ORIGINAL RESEARCH

How the rich get richer: affluence cues at universities increase the social class achievement gap

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Abstract

Past research on socioeconomic status (SES) and test performance in higher education has highlighted the factors that depress performance among students from low-SES backgrounds. We complement this work by focusing on how cues of affluence and prestige in the physical environments of elite universities may *boost* performance among students from *high-SES* backgrounds, thereby exacerbating the existing performance gap between high and low-SES students. We randomly assigned 122 high-SES and 100 low-SES students to take a standardized test in an environment with affluence cues or one without affluence cues. We found a significant interaction between student-SES and testing environment, such that students from high-SES backgrounds outperformed students from low-SES backgrounds to a greater extent when affluence cues were present than when they were absent. These findings suggest that the physical environments of elite universities can contribute to the achievement gap between high and low-SES students. Theoretical and educational policy implications are discussed.

Keywords Social class · Environmental cues · Privilege · Test performance · Achievement gap

1 Introduction

Past research shows that socioeconomic status (SES) robustly predicts academic outcomes among university students, with those from high-SES backgrounds consistently outperforming their low-SES peers (Stephens et al. 2014). Students from high-SES backgrounds earn higher grades and are less likely to drop out of school than students from low-SES backgrounds (Pascarella et al. 2004). In addition to

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structural factors such as academic preparation and differential access to resources, prior work suggests that psychological mechanisms also play an important role in driving this disparity (Croizet and Claire 1998; Johnson et al. 2011; Ostrove and Long 2007; Stephens et al. 2015). However, past research in social psychology has largely focused on factors which *depress* the performance of students from low-SES backgrounds relative to their abilities, such as a lack of belonging (Ostrove and Long 2007) or the threat of confirming negative stereotypes about their group (Croizet and Claire 1998). In the current work, we turn the focus to *high-SES students* and the *psychological advantages* that they may receive in university environments that match their social class backgrounds. Specifically, we focus on the role of high social class cues commonly found in university environments and how they may boost the performance of students from high-SES backgrounds, thus contributing to the social class achievement gap.

1.1 Social class cues in university environments

The physical environments of university campuses contain many cues that convey affluence, prestige, and high social status. Some examples include imposing brick buildings, wrought-iron gates and expansive green lawns. These high social class cues match the social class backgrounds of high-SES students but not low-SES students, and are especially prevalent at selective "elite" universities where much of the research on social class disparities in university education has been conducted (for examples see Granfield 1991; Jack 2019; Johnson et al. 2011; and Ostrove 2003). However, the effect of universities' physical environments on students' academic performance is a novel and relatively unexplored phenomena. Therefore, in this study, we explore the downstream consequences of universities' environmental cues on high and low-SES students, specifically in the context of their academic performance. We examine whether environmental cues of affluence on university campuses may benefit high-SES students and may thus contribute to the social class performance gap which is prevalent at elite universities.

1.2 The impact of affluence cues at universities on high socioeconomic status students

Students from high-SES backgrounds, who have high family incomes and whose parents are likely to have gone to college themselves, comprise an advantaged group at selective universities (see Stephens et al. 2014 for a review). In addition to benefitting from better academic preparation and more access to resources than students from low-SES backgrounds (Pascarella et al. 2004; Warburton et al. 2001), high-SES students enjoy an additional advantage that often goes unrecognized: The physical environments of elite universities are congruent with their own social class backgrounds and upbringing. Four-year universities in general and elite institutions in particular are likely to contain cues in their physical environments that convey affluence and prestige: Tree-lined avenues, manicured green lawns, and libraries with dark wood paneling and leather-bound books. While high-SES families may

not necessarily have affluence cues such as executive chairs and leather-bound books in their homes, these items evoke a sense of wealth and privilege and can produce a sense of overall familiarity independent of familiarity with specific objects in the environment. High social class spaces on university campuses feel psychologically similar to the social class environments that students from high-SES backgrounds were raised in and are familiar with (Kusserow 2012), even if the university environment itself is new to them. There is a match between high-SES students' social class backgrounds and the physical environment of the university, something we refer to as a *social class-environment match*. We suggest that this social class-environment match confers advantages on high-SES students in two ways which may ultimately increase their test performance in affluent environments: via increased perceptions of belonging, and by priming a high social class identity which increases their likelihood of success at individually-oriented achievement tasks.

