Measuring the Prevalence and Impact of 'Acting White'*

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PRELIMINARY AND INCOMPLETE

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Abstract

There is a debate among social scientists regarding the prevalence of an insidious peer effect commonly referred to as 'acting white.' Using a newly available data set (the National Longitudinal Study of Adolescent Health), which allows one to construct an objective measure of a student's popularity, we demonstrate that there are large racial differences in the relationship between popularity and academic achievement, which we label 'acting white.' The effect is intensified among high achievers and in schools with more interracial contact, but non-existent among students in predominantly black schools. The patterns in the data appear most consistent with a signaling model in which investments in education are thought to be indicative of an individual's opportunity costs of group loyalty. Eliminating racial differences in the relationship between social status and achievement can potentially explain 32% of the black-white test score gap and 36% of the Hispanic-white test score gap among high achievers, though the effect on the average student is negligible.

"Go into any inner city neighborhood, and folks will tell you that government alone can't teach kids to learn. They know that parents have to parent, that children can't achieve unless we raise their expectations and turn off the television sets and eradicate the slander that says a black youth with a book is acting white."

Senator Barack Obama, 2004 Democratic National Convention Keynote Address

I. Introduction

The racial achievement gap is a vexing reality. Black children enter kindergarten lagging whites, and these differences grow throughout the school years.[1] On every subject at every grade level there are large achievement differences between Blacks and Whites (Campbell, Hombo, and Mazzeo 2000, Neal 2004). The typical Black seventeen year-old reads at the proficiency level of the typical White thirteen year-old (Campbell, Hombo, and Mazzeo 2000). On the Scholastic Aptitude Test, Black students score, on average, more than one standard deviation below white college goers; Blacks are the lowest performing minority group (Card and Rothstein 2004). Even in affluent neighborhoods, the racial divide is daunting (Ferguson 2001, 2002 and Ogbu and Davis 2003). Including a myriad controls, the achievement gap remains essentially unchanged (Jencks and Phillips 1998).

Racial differences also persist on a wide range of cultural habits and styles including musical preferences (Waldfogel 2003), linguistic rhythm (Wolfram and Thomas 2002), first names (Fryer and Levitt 2004, Figlio 2004) and many other consumption choices. *Seinfeld* and *Friends*, two of the most popular sitcoms in television history among whites, never ranked in the top 50 among Blacks. Of the top ten shows

[1] This fact was first established by Coleman et al. (1966). For more recent analysis, see Campbell, Hombo, and Mazzeo (2000), Carneiro and Heckman (2002), Fryer and Levitt (2004, 2005), Neal (2004), or Phillips, Crouse, and Ralph (1998).

with the highest viewership among Whites during the 2002-2003 television season, only one show was also among the top ten for blacks: American Idol.[2]

Understanding whether cultural differences among racial and ethnic groups are a cause of economic and social inequality is a question of great importance. Cultural differences may be a cause of Black academic underachievement if Black culture inhibits the acquisition of human capital or otherwise lowers the return to education.[3] On the other hand, the presence of a Black culture may simply be the consequence of past and current racial isolation and economic inequality, but play no role in perpetuating current academic disparities. Distinctive first names are prevalent among blacks, especially in low-income segregated areas, but have been shown to have no negative relationship to a host of economic, social, and educational outcomes after accounting for a child's economic and social circumstances at birth (Fryer and Levitt 2004). If Shameka were Sally, she would be just as likely to be a teen mother, be unemployed, live in a low-income zip code, or earn a high school diploma. Eliminating cultural differences in this scenario would have no overall impact on Black welfare relative to Whites.

In this paper, we focus on a highly controversial and well-publicized aspect of Black peer culture – the prevalence of an insidious peer effect commonly referred to as 'acting white.'[4] 'Acting White' is a peculiar set of social interactions in which Black

[2] This is according to Nielsen Media Research. See http://www.nielsenmedia.com/ethnicmeasure.
[3] For instance, speaking "Ebonics" may interfere with the ability to interact with Whites, or disrupt human capital acquisition more directly. As Orr (1989) writes: "I did not even know there was something called Black English when I began to realize that many of the difficulties that my students were having were rooted in language. It was the incongruence of the obvious intelligence and determination of these students with the unusual kinds of misunderstandings that persisted in their work that drove me to find answers....For the students whose first language was Black English vernacular, language can be a barrier to success in mathematics and science."
[4] It is imperative to note that there is nothing unique about Black culture. A version of 'acting white' is also prevalent in ethnographies involving the Buraku Outcastes of Japan (DeVos and Wagatsuma 1966), Italian immigrants in Boston's West End (Gans 1962), the Maori of New Zealand (Chapple, Jefferies, and Walker

adolescents chaff other black adolescents for investing in behaviors characteristic of whites (having an interest in ballet, raising their hand in class, or making good grades, e.g.).[5] A primary obstacle to the study of 'acting white' has been the lack of quantitative measures of the phenomenon. We focus on racial differences in the relationship between *social status* and *academic achievement*, our (albeit narrow) definition of 'acting white'.

We begin by constructing an index of social status. The index measures, for each student, the number of same-race friends within her school, weighted by the popularity of each friend. We implement the index using detailed information on friendship networks within schools available in the National Longitudinal Study of Adolescent Health (Addhealth). Addhealth is, in many respects, the ideal data for understanding the prevalence and impact of 'acting white.' To our knowledge, it is the only available dataset that contains within-school friendship networks, from which it is possible to construct *objective* measures of social status, along with detailed data on parental characteristics, academic achievement, and so forth. The survey covers a sample of more than 90,000 junior high and high school students from 175 schools in 80 communities around the country.

Our analysis of the prevalence and impact of 'acting white' uncovers a rich set of new facts. In stark contrast to the previous literature, we demonstrate that there are large racial differences in the relationship between social status and achievement. Among whites, higher grades yield higher popularity. For Blacks, higher achievement is

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1997), and the working class in Britain (Willis 1977), among others. In all cases high achievers receive a derogatory label from their peer group. For example, in the peer group society documented in Gans (1962), upward mobile youth interested in education were labeled "mobiles" and "sissies." See Fryer (2004) for a detailed discussion of these groups. Furthermore, we examine Hispanics in addition to blacks throughout this paper.

[5] There are many working definitions of 'acting white' which we discuss in section II.

associated with modestly higher popularity until a grade point average of 3.2, when the slope turns negative. A black student with a 4.0 has, on average, 1.5 fewer friends than a white student with a 4.0. Among Hispanics, there is little change in popularity from a grade point average of 1 through 2.5. After 2.5, the gradient turns sharply negative. A Hispanic student with a 4.0 grade point average is the least popular of all Hispanic students, and has 3 fewer friends than a typical white student with a 4.0 grade point average. Put differently, evaluated at the sample mean, a one standard deviation increase in grades is associated with roughly a .103 standard deviation decrease in social status for Blacks and a .171 standard deviation decrease for Hispanics. For students with a 3.5 grade point average or better, the effect triples. The 'acting white' effect also differs discernibly as children age. For Black students in junior high school (grades 7-9) a one standard deviation increase in grades is associated with a .13 standard deviation decrease in popularity; the decrease is .07 for high school students.

Racial differences in the relationship between social status and achievement are robust across many alternative specifications, subsets of the data, and different definitions of social status. 'Acting white' is more salient in public schools and schools in which the percentage of black students is less than twenty, but non-existent among blacks from high socio-economic status families, among blacks in predominantly black schools, or those who attend private schools. Schools with more interracial contact have an 'acting white' coefficient twice as large as more segregated schools. Accounting for the number of students at each GPA level does little to temper the 'acting white' effect, suggesting that the supply of potential friends does not explain the phenomenon. Self-selection of students into particular activities (sports, band, debate, etc) matters little, and substitution

towards other race friendships does not fully explain the stark difference in the social status – achievement gradient.

The patterns in the data are most consistent with a two-audience signaling model in which investments that garner economic success are investments that engender peer rejection. Other models that we consider such as self-sabotage among blacks or the prevalence of an oppositional culture identity, all contradict the data in important ways.

To measure the potential impact of racial differences in the relationship between social status and achievement, we estimate the fraction of the racial test score gap that could be "explained" if 'acting white' did not exist. The decomposition consists of two parts. First, we give blacks the same social status-achievement relationship that exists among whites, and predict the resulting black grades. Second, we estimate how these increased grades will feed onto test scores. Eliminating the difference between blacks and whites in the relationship between popularity and grades can potentially account for 32% of the black-white test score gap and 36% of the Hispanic-white gap among high achievers. For the average student, the effect of 'acting white' is negligible, which is due to the fact that low-performing Black students are more popular than whites.

The remainder of the paper is structured as follows. Section II provides a brief review of the literature on 'acting white.' Section III describes and summarizes the data used in the analysis. Section IV estimates the relationship between social status and achievement among racial groups. Section V attempts to reconcile the set of stylized facts with a range of competing theories. Section VI measures the potential impact of 'acting white.' Section VII attempts to reconcile our results with the existing empirical literature. Section VIII concludes. There are two appendices: a technical appendix provides a

mathematical description and derivation of our index of social status, and a data appendix which provides the details of our sample and definitions of relevant variables.

II. Background and Previous Literature

'Acting white' is a slippery and politically loaded phrase, with little consensus on a precise definition. Neal-Barnett (2001) assembled student focus groups in an attempt to deduce what specific behaviors led to accusations of 'acting white.' The list included being enrolled in honors or advanced placement classes, speaking standard English, wearing clothes from the Gap or Abercrombie and Fitch (instead of Tommy Hilfiger or FUBU), and wearing shorts in the Winter! While we are cognizant of the complications and nuances in what is often meant by 'acting white,' our data are not rich enough to test many of the plausible definitions.[6] As such, for the purposes of this paper*, we say 'acting white' exists if there are statistically significant racial differences in the relationship between popularity and grades.*

For nearly two decades, there has been a rancorous debate among sociologists, cultural anthropologists, newspaper journalists and policy wonks on the prevalence of 'acting white'. Fordham and Ogbu (1986) set the stage with their path-breaking and controversial analysis of "Capital High," a predominantly black high school in a low-income area of Washington, D.C. Fordham and Ogbu (1986) argue for the prevalence of an oppositional culture among black youth that eschew behaviors traditionally seen as the prerogative for whites.

Following the seminal work of Fordham and Ogbu (1986), there has been a flurry of conflicting opinions as to the nature, extent, and definition of 'acting white'.

[6] See Ferguson (1998) for a very nice discussion.

Ethnographic evidence is hopelessly divided, and the only two nationally representative studies dismiss 'acting white' as nothing more than an urban (or more precisely, ethnographic) legend. Table 1 provides a brief summary of many of the influential papers in this literature. For each study, we include the type of research (ethnographic or empirical), the location in which the participant observation took place, a description of the subjects, and a brief depiction of their findings as they relate to the prevalence of 'acting white.'

