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Stereotype threat, identity salience, and spatial reasoning

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Abstract

Stereotype threat research provides insight into how the low standardized test scores of students from stigmatized social groups may derive in part from the negative performance expectations about these groups. Because these students belong to many social groups, one means of mitigating the threat is to remind them of their membership in groups for which there are positive performance expectations. We tested this hypothesis by priming different social identities among undergraduates prior to administering a standardized test of spatial reasoning, the Vandenberg Mental Rotation Test. We found that females who were primed to contemplate their identity as students at a selective private college performed better than those who were primed to contemplate their sex or a test-irrelevant identity. For males, priming their sex increased performance relative to the test-irrelevant or private college student primes. These results demonstrate the potential of reminding students of their achieved identities (e.g., private college student) in an effort to subdue evaluation apprehension created by negative stereotypes about their ascribed identities, such as being female in the case of spatial abilities.

Keywords: Stereotype threat; Sex differences; Spatial performance; Identity

1. Introduction

Differences in academic performance across ethnic and gender groups persist, even among populations comparable on factors known to be correlated with achievement (Ferguson, 1998; Jencks & Phillips, 1998; Pinkerton, 1998). These differences have been the focus of research seeking to level the academic playing field for students from diverse backgrounds. In recent years, researchers in psychology and education have focused on the contribution of stereotypes to these differences. In particular, Steele and his colleagues have suggested that the underperformance of students from certain social categories may be due in part to a disruptive level of self-preoccupation and evaluation apprehension experienced by these students in test-taking situations (Aronson & Steele, 2004; Davies, Spencer, & Steele, 2005; Steele & Aronson, 1995). According to their proposal, these students enter the testing situation with not only trepidation about how they will perform on the test, but also with dread that a poor performance on their part will confirm a widely held stereotype imputing intellectual inferiority to their social category. As a result, these students

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experience "stereotype threat," in that they are prone to interpret the difficulty they experience on a demanding test as stemming from the alleged inferiority of their social category.

In their initial set of experiments, Steele and Aronson (1995) demonstrated how the presence of stereotype threat can undermine the performance of even highly talented and prepared minority students. In one experiment, African American and European American Stanford University undergraduates completed the verbal portion of the Graduate Records Examination (GRE) after filling out a brief demographic questionnaire. For half of the test takers, the questionnaire included an item asking them to indicate their race, thereby suggesting that the experimenters might be evaluating them with race – and hence, the stereotypes about African American and European American students' intellectual abilities – in mind. This subtle reminder of the stereotype and the possibility of being judged by it aroused enough anxiety among the African American students to make them perform significantly worse than all other test takers; they solved about half as many problems as those not asked to indicate their race. Similar impairments have been documented in the performance of Latino students on verbal tests (Aronson & Salinas, 2005) and female students on mathematics tests (Spencer, Steele, & Quinn, 1999) when they are subtly reminded of performance-based stereotypes.

Subsequent research on stereotype threat has suggested that the threat is a function of the broader social context as much as it is of the person's ethnicity or sex. Interestingly, it can be experienced by a member of any group, even a group that is not typically targeted by negative stereotypes about ability—such as European American males. For example, Aronson et al. (1999) gave European American male undergraduates a challenging math test and told half of them that the purpose was to find out why Asians typically outscored European Americans on tests of this sort. Mention of this intended comparison made the European American male students mindful of the stereotype of Asian mathematical superiority, and consequently impaired their performance relative to other European American males who were not told that this comparison would be made. This impairment occurred despite the fact that the European American males in this study had good reason to be confident in their math skills—most were math majors at Stanford University who entered college with quantitative SAT scores above 700. This finding demonstrates how the predicament of being stereotype-threatened can overwhelm factors such as skill, preparedness, and cultural background, factors to which academic performance is customarily attributed. Similar effects with women in the domain of mathematics further strengthen the claim that the broader social context makes a sizable contribution to the dismal school outcomes of many stigmatized students (Aronson & Steele, 2004; Spencer et al., 1999).