The first way that this social class-environment match can influence the psychological mindset of high-SES students is by providing them with a sense of belonging. Physical cues in an environment serve as reminders of who *should be* in those environments (Cheryan et al. 2009). Because cues of affluence on university campuses match the social class backgrounds of high-SES students, they signal to these students that they belong and are welcome at these institutions. This analysis is consistent with research which shows that students from high-SES backgrounds are more likely to say that they feel at home at 4-year universities than students from low-SES backgrounds (Ostrove and Long 2007; Stephens et al. 2015). Increasing one's sense of belonging has been shown to have a positive effect on academic performance (Cohen and Garcia 2008; Walton and Cohen 2011). Thus, the social class-environment match should lead students from high-SES backgrounds to feel like they belong at elite universities—an advantage which may boost academic performance relative to conditions that reflect a mismatch (i.e., when affluence cues are not present).

In addition to creating a sense of belonging, affluence cues embedded in classrooms and other physical spaces at elite universities may offer an additional psychological advantage to high-SES students by priming their high social class identity. Past research has shown that having a high versus low social class identity affects a range of psychological outcomes, many of which have implications for performance. For example, people who perceive themselves as high social class tend to show more self-oriented psychological tendencies, focusing on their own goals in the context of individual achievement motivations (Markus and Stephens 2017). The priming of a high social class identity also increases perceptions of power (Kraus et al. 2009), leading high social class individuals to be more likely to believe that they can actually achieve their goals. Believing that one can achieve one's goals is associated with an increased sense of control (Kraus et al. 2009), greater self-efficacy (Wiederkehr et al. 2015), and an increase in promotion-oriented behaviors (Markus and Stephens 2017). All of these elements, in turn, are likely to boost performance on an individual achievement task in which there is no penalty for incorrect responses, such as a test-taking paradigm. Therefore, for high-SES students, affluence cues in universities may prime their high social class identity and its association with achievement and efficacy in goal attainment—a mindset that enhances academic performance.

This analysis of the impact of environmental affluence cues on students from high-SES backgrounds leads us to posit that high-SES students will perform better when affluence cues are present in the environment than when they are absent. We do not believe that this performance boost will occur for students from low-SES backgrounds, suggesting that the presence of affluence cues widens the social class achievement gap between high and low-SES students relative to when these cues are not present.

1.3 Affluence cues at universities and the social class achievement gap

In contrast to their high-SES peers, students from low-SES backgrounds enter college having less experience with affluent environments. Students from low-SES backgrounds grow up in lower socioeconomic neighborhoods and often have parents who have not attended college. Thus, cues indicative of high social class in the physical spaces of elite universities are not congruent with low-SES students' social class backgrounds, resulting in a *social class-environment mismatch*. Therefore, while we would expect affluence cues in the environment to increase the performance of high-SES students, we would not expect the same for low-SES students, since these environmental cues are not congruent with their social class backgrounds. This leads us to predict an interaction between student SES and the presence of affluence cues in the environment, such that students from high-SES backgrounds will outperform students from low-SES backgrounds to a greater extent when affluence cues are present than when they are absent. We test this interaction hypothesis in the current study.

2 Research overview

Our goal in the current study is to examine whether environments with affluence cues versus those without would differentially affect the performance of high and low-SES students. Among high-SES students, existing theory and evidence converge on the prediction that being in an environment with affluence cues will lead to a performance boost relative to an environment without affluence cues. Meanwhile, we do not believe these processes will occur for students from low-SES backgrounds, suggesting the presence of affluence cues will increase the performance gap between high and low-SES students. We examined this hypothesis in an experiment that manipulated the presence or absence of affluence cues and assessed students' performance on a standardized test. Our sample was drawn from students at an elite university (12% admittance rate, 2018) who self-identified as either high or low-SES.

3 Methods

3.1 Participants

Two hundred and forty-four students from a highly selective West Coast university participated in the study. Students were recruited via the psychology subject pool (in which case they received course credit) and also via flyers on campus (in which

case they received $10). The sample size was determined by using G*Power to calculate the sample size needed to detect small to medium effect sizes with 80% power (Faul et al. 2009). Sample size was determined and all data were collected before any data analysis took place. In a prequalification survey, we provided students with the demographic information of five different social class levels in the United States (*very high SES*, *high SES*, *median SES*, *low SES* and *very low SES*). The description of each social class level included descriptive information commonly used in social class research such as income, occupation, and education (Gilbert 2011). For example, families from high-SES backgrounds were described as "highly-educated, often with graduate or professional degrees, who had large work autonomy and annual household incomes of $75,000–$150,000." In contrast, families from low-SES backgrounds were described as "blue-collar workers or individuals with low job security who may have completed high school and who had annual household incomes of $16,000–$35,000" (see "Appendix" for verbatim descriptions of each of the five social class levels). Participants were then asked to select the profile that best described their family. Because the descriptors were based on social class categories in the United States, only students who were born in the U.S. were invited to participate in the study. In addition, only students who self-identified as very high to high SES or low to very low SES were invited to participate in the study (i.e., any participants who self-identified as median SES/middle class were excluded from participation in the study).