An interesting feature of table 1 is that most of the ethnographic studies report some negative relationship between "white behaviors" and social status among blacks. The key differences lie in the fact that many of the authors do not report that academic achievement, per se, is identified as a "white behavior." That is, the literature paints a picture whereby Black kids do not ridicule other Black kids for making good grades – instead, they ridicule them for the behaviors that are often associated with good grades (answering questions in class, being in advanced classes, or proper diction e.g.). Even when academic achievement is highly correlated with "white behaviors," many authors seemingly prefer to make a distinction between resenting achievement and resenting behaviors that are associated with achievement.[7]

Given our definition of 'acting white,' these distinctions are vacuous. To be sure, understanding the precise behaviors that lead to accusations of 'acting white' may be useful in designing effective policies. The first-order problem, which has yet to be answered in the affirmative, is whether racial differences in the relationship between

[7] This reticence could be due, in part, to the fear that some may equate 'acting white' with Black cultural dysfunctionality. Yet, economic theory informs us that 'acting white' is an equilibrium phenomenon; it is the consequence of two-audience signaling (see Austen-Smith and Fryer 2005). As such, any group presented with the same set of payoffs, strategies, and so on, would behave identically.

social status and achievement exist; as this feeds into student's investment decisions regarding human capital, social affiliations, and so on.[8] To say that 'acting white' is not salient because peers focus their gibe on behaviors correlated with achievement, but not achievement itself, is to risk "fiddling while Rome burns."

III. The Data

The Addhealth database is a nationally representative sample of 90,118 students entering grades 7 through 12 in the 1994-1995 school year. A stratified random sample of 20,745 students was given an additional (and remarkably comprehensive) in-home interview; 17,700 parents of these children were also interviewed. Thus far, information has been collected on these students at 3 separate points in time: 1995, 1996, and 2002. There are 175 schools in 80 communities included in the sample, with an average of more than 490 students per school, allowing within school analysis. Students who are missing data on race or grade level are dropped from the sample.

A wide range of data are gathered on the students, as described in detail on the Addhealth website (http://www.cpc.unc.edu/projects/addhealth). For our purposes, the most interesting and unique aspect of the Addhealth data is the detailed information regarding friendship associations in schools. All students contained in the in-school survey were asked, "List your closest male/female friends. List your best male/female friend first, then your next best friend, and so on." Students were allowed to list as many as 5 friends from each sex. Each friend can be linked in the data and the full range of

[8] For example, some black students may be accused of 'acting white' because of the way they talk or dress, not because they get good grades. This may be because they are in high-ability classes (AP, Honors, etc) where there are few black students, and consequently their social circle may have few blacks. See Ferguson (2001).

covariates in the in-school survey (race, gender, grade point average, etc) can be gleaned from each friend.

To circumvent the problems inherent in using self-reported measures of popularity, we make use of the information on friendship networks within schools to construct an "objective" measure of social status. Each student was asked to list 10 friends in their school. Instead of using raw counts, our measure of popularity for an individual *i* depends on the number of same-race students, *j*, that list *i* as a friend, weighted by the popularity of each *j*. The key innovation here is that we want a student to be more popular the more popular her friends are. That is, if students A and B have the same number of individuals who list them as a friend – student A will be more popular if and only if her friends are more popular. We call this the Spectral Popularity Index and provide the theoretical foundations for which it is based in Appendix A.[9]

Summary statistics for the variables we use in our core specifications are displayed by race in table 2, with White and Black referring solely to non-Hispanic whites and Blacks, respectively. Hispanics include any individual who checked yes to the question: "Are you of Hispanic or Spanish origin." Our primary outcome variable is the spectral popularity index. The index is normalized such that it has a mean of 0 and a standard deviation of 1. On average, Blacks and Hispanics are less popular than whites. Whites are .142 above the mean in popularity whereas blacks are .024 below the mean, yielding a black-white difference in popularity of .166. Hispanics are .141 below the mean popularity, yielding a Hispanic-white gap of .283. The table also indicates the

[9] The Spectral Popularity Index is a special case of the Spectral Segregation Index developed in Echenique and Fryer (2004).

average number of friends students have from different racial backgrounds. The typical Black and White student each has one friend of a different race.

The remainder of Table 2 presents summary statistics for the other variables used in our analysis. The most important of these covariates is a composite measure of grade point average (GPA) that we constructed. Each student was asked, "At the most recent grading period, what was your grade in each of the following subjects?" The subjects included were English/Language Arts, Mathematics, History/Social Studies, and Science.[10] Each of these grades was given on a 4.0 scale (A= 4, D or Lower =1). Relative to whites, Blacks and Hispanics have lower grades (3.0 grade point average relative to 2.5).

Other variables used as controls include: parental education, parental occupation, various school activities (varsity sports, student government, and cheerleading) and school characteristics. There are substantial differences across races on many of these variables. Black and Hispanic students come from lower socio-economic status families (mother and father less likely to be college educated and work in professional jobs), are more likely to live in urban neighborhoods and less likely to attend private schools, and so on. While this may seem like a peculiar set of covariates to use, they comprise all the social and demographic variables available in the in-school survey of 90,118 students.[11]

We strongly caution against a causal interpretation of the coefficients on the covariates, which we view as proxies for a broad set of environmental and behavioral

[10] In calculating the GPA of each student, we only used courses in which valid grades were received, as some students did not take particular subjects in every grading period. Students who did not have a grading period that academic year were told to provide grades from the last grading period of the previous academic year. Students in schools that do not assign grades were dropped from the sample.

[11] A much more exhaustive set of covariates is available for individuals who completed the in-home survey (covering approximately ¼ of the sample).

factors. Even our main parameter is not void of the potential for reverse causality. We implicitly assume that high grades cause lower popularity; it is plausible that low popularity causes high grades. Given our interest is in the racial differences in this relationship, there is much less worry.

V. Measuring the Prevalence of 'Acting White.'

Figure 1A presents the relationship between popularity and grades among whites, blacks, and Hispanics in the raw data. At low grade point averages, there is little difference among racial groups in the relationship between popularity and grades; blacks are more popular than whites. At roughly a 2.5 GPA (an even mix of B's and C's) racial differences start to emerge. Hispanic students lose popularity at an alarming rate after this cut-off – while Blacks and Whites continue to garner friends as their grades increase; the white slope is steeper. Black popularity peaks at a grade point average of roughly 3.2 and turns down afterward. Blacks with straight A's are as popular as Blacks with a 2.0 GPA. Whites continue to gain popularity as their grades increase.

Racial differences in the popularity-grades gradient may be due to various background factors that are positively related to popularity (having high income parents, e.g.). Figure 1B estimates a non-parametric relationship between popularity and grades for Blacks, Hispanics, and Whites, controlling for background factors including school fixed effects. [12] Our core set of controls include gender, age, parental education and

[12] To understand the details, consider the following model: $popularity = H(grades) + X\gamma + e$. We cannot estimate this directly because we do not know H(.).
But, $E(popularity \mid grades) = H(grades) + E(X \mid grades)\gamma + E(e \mid grades)$. Taking the difference, $popularity - E(popularity \mid grades) = [X - E(X \mid grades)]\gamma + [e - E(e \mid grades)]$. Thus, to obtain $H(grades)$, one needs to: (1) obtain estimates of E(popularity|grades) by running a non-parametric regression of popularity on grades; (2) obtain estimates of E(X|grades) by running a non-parametric

occupation, a measure of effort, and various school activities such as cheerleading, athletics, and student government. Figure 1B demonstrates that including these controls shrinks the popularity differential among low achievers while maintaining the shape of the popularity-grades gradient. Black and Hispanic high achievers continue to be much less popular than similar whites.

Table 3 presents a series of estimates designed to quantify the prevalence of 'acting white' among Blacks and Hispanics; providing numbers to the figures we described. Econometrically, our analysis is of the form:

$$(2) \quad Spectral\ popularity_i = \beta_0 + \beta_1 \cdot Achievement_i + \beta_2 \cdot Black_i + \beta_3 \cdot Black_i \cdot Achievement_i + \beta_4 \cdot Hispanic_i + \beta_4 \cdot Hispanic_i \cdot Achievement_i + \gamma \cdot X_i + \theta \cdot Z_s + \varepsilon_i$$

where X_i denotes an array of individual level variables for agent *i*, and Z_s represents school level variables. The model is estimated on a sample of only Black, White, and Hispanic students; thus β_2 and β_3 are interpreted as black coefficients relative to whites and β_4 and β_5 are Hispanic coefficients relative to whites. We refer to β_3 and β_5 as the 'acting white' coefficients for Blacks and Hispanics, respectively. The dependent variable is our spectral popularity index. The independent variables vary by column, but are generally increasing from left to right. In all cases the estimation is done using weighted least squares, with weights corresponding to sample weights provided in the data.

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regression of X on grades; (3) compute popularity - E(popularity|grades) and X - E(X|grades); (4) obtain $\hat{\gamma}$ by estimating the linear regression:
$popularity - E(popularity \mid grades) = [X - E(X \mid grades)]\gamma + [e - E(e \mid grades)]$; and (5) estimate $popularity - X\hat{\gamma} = H(grades) + e$ (non-parametric regression of $popularity - X\hat{\gamma}$ on grades).

The first column reports the racial difference in popularity without including any covariates. These results simply reflect the raw popularity differences reported in Table 2. The next specification adds controls for grades and interaction terms Black*Grades (β_4) and Hispanic*Grades (β_5). For Blacks and Hispanics, the race effect is positive, but the interaction is negative and statistically significant, which is consistent with our definition of 'acting white'.[13]

The fact that the 'acting white' coefficient is negative and statistically significant could be due to self-selection of blacks into particular school activities or other characteristics that are correlated with lower popularity conditional on grades. The third column adds controls that are meant to proxy for a student's socioeconomic background (parental occupation and education), school activities (cheerleading, sports, and student government), and the amount of effort that the student exerts. These controls do little to alter the 'acting white' burden – changing the coefficient on black*grades from -.112 to -.101 and the coefficient on Hispanic*grades from -.20 to -.186. This suggests that racial differences in covariates are not driving the negative 'acting white' coefficient. Students who put in more effort are less popular, but differential effort does not appear to explain much. The fourth column, which adds controls for school level characteristics such as the type of neighborhood that the school is located in (urban, suburban, or rural), the percent of black and Hispanic teachers, and whether the school is public or private, does nothing to change the results.

[13] The fact that the main race effect is positive is an artifact of imposing a linear model. The cross-over point for blacks is a GPA of 1.782 (twenty percent grades beneath this threshold). As such, little can be extrapolated from the main race effect.

Column 5 presents results with the inclusion of school fixed-effects, the specification of greatest interest. By comparing students who attend the same school (and likely live in similar neighborhoods), one controls for different grading standards, social norms, and mean popularity levels across schools. If high-achieving black students attend schools where grading standards are lax and popularity levels inflated, then this specification will purge the upward bias. Column 5 confirms our previous results, demonstrating that 'acting white' is large and robust even after the inclusion of school fixed effects. Other coefficients enter with the expected signs and essentially stay the same.

