group (*r*GE). The results supported both hypotheses by showing a strong predictive relationship between the target individual's GPA and that of his/her peers and by revealing that 72% of the variance in peer group GPA was explained by genetic influences.

Since the publication of Lazarsfeld and Merton's seminal work on peer group processes in 1954, social scientists have devoted considerable efforts to understanding peer group homophily. *Homophily* is typically defined as the tendency for individuals with shared interests to form friendship (or network) ties. A popular colloquialism is commonly used to define homophily: "birds of a feather flock together" (McPherson et al., 2001). Much research has been devoted to understanding the origins (Rushton et al., 1984; Young, 2011; Young et al., 2013) and effects of homophily (McPherson et al., 2001; Rivera et al., 2010), but there are certain aspects of peer group formation that have yet to be analyzed. The current study will shed light on one aspect of adolescent peer group homophily that has, for the most part, been overlooked by social scientists. Specifically, this analysis will examine whether youth tend to associate with peers who perform similarly at school and whether genetic factors are able to explain the phenomenon.

Drawing on a nationally representative data source—and a large subsample of twin pairs—the current study will test two hypotheses dealing with academic ability and peer group homophily. The first hypothesis is that adolescents will show a strong correlation with their peers on grade point average (GPA). Recognizing that a correlation between one's GPA and his or her peers' GPA could be the result of several causal mechanisms, we propose a second hypothesis: peer group GPA is structured by genetic factors. A nascent body of evidence indicates that genetic factors correlate with peer group formation and selection (Beaver et al., 2008; Fowler et al., 2009; Rushton et al., 1984; Yun et al., 2011), lending theoretical support for our second hypothesis. Below, we expand our discussion of these two topics and lay the theoretical groundwork for both hypotheses.

1. Homophily in peer groups

A large body of evidence has revealed that members of a peer group tend to resemble one another on a host of traits. Evidence from psychology reveals, for example, that individuals tend to resemble their peers on measures of physical characteristics, attitudes, and aspirations (Caspi and Roberts, 2001; Harris, 1998; McPherson et al., 2001). Similarly, sociological and criminological evidence indicates that peers tend to resemble one another on measures of delinquent and criminal involvement (Akers, 1998; Kandel, 1978; Pratt et al., 2010). Perhaps the most important question underlying all of this research is whether the similarity between peers is due to causation, selection, or a mixture of both. The answer to this question has major implications for theories that cut across social science disciplines and for interventions that target specific causal mechanisms.

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Interestingly, current evidence seems to suggest that peer groups may indeed have a causal influence on the behavior of individual members. A string of recent articles by Christakis and Fowler revealed how changes in behavioral tendencies can spread through a peer group, wherein peers tend to resemble one another in obesity (Christakis and Fowler, 2007), sleep loss (Mednick et al., 2010), smoking behaviors (Christakis and Fowler, 2008), drinking behaviors (Rosenquist et al., 2010a), depression (Rosenquist et al., 2010b), and in levels of happiness (Fowler and Christakis, 2008). Studies exploiting random assignment in college dormitories have found that roommates influence one another's GPA (Sacerdote, 2001; Zimmerman, 2003) and fitness level (Carrell et al., 2009). Importantly, all of these studies reported evidence consistent with a causal explanation—that the behavior of group members is partially endogenous and a consequence of peer influence. For example, evidence indicated that a person's risk of smoking was decreased if their spouse quit smoking, if their sibling quit smoking, if their friend quit smoking, or if their coworker quit smoking (Christakis and Fowler, 2008). A similar pattern of results was reported in other studies carried out by this group of researchers (e.g., Christakis and Fowler, 2007; Fowler and Christakis, 2008; Rosenquist et al., 2010a,b).

Although the Christakis–Fowler studies have provided compelling support for the causal explanation, their analytical models were unable to account for all causes of peer similarity. Moreover, the question remains as to whether the same pattern of findings would emerge if the outcome were something known to be more stable over time such as cognitive ability or academic performance (Deary et al., 2000; Sameroff et al., 1993). As Sacerdote's (2001) analysis of randomly assigned college roommates revealed, roommates influence one another's GPA, raising the question of whether peers (note that roommates may not always perceive themselves as friends) sort themselves according to academic performance or whether the relationship is causal.