Of the 244 eligible participants, two were excluded—one for being under the age of 18 and one for not reporting their age. At the end of the study, we again asked participants to identify their SES category, using the same descriptors from the prequalification survey. Two students were excluded from analysis for not providing a response, and 18 students were excluded for selecting a SES profile that was inconsistent with their response on the prequalification survey (all of whom selected the median SES category rather than a low or high SES category, thus making them ineligible for our study).

Our final sample consisted of 222 participants (72% women, $M_{age} = 19.13$, $SD = 1.19$). The ethnicity of our participants reflected the diversity of the university from which the sample was drawn: 32.4% Asian Americans, 27.9% White, 26.6% Latino/Hispanic, 9.5% multiracial or other ethnicity, and 3.6% Black/African American.

3.2 Experimental design and procedures

The study employed a 2 (participant SES: high vs. low) X 2 (environmental cues of affluence: present vs. absent) between subjects design.[1] Participants came into the lab and were taken into rooms which were set up as study spaces. Physical objects

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[1] In addition to the affluence cues manipulation, we included a university identity prime manipulation by giving half of the participants t-shirts and pencils with the school's logo, and the other half a plain t-shirt and pencil. Our goal was to assess if the effects of affluence cues would be moderated by whether students were reminded of their identity as members of the university. This identity salience manipula-

in the rooms varied to reflect either the presence or absence of affluence cues, and participants were told that the study was ostensibly about object perception. After opportunities to observe and interact with the objects in the room, participants completed a GRE-style math test and were debriefed.

3.3 Study design

3.3.1 Manipulation of affluence cues in testing room (present/absent)

Affluence cues were manipulated via the objects in the testing room. Each room featured 12 objects commonly found in study spaces, such as books, a pencil sharpener, a lamp, and a chair. Objects in the room with affluence cues included leather-bound books, a bronzed lamp, and a leather high-back executive chair. Corresponding objects in the room without affluence cues included paperback books, a plastic lamp, and a leather task chair purchased from a mass-market retailer. For photos of key objects in each room, please see the "Appendix." Participants were asked to interact with the objects in their room for 3 minutes. Additional interactions with the objects were built into the procedures, such as giving participants unsharpened pencils so they would be required to use the pencil sharpener in the room, and placing study materials in the desk organizer.

3.3.2 Participant SES (high or low)

Based on participants' response to the question about their self-identified family SES, we coded them as either high or low SES. Participants who indicated they were very high (n=28) or high SES (n=94) were placed in the high-SES category, while participants who identified as low-SES (n=83) or very low-SES (n=17) were placed in the low-SES category. There were slightly more participants in the high-SES category (n=122) than the low-SES category (n=100).

3.4 Dependent variable

3.4.1 Test performance

We used a validated multiple-choice standardized math test that consisted of 12 challenging GRE-type problems (Shih et al. 1999). A math test was chosen because it had been shown to be sensitive to performance boost effects in previous research (Shih et al. 1999), and it is likely to be less culturally biased than a language-based test for a multicultural and diverse student population such as the one found at this

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Footnote 1 (continued)

tion did not have any effect on students' test performance, $F(1,214)=.02$, $p=.89$, and also did not significantly interact with either students' SES or the presence of affluence cues in the environment (all p's greater than .4). Therefore, in this paper we report findings collapsed across the identity prime conditions.

university. One of the 12 problems inadvertently contained a typographic error and was removed from analysis. Participants were given up to 30 minutes to complete the test. In line with past work on situational cues and test performance (Shih et al. 1999; Steele and Aronson 1995), test performance was measured in two ways: (1) total number of questions answered correctly, ranging from 0 to 11 and (2) response accuracy (i.e., the number of questions answered correctly divided by the number of questions attempted), ranging from 0 to 1.