One possible reason that blacks face a steeper popularity-grades gradient is a supply shortage of high achieving black students. If students tend to associate with other students with similar backgrounds (in terms of race, grades, neighborhood location, etc), then one might observe a steep trajectory for blacks at higher GPA levels simply due to the fact that there are few blacks in their classes. Sociologists have argued for some time that this is a likely reason for the alienation of black high achieving students. If so, this potentially provides a different qualitative understanding of the 'acting white' phenomenon.[14]

The final column in table 3 presents estimates designed to understand the potential role of the lack of high achieving black students on the racial difference between popularity and achievement.[15] We control for the number of same-race students with similar grades in each school, by dividing the GPA distribution into four categories:

[14] The supply of students with particular grades is itself an endogenous outcome of 'acting white,' thus these results should be interpreted with some care.

[15] Black high achievers also report more risky behaviors (smoking, drinking, lying to their parents) and less happiness than White high achievers, which is consistent with 'acting white.'

less than 2.0, 2.0 – 3.0, 3.0 – 3.5, and greater than 3.5.[16] Within each grade category, we count the number of students by race separately for each school, and we include this variable as an independent regressor in our basic model linearly (denoted "Potential friends" in the last row of table 3).[17] Accounting for the supply of black high achievers has little effect on the 'acting white' coefficient, reducing it from -.103 to -.081, and virtually no effect on other covariates.[18]

Theoretically, one could imagine that the prevalence of 'acting white' could change as students are maturing and developing their identities (Cross and Fhagen-Smith 2001). Table 4 estimates our main fixed effects equation separately for each grade level from 7 to 12. As one moves across the columns (increasing grade levels) the coefficients on the main race effect and the race-grades interaction change slightly. Comparing the first and sixth columns, the main race effect decreases (.32 to .18) and so too does the popularity-grades gradient (-.11 to -.07). Other coefficients remain essentially unchanged. The final two columns pool grades 7-9 (junior high school) and 10-12 (high school). The 'acting white' coefficient is twice as large in junior high school relative to high school, though we caution against making too much of the difference.[19]

[16] These cut-offs were chosen with two desiderata in mind: (1) roughly equalizing the number of students in each category; and (2) being consistent with the breaks in the popularity-grades gradient in figure 1B.
[17] Thus for each school, there are 12 categories of students (three race categories times four GPA categories) and we count how many students there are in each category.
[18] We have repeated this specification among students from junior high schools and high schools, respectively. In both instances, accounting for the supply of black high achievers modestly reduces the racial difference in the popularity-grades gradient. The magnitude of the effect remains higher among junior high school students. We have also partitioned the number of potential friends into 20 equally sized bins and included them as dummy variables. Using this non-linear approach modestly decreases the 'acting white' effect.
[19] There are many reasons 'acting white' could be more salient in junior high school relative to high school including identity development, selection of low-achieving students out of high school, or compression of the grade distribution in high school due to the burden of 'acting white' in earlier grades. We are unable to adequately test between these competing hypotheses.

Accusations of 'acting white' are thought to be concentrated on high achievers.[20] To the extent that we are adequately capturing the phenomenon, we would expect a larger effect on students with higher grade point averages. Table 5 conceptualizes 'acting white' in this way. Students are grouped into one of four categories based solely on GPA. As before, the categories include students with GPAs of 1 to 2.0, 2.0 to 3.0, 3.0 to 3.5, and 3.5 and higher. In all cases, we estimate our main specification, including school fixed effects. As expected, the salience of 'acting white' increases monotonically with achievement. For low achievers (students with less than a 2.0 GPA) there is no 'acting white' effect, which is consistent with Figure 1B. For students with a 3.5 GPA or better, the 'acting white' coefficient is -.329, over three times the magnitude of the effect in the overall sample. This captures the divergence in popularity among black and white high achievers depicted in figure 1B. For Hispanics, the results are more mixed. The smallest effect exists among low achievers, but 'acting white' is most salient among Hispanics with grade point averages between 3 and 3.5.

A. Sensitivity Analysis and Extensions of the Basic Model

In an effort to uncover other factors that are associated with 'acting white', Table 6 explores the sensitivity of our results across a wide variety of sub-samples of the data and alternative specifications. We report only the 'acting white' coefficients for Blacks and Hispanics and associated standard errors in the table. The top row of the table presents the baseline results from column 5 in table 3.

[20] Indeed, previous analysis of 'acting white' in nationally representative samples use, as a measure of achievement, whether or not a students "makes mostly A's" (Cook and Ludwig 1997).

As one peruses the table, it becomes evident that the 'acting white' phenomenon is robust across most subsets of the data, though there are a several notable exceptions. 'Acting white' is modestly more prevalent among Black males relative to Black Females.[21] Whether or not one uses the sample weights provided in the Addhealth data matters little. 'Acting White' is large in public schools and non-existent among blacks in private schools. This latter finding may partially explain why black kids in private schools appear to do especially well (Akerlof and Kranton 2002, Neal 1997 and Grogger and Neal 2000).[22]

ALTERNATIVE MEASURES OF POPULARITY

The 'acting white' coefficient is also robust to different measures of social status. We include the following three alternative measures of popularity: (1) non-normalized Spectral popularity; (2) same-race friends – measured as how many individuals *j* put *i* down as a friend (*not* weighted by the popularity of each *j*); (3) all-race popularity; and (4) other-race popularity. All these measures have been normalized such that they have a mean of zero and a standard deviation of one. The sign and magnitude of the 'acting white' coefficient for Blacks and Hispanics is robust across the first three measures. The positive coefficient on other-race popularity suggests that blacks and Hispanics substitute towards other-race friends in the presence of 'acting white'. The magnitude of the coefficient, however, is significantly smaller so that on net, 'acting white' (race effect

[21] Plotting race-specific popularity and grades by race and gender reveals that popularity decreases for black boys earlier (3.25 GPA relative to a 3.5 GPA) and the gradient for high achievers is steeper.
[22] We have also investigated whether 'acting outlier' is the underlying problem and not 'acting white' as such, by estimating the relationship between popularity and grades among whites in schools with low average test scores. Whites in these schools continue to have a positive relationship between popularity and grades.

minus the substitution effect) still dominates.[23] Blacks and Hispanics with a GPA above 3.5 are actually losing other-race friends, exacerbating the effect of 'acting white' among this select group. This result is troubling, as one would hope that high achieving minority students could find refuge among high achieving whites.[24]

STUDENT ACTIVITIES

There are many opportunities in schools for students to self-select into particular activities, ensuring that most of their peer interactions are with other students with similar interests. This includes organized sports and cheerleading, various clubs (languages, math or science, drama, or debate), band and music, or the national honor society. These activities likely differ in their affirmation of high achievement; the honor society likely affirms achievement in a way that organized sports does not. Yet, across this diverse set of potential student activities, only one eliminates the racial difference in the relationship between social status and achievement: the national honor society. In all other activities, there remains a substantial gap, suggesting that self-selection into extra-curricular activities does not eliminate the deleterious effects of high grades among blacks and Hispanics. Thus, the hypothesis by some that high-achieving blacks take up extracurricular activities to deflect hostility (e.g. Farkas et al 2002) is not borne out in the data.

[23] The bulk of the substitution effect is occurring among students with a GPA between 3.0 and 3.5, especially among blacks. Including controls for number of "potential friends" (i.e. number of same-race students in GPA category by school as in Table 3) does little to change this.
[24] We are by no means implying that high achieving whites are in any way *refusing* to befriend minorities; only reporting a correlation in the data.

INTERRACIAL CONTACT

The most striking aspect of table 6 is how the coefficient on 'acting white' varies in arenas with more or less interracial contact. Remarkably, schools that are less than 20 percent black have the largest 'acting white' effect for Blacks and Hispanics.[25] Schools in which blacks comprise greater than 80% of the student body there is no 'acting white' effect. Indeed, in all black schools, the coefficient on black*grades is positive.

Results in table 6 are also contrasted between high and low segregated schools. The amount of segregation in any school A is measured as:

$$(3) \qquad \text{Segregation}_A = \frac{\text{Expected(CrossRace Friends)} - \text{Observed(Cross Race Friends)}}{\text{Expected(CrossRace Friends)}},$$

where cross race friends refers to the total number of friends from each race with students from different races.[26] The segregation index ranges from -1 (pure out group preference) to 1 (total segregation). A value of 0 indicates that there is no group preference: friends are random with respect to race. The measure of segregation was calculated for each school and divided the set into high and low segregation school; cutting at the median.

Surprisingly, blacks in more segregated schools incur less of a tradeoff between popularity and achievement. The coefficient on the 'acting white' term is twice as large in schools that are above the median in terms of segregation. This result holds true after accounting for the potential supply shortage of black students in very integrated schools. The fact that 'acting white' is more prevalent in integrated schools is surprising, but

[25] This is true even after controlling for the number of blacks within a school or controlling for the number of blacks with similar grades.
[26] This index is a modification of Freeman (1978) and related to Echenique and Fryer (2005). For a complete derivation, see the Addhealth's School Network Variables Codebook available at: http://www.cpc.unc.edu/projects/addhealth/codebooks/wave1.

consistent with evidence that there can be significant pressure in racially heterogenous schools to toe the racial line (Tatum 1997).

VI. Understanding the Patterns in the Data Through the Lens of Economic Theory

A number of stylized facts emerge from the analysis of the preceding sections. There are large racial differences in the relationship between popularity and grades. These differences are nearly twice as large among junior high school students relative to high school students, and roughly three times as large for black students with a 3.5 grade point average or higher. 'Acting White' is more salient in public schools and among children from low education families. Accounting for self selection into extra-curricular activities or the supply of black high achievers does little to undermine the effect. Environments with more interracial contact are associated with a steeper popularity-grades gradient among blacks. The results are not an artifact of our particular measure of popularity. While there is some substitution towards other-race friends in the presence of 'acting white,' the magnitude is trivial.

In this section, we turn to the great clarifying power of economic theory to disentangle this set of facts.

A. A Sabotage Model

One explanation for racial differences in the relationship between social status and achievement is that blacks simply sabotage their high achieving peers.[27] McWhorter (2000) is a prominent advocate of this view.

[27] There are several mechanisms that could lead to such behavior. The most simplistic is that black and Hispanic cultures are dysfunctional; punishing successful members of their group rather then rewarding their success.

Consider the following skeletal outline of a sabotage model. Imagine a world with two neighborhoods: a majority community and a minority community, each containing many individuals. Individuals come in two flavors: high ability and low ability, which are determined by Nature and publicly observed within a community. There are two states of the world: discriminatory and fair; which are unknown. Individuals observe their ability type and make a dichotomous human capital decision. Assume that human capital is less costly to obtain for high ability workers. Individual utility is partly determined by what others (outside the community) perceive about their ability.

Firms observe each individuals level of human capital and decides whether or not to hire them. When the state of the world is discriminatory, firms refuse to hire minority workers. In a fair state, workers are hired if and only if they have invested in human capital. Assume that payoffs are such that low ability types never have incentive to acquire human capital.

In this framework, low ability agents have incentive to "hold back" individuals with high ability when the cost of doing so is greater than the net benefit; independent of the state of the world. As more high ability individuals invest in human capital and garner success, the world may be revealed to be fair, putting the onerous of non-achievement on low ability individuals. Thus, the net benefit of sabotage is increasing in the fraction of individuals who escape.