The numerous demonstrations of stereotype threat in college aged populations all hinge on cues (a demographics question about ethnicity or sex, a statement about how test results will be used, etc.) that increase the salience of a student's stigmatized identity in the testing environment. Ascribed identities such as one's sex or ethnicity – the primary stigmatized identities investigated in stereotype threat research – are already well-formed, pivotal aspects of the self-concept before the age of five (Aboud, 1988). Young children are not only cognizant of (and conversant about) their ascribed identities, but also familiar with the stereotypes associated with these identities by their early elementary school years (Ambady, Shih, Kim, & Pittinsky, 2001; Bigler, Jones, & Lobliner, 1997; Ruble & Martin, 1998). By late adolescence, the longstanding centrality of sex and ethnicity to one's sense of self, combined with the stereotypical associations of these identities established during childhood ("Blacks aren't as smart as Whites," "boys are better at math than girls," etc.) render college students with stigmatized ascribed identities especially vulnerable to stereotype threat.

Despite this vulnerability, other aspects of personal identity that emerge relatively late in adolescence may mitigate ego threat (Marcia, 1966). In particular, domains of identity predicated on interpersonal interaction (e.g., college student), religion (e.g., Roman Catholic), ideology (e.g., liberal), intellectual interests (e.g., communication major), and occupational aspirations (e.g., pre-law) come to the fore as adolescents formulate a sense of self based on their own preferences, choices, and accomplishments (Patterson, Sochting, & Marcia, 1992; Waterman, 1982). These "achieved identities" are adaptive for any adolescent as she negotiates the spheres of independence and non-familial interdependence associated with adulthood. However, achieved identities also provide a potential substrate specifically for female and ethnic minority adolescents to transcend the negative expectations associated with their stigmatized ascribed identities (Kobrynowicz & Biernat, 1998). The present research explored the hypothesis that the deficits in test performance caused by stereotype threat – a threat triggered by the salience of an ascribed identity – might be attenuated by shifting the test taker's focus to an achieved identity for which there are positive performance expectations. To conduct a rigorous test of this hypothesis, we explored a testing domain that has consistently yielded large performance differences associated with an ascribed identity characteristic—spatial reasoning.

1.1. Social identity and women's spatial reasoning

Although the gap between men and women's academic and professional exposure to visual–spatial tasks has closed rapidly over the last 30 years, the gap in their performance on tests of this reasoning capacity has remained fairly stable (Geary, 1995, 1996; McGillicuddy-De Lisi & De Lisi, 2002). Of the numerous dimensions of this complex capacity that have been studied, mental rotation appears to produce the largest performance gap in favor of males. Tests of this ability typically require the taker to visualize a static two- or three-dimensional target object from one of several different perspectives and to determine whether the "mentally rotated" target object matches the shape of one or more comparison objects. On tasks such as the original Shepard and Metzler (1971) mental rotation paradigm and the Vandenberg Mental Rotation Test (Vandenberg, 1971; Vandenberg & Kuse, 1978), meta-analyses of the extant studies on sex differences in spatial reasoning performance yield *d*'s ranging from .87 to .94 (approximately one full standard deviation), the largest documented sex difference in any cognitive ability (Linn & Petersen, 1985; Masters & Sanders, 1993; Willis & Schaie, 1988). In this case, $d = .9$ indicates that among those scoring above average, approximately 75% are male and 25% are female. These findings have emboldened critics of socialization accounts of women's lower test scores. For example, Harvard University President Lawrence Summers recently attributed the underrepresentation of women in the math and science professorate to differences in "innate ability." However, most scientists familiar with the gender gap recognize that it is so large that it probably requires a combination of genetic and socialization theories to explain it (Hooven, Chabris, Ellison, & Kosslyn, 2004; McGillicuddy-De Lisi & De Lisi, 2002).

What contributing role might the stereotype of female visual–spatial inferiority play in this spatial reasoning gap? This stereotype is one facet of a more general cultural stereotype imputing inferior quantitative ability to women (Fennema & Leder, 1990; Gallagher & Kaufman, 2005). Consequently, women in a visual–spatial reasoning testing context must contend with the possibility that poor performance will confirm a negative stereotype about their ability. Consideration of this possibility divides their attention between the test and evaluative concerns, thereby potentially impairing their performance. Consistent with this claim, Spencer et al. (1999) found that women's performance on a difficult mathematics test was equal to that of men's when they were told beforehand that the test was not sensitive to sex differences in math ability; when the test was presented without this stereotype-nullifying information, women performed far worse than men.