4 Results

Before we tested the main hypotheses, we examined whether high and low-SES students differed in their persistence as assessed by the number of questions attempted. There was no significant difference in the number of questions attempted between students from high-SES backgrounds ($M = 10.70$, $SD = .79$) and students from low-SES backgrounds ($M = 10.46$, $SD = 1.21$), $F(1,218) = 3.66$, $p = .06$. This suggests that students from different social class backgrounds did not differ in their persistence on the test. Below, we report tests of the main predictions. The data were analyzed using t-tests, omnibus between-subjects analyses of variance (ANOVAs) and planned contrasts to test the hypothesis that high-SES students would receive a performance boost in the affluent room versus the non-affluent room.

4.1 Test performance

We looked at two different measures of test performance to test the hypothesis that students from high-SES backgrounds would perform better in the room with affluence cues than the room without affluence cues. We also examined the performance of low-SES students as a function of the testing environment, expecting a smaller or no difference in performance.

4.1.1 Total responses correct

Our first method of analyzing test performance was by examining the total number of correct responses. The mean number of correct responses was 4.97 ($SD = 2.08$) out of 11 total questions, suggesting this was a difficult test for many students. Analysis of variance (ANOVA) showed a main effect of student SES on test performance, such that high-SES students ($M = 5.54$, $SD = 2.11$) performed better than low-SES students ($M = 4.27$, $SD = 1.83$), $F(1, 218) = 23.05$, $p < .001$, $\eta_p^2 = .10$, 95% CI [.034; .174] overall. There was no main effect of environmental affluence cues on test performance, $F(1, 218) = .697$, $p = .41$. However, the main effect of student SES was qualified by a significant two-way interaction, $F(1,218) = 3.97$, $p = .05$, $\eta_p^2 = .02$, 95% CI [.000; .067] such that the effect of affluence cues in the environment on test performance differed for students from high versus low-SES backgrounds (Fig. 1). Simple effects analyses revealed students from high-SES backgrounds answered significantly more questions correctly in the room with affluence cues
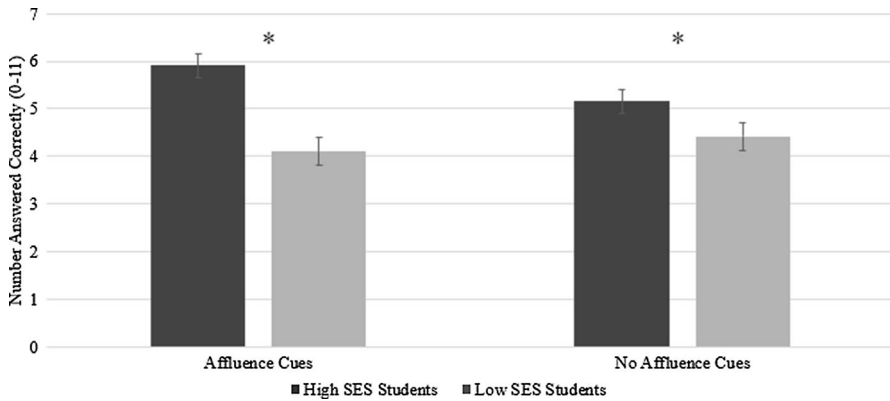
Fig. 1 Effect of student SES and environmental affluence cues on number of questions answered correctly, ranging from 0 to 11

($M = 5.92$, $SD = 2.06$) than the room without affluence cues ($M = 5.16$, $SD = 2.11$), $F(1,218) = 4.45$, $p = .04$, $\eta_p^2 = .02$, 95% CI [.000; .070]. Among low-SES students, there was no difference in test performance between those who took the test in the room with affluence cues ($M = 4.11$, $SD = 2.07$) versus those who took the test in the room without such cues ($M = 4.42$, $SD = 1.60$), $F(1, 218) = .61$, $p = .44$.

For further insights, we examined the effect of student SES within each testing room. In the room with affluence cues, students from high-SES backgrounds answered significantly more questions correctly than students from low-SES backgrounds, $M = 5.92$, $SD = 2.06$ versus $M = 4.11$, $SD = 2.07$, $F(1,218) = 22.29$, $p < .001$, $\eta_p^2 = .09$, 95% CI [.032; .171]. When affluence cues were not present, there was a smaller but significant performance difference between students from high and low-SES backgrounds, $M = 5.16$, $SD = 2.11$ versus $M = 4.42$, $SD = 1.60$, $F(1, 218) = 4.07$, $p = .05$, $\eta_p^2 = .02$, 95% CI [.000; .067]. Regardless of testing environments, high-SES students outperformed low-SES students. However, the effect was less strong in the testing room without affluence cues.