The sabotage theory, irrespective of the details, is at odds with the fact that blacks in predominantly black schools face no tradeoff between social status and achievement – the 'acting white' coefficient is weakly positive in these schools. The theory also does not

adequately explain why 'acting white' is particularly salient in schools with more interracial contact.

B. An Oppositional Culture Identity Model

The most prominent theory to explain the stylized facts put forth is the oppositional culture hypothesis, developed in Fordham and Ogbu (1986).[28] The hypothesis states that the observed disparity between blacks and whites stems from the following factors: (1) white people provide them with inferior schooling and treat them differently in school; (2) by imposing a job ceiling, white people fail to reward them adequately for their academic achievement in adult life; and (3) black Americans develop coping devices which, in turn, further limit their striving for academic success. Fordham and Ogbu (1986) suggest the problem arose partly because white Americans traditionally refused to acknowledge that black Americans were capable of intellectual achievement, and partly because black Americans subsequently began to doubt their own intellectual ability, began to define academic success as white people's prerogative, and began to discourage their peers, perhaps unconsciously, from emulating white people in striving for academic success.

The Fordham and Ogbu hypothesis can be directly imputed into a simple economic model of identity and human capital acquisition, ala Akerlof and Kranton (2000, 2002). In their language, identities are accompanied by certain "prescriptions" that define appropriate behaviors for a person of that type. When an individual makes decisions in line with these prescriptions, there is a utility benefit. In standard models, a

[28] Since then, efforts have been focused on refuting Fordham and Ogbu's hypothesis, not developing alternative theories.

student invests in human capital until the marginal cost of investment equals the marginal benefit of that investment. Fordham and Ogbu (1986) argue that institutional discrimination lowers the marginal benefit of investment for certain minority groups. As a rational response, these minorities began to equate educational achievement with whiteness, thereby altering the prescriptions (e.g. what it means to "be black").

The predictions of the oppositional culture identity model face mixed success in terms of the patterns observed in the data. Consistent with the theory, there are no racial differences in the relationship between popularity and achievement among blacks in private schools and from high socioeconomic status families, as these environments likely change identity prescriptions. It is unclear what the oppositional identity model predicts about the salience of 'acting white' as a function of the percentage of black students in a school.[29]

The theory, however, does quite poorly in explaining why environments of increased interracial contact fuel -- not temper -- 'acting white.' Schools with high levels of segregation, which presumably trigger racial awareness and identity, have a muted 'acting white' effect relative to schools with more integration.

[29] Oppositional culture might be more prevalent in predominantly black or highly segregated schools and less prevalent in integrated and less segregation environment. As opportunities and the likelihood of success increases, the oppositional culture model predicts that incentives to develop oppositional identities decrease and hence, 'acting white' decreases. The countervailing effect is that black identities likely become less salient as the percentage of blacks in a school increase (similar to "American" identities becoming more prevalent in one travels abroad). Which effect will dominate is unclear.

C. A Two-Audience Signaling Model

The previous models make clear that there is a subset of the stylized facts that are difficult to explain without incorporating signaling. We now do just that, taking from the model developed in Austen-Smith and Fryer (forthcoming).

The key idea is that individuals face a two audience signaling quandary: behaviors that promote labor market success are behaviors that induce peer rejection. The model involves an environment with three sorts of agents: individuals, firms, and a (suitably anthropomorphized) peer group. Individuals are endowed with a two-dimensional type: social and economic. The social type represents their value to the group and the economic type their value in the economic market. Individuals are also endowed with a unit of time to be allocated between schooling and leisure. After observing their two-dimensional type, individuals choose a fraction of time to devote to education which serves as a signal to firms about future productivity and to peers about social compatibility. Upon observing individual investments in education, the group decides whether or not to accept the individual and wages are set by firms who engage in Bertrand bidding to produce a homogeneous product.

Firms are assumed to have no interest in any employee's group membership, and groups are assumed not to have any basic preference over whether a potential member works hard at school, is employed or wealthy. Consequently, there is no intrinsic conflict built into the model between individuals being highly educated and employed, and being members of a group; to the extent that such conflict emerges, therefore, it is as an equilibrium consequence of two-audience signaling. At the same time, other things equal, all social types strictly prefer to be accepted rather than rejected by their peer group. And,

just as group acceptance is valuable to the individual, individuals yield value to the group through consumption externalities, community policing, so on and so forth. Peer groups, however, only want to accept members who are socially compatible group members in that they can be depended upon to support the group in difficult times.

The stylized facts appear to be consistent with the two-audience signaling model described above. The theory predicts racial differences in the relationship between popularity and grades, which has been documented. Environments where peer norms affirm academic achievement we would expect that 'acting white' is not salient. This is true in private schools and among members of the national honor society. To the extent that high grades are not a credible signal of one's racial loyalty, the theory predicts that acting white will not exist. This helps explain why there is no trade-off between social status and achievement among predominantly black schools.

In the two-audience signaling model, there is a tension between signaling group loyalty and signaling economic potential. This tension is likely to be exacerbated in environments with more interracial contact as one has to provide stronger signals of their loyalty. This mechanism is consistent with the findings that 'acting white' appears to be more salient in schools with more interracial contact.

The evidence in support of the two-audience signaling model is far from overwhelming, but it is the only theory examined that does not directly contradict the patterns observed in the data.

VI. Measuring the Potential Impact of 'acting white.'

To understand the potential impact of 'acting white' we pose the following thought experiment: "What fraction of the racial test score gap could be 'explained' if racial differences in the relationship between popularity and grades did not exist?"[30] We form the relevant counterfactual by making two fundamental assumptions regarding black achievement: (1) blacks would have the same grades-popularity relationship as whites in our data if there were no 'acting white' phenomenon; and (2) this effect would feed onto higher black test scores (and other achievement outcomes in general) through the relationship between test scores and grades among blacks. This is perhaps the simplest way of estimating how black achievement would change if blacks had the same popularity-grades relationship as whites.[31]

We begin by giving blacks the white grades-popularity relation. Formally, we estimate the following equation:

$$Grades = f(popularity) + X\beta + \varepsilon, \quad (4)$$

separately for blacks and for whites.[32] We then predict what blacks grades would be conditional on black popularity, using equation (4) with the *f(.)* estimated from the white

[30] This is by no means a causal story; only a simple "accounting" exercise. We may overstate the amount of the test score gap that 'acting white' can explain because the potential general equilibrium effects are left un-modeled.

[31] We also attempted to measure the impact of 'acting white' directly. Using data from high schools in the sample, we calculated the prevalence of 'acting white' in each high school. Then, for each junior hi school student, we identified the high school that they "should" (based on geographic boundaries) attend. Thus, one can compare students in similar junior high schools who attend radically different high schools on the 'acting white' dimension. We were severely handicapped in our ability to execute this approach because the follow-up surveys occurred 1 and 6 years after the baseline survey. The first follow-up was too close to the original survey which made our sample size too small, and by the subsequent follow-up students had graduated from high school.

[32] We model grades as the dependent variable in this section, as opposed to popularity in the previous tables. It is reasonable to believe that black grades, not popularity, is the crucial factor that is affecting achievement outcomes. However, this distinction is not important since the shape of the *f(.)* function here is roughly the same shape as the popularity-grades relationship in our figures.

regression, maintaining the estimated β from the black equation.[33] That is, we calculate what black grades would have been, but for 'acting white,' as:

(5) $$Grades_{black} = f_{white}(popularity) + X\beta_{black} + \varepsilon .$$[34]

Recall, figure 1B demonstrates that the racial difference in the grades-popularity relationship is especially large among high-achievers. As black high-achievers approach a 4.0 GPA, their popularity declines, while no such pattern is seen among whites. By allowing a non-linear *f(.)* function, this pattern can be captured in the counterfactual. When we give blacks the white popularity-grades distribution in our counterfactual, we will see black grades increase, particularly among high-achievers, which will feed onto higher test scores. The reverse will be true for low achievers, given blacks are more popular than whites among this group.

The second step in our thought experiment is to estimate a test score-grades relationship specifically for blacks to determine how the increased counterfactual grades among blacks (estimated in equation 5) feed onto higher test scores. Our specification is:

(6) $$Testscore = h(grades) + X\gamma + \upsilon .$$[35]

Then, we predict test scores from counterfactual grades using the black equation. In symbols,

(7) $$Testscore_{black} = h_{black}(grades_{black}) + X\gamma_{black} + \upsilon ,$$

[33] We do not give blacks the white β because racial differences in the payoff to covariates are not directly relevant to 'acting white'. This method can also be considered a lower bound, since giving blacks the white β would likely inflate black grades beyond our estimated counterfactual.

[34] To operationalize this, we include popularity as a vector of dummies for simplicity – in other words, we "spline" popularity. Specifically, we spline spectral popularity into categories of 0.4 width and topcode popularity at 6, giving approximately 17 indicator categories. Splining into finer categories, for example 0.2, does not change the results in this section.

[35] We model grades non-linearly by transforming (predicted) grades into a vector of dummies. We use a width of 0.2 which yields 16 indicator dummies.

where $grades_{black}$ is derived from the previous step.[36]

Decomposition results are shown in table 7. The first column reports results from the overall sample; subsequent columns alter the sample by grade level and achievement category. The top row provides the unadjusted gap in test scores. Black test scores are .721 standard deviations below whites; Hispanics are .794 below. Eliminating racial differences in the relationship between social status and achievement produces a test score gap of .730 between blacks and whites and a gap of .763 between Hispanics and whites. Thus, for the average black student, eliminating 'acting white' actually increases the test score gap. This is due to the fact that among students with relatively low grade point averages (where the bulk of the blacks reside), blacks are more popular than whites. For Hispanics, eliminating 'acting white' reduces the test score gap by roughly 4% for the average student. Similar results are obtained when we split the sample into junior high and high schools.

Focusing the impact of 'acting white' on the mean student masks the significant heterogeneity that lies beneath. Columns 2 and 3 calculate the burden for low achievers (GPA less than 2.0) and high achievers (GPA of 3.5 or greater), respectively. Among low achievers, 'acting white' explains a trivial amount of the black-white test score gap and increases the gap between Hispanics and whites. Conversely, for high achievers, 'acting white' is a colossal impediment; accounting for 32% of the black-white test score gap and

[36] Note that we estimate the regression equation with actual grades on the right hand side, and then we predict test scores using "adjusted" grades on the right hand side. This is in line with other Oaxaca-type decomposition techniques.

36% of the Hispanic gap.[37,38] Similar results are obtained when junior high and high schools are estimated separately.

These results suggest that eliminating racial differences in the relationship between social status and achievement is unlikely to solve the racial achievement gap. However, for high achievers, eliminating these differences could have enormous effects on their achievement, social affiliations, college attendance, and resulting labor market.