1.2. Multiple social identities and stereotype threat

Women's preoccupation with evaluative concerns of this sort can also be attenuated or exacerbated by manipulating the social identity that is most salient to women in the testing environment. Prior to administering a mathematics test, Shih, Pittinsky, and Ambady (1999) presented their Asian American female participants with a brief questionnaire comprised of questions designed to make salient their identity as women (e.g., *Do you prefer single sex or coed college dormitories?*), their identity as Asian Americans (e.g., *How many generations of your family have lived in America?*), or their identity as members of a test-irrelevant social category (cable TV subscribers). Participants primed to categorize themselves as women achieved the lowest performance of all three groups, consistent with the negative stereotype about women's math ability. In contrast, participants primed to categorize themselves as Asian American achieved the highest performance of all groups, consistent with the stereotype crediting this group with superior math ability. Inzlicht and Ben-Zeev (2000) found that groups of women performed worse on a math (but not a verbal) test when a male test-taker was present, presumably because this made their female identity salient (see also Inzlicht & Ben-Zeev, 2003). These findings are important in that they highlight the importance of sociocultural influences on women's performance in evaluative contexts (Barinaga, 1994). Furthermore, they suggest that when students' multiple social identities are considered in an academic context, stereotype threat phenomena may be approached far more strategically than previously recognized. Their findings raise the intriguing possibility that subtle interventions designed to increase the salience of certain social identities but not others can improve students' test performance. Shih et al.'s findings demonstrate that stereotype threat can be subdued by a subtle process of ascribed identity manipulation—in this case, focusing people's attention on an ascribed identity (Asian ethnicity) for which there is a positive test-relevant stereotype ("Asians are good at math") rather than one for which there is a negative stereotype ("females are bad at math"). In the present study, we investigated the possibility that the manipulation of an individual's salient achieved identity (i.e., membership in social categories based on an individual's choices and achievements) can produce comparable benefits. With very few exceptions, the intellectual performance stereotypes associated with ascribed identities (sex and ethnicity) tend to be negative (e.g., "females are bad at math," "African

Americans aren't good readers," etc.). Furthermore, the handful of positive performance stereotypes associated with ascribed identities (e.g., "Asians are good at math," "Jews are good at handling money," etc.) are often predicated on negative stereotypes about members' motivation (e.g., "Jews are greedy"). The domain of achieved identities is broader than that of ascribed identities, and includes many positive performance stereotypes without negative motivational baggage. For example, consider the positive intellectual performance stereotype associated with the category of "private college students." Although this identity may be linked in some cases to ascribed characteristics (e.g., an individual who is born into a family with the means to afford a private college education), clearly an individual must *choose* a college and thus might contemplate the strong positive intellectual performance stereotype associated with this achieved identity (i.e., "private college students are academically gifted"). Contemplation of this stereotype by women prior to performing a visual–spatial task might serve to attenuate the anxiety produced by the negative stereotype imputing inferior visual–spatial ability to their ascribed identity as "females" (see Ben-Zeev, Fein, & Inzlicht, 2005).

We applied and extended Shih et al.'s logic to our exploration of the influence of differential identity salience on women's visual–spatial reasoning performance. We expected that manipulating the salience of participants' social identities would make operative different stereotypes about their abilities and consequently influence their performance on the subsequently presented Vandenberg Mental Rotation Test. In light of the well-known stereotype of men's superiority to women in visual–spatial ability (Fennema & Leder, 1990; McGillicuddy-De Lisi & De Lisi, 2002), we predicted that priming participants' gender status would impair women's performance, but potentially improve men's performance (Walton & Cohen, 2003), relative to a control condition in which a task-irrelevant identity ("Northeasterner") was primed. In contrast, we expected that priming the participant's status as a student at a private college would potentially improve the performance of both females and males, in line with the stereotype that students attending a selective private college have more intellectual talent and motivation than public college students.

2. Method

2.1. Participants

Ninety undergraduates (45 female) at a selective liberal arts college in the northeastern United States participated in this experiment. Students received extra credit in introductory psychology courses for their participation. All were native English speakers and none were mathematics or physics majors.

2.2. Measures and procedure

We administered the Vandenberg Mental Rotation Test (VMRT), a standard test of visual–spatial ability, to our sample. The items on this test consist of two-dimensional depictions of three-dimensional objects presented at various angles. Each item contained one "target" object and four "comparison" objects (see Fig. 1). Two of the comparison objects were identical in shape to the target but were presented at different angular rotations, while the other two comparison objects were dissimilar in shape as well as angular rotation. The participant's objective on each item was to identify the two comparison objects that were identical to the target in shape. Six minutes were allotted for participants to complete 30 such items, and thus they were under pressure to complete each item as quickly as possible.