4.1.2 Response accuracy

Our second measure of test performance was response accuracy, defined as the number of questions answered correctly divided by the number of questions attempted (Shih et al. 1999; Steele and Aronson 1995), ranging from 0 to 1. Response accuracy has been posited to be a better overall measure of test performance than the number of questions answered correctly because it takes into account the number of questions attempted (Shih et al. 1999). Overall, high-SES students answered a greater percentage of questions correctly out of those they attempted ($M = .52$, $SD = .20$) than low-SES students ($M = .41$, $SD = .17$), $F(1,218) = 19.81$, $p < 001$, $\eta_p^2 = .08$, 95% CI [.026; .159]. There was no main effect of affluence cues on student response accuracy, $F(1,218) = 1.97$, $p = .16$. However, there was a significant interaction between students' SES and affluence
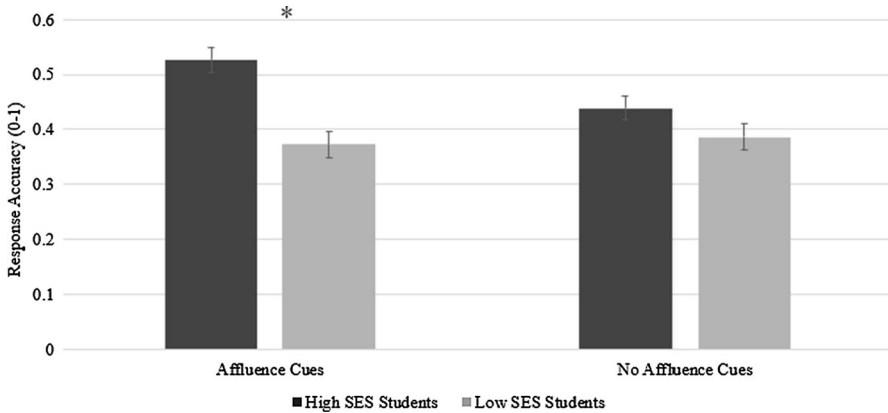
Fig. 2 Effect of student SES and environmental affluence cues on response accuracy, ranging from 0 to 1

cues, $F(1,218) = 4.52$, $p = .04$, $\eta_p^2 = .02$, 95% CI [.000; .078] (Fig. 2). Students from high-SES backgrounds had significantly higher response accuracy in the room with affluence cues ($M = .56$, $SD = .19$) than in the room without affluence cues ($M = .47$, $SD = .19$), $F(1,218) = 6.93$, $p = .009$, $\eta_p^2 = .03$, 95% CI [.002; .088]. There was no difference in response accuracy among students from low-SES backgrounds in the affluent room ($M = .40$, $SD = .20$) versus the non-affluent room ($M = .42$, $SD = .15$), $F(1,218) = .24$, $p = .63$.

Again, we examined the effect of student SES within each testing room. When affluence cues were present, students from high-SES backgrounds had significantly higher response accuracy than students from low-SES backgrounds ($M = .56$, $SD = .19$ vs. $M = .40$, $SD = .20$, $F(1,218) = 20.93$, $p < .001$, $\eta_p^2 = .09$, 95% CI [.029; .164]. In contrast, when affluence cues were not present, there was no significant difference in response accuracy between high-SES ($M = .47$, $SD = .19$) and low-SES ($M = .42$, $SD = .15$) students, $F(1,218) = 2.80$, $p = .10$. This result differs from what was found for questions answered correctly, in which a significant difference was found between high and low-SES students in the room without affluence cues.

5 Discussion

In this study, we examined a previously unexplored explanation for the social class achievement gap prevalent in elite university settings: these environments contain cues of affluence which our findings show elevate test performance among high-SES students but not low-SES students. These findings suggest that the seemingly subtle social class cues embedded into the physical environments that college students are immersed in every day can contribute to and further exacerbate social class disparities in test performance that already exist due to structural factors such as differential access to educational resources (Pascarella

et al. 2004; Warburton et al. 2001) *and* well-documented psychological factors that focus on the social identity threat experienced by low-SES students (e.g., Croizet and Claire 1998).

5.1 The role of physical environments on test performance

This research adds to a small but growing body of literature which show that cues in physical environments can shape peoples' perceptions and behavior (Cheryan et al. 2009; Latu et al. 2013; Mendoza-Denton et al. 2009). This is the first study that we are aware of that demonstrates how physical cues of affluence on college campuses can differentially affect the performance of students from high versus low social class backgrounds. In a controlled experiment using two different measures of performance (questions answered correctly as well as response accuracy), we found a significant interaction between student SES and environmental affluence cues, such that students from high-SES backgrounds outperformed students from low-SES backgrounds to a greater extent when affluence cues were present than when they were absent. In designing immersive environments in the laboratory in which we systematically manipulated the salience of high social class cues, we were able to assess the effect of different physical spaces on student test performance. In addition, our testing environments mimic students' real-life study spaces, which suggests that the effects observed in a controlled lab experiment are ecologically valid and likely to generalize to the real-life experiences students have engaging in challenging academic tasks in the classroom and in campus study spaces such as libraries.