VII. Reconciling our Results with the Previous Literature on 'Acting White.'

The results presented in the previous sections are at odds with the conventional wisdom on 'acting white.' There have been two previous studies on the prevalence of 'acting white' using nationally representative data (Cook and Ludwig 1998 and Ainworth-Darnell and Downey 1998), both based on the National Educational Longitudinal Study (NELS). These studies provide evidence that peer group norms are not significantly different between black and white 10th graders by examining the relationship between self-reported measures of popularity and academic achievement. Cook and Ludwig (1998) find that high-achievers are actually more popular than low-achievers, and that this positive achievement-popularity relationship is not significantly

[37] Controlling for individual-level covariates leaves all results for blacks and Hispanics here essentially the same.

[38] We also experimented with changing the black popularity distribution as part of the counterfactual, since 'acting white' is supposedly suppressing black popularity. We gave blacks the white popularity distribution, specifically by giving each black at the nth percentile of the black popularity distribution the white popularity value for the nth percentile of the white popularity distribution. The advantage of this approach is that it preserves within-race rank in popularity, and it makes no distributional assumptions meaning that e.g. fat tails are preserved (i.e. among the very popular). Making this adjustment to black popularity as the initial step in the counterfactual procedure, however, makes very little difference to the results.

different between whites and blacks – if anything, the relation is stronger among blacks, providing evidence that 'acting white' does not exist.[39]

One shortcoming of the previous work is that it relies on self-reported measures of popularity. The NELS contains a question that asks if the student "thinks others see him/her as popular." The answer choices are: not at all; somewhat; or very. Unfortunately, it is doubtful that individuals truthfully report potentially self-damaging information.[40] Asking a 10th grade student how popular they are is paramount to asking a 13 year old boy how often he has sex. The result is a classic measurement error problem which may lead to misleading inferences (beyond greater standard errors) if the error in the self-reported variable is related to race or achievement levels.

Another potential weakness with the previous studies is that achievement levels are defined dichotomously. Cook and Ludwig (1997) use two such measures: (1) whether the student earns "mostly A's in math"; and whether the student is in the honor society. When we investigate how popularity varies across a continuous measure of achievement (GPA) in the NELS using our basic specification from the Addhealth, we find that 'acting white' exist and is robust to including a myriad controls.

Table 8 estimates the prevalence of 'acting white' among eighth and tenth grade students in the NELS. The equation estimated is identical to that implemented in the Addhealth data, described by equation (2). Popularity is measured as a dichotomous variable; equal to one if students in class see the respondent as very popular and equal to

[39] Their results hold even when they control for nonacademic variables that influence popularity, including family income and participation in varsity sports or band (Cook and Ludwig 1997).
[40] A classic example of this is that roughly 25% of non-voters report having voted immediately after an election. See Tanur (1992) for more examples of this bias. We are grateful to Jennifer Hochschild for pointing us to this literature.

zero if not.[41] The independent variables vary by column and are generally increasing from left to right.

Columns 1 and 5 of table 8 show that there is a positive relationship between grades and popularity, though the relationship is smaller for blacks, which is consistent with 'acting white.' The 'acting white' coefficient is large and statistically significant for Blacks in both eighth and tenth grades, but never statistically significant for Hispanics. Columns 2 and 6 include controls for test score, effort, SES, gender, and extracurricular activities (athletics, student government, and cheerleading). The coefficient on grades and the acting white coefficient change little, suggesting that black-white differences in covariates are not driving the negative 'acting white' coefficient (similar to the results in the Addhealth).[42]

Columns 3 and 7 include controls for school characteristics. Private school attendance is associated with greater reported popularity, but the inclusion of school characteristics does not alter the 'acting white' coefficient. Columns 4 and 8 present results with the inclusion of school fixed-effects. These results are consistent with our previous analysis using the Addhealth. There is no statistical difference between Hispanics and Whites in the relationship between popularity and grades in the NELS. Other coefficients stay essentially the same.

[41] In the raw data, the measure takes on three values, whether or not students see the respondent as: (1) very popular; (2) somewhat popular; or (3) not popular at all. Only 15% of the 10th grade sample (and 18% of the 8th grade sample) reported being not popular at all – thus we merged responses (2) and (3). See the data appendix for details.

[42] Including the interactions Black*Test Score, Black*Effort, or Black*SES does little to alter the results.

VIII. Conclusion

For nearly 20 years, there has been a debate among social scientists as to the prevalence and potential impact of negative peer sanctions often referred to as 'acting white.' The *consensus gentium* is: (1) 'acting white' does not exist in nationally representative samples, and (2) to the extent that it is discernible in data, it is concentrated in low-income minority schools. This paper demonstrates that the facts point in the exact opposite direction: 'acting white' is observable in nationally representative data, but non-existent in predominantly black schools.

More generally, we demonstrate that the relationship between social status and achievement is categorically different between racial groups, and this difference is remarkably robust across a variety of different specifications, sub-samples of the data, and definitions of social status. Particularly interesting is that high achieving students and students in environments with more interracial contact are most burdened by 'acting white.' We argue (and provide circumstantial evidence) that 'acting white' is an equilibrium phenomenon, the consequence of two-audience signaling; not self-sabotage among blacks or the result of an oppositional cultural identity that declares education useless.

To the question of whether or not black culture is a cause or consequence of black academic underachievement, the answer is enigmatic. Eliminating 'acting white' can potentially account for roughly 32% of the black-white test score gap and 36% of the Hispanic-white test score gap among high achieving students. The effects on the mean student are negligible. Eradicating 'acting white' will likely do little to increase high

school graduation rates, but may be an important reason that minorities do poorly in middle-class neighborhoods and are not adequately represented at elite universities.

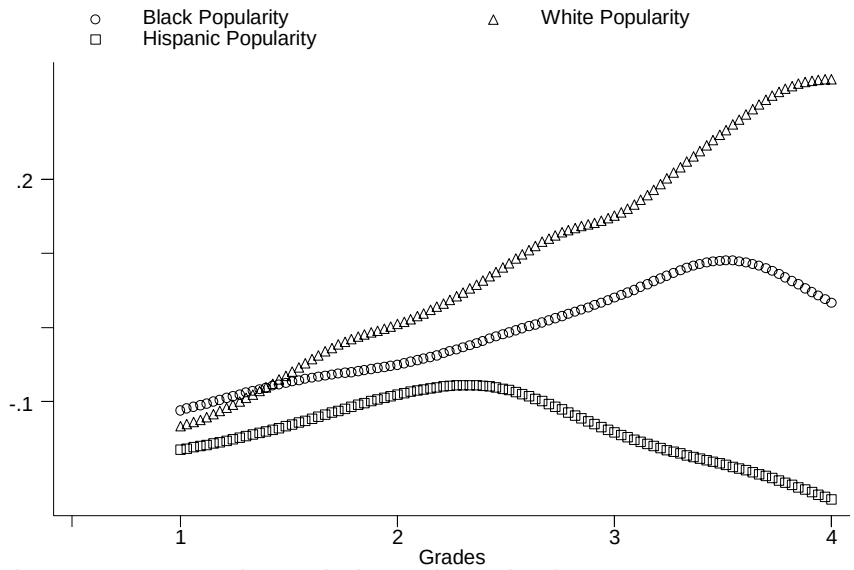

Figure 1A: Spectral Popularity and Grades by Race, Raw Data

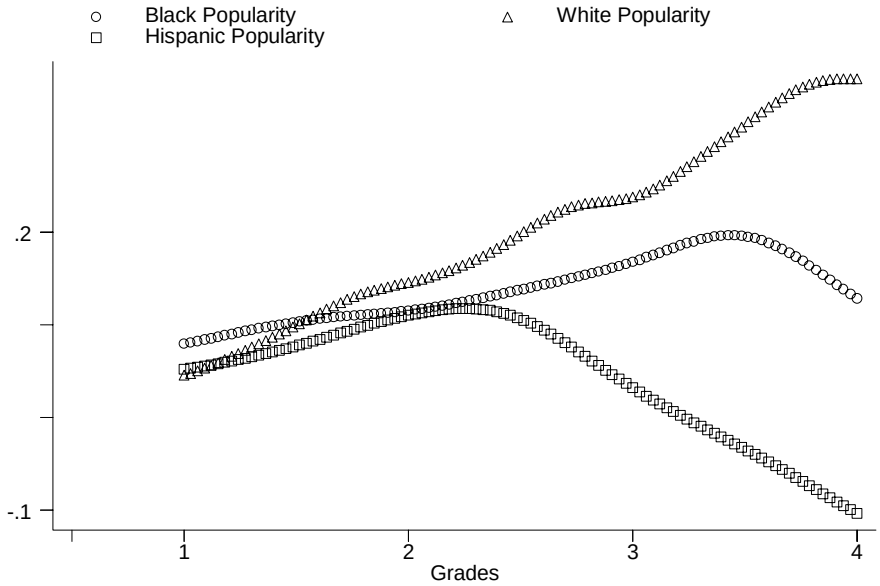

Figure 1B: Spectral Popularity and Grades by Race, With Controls

Table 1: Summary of Previous Literature on 'Acting White'

Author(s)	Type of Analysis	Location	Subjects	Findings
Cook and Ludwig (1998)	Empirical	US	National Educational Longitudinal Study, 10th graders	No evidence that black high-achievers suffer in terms of social standing, relative to white high-achievers.
Ainsworth-Darnell and Downey (1998)	Empirical	US	National Educational Longitudinal Study, 10th graders	Black students are especially popular when they are seen as very good students, compared to whites (contra acting white).
Fordham and Ogbu (1986)	Ethnography	Washington DC	Black high school students in a low-income area	Following the practices of the the mainstream school system is equated with "acting white" by black americans. Many high-achieving students are called "brainiacs" or "pervert brainiacs" (questioning their heterosexuality).
Ferguson (2002)	Empirical	US	Middle and high scool students in middle- and upper-middle income districts	Whites and asians appear to be more academically engaged in terms of homework completion rates.
Roderick (2003)	Ethnography and Empirical	Chicago	Longitudinal sample of blacks transitioning from 8th grade to high school on Chicago's South Side	9th grade teachers report much more negative behavior than 8th grade teachers for both males and females, though more marked for males.
Horvat and Lewis (2003)	Ethnography	California	Females in two urban public high schools	Successful black females often "managed" their success, camouflaging it with some (unsupportive) peers and emphasizing it with other (supportive) peers.
Bergin and Cooks (2002)	Ethnography	Midwestern City	African-American and Hispanic high-achieving high school students	Black students sometime accused of acting white if they talk "too proper" or spend too much time with white students. Not a single student admitted to changing behavior to avoid accusations of acting white.
Datnow and Cooper (1996)	Ethnography	Baltimore	African-american high school students enrolled in predominantly white elite schools	At elite schools, it is "cool" to be smart in Black peer groups (as opposed to public schools).