Prior to administration of the test, participants completed one of three brief questionnaires comprised of six probe questions designed to make salient a particular social identity. One version of this questionnaire was identical to that used by Shih et al. (1999) to prime gender identity, containing items that made reference to the participant's sex or gender (e.g., *List three reasons why one might prefer living a coed floor in a dormitory*). A second version was comprised of items designed to make salient the participant's status as a student at a private school (e.g., *List three reasons why one might attend a private liberal arts college*). Finally, a third version was comprised of items designed to make salient the participant's status as a resident of the Northeastern United States, a control condition (e.g., *List three reasons why one might prefer living in the Northeast to other parts of the U.S.*).

3. Results

A preliminary analysis indicated that the administration of the VMRT to our sample yielded a degree of internal consistency (Cronbach's $\alpha = .79$) comparable to that reported in the test manual ($\alpha = .83$) and observed in previous

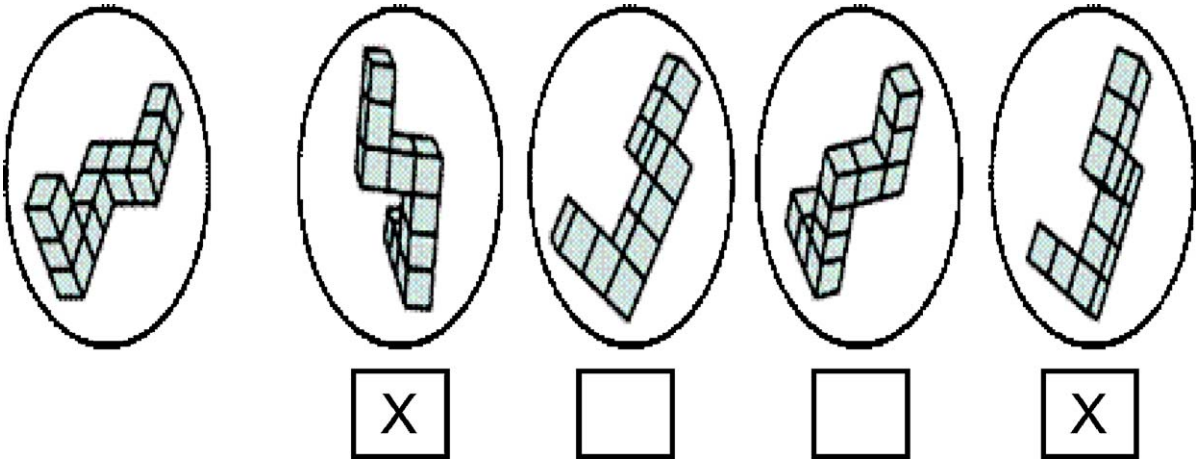

Fig. 1. Example item from the Vandenberg Mental Rotation Test (Vandenberg, 1971). The target object is on the far left and the four comparison objects are on the right. Checked boxes below two of the comparison objects indicate that they are identical in shape to the target object but are presented at different angular orientations.

studies employing this test (Alias, Black, & Gray, 2002; Hegarty & Waller, 2004; Hooven et al., 2004; Qubeck, 1997; Vandenberg & Kuse, 1978). The mean VMRT scores by participant sex and identity prime condition are presented in Fig. 2.

To determine the influence of the identity primes on participants' performance, we conducted a 2 × 3 ANOVA on VMRT scores. Overall, a main effect of participant sex revealed that male participants achieved higher scores on average than female participants, $M(SD)_{\text{males}}$ = 20.0 (2.43) compared to $M(SD)_{\text{females}}$ = 15.4 (2.19), $F(1, 84)$ = 30.4, $p < .01$; $\alpha_p^2 = .51$. The direction and magnitude of this effect are comparable to those observed in previous studies of sex differences in VMRT performance (e.g., Hooven et al., 2004; Vandenberg & Kuse, 1978). However, as hypothesized, this main effect of participant sex was qualified by a reliable sex × identity prime interaction, $F(2, 84) = 7.68$, $p < .03$; $\alpha_p^2 = .38$. As predicted, female participants' VMRT performance was differentially influenced by the social identity primed via the different questionnaire versions. Females in the gender prime condition achieved lower average scores, $M(SD)$ = 13.8 (2.2), than those in the task-irrelevant prime (control) condition, $M(SD)$ = 15.3 (2.47), while those in the private college prime condition achieved higher average scores, $M(SD)$ = 16.7 (2.1). A multiple comparison test indicated that although the mean scores in the gender identity prime and private college identity prime conditions were reliably different, Fisher's LSD = 1.9, $p < .05$; neither differed reliably from the mean for the task-irrelevant control prime condition. We thus conclude that females for whom