5.2 Why affluence cues may have boosted performance among high socioeconomic status students

Our study shows that environmental cues can contribute to academic disparities between high and low-SES students by giving high-SES students a performance boost in the affluent environments of highly selective universities. We hope this initial demonstration of the effect and the development of a laboratory paradigm in which to test it will motivate additional work. We feel that it is important to replicate this effect in future research, as well as to systematically explore the psychological mechanisms that underlie it. We suggest that there are two main possibilities worth pursuing. The first is that an environment that is congruent with one's social identity can lead to increased feelings of comfort and belonging. Such a secure psychological state may reduce or constrain anxiety that can otherwise harm test performance relative to baseline abilities (Walton and Cohen 2011). The second possibility is that the affluent environment activated elements commonly associated with high social class identities in students from high-SES backgrounds, which in turn boosted their test performance on this particular task.

Both of these potential explanations for why students from high-SES backgrounds performed better in the affluent environment versus the non-affluent environment rely on the idea that environments influence people's sense of self and their

perceptions of their social identities. These two explanations each have the potential to explain why affluence cues in the environment resulted in increased performance for high-SES students, and therefore future research should focus on how environments influence perceptions of one's social identities.

5.3 Why affluence cues did not affect performance among low socioeconomic status students

Interestingly, we found that the presence versus absence of affluence cues in the environment neither increased nor decreased the performance of students from low-SES backgrounds. This finding stands in contrast to previous work which has suggested that when students from low-SES backgrounds face social identity threats that have the potential to challenge their self-worth in educational contexts, their performance suffers (Croizet and Claire 1998). However, we feel that our study differs from past research in that we did not seek to use the affluent environment to activate a social identity threat in low-SES students. Past research has directly sought to activate a sense of threat in low-SES students by using manipulations which focus low-SES students' attention on the negative stereotype of their group as unintelligent. For example, past research has found that low-SES students underperform if they are told that the test is a measure of intellectual ability (Croizet and Claire 1998), or if they are placed in direct, public competition with their high-SES peers (Goudeau and Croizet 2017). Our manipulation of ambient testing environments did not seek to activate social identity threat or performance anxieties in low-SES students. In fact, we protected against social identity threat in a number of ways: Students took the test in a private space, were not told that the test was a measure of intellectual ability, and did not report their SES until after completing the performance measures. These reasons may explain why we did not see a change in the performance of low-SES students as a function of the testing environment. Future research should explore the scenarios under which physical environments would significantly change the test performance of students from low-SES backgrounds.

5.4 Limitations and future directions

The study has two main limitations which should be addressed by future research. The first is that our study did not directly test the mechanisms which may have differentially affected performance for high and low-SES students in the affluent versus non-affluent environments. Earlier, we theorized on some of the possible pathways through which the environment may have an effect on performance, particularly via the social class identities of high and low-SES students. We hope that future research will explore these mechanisms in order to provide us with a fuller understanding of how physical environments interact with social identities to predict performance.

The second limitation concerns the intersectionality between race and socioeconomic status in our sample. The racial/ethnic breakdown of our sample covaried somewhat with socioeconomic status: Most White students identified

as high-SES and most African American and Latino students identified as low-SES. Asian American students were the only racial group in which both high-SES and low-SES students were somewhat equally represented. We ran analyses on the test performance of Asian American students and saw similar patterns as those reported for the overall sample, with high-SES Asian American students outperforming low-SES Asian American students to a greater extent when affluence cues were present than when they were absent. This lends credence to the idea that our observed results were driven primarily by student SES and not by race. However, a complete study design would have high and low-SES participants from each major racial/ethnic category to test whether there are independent effects for race and socioeconomic status on test performance.