Chin and Phillips (2004)	Ethnography	Southern Californ	Fifth graders at various middle schools	Students desire for good grades was tempered by insistence that others should be socially competent (and not focus exclusively on school). Some blacks accused of "acting white" because of their speech and attitude, as are other students who "act" like a different race, though no accusations specifically tied to achievement in school.
Farkas et al (2002)	Empirical	US	Fourth graders (NAEP) and tenth graders (NELS)	NELS: Find that in high minority schools, for black males and black females only, being a very good student increases likelihood of being put down by classmates. NAEP: Males experience significantly more peer opposition to school effort than do females, and black experience more opposition than do whites. Students in Title I School (low-income) report more peer hostility to school achievement.
Tyson et al (2004)	Ethnography	North Carolina	Students of all races in eleven elementary, middle, and high schools	In only one high school did black students specifically discuss the burden of 'acting white' with respect to academic achievement. Some interviews suggest that black students in the high-ability track may face more jealously and hostility than white students in that track, possibly due to racial and socioeconomic inequality apparent in the tracking system.

Table 2: Summary Statistics by Race, Addhealth

	All		Whites		Blacks		Hispanics	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
White	0.524	0.498	1.000	0.000	0.000	0.000	0.000	0.000
Black	0.156	0.363	0.000	0.000	1.000	0.000	0.000	0.000
Hispanic	0.170	0.376	0.000	0.000	0.000	0.000	1.000	0.000
Asian	0.047	0.211	0.000	0.000	0.000	0.000	0.000	0.000
Mixed Race	0.103	0.304	0.000	0.000	0.000	0.000	0.000	0.000
Popularity	0.000	1.000	0.142	1.177	-0.024	0.698	-0.141	0.871
Grade Point Average	2.800	0.808	2.914	0.793	2.561	0.754	2.552	0.801
Age	14.999	1.706	15.019	1.672	14.922	1.704	15.188	1.750
Male	0.497	0.500	0.502	0.500	0.466	0.499	0.503	0.500
Effort	3.092	0.950	3.137	0.798	3.136	1.064	2.926	1.175
Sports	0.510	0.500	0.540	0.498	0.506	0.500	0.425	0.494
Student Government	0.073	0.260	0.076	0.265	0.090	0.285	0.050	0.219
Cheerleading	0.080	0.271	0.075	0.263	0.106	0.308	0.070	0.255
Mother College Educated	0.251	0.434	0.292	0.455	0.225	0.417	0.126	0.331
Father College Educated	0.241	0.428	0.304	0.460	0.140	0.347	0.118	0.323
Mother Professional	0.273	0.445	0.311	0.463	0.282	0.450	0.162	0.369
Father Professional	0.240	0.427	0.314	0.464	0.118	0.323	0.126	0.332
Urban	0.343	0.475	0.243	0.429	0.406	0.491	0.610	0.488
Suburban	0.559	0.497	0.630	0.483	0.494	0.500	0.357	0.479
Private School	0.061	0.240	0.074	0.263	0.033	0.179	0.031	0.174
Percent Black in School	12.424	19.756	5.491	9.978	35.399	28.772	14.436	17.382
Percent Hispanic in School	3.351	8.885	1.409	2.905	2.514	6.896	10.877	17.434
Frequency of Missing Values:								
Missing Age	0.002	0.048	0.001	0.026	0.005	0.068	0.004	0.063
Missing Mother's Education	0.217	0.412	0.151	0.358	0.254	0.435	0.320	0.466
Missing Father's Education	0.367	0.482	0.260	0.438	0.573	0.495	0.477	0.499
Missing Mother's Occupation	0.246	0.431	0.176	0.381	0.337	0.473	0.332	0.471
Missing Father's Occupation	0.391	0.488	0.287	0.452	0.616	0.486	0.481	0.500
Missing Effort	0.005	0.072	0.004	0.060	0.004	0.067	0.008	0.091
Missing Gender	0.046	0.209	0.020	0.141	0.072	0.258	0.095	0.293

Table 3: The Relationship Between Social Status and Academic Achievement

	(1)	(2)	(3)	(4)	(5)	(6)
Black	-0.16	0.18	0.174	0.158	0.148	0.125
	0.009**	0.031**	0.032**	0.031**	0.031**	0.030**
Hispanic	-0.381	0.18	0.188	0.18	0.164	0.153
	0.009**	0.030**	0.031**	0.031**	0.031**	0.030**
Grades		0.168	0.129	0.132	0.135	0.118
		0.007**	0.007**	0.007**	0.007**	0.007**
Black*Grades		-0.112	-0.101	-0.099	-0.103	-0.081
		0.012**	0.012**	0.012**	0.012**	0.011**
Hispanic*Grades		-0.2	-0.186	-0.182	-0.171	-0.145
		0.011**	0.011**	0.011**	0.011**	0.011**
Effort			-0.034	-0.038	-0.035	-0.035
			0.006**	0.006**	0.006**	0.005**
Male			0.021	0.021	0.021	0.022
			0.008**	0.008**	0.008**	0.007**
Age			-0.004	-0.003	-0.014	-0.014
			0.002*	0.002	0.003**	0.003**
Cheerleading			0.199	0.201	0.205	0.199
			0.017**	0.017**	0.016**	0.016**
Athlete			0.192	0.205	0.21	0.203
			0.007**	0.008**	0.007**	0.007**
Student Government			0.187	0.185	0.195	0.192
			0.018**	0.018**	0.017**	0.017**
Father Education			0.006	0.023	0.039	0.038
			0.013	0.013	0.013**	0.012**
Father Professional			0.029	0.046	0.057	0.054
			0.012*	0.012**	0.012**	0.012**
Mother Education			0.018	0.027	0.032	0.03
			0.012	0.012*	0.012**	0.011**
Mother Professional			0.04	0.042	0.039	0.037
			0.011**	0.011**	0.011**	0.010**
Father Househusband			-0.152	-0.158	-0.151	-0.145
			0.039**	0.040**	0.041**	0.039**
Mother Housewife			-0.029	-0.024	-0.023	-0.022
			0.012*	0.012*	0.011*	0.011*
Private				-0.2		
				0.018**		
Suburban				-0.078		
				0.012**		
Urban				-0.176		
				0.012**		
% Teacher Black				0.001		
				0.000**		
% Teacher Hispanic				0.005		
				0.000**		
Potential friends						.0006
						.00004**
School Fixed Effects?	N	N	N	N	Y	Y
Observations	68312	68312	68201	68201	68201	68201
R-squared	0.04	0.05	0.08	0.09	0.11	0.11

Note: * denotes significant at 5% level, ** denotes significant at 1% level. All data are drawn from the National Longitudinal Study of Adolescent Health. Robust standard errors used. Standard errors under coefficients. Dummies for missing values for all variables except race and grades. Weights used in all regressions. The dependent variable is Spectral Popularity (see Appendix A for details).

Table 4: The Prevalence of 'Acting White,' by Grade Level

	7th	8th	9th	10th	11th	12th	Junior High	High School
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Black	0.319	0.175	0.261	-0.028	0.031	0.176	0.251	0.025
	0.078**	0.079*	0.066**	0.063	0.072	0.087*	0.044**	0.043
Hispanic	0.048	0.297	0.297	0.093	0.007	0.243	0.203	0.092
	0.072	0.089**	0.062**	0.066	0.085	0.078**	0.043**	0.044*
Grades	0.084	0.17	0.202	0.105	0.125	0.104	0.162	0.112
	0.014**	0.019**	0.017**	0.016**	0.015**	0.016**	0.010**	0.009**
Black*Grades	-0.109	-0.144	-0.144	-0.092	-0.083	-0.069	-0.132	-0.072
	0.028**	0.028**	0.027**	0.024**	0.027**	0.034*	0.017**	0.016**
Hispanic*Grades	-0.086	-0.257	-0.251	-0.168	-0.086	-0.156	-0.199	-0.133
	0.025**	0.031**	0.024**	0.023**	0.032**	0.028**	0.015**	0.016**
Effort	-0.05	-0.024	-0.042	-0.015	-0.005	-0.019	-0.049	0.236
	0.013**	0.015	0.014**	0.011	0.012	0.013	0.009**	0.010**
Male	-0.008	0.023	-0.001	0.004	0.056	0.092	-0.008	0.218
	0.015	0.02	0.02	0.017	0.018**	0.016**	0.012	0.023**
Age	0.019	-0.017	-0.051	-0.025	-0.068	-0.033	0.05	0.038
	0.01	0.015	0.012**	0.011*	0.013**	0.013*	0.007**	0.017*
Cheerleading	0.151	0.244	0.181	0.22	0.262	0.219	0.187	0.04
	0.029**	0.038**	0.041**	0.030**	0.038**	0.039**	0.022**	0.015**
Athlete	0.085	0.204	0.225	0.245	0.226	0.235	0.173	0.019
	0.015**	0.019**	0.017**	0.015**	0.018**	0.019**	0.010**	0.016
Student Government	0.133	0.224	0.233	0.234	0.169	0.231	0.189	0.033
	0.032**	0.043**	0.048**	0.036**	0.036**	0.040**	0.025**	0.015*
Father Househusband	-0.128	-0.053	-0.155	-0.227	-0.22	-0.118	-0.129	-0.018
	0.050*	0.107	0.107	0.079**	0.101*	0.125	0.055**	0.007**
Mother Housewife	-0.064	-0.047	-0.054	-0.01	-0.024	0.019	-0.05	0.045
	0.023**	0.03	0.027*	0.023	0.026	0.028	0.016**	0.010**
Father Education	0.046	0.034	0.025	0.068	0.025	0.021	0.037	-0.034
	0.024	0.033	0.032	0.027*	0.027	0.028	0.019*	0.005**
Father Professional	-0.006	0.09	0.142	0.076	0.03	0.025	0.075	0.228
	0.022	0.032**	0.031**	0.026**	0.024	0.027	0.018**	0.022**
Mother Education	0.011	0.106	0.013	0.027	0.056	-0.042	0.038	-0.201
	0.022	0.029**	0.028	0.024	0.026*	0.027	0.017*	0.056**
Mother Professional	-0.005	0.036	0.08	0.034	0.022	0.041	0.047	-0.006
	0.02	0.027	0.026**	0.023	0.024	0.025	0.016**	0.015
School Fixed Effects?	Y	Y	Y	Y	Y	Y	Y	Y
Observations	8539	8435	14165	13808	12243	11011	31139	37062
R-squared	0.23	0.22	0.23	0.22	0.13	0.17	0.15	0.12

Note: * denotes significant at 5% level, ** denotes significant at 1% level. All data are drawn from the National Longitudinal Study of Adolescent Health. Robust standard errors used. Standard errors under coefficients. Dummies for missing values for all variables except race and grades. Weights used in all regressions. The dependent variable is Spectral Popularity (see Appendix A for details).