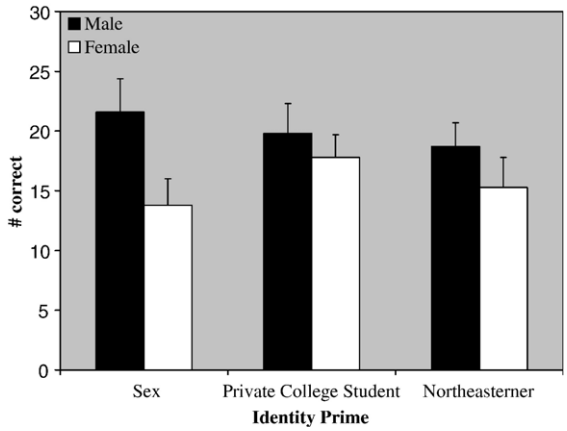

Fig. 2. Mean (and *SD*) number correct on the VMRT by participant sex and identity prime conditions.

gender identity was made salient were at a significant disadvantage in VMRT performance relative to those whose identity as private college student was primed.

There was a different pattern of identity prime influence among our male participants. As predicted, males in the gender identity prime and private college identity prime conditions achieved higher average scores, $M(SD) = 21.6$ (2.62) and $M(SD) = 19.4$ (2.38), respectively, on the spatial ability test than those in the task-irrelevant identity prime condition, $M(SD) = 18.5$ (2.03). However, comparison of the means for the priming conditions using the Fisher's *LSD* criterion indicated that only the gender identity prime and task-irrelevant control prime means were reliably different at the .05 level. We interpret this finding as evidence that priming males' gender identity produced a reliable boost in their VMRT performance relative to the task-irrelevant condition, but priming their identities as private college student did not.

4. Discussion

We can draw two conclusions regarding the effectiveness of our manipulation in attenuating stereotype threat's effects on women's spatial reasoning performance. First, the salience of different social identities can exert an influence on students' visual–spatial performance comparable to that observed for mathematics performance (McGlone, Kobrynowicz, & Aronson, 1999; Shih et al., 1999). Women primed to consider their status as private college students performed at a significantly higher level than those primed to consider their gender status. In contrast, priming private college student status did not reliably improve men's performance relative to a control prime (although the means were in that direction), but priming their gender status did improve their performance. This finding strongly suggests that both men and women are mindful of gender stereotypes pertaining to visual–spatial ability and are differentially affected by these stereotypes.

Second, our results demonstrate that social identities other than ascribed biological or cultural categories (e.g., male, female, African American, European American) can exert an influence on intellectual performance. During adolescence, people begin to seek out social connections that transcend ethnicity or gender based on their choices, preferences, and accomplishments (Elder, 1980; Newman & Newman, 2001). The acquisition of these "achieved" identities by adolescents and young adults contributes not only to the formation of a mature, differentiated personal identity (Levitt, Guacci-Franco, & Levitt, 1993), but also to the repertoire of ego defense mechanisms one may draw upon when some facet of personal identity is threatened (Kobrynowicz & Biernat, 1998; McGlone et al., 1999). Specifically, we contend that contemplating positive achieved identities one possesses can mitigate the anxiety she may feel as a result of the negative stereotypic expectations associated with an ascribed identity. The fact that females primed with questions about their identity as "private college students" achieved higher VMRT scores than those primed with questions about their sex supports this contention.

It would of course be ideal to eliminate the negative stereotypes associated with any social category, ascribed or not. However, current students cannot wait for that to occur while they become disillusioned with academic performance. Instead, these results point encouragingly to the attainment of additional identities – those associated with positive academic expectations–as a means of improving academic performance. We consequently do not advocate the elimination of all overt references to a student's negatively stereotyped identity in evaluative contexts; rather, our results suggest that reminding students of achieved positive identities prior to the administration of an exam may be sufficient to subdue stereotype threat. In this case, the positive identity we primed (private college student) was relevant to the task, which ostensibly measures an intellectual ability. Although it is possible that priming positive task-irrelevant achieved identities (student government representative, volunteer worker) may also yield such benefits, we have not explored this possibility in the reported research.