5.5 Implications for socioeconomic disparities in education

This research has important implications for socioeconomic disparities in education. It shows the un-equalizing effect of affluent environments on college campus on high and low-SES students: Specifically, how these environments can advantage high-SES students but not low-SES students and contribute to the social class achievement gap. Even though cues of affluence did not decrease performance among low-SES students, the fact that they increased performance among high-SES students means that these cues further contributed to group-based disparities between students from different social class backgrounds. Consistent with past research (Pascarella et al. 2004), we found a main effect of student-SES on performance, such that high-SES students outperformed low-SES students overall. However, this effect was driven by the affluent cues condition. The performance boost that high-SES students received from the affluent environment caused them to outperform students from low-SES backgrounds, but this only occurred when affluence cures were present. That is, high-SES students outperformed low-SES students in the affluent environment, but both groups of students performed equally well (as measured by response accuracy) in the non-affluent environment. This suggests that many of the advantages that high-SES students experience in higher education may disappear if testing environments are more equitable and college campuses contain less affluence cues.

It is the stated goal of many universities to recruit and retain first-generation and low-income students (Medina 2019; Wilson et al. 2012). Education is commonly seen as one of the best ways to increase social mobility in the United States (Haveman and Smeeding 2006), and doing well in college leads to higher incomes and more prestigious occupations for students. Therefore, factors that advantage high-SES students over low-SES students in university settings contribute to growing societal income inequality. Our study found that affluence cues in the environment increased the performance gap between high and low-SES students relative to an environment without affluence cues. This research finding brings awareness to the fact that environmental cues of affluence on university campuses may confer an invisible advantage on high-SES students and may be

one of the reasons that high-SES students outperform low-SES students in environments where these cues are present. For university administrators, keeping in mind the potentially unintended consequences of environmental cues of affluence when designing college environments may help reduce disparities between students from advantaged and disadvantaged backgrounds.

6 Conclusion

Our goal was to examine the role that the physical environments of universities play in the test performance of students from high versus low-SES backgrounds. In a controlled research study, we found that environments with affluence cues increased the test performance of students from high-SES backgrounds but not students from low-SES backgrounds relative to environments without affluence cues. This resulted in students from high-SES backgrounds outperforming students from low-SES backgrounds to a greater extent when affluence cues were present than when they were absent. This research shows how the presence of affluence cues on university campuses can potentially advantage high-SES students over low-SES students and contribute to class-based disparities in education.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest with respect to their authorship or the publication of this article.

Statement on ethical approval and informed consent All procedures performed in this study were approved by the institutional review board of the researchers' and participants' university. All procedures are in accordance with the ethical standards of the institutional research committee. In addition, informed consent was obtained from all individual participants included in the study.

Appendix

Examples of objects in the affluent and control testing environments

	Affluent room	Control room
Books and bookends		
Lamps		
Chairs		

Social class levels question

Socioeconomic status (SES) refers to the combination of education, income, and job an individual possesses. A teacher with a Masters Degree in Education who earns $40,000 a year may consider herself a median SES; although she does not earn much, her professional degree places her in a higher SES bracket. Please indicate where you believe your family to fall compared to other Americans:

- Very high SES: Top-level executives, multi-millionaires, celebrities, and national politicians; individuals often have an Ivy League education and professional degrees. Annual household incomes of $150,000–$500,000 and above.
- High SES: Highly-educated individuals, often with graduate or professional degrees, corporate elite and/or middle management with large work autonomy and economic security. Annual household incomes of $75,000–$150,000.
- Median SES: College-educated workers, white-collared semi-professionals and/or craftsmen with some work autonomy. Annual household incomes of $35,000–$75,000.
- Low SES: Blue collar workers or individuals with low job security; may have completed high school education. Annual household incomes of $16,000–$35,000.
- Very low SES: Individuals typically living below poverty line with little to no participation in the work force and may have some high school education.

References

Cheryan, S., Plaut, V. C., Davies, P. G., & Steele, C. M. (2009). Ambient belonging: How stereotypical cues impact gender participation in computer science. *Journal of Personality and Social Psychology, 97,* 1045–1060.

Cohen, G. L., & Garcia, J. (2008). Identity, belonging, and achievement: A model, interventions, implications. *Current Directions in Psychological Science, 17,* 365–369.

Croizet, J.-C., & Claire, T. (1998). Extending the concept of stereotype threat to social class: The intellectual underperformance of students from low socioeconomic backgrounds. *Personality and Social Psychology Bulletin, 24,* 588–594. https://doi.org/10.1177/0146167298246003.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41,* 1149–1160.

Gilbert, D. (2011). *The American class structure in an age of growing inequality* (8th ed.). Thousand Oaks, CA: Pine Forge Press.

Goudeau, S., & Croizet, J.-C. (2017). Hidden advantages and disadvantages of social class: How classroom settings reproduce social inequality by staging unfair comparison. *Psychological Science, 28,* 162–170. https://doi.org/10.1037/xge0000014.