Table 5: The Prevalence of 'Acting White,' by GPA

	< 2.0	**2.0 - 3.0**	**3.0 - 3.5**	**> 3.5**
	(1)	**(2)**	**(3)**	**(4)**
Black	0.013	0.134	0.488	0.986
	0.097	0.117	0.487	0.432*
Hispanic	-0.09	0.173	0.761	0.269
	0.094	0.122	0.409*	0.372
Grades	0.118	0.157	0.223	0.097
	0.042**	0.034**	0.089**	0.056*
Black*Grades	-0.035	-0.097	-0.198	-0.329
	0.066	0.049*	0.157	0.116**
Hispanic*Grades	-0.048	-0.171	-0.347	-0.2
	0.065	0.051**	0.131**	0.099*
Effort	-0.009	-0.013	-0.028	-0.005
	0.006	0.004**	0.006**	0.007
Male	0.015	0.019	0.045	0.013
	0.015	0.011*	0.016**	0.018
Age	0.003	-0.038	-0.06	-0.039
	0.009	0.009**	0.012**	0.014**
Cheerleading	0.109	0.187	0.218	0.284
	0.015**	0.011**	0.016**	0.017**
Athlete	-0.001	0.195	0.229	0.189
	0.05	0.033**	0.036**	0.028**
Student Government	0.143	0.159	0.221	0.261
	0.042**	0.025**	0.032**	0.033**
Father Househusband	0.014	0.035	0.046	0.009
	0.025	0.017*	0.023*	0.025
Mother Housewife	0.015	0.033	0.029	0.044
	0.027	0.019*	0.024	0.027
Father Education	0.003	0.035	0.013	0.072
	0.022	0.016*	0.023	0.024**
Father Professional	0.059	0.045	0.071	0.056
	0.027*	0.018**	0.025**	0.025*
Mother Education	-0.019	0.01	-0.029	-0.043
	0.023	0.019	0.023	0.024*
Mother Professional	-0.038	-0.119	-0.128	-0.249
	0.058	0.082	0.074*	0.087**
School Fixed Effects?	Y	Y	Y	Y
Observations	9464	24055	15984	18698
R-squared	0.11	0.09	0.1	0.13

Note: * denotes significant at 5% level, ** denotes significant at 1% level. All data are drawn from the National Longitudinal Study of Adolescent Health. Robust standard errors used. Standard errors under coefficients. Dummies for missing values for all variables except race and grades. Weights used in all regressions. The dependent variable is Spectral Popularity (see Appendix A for details).

Table 6: Sensitivity Analysis and Extensions of the Basic Model

	Black*Grades	Hispanic*Grades	Black*Grades	Hispanic*Grades	Black*Grades	Hispanic*Grades	Black*Grades	Hispanic*Grades
BASELINE	**Weighted**		**Unweighted**					
	-0.103	-0.171	-0.094	-0.178				
	0.012**	0.011**	0.011**	0.011**				
ALTERNATIVE MEASURES OF POPULARITY								
	Non-Normalized Spectral Popularity		**Same-Race Friends**		**All-Race Popularity**		**Other-Race Popularity**	
	-1.534	-2.544	-0.442	-0.731	-0.074	-.123	0.038	0.079
	0.175**	0.164**	0.066**	0.059**	0.019**	0.018**	0.018**	0.032*
SCHOOL TYPE	**Private**		**Public**					
	0.053	-0.039	-0.111	-0.180				
	0.050	0.054	0.012**	0.011**				
GENDER	**Male**		**Female**					
	-0.101	-0.181	-0.116	-0.170				
	0.017**	0.016**	0.016**	0.015**				
URBANICITY	**Suburban**		**Urban/Rural**					
	-0.106	-0.169	-0.095	-0.157				
	0.016**	0.015**	0.017**	0.016**				
PARENTAL EDUCATION	**Both College-educated**		**Other**					
	-0.030	-0.117	-0.104	-0.174				
	0.040**	0.040**	0.012**	0.012**				
EXTRACURRICULAR ACTIVITIES	**Athletes**		**Cheerleading**		**Music/Band**			
	-0.131	-0.192	-0.238	-0.245	-0.085	-0.189		
	0.017**	0.017**	0.045**	0.043**	0.025**	0.024**		
CO-CURRICULAR ACTIVITIES	**Student Government**		**Clubs**		**National Honor Society**			
	-0.07	-0.183	-0.094	-0.148	-0.024	-0.048		
	0.05	0.048**	0.024**	0.022**	0.069	0.058		
LEVEL OF INTERRACIAL CONTACT	**High Segregation**		**Low Segregation**		**<20% Black**		**>80% Black**	
	-0.055	-0.115	-0.136	-0.208	-0.137	-0.187	0.121	--
	0.013**	0.013**	0.023**	0.017**	0.013**	0.013**	0.088	--

Note: * denotes significant at 5% level, ** denotes significant at 1% level. All data are drawn from the National Longitudinal Study of Adolescent Health. Regressions run on blacks, whites, and hispanics as in previous tables. Fixed-effects specification from previous table is used. Robust standard errors used. Standard errors under coefficients. All regressions weighted except for "unweighted" line. The dependent variable is Spectral Popularity (see Appendix A for details), except for the second panel.

Table 7: The Impact of 'Acting White' on Achievement Test Scores

	Full Sample			Junior High School			High School		
	All	Low Achievers	High Achievers	All	Low Achievers	High Achievers	All	Low Achievers	High Achievers
Blacks									
Raw Test Score Differential	-0.721	-0.538	-0.774	-0.771	-0.583	-0.824	-0.657	-0.479	-0.698
	0.032	0.061	0.059	0.038	0.081	0.067	0.053	0.088	0.107
Counterfactual Test Score Gap	-0.730	-0.537	-0.526	-0.796	-0.598	-0.630	-0.657	-0.501	-0.388
	0.017	0.039	0.033	0.023	0.054	0.044	0.024	0.054	0.057
% Gap Explained	-1.308	0.147	32.021	-3.313	-2.609	23.490	0.102	-4.703	44.343
Hispanics									
Raw Test Score Differential	-0.794	-0.505	-0.940	-0.833	-0.486	-1.021	-0.753	-0.540	-0.837
	0.042	0.065	0.079	0.055	0.090	0.108	0.065	0.087	0.111
Counterfactual Test Score Gap	-0.763	-0.627	-0.597	-0.789	-0.476	-0.921	-0.733	-0.525	-0.698
	0.017	0.039	0.033	0.023	0.055	0.053	0.025	0.054	0.060
% Gap Explained	3.920	-24.033	36.450	5.238	2.064	9.810	2.619	2.784	16.577

Note: See paper for the model that these decompositions are based upon. All data are drawn from the National Longitudinal Study of Adolescent Health. Standard errors under coefficients. Weights used for all results and in all auxilliary decomposition regressions. N=9677 for black counterfactual test scores, and N=10828 for hispanics.

Table 8: The Relationship Between Social Status and Achievement, NELS

	8th grade				10th grade			
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Black	0.261	0.214	0.212	0.210	0.161	0.160	0.171	0.214
	0.040**	0.040**	0.041**	0.042**	0.057**	0.063*	0.065**	0.052**
Hispanic	0.086	0.075	0.087	0.094	0.054	0.067	0.081	0.028
	0.035*	0.035*	0.035*	0.037*	0.054	0.054	0.055	0.043
Grades	0.034	0.037	0.037	0.037	0.013	0.030	0.030	0.038
	0.004**	0.006**	0.006**	0.006**	0.006*	0.008**	0.008**	0.008**
Black*Grades	-0.054	-0.047	-0.047	-0.042	-0.044	-0.052	-0.053	-0.061
	0.014**	0.014**	0.014**	0.015**	0.021*	0.023*	0.023*	0.019**
Hispanic*Grades	-0.023	-0.022	-0.021	-0.018	-0.020	-0.026	-0.021	-0.006
	0.012	0.012	0.012	0.013	0.018	0.018	0.017	0.015
Current Test Score		-0.039	-0.041	-0.038		-0.038	-0.039	-0.040
		0.004**	0.004**	0.004**		0.006**	0.006**	0.005**
Ability Group		0.061	0.063	0.061		0.034	0.036	0.041
		0.008**	0.008**	0.008**		0.010**	0.010**	0.010**
Effort Measure		-0.024	-0.025	-0.027		-0.027	-0.028	-0.027
		0.004**	0.004**	0.004**		0.005**	0.005**	0.005**
SES < 25th Percentile		-0.030	-0.027	-0.038		-0.025	-0.025	-0.031
		0.007**	0.007**	0.008**		0.013*	0.013	0.009**
SES > 75th Percentile		0.023	0.019	0.028		0.011	0.011	0.018
		0.007**	0.008*	0.008**		0.011	0.011	0.010
Male		0.027	0.027	0.027		0.005	0.005	0.017
		0.006**	0.006**	0.006**		0.009	0.009	0.007*
Athlete		0.080	0.078	0.081		0.058	0.056	0.071
		0.006**	0.006**	0.006**		0.009**	0.009**	0.008**
Student Government		0.139	0.140	0.145		0.156	0.153	0.163
		0.012**	0.012**	0.012**		0.019**	0.019**	0.018**
Cheerleading		0.084	0.082	0.086		0.078	0.078	0.086
		0.012**	0.012**	0.012**		0.024**	0.023**	0.018**
Urban School			0.002				-0.013	
			0.009				0.015	
Suburban School			-0.008				-0.018	
			0.007				0.009	
% Black in School (0-100)			-0.000				-0.000	
			0.000				0.000	
% Asian in School (0-100)			0.001				-0.001	
			0.001				0.001	
% Hispanic in School (0-100)			-0.000				-0.001	
			0.000*				0.000*	
Private School			0.035				0.038	
			0.009**				0.021	
School Fixed Effects?	N	N	N	Y	N	N	N	Y
n	20766	20766	20766	20766	13598	13598	13598	13575
R-squared	0.01	0.06	0.07	0.13	0.00	0.05	0.05	0.27

Note: * denotes significant at 5% level, ** denotes significant at 1% level. All data are drawn from the National Educational Longitudinal Study. Robust standard errors used. Standard errors under coefficients. Dummies for missing values for all variables except race and grades. Regression only on Blacks, Whites, and Hispanics. Weights used in all regressions. The dependent variable is dichotomous version of self-reported popularity (see Appendix B for details).

Appendix A: The Spectral Popularity Index

Let *K* denote a finite set of students, let *H* be a finite set of race and ethnic groups, and let $a : K \to H$ denote an assignment of students to a race. Thus, $h = a(k)$ implies that (under assignment a) student $k \in K$ belongs to race $h \in H$. And, let A_a^h denote the same-race friendship network of race *h* under assignment *a*.

Definition: *A popularity index is a map:* $a \mapsto \left(P^h(a), p_i^h(a)_{i \in h}\right)$, *where* $p_i^h(a) \geq 0$ *and* $P^h(a) = \sum_{i \in h} p_i^h(a)$.

$P^h(a)$ is the school level popularity of minority *h* under assignment a, and $p_i^h(a)$ is the level of popularity of individual $i \in h$ under assignment a. Individual popularity is measured in the same units as minority popularity. Minority popularity is the sum of the popularity of all individuals that belong to the minority. Below, we describe three desirable properties of any popularity index.

Three Axioms of a Desirable Measure of Popularity

- **Axiom 1:** (Monotonicity) Let assignments a and a' be such that the collection of friends $F_i\left(A_a^h\right)_{i \in K}$ in A_a^h and $F_i\left(A_{a'}^h\right)_{i \in K}$ in $A_{a'}^h$ satisfy $F_i\left(A_a^h\right) \subset F_i\left(A_a^h\right)$ for all *i* and $F_i\left(A_a^h\right) \not\subset F_i\left(A_a^h\right)$ for at least one *i*. Then, $P^h(a) < P^h(a')$.