These results add to the growing literature supporting the utility of the stereotype threat construct. When a social scientific construct parsimoniously explains data in different disciplines, it is fitting that the discussion turn from disparate phenomenologies to an integrated account of the necessary and sufficient conditions under which the construct can be used to predict and potentially intervene in behavior. As we (and others) have demonstrated, stereotype threat responses are predicated in large part on the social identity that is currently salient to a susceptible individual. The cues available to trigger one's social identity in a testing environment are numerous—a standard demographics question about ethnicity, the use of a phrase associated with a particular cultural community, the difficulty of a test, as well as the faces of the other test takers and the teachers in a testing environment (Aronson, Quinn, & Spencer, 1998; Inzlicht & Ben-Zeev, 2000; McGlone et al., 1999). Any of these contextual dimensions has the potential to prompt a stereotype threat response. However, these same dimensions can also be transmuted to cue self-affirming identities, thereby

thwarting threat responses, and in some cases even boosting an individual's performance. Social identity thus appears to be not only a vector for stereotype threat phenomena, but also a potential antidote for their ill effects. More generally, these results underscore the complexity of the factors that shape intellectual achievement. As noted earlier, the weight of the evidence for a biological role in mathematics-related performance is considerable. Our findings nonetheless call into question the simplistic conclusion that biological differences adequately explain both performance and interest in mathematics and spatial tasks.

References

Aboud, F. E. (1988). *Children and prejudice.* Oxford England: Blackwell.

Alias, M., Black, T. R., & Gray, D. E. (2002). Effect of instructions on spatial visualisation ability in civil engineering students. *International Education Journal*, *3*, 1−12.

Ambady, N., Shih, M., Kim, A., & Pittinsky, T. L. (2001). Stereotype susceptibility in children: Effects of identity activation on quantitative performance. *Psychological Science*, *12*, 385−390.

Aronson, J., Lustina, M. J., Good, C., Keough, K., Steele, C. M., & Brown, J. (1999). When White men can't do math: Necessary and sufficient factors in stereotype threat. *Journal of Experimental Social Psychology*, *35*, 29−46.

Aronson, J., Quinn, D. M., & Spencer, S. J. (1998). Stereotype threat and the academic underperformance of minorities and women. In J. K. Swim & C. Stangor (Eds.), *Prejudice: The target's perspective* (pp. 83−103). San Diego, CA: Academic Press.

Aronson, J., & Salinas, M. (2005). Is low performance the cost of high self-esteem? Manuscript under review.

Aronson, J., & Steele, C. M. (2004). Stereotypes and the fragility of academic competence, motivation, and self-concept. In A. J. Elliot & C.S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 436−456). New York: Guilford.

Barinaga, M. (1994). Surprises across the cultural divide. *Science*, *263*, 1468−1472.

Ben-Zeev, T., Fein, S., & Inzlicht, M. (2005). Stereotype threat and arousal. *Journal of Experimental Social Psychology*, *41*, 174−181.

Bigler, R. S., Jones, L. C., & Lobliner, D. B. (1997). Social categorization and the formation of intergroup attitudes in children. *Child Development*, *68*, 530−543.

Davies, P. G., Spencer, S. J., & Steele, C. M. (2005). Clearing the air: Identity safety moderates the effects of stereotype threat on women's leadership aspirations. *Journal of Personality and Social Psychology*, *88*, 276−287.

Elder Jr., G. H. (1980). Adolescence in historical perspective. In J. Adelson (Ed.), *Handbook of adolescent psychology* (pp. 3−46). New York: Wiley.

Fennema, E., & Leder, G. C. (1990). *Mathematics and gender.* New York: Teacher's College Press.

Ferguson, R. F. (1998). Can schools narrow the Black–White test-score gap? In C. Jencks & M. Phillips (Eds.), *The Black–White test score gap* (pp. 318−374). Washington, DC: Brookings Institutions Press.

Gallagher, A. M., & Kaufman, J. C. (2005). *Gender differences in mathematics: An integrative psychological approach.* Cambridge: Cambridge University Press.

Geary, D. C. (1995). Sexual selection and sex differences in spatial cognition. *Learning and Individual Differences*, *7*, 289−301.

Geary, D. C. (1996). Sexual selection and sex differences in mathematical abilities. *Behavioral and Brain Sciences*, *19*, 229−284.

Hegarty, M., & Waller, D. (2004). A dissociation between mental rotation and perspective-taking spatial abilities. *Intelligence*, *32*, 175−191.