Granfield, R. (1991). Making it by faking it: Working-class students in an elite academic environment. *Journal of Contemporary Ethnography, 20,* 331–351. https://doi.org/10.1177/089124191020003005.

Haveman, R., & Smeeding, T. (2006). The role of higher education in social mobility. *The Future of Children, 16,* 125–150.

Jack, A. A. (2019). *The privileged poor: How elite colleges are failing disadvantaged students*. Cambridge, MA: Harvard University Press.

Johnson, S. E., Richeson, J. A., & Finkel, E. J. (2011). Middle class and marginal? Socioeconomic status, stigma, and self- regulation at an elite university. *Journal of Personality and Social Psychology, 100,* 838–852.

Kraus, M. W., Piff, P. K., & Keltner, D. (2009). Social class, sense of control, and social explanation. *Journal of Personality and Social Psychology, 97,* 992–1004. https://doi.org/10.1037/a0016357.

Kusserow, A. (2012). When hard and soft clash: Class-based individualisms in Manhattan and Queens. In S. T. Fiske & H. R. Markus (Eds.), *Facing social class: How societal rank influences interaction* (pp. 195–215). New York, NY: Russell Sage Foundation.

Latu, I. M., Mast, M. S., Lammers, J., & Bombari, D. (2013). Successful female leaders empower women's behavior in leadership tasks. *Journal of Experimental Social Psychology, 49,* 444–448. https://doi.org/10.1016/j.jesp.2013.01.003.

Markus, H. R., & Stephens, N. M. (2017). Editorial overview: inequality and social class: The psychological and behavioral consequences of inequality and social class: a theoretical integration. *Current Opinion in Psychology, 18,* 4–12.

Medina, J. (2019). What's life like as a student at U.S.C.? Depends on the size of the bank account. *The New York Times.* Retrieved from https://www.nytimes.com/2019/04/03/us/usc-admissions-scandal-students.html. Accessed 25 Sept 2019.

Mendoza-Denton, R., Shaw-Taylor, L., Chen, S., & Chang, E. (2009). Ironic effects of explicit gender prejudice on women's test performance. *Journal of Experimental Social Psychology, 45,* 275–278. https://doi.org/10.1016/j.jesp.2008.08.017.

Ostrove, J. M. (2003). Belonging and wanting: Meanings of social class background for women's constructions of their college experiences. *Journal of Social Issues, 59,* 771–784. https://doi.org/10.1046/j.0022-4537.2003.00089.x.

Ostrove, J. M., & Long, S. M. (2007). Social class and belonging: implications for college adjustment. *Review of Higher Education, 30,* 363–389.

Pascarella, E. T., Pierson, C. T., Wolniak, G. C., & Terenzini, P. T. (2004). First-generation college students: Additional evidence on college experiences and outcomes. *Journal of Higher Education, 75,* 249–284.

Shih, M., Pittinsky, T. L., & Ambady, N. (1999). Stereotype susceptibility: Identity salience and shifts in quantitative performance. *Psychological Science, 10,* 80–83. https://doi.org/10.1111/1467-9280.00111.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69,* 797–811. https://doi.org/10.1037/0022-3514.69.5.797.

Stephens, N. M., Brannon, T. N., Markus, H. R., & Nelson, J. E. (2015). Feeling at home in college: Fortifying school-relevant selves to reduce social class disparities in higher education. *Social Issues and Policy Review, 9,* 1–24. https://doi.org/10.1111/sipr.12008.

Stephens, N. M., Markus, H. R., & Phillips, L. T. (2014). Social class culture cycles: How three gateway contexts shape selves and fuel inequality. *Annual Review of Psychology, 65,* 611–634.

Walton, G. M., & Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes among minority students. *Science, 331,* 1447–1451.

Warburton, E. C., Bugarin, R., & Nuñez, A. (2001). *Bridging the gap: Academic preparation and postsecondary success of first-generation students (NCES 2001-153).* Washington, DC: National Center for Education Statistics, U.S. Government Printing Office.

Wiederkehr, V., Darnon, C., Chazal, S., Guimond, S., & Martinot, D. (2015). From social class to self-efficacy: Internalization of low social status pupils' school performance. *Social Psychology of Education, 18,* 769–784. https://doi.org/10.1007/s11218-015-9308-8.

Wilson, J. L., Meyer, K. A., & McNeal, L. (2012). Mission and diversity statements: What they do and do not say. *Innovative Higher Education, 37,* 125–139.

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