2. Cognitive ability as a sorting factor

Findings from one stream of research speak to the intellectual similarity of individuals within a peer group (Bonney, 1942). Two classic studies are particularly relevant when considering the level of similarity between peers on measures of cognitive ability. In the first study, Almack (1922) performed one of the first analyses examining intelligence as a peer-sorting factor. Participants were drawn from grammar and middle schools in San Jose, California and were administered IQ tests. Next, each respondent was asked to identify a single student who they would choose to help them with some work they had been assigned to complete. Respondents were also instructed to identify the student who they would invite to a party. For work assignment and party invitation, the analysis revealed that participants tended to chose students who were similar to themselves in regard to intelligence. Indeed, the correlation between the respondent's IQ and the peer's IQ ranged between .304 and .408.

In the second study, Seagoe (1933) approached the issue in a fashion similar to Almack (1922) by studying a group of 3rd through 8th graders and asking them the following question: "Suppose you were going to a party and could invite just one person to go with you. Suppose it could be either a boy or a girl, but not a member of your family. Whom would you ask to go with you?" Based on the responses to this question, Seagoe analyzed the similarity of pairs of friends for traits such as height, athleticism, and intelligence. Important for the current focus was that peers exhibited a moderate-to-high correlation for IQ score, with the correlations ranging between .386 and .513 depending on the stability of the friendship bond. Unfortunately, multiple regression analysis was not performed, so it was impossible to rule out other sources of spuriousness such as propinquity. Nevertheless, these findings raise an important issue that begs further attention: do people select their friends based on similar levels of cognitive ability?

Both Almack's (1922) and Seagoe's (1933) early assessments appear to suggest that peer selection is partially influenced by the degree to which two people have similar intelligence levels. More recent evidence also supports this viewpoint but suggests that causal influences may also play a role in peer group academic performance (Lomi et al., 2011; Sacerdote, 2001). For example, Lomi et al. (2011) used stochastic agent-based models to examine the simultaneous relationship between changes in GPA and network transformation. These authors reported, "the academic performance of an individual student tends to become similar to (or 'assimilate') the performance of his or her peers (or to *remain* similar)" (emphasis in original, p. 1514). These results suggest that correlated academic performance may be a product of *both* selection and causation.

3. Genetic influences on peer group selection

Building on principles of evolutionary biology, Rushton et al. (1984) proposed a genetic similarity theory which states that organisms detect other genetically similar organisms via the manifestation of genotype through phenotype (e.g., behavior) and exhibit favoritism and protective behaviors toward those similar others. In other words, the genetic influences are expressed as phenotypic outcomes, or signals, that are then noticed by similar others. The more phenotypically (genetically) similar two organisms are, the more likely it is that they will demonstrate altruistic behavior toward one another. In terms of the friendship network, this means that individuals may seek out other phenotypically (genetically) similar individuals and provide mutually supportive environments. Genetic similarity theory suggests that genes are the underpinnings to friendship, in that liking an individual leads to friendship and this friendship then leads to mutually beneficial, cooperative behavior. To be sure, genetic similarity theory argues that there are evolutionary advantages for individuals having the ability to detect genetic similarities in others and then forming a friendship. Namely, such friendship ties are more likely to lead to reciprocal altruism, which could positively impact fitness levels (evolutionarily speaking).

Research has revealed that adolescent peer groups form as a result of various factors, many of which are social/environmental in origin (McPherson et al., 2001; Rivera et al., 2010; Seagoe, 1933). Emerging evidence is, however, beginning to suggest that adolescent peer groups form as a result of active gene–environment correlation (*r*GE), a finding that appears to support Rushton et al. (1984) theory of genetic similarity. Behavioral geneticists (Plomin et al., 1977; Scarr and McCartney, 1983) have proffered the term "active *r*GE" as a way to explain the tendency for humans to select into environments that suit their genetic propensities. Since personality development is at least partially the function of genetic factors (Bouchard et al., 1990) and since peers have been shown to correlate strongly for personality traits (McPherson et al., 2001), scholars have begun to search for genetic influences on peer group selection by drawing on the inferences proffered by Rushton et al. (1984) genetic similarity theory and similar other statements (e.g., Harris, 1998). This line of research has already produced consistent evidence suggesting that peer group selection is partially governed by genetic factors (Beaver et al., 2008, 2011; Cleveland et al., 2005; Fowler et al., 2009; Guo, 2006; Yun et al., 2011).

Though each study has approached the peer group selection issue in a slightly different way, most have hypothesized that genetic factors influence personality development (i.e., the