Hooven, C. K., Chabris, C. F., Ellison, P. T., & Kosslyn, S. M. (2004). The relationship of male testosterone to components of mental rotation. *Neuropsychologia*, *42*, 782−790.

Inzlicht, M., & Ben-Zeev, T. (2000). A threatening intellectual environment: Why females are susceptible to experiencing problem-solving deficits in the presence of males. *Psychological Science*, *11*, 365−371.

Inzlicht, M., & Ben-Zeev, T. (2003). Do high-achieving female students underperform in private? The implications of threatening environments on intellectual processing. *Journal of Educational Psychology*, *95*, 796−805.

Jencks, C., & Phillips, M. (1998). The Black–White test-score gap: An introduction. In C. Jencks & M. Phillips (Eds.), *The Black–White test score gap* (pp. 3−15). Washington, DC: Brookings Institutions Press.

Kobrynowicz, D., & Biernat, M. (1998). Considering correctness, contrast, and categorization in stereotyping phenomena. In R. S. Wyer Jr. (Ed.), *Stereotype activation and inhibition: Advances in social cognition*, *Vol. 11*. (pp. 109−126). Mahwah, NJ: Erlbaum.

Levitt, M. J., Guacci-Franco, N., & Levitt, J. L. (1993). Convoys of social support in childhood and early adolescence: Structure and function. *Developmental Psychology*, *29*, 811−818.

Linn, M. C., & Petersen, A. C. (1985). Emergence and characterization of sex differences in spatial ability: A meta-analysis. *Child Development*, *56*, 1479−1498.

Marcia, J. E. (1966). Development and validation of ego identity status. *Journal of Personality and Social Psychology*, *21*, 551−559.

Masters, M. S., & Sanders, B. (1993). Is the gender difference in mental rotation disappearing? *Behavior Genetics*, *23*, 337−341.

McGillicuddy-De Lisi, A. V., & De Lisi, R. (2002). *Biology, society, and behavior: The development of sex differences in cognition.* Greenwich, CT: Ablex/Greenwood.

McGlone, M.S., Kobrynowicz, D., Aronson, J., (1999, July). *Grounds for stereotype threat: Social identity and test difficulty.* Paper presented at the Symposium on stereotype threat at the Annual Meeting of the European Association of Experimental Social Psychology, Oxford University (Keble College), U.K.

Newman, B. M., & Newman, P. R. (2001). Group identity and alienation: Giving the we its due. *Journal of Youth and Adolescence*, *30*, 515−538.

Patterson, S., Sochting, I., & Marcia, J. (1992). The inner space and beyond: Women and identity. In G. Adams, T. Gullotta & R. Montemayor (Eds.), *Adolescent identity formation* (pp. 9−24). Newbury Park, CA: Sage.

Pinkerton, S. (1998). *The condition of education.* Washington DC: U.S. Department of Education, National Center for Education Statistics.

Qubeck IV, W. R. (1997). Mean differences among subcomponents of Vandenberg's Mental Rotation Test. *Perceptual and Motor Skills*, *85*, 323−332.

Ruble, D., & Martin, C.L. (1998). Gender development. In W. Damon (Series Ed.) & N. Eisenberg (Vol. Ed.), *Handbook of child psychology*: Vol. 3. Social, emotional, and personality development (5th ed., pp. 933−1016). NY: Wiley.

Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science*, *171*, 701−703.

Shih, M., Pittinsky, T. L., & Ambady, N. (1999). Stereotype susceptibility: Identity salience and shifts in quantitative performance. *Psychological Science*, *10*, 80−83.

Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social Psychology*, *35*, 4−28.

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.

Vandenberg, S. G. (1971). *Mental rotation test.* Boulder: University of Colorado.

Vandenberg, S. G., & Kuse, A. R. (1978). Mental rotations, a group test of three-dimensional spatial visualization. *Perceptual and Motor Skills*, *47*, 599−604.

Walton, G. M., & Cohen, G. L. (2003). Stereotype lift. *Journal of Experimental Social Psychology*, *39*, 456−467.

Waterman, A. (1982). Identity development from adolescence to adulthood: An extension of theory and a review of research. *Developmental Psychology*, *18*, 341−358.

Willis, S. L., & Schaie, K. W. (1988). Gender differences in spatial ability in old age: Longitudinal and intervention findings. *Sex Roles*, *18*, 189−203.