  Monotonicity requires that if s/chool A's same-race friendship networks are always larger than school B's, school A exhibits a higher degree of same-race popularity than B.

- **Axiom 2:** (Homogeneity) Let a be such that A_a^h is a regular graph with degree *d*. Then, $P^h(a) = d$.

Homogeneity says that if a friendship network were regular, so everyone has exactly the same number of same race friends, the index should simply be this number of friends. Homogeneity describes the index's unit of measurement; providing a way to interpret a value of the index. If $P^h(a) = 2.4$, then we know that minority *h* is more popular than if every individual had exactly two same-race friends, but less than if they all had exactly three. Homogeneity also provides a "scale free" like property: If school A has more students than school B, but each individual in both schools has *d* same race friends, the index will report the same level of popularity for both schools. Note, however, that because of differences in population, $P^h(a) = \sum_{i \in h} p_i^h(a)$ ensures that the individual measures $p_i^h(a)$ will be smaller for school A than for school B. Thus, individual $p_i^h(a)$ are not comparable across schools or across racial groups, unless one makes adjustments to take scale into account. One obvious adjustment, which we make in the empirical implementation of the index, is to multiply all $p_i^h(a)$ by the number of race *h* students, $p_i^h(a)\left|a^{-1}(h)\right|$, and have $P^h(a)$ denote the average of the resulting individual measures. (The characterization of the index remains the same.)

- **Axiom 3:** (Linearity) If $P^h(a) \neq 0$, $p_i^h = \frac{1}{P^h} \sum_{j \in F_i\left(A_a^h\right)} p_j^h$

Linearity is the most important of the three properties in terms of substance and interpretation. The intuition is simple. We want individuals' popularity to be affected by how popular their friends are. That is, for some function Γ, we want $p_i^h(a) = \Gamma\left(p_j^h(a)\right)$.[43] The Linearity axiom posits $\Gamma(\cdot)$ takes on a linear form. Recall, Homogeneity pins down the index for regular friendship networks. But, no real school is regular (there does not exists a school in which every kid has the same number of friends, for example). How then do we weigh the different number of same race friends that different individuals have? Linearity requires that, if *i* and *j* both have the same number of friends, *i* will have a higher weight in the h-wide index, $P^h(a)$, if *i*'s friends are more popular than *j*'s.

With these properties in hand, we can now formally define our index of popularity.

Definition: *The spectral popularity index is the index:* $a \mapsto \left(P^h(a), p_i^h(a)_{i\in h}\right)$, *where* $P^h(a)$ *is the largest eigenvalue of graph* A_a^h *and* $p_i^h(a) = P^h(a)x_i$; x_i *is the principal eigenvector normalized so that* $\sum_{i=1}^{N} x_i = 1$.[44]

The next theorem shows that our spectral popularity index satisfies the three axioms above, and that no other popularity index does.

Theorem 1: A Popularity index satisfies Monotonicity, Homogeneity and Linearity if and only if it is the Spectral Popularity Index.

[43] This is what makes the spectral index unique (literally and figuratively), and more intuitive than simple population counts.

[44] The spectral popularity index is well defined. By the Perron-Frobenius Theorem (Theorem 8.4.4 in Horn and Johnson 1985), the largest eigenvalue of A_a^h is positive, and has an associated positive eigenvector.

The proof of Theorem 1 proceeds by stating and proving 5 lemmas that together establish the theorem. First, we verify that the spectral popularity index satisfies our three axioms.

Lemma 1: The Spectral Popularity Index satisfies Monotonicity.

Proof of Lemma 1: Let assignments a and a' be as in the statement of Monotonicity. Let $A = a_{ij}$ and $A' = a'_{ij}$ be their respective adjacency matrices. Then, $a_{ij} \leq a'_{ij}$ for all i and j. And, $a_{ij} < a'_{ij}$ for at least one i and j. Now, as $P^h(a)$ is the largest eigenvalue of A, it is the value of the maximization program:

$$\max_{x \in \Re^{|h|}} \frac{x'Ax}{x'x}.$$

Let $\hat{x}$ be a solution to the program; so $\hat{P}^h(a) = \frac{\hat{x}'A\hat{x}}{\hat{x}'\hat{x}}$. But, $x_i > 0$ for all i, (by the Perron-Froebenius Theorem, Theorem 8.4.4 in Horn and Johnson (1985)), so the indicated relation between A and A' implies $\frac{\hat{x}'A\hat{x}}{\hat{x}'\hat{x}} < \frac{\hat{x}'A'\hat{x}}{\hat{x}'\hat{x}}$. Now, $\hat{P}^h(a')$ solves the program $\max_{x \in \Re^{|h|}} \frac{x'A'x}{x'x}$. The value of the maximand at $\hat{x}$ is strictly larger than $\hat{P}^h(a)$, so $\hat{P}^h(a) < \hat{P}^h(a')$ follows. *Q.E.D.*

Lemma 2: The Spectral Popularity Index satisfies Homogeneity.

Proof of Lemma 2: If A_a^h is a regular graph of degree d, then (by Theorem 2.1.2 in Cvetkovic, Rowlinson and Simic (1997), page 23) its adjacency matrix has an eigenvector all of whose components are equal to one. Further, d is the eigenvalue associated with this eigenvector. By Corollary 8.1.30 in Horn and Johnson, this eigenvector is the unique (up to scalar multiple) positive eigenvector of A_a^h. Thus, d must coincide with $P^h(a)$, the largest eigenvalue of A_a^h. *Q.E.D.*

Lemma 3: The Spectral Popularity Index satisfies Linearity.

Proof of Lemma 3: Since $P^h(a)$ is an eigenvalue with eigenvector x_i, then for any j,

$$p_j^h(a) = P^h(a)x_j = A_a^h \cdot x_i\big|_j = \sum_{i \in F_j(A_a^h)} x_i = \frac{1}{P^h} \sum_{i \in F_j(A_a^h)} p_i^h .$$

This establishes the Lemma. *Q.E.D.*

We now show that any index that satisfies the three axioms must coincide with the spectral index. Let $\left(P^h(a), p_i^h(a)_{i \in h}\right)$ be a popularity index that satisfies the three axioms.

Lemma 4: If $d_i = 0$ for all *i* then the index must coincide with the Spectral Popularity Index.

Proof of Lemma 4: By Homogeneity $P^h(a) = 0$ and $p_i^h(a) = 0$ for all *i*. Monotonicity and Linearity hold trivially, thus, we have the desired result.

Lemma 5: If $d_i \neq 0$ for at least one *i*, then the index must coincide with the Spectral Popularity Index.

Proof of Lemma 5: Suppose then that $d_i > 0$ for at least one *i*. Then, Monotonicity requires that $P^h(a) > 0$, as $P^h(a') = 0$ when $A_{a'}^h$ has $F_i\left(A_{a'}^h\right) = \varnothing$ for all *i*. For convenience, let $x_i = \dfrac{p_i^h(a)}{P^h(a)}$ and let $I = \{i : d_i > 0\}$. If $i \notin I$, then $p_i^h(a) = 0$ (by Linearity), thus $x_i = 0$. If $i \in I$ then i is in the unique nontrivial connected component of A_a^h. Thus, we must have $p_i^h > 0$; for $P^h(a) > 0$ requires that some $j \in I$ has $p_j^h > 0$. By Linearity then all friends j' of j have $p_{j'}^h > 0$. By Linearity and recursion, $p_i^h > 0$.

So $x_i > 0$, and A_a^h restricted to *I* is connected. Then $P^h(a)$ is a positive eigenvalue of A_a^h restricted to *I*, and $(x_i)_{i \in I}$ is a positive eigenvector.

By the Perron-Froebenius Theorem (Theorem 8.4.4 in Horn and Johnson 1985) there is a positive eigenvalue λ of A_a^h (restricted to *I*) with associated eigenvector $u > 0$. By Corollary 8.1.30 in Horn and Johnson, *u* is the unique, up to a scalar multiple, positive eigenvector. Hence $P^h(a)$ and $(x_i)_{i \in I}$ must coincide with λ and *u*, which establishes the Lemma. *Q.E.D.*

Lemmas 1 through 5, taken together, establish Theorem 1.

Appendix B: Data Description

The Longitudinal Study of Adolescent Health (Addhealth)

Grades
Students were asked "At the most recent grading period, what was your grade in each of the following subjects?" where the subjects were English/Language Arts, Mathematics, History/Social Studies, and Science, and possible answers were A, B, C, or "D or lower". Assuming student answered that their school grades on a letter basis, we averaged the grades in these 4 subjects according to a 4.0 scale (i.e. A=4.0, B=3.0, C=2.0, and D or lower=1.0).

Race
Students were asked "What race are you?" and "Are you of Hispanic or Spanish origin?" Non-Hispanic white, black, or Asians were coded as separate values. Students answering yes to the latter question were coded as Hispanic. Answers to the former question could include multiple races; non-Hispanic mixed race students (i.e. students selecting multiple races) were also coded separately.

Gender
Students were asked "What sex are you?" Male or female.

Age
Students were asked "How old are you?" Answers range from 10 to 19, where 19 indicates age is 19 or older.

Effort

Students were asked "In general, how hard do you try to do your school work well?" Possible answers were "I try very hard to do my best"; "I try hard enough, but not as hard as I could"; "I don't try very hard at all"; and I never try at all". We coded these on a 1-4 scale where 4 represents the highest level of effort (i.e. the first response) and 1 represents the lowest.

Athletics

Students were asked whether they were participating or planned to participate in a number of clubs or teams. This variable was coded as one if any of the following teams were indicated: baseball/softball, basketball, field hockey, football, ice hockey, soccer, swimming, tennis, track, volleyball, wrestling, or other sport.

Student Government

This variable was coded as one if student indicated he/she participated in the student council.

Cheerleading

This variable was coded as one if student indicated he/she participated in the cheerleading or dance team.

Parental Education

Student was asked how far in school their mother and father went. This variable is coded as one if the parent graduated from a college or university, or if they had professional training beyond a four-year college. If the student doesn't know the exact level of education, it is coded as missing. Otherwise, other educational levels are coded as zero.

Parental Occupation

We coded two variables each for the mother and father. The first is based on the student's description of their mother or father's job—whether they are "white collar professionals". It was coded as one if according to the student, the parent's occupation is "Professional 1" (such as doctor, lawyer or scientist); "Professional 2" (such as teacher, librarian, nurse); "Manager" (such as executive or director); or "Technical" (such as computer specialist or radiologist). Other professions are coded as zero. If the parent doesn't work or is disabled or retired, it is coded as missing. The second variable is coded as one if the parent is a housewife or househusband, according to the student, and zero otherwise.

Urban/Suburban/Rural and Public/Private School

We created dummies for whether the school is public or private and whether it is located in an urban, suburban, or rural setting, according to the school administrator questionnaire.

Percent Teachers Black/Asian/Hispanic

These variables are taken from the school administrator's answer to the question "Approximately what percentage of your full-time classroom teachers are of each of the following races?" where races listed include black, Asian, and Hispanic.

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