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Choking under pressure: When an additional positive stereotype affects performance
for domain identified male mathematics students

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Abstract

This research aimed to establish if the presentation of two positive stereotypes would result in choking under pressure for identified male mathematics students. Seventy-five 16 year old men, who had just commenced their AS-level study, were either made aware of their gender group membership (single positive stereotype), their school group membership (single positive stereotype) or both group memberships (dual stereotype) before being given a maths test. Analysis revealed that male students who studied maths (identified) underperformed in the dual stereotype condition, compared to both single stereotyped conditions, in line with the choking under pressure hypothesis. In comparison, no such effect was found for male non-maths students (disidentified), suggesting that choking under pressure only occurs for individuals for whom the group membership is important to their self-perception.

While the phenomenon of stereotype threat has received a large amount of attention in the last few years, little attention has been given to the apparent conflicting positions of stereotype lift / boost and choking under pressure. Stereotype threat (Steele & Aronson, 1995) describes the finding that people conform to negative stereotypes associated with their group membership. For example, White men may under-perform on a mathematics test because of the stereotype that White men are poorer at mathematics than Asian men, and not because of their actual ability. In contrast, if White men are compared to White women, they may experience an improvement in performance (Bosson, Haymovitz, & Pinel, 2004; Gonzales, Blanton, & Williams, 2002; Shih, Pittinsky, & Ambady, 1999; Spencer, Steele, & Quinn, 1999; Steele & Aronson, 1995). This performance enhancement generally exists as a trend within stereotype threat literature, only reaching statistical significance in relatively few studies (Walton & Cohen, 2003). An exception to this is Croizet, Deprés, Gauzins, Huguet, Leyens, and Méot (2004) who found a significant, positive difference for science students who were compared to psychology students on an intellectual test. Walton and Cohen labelled this effect *stereotype lift*, although the effect has also been termed *stereotype boost* (Cheryan & Bodenhausen, 2000).

Cheryan and Bodenhausen (2000) suggest that stereotype lift effects are the result of an increase in confidence and expectation of success, which consequently increases performance. However, they note that positive expectations are not always advantageous, and can lead to the individuals *choking under pressure* (Baumeister, 1984; Cheryan & Bodenhausen, 2000) where instead of improving their performance, members of the positively stereotyped group will actually under-perform when reminded of the positive stereotype associated with their group membership. They

examined this by administering a mathematics test to Asian American women. Lower performance was found where participants' ethnicity was made salient, compared to when their gender was made salient and the control condition. Therefore they concluded that positive expectations associated with ethnicity led to a choking effect.

Brown and Josephs (1999) presented participants with a mathematics task which was either presented as indicative of people with either markedly strong or weak maths abilities. While women under-performed in the weak condition, compared to the strong condition, men experienced the reverse effect. This outcome was perceived by Brown and Josephs as a concern by men to confirm the positive stereotype, consistent with the choking under pressure hypothesis.

With the apparent conflicting findings for members of positively stereotyped groups, clarification was sought with the current research. Through focusing on a group with two positive stereotypes, it was hypothesised that emphasising both stereotypes would result in choking under pressure. Individuals reminded of their two positive stereotypes were perceived likely to under-perform compared to individuals reminded of just one positive stereotype. In addition the study aimed to examine the role of domain identification with respect to choking under pressure. While the general consensus of stereotype threat literature suggests that only highly identified individuals are susceptible to stereotype threat, it is currently unclear how this relates to choking under pressure.

The role of identification

An outcome of stereotype threat is disidentification (Steele, 1997), which involves the individual extracting the domain from their self-identity, and occurs as a result of a fear of underperforming and confirming their negative stereotype. Due to the

nature of stereotype threat, those who remain within the stereotyped domain (e.g. mathematics) are the individuals who are the most likely to come under stereotype threat, as they still regard the domain as important to their self-concept (highly identified). Thus, while individuals who are identified with the domain are likely to under-perform due to stereotype threat, those that are no longer identified with the domain will under-perform as a result of disidentification.

While it is highly identified members of negatively stereotyped groups who come under stereotype threat, it also appears from the literature (which tends to focus solely on highly-identified individuals) that stereotype lift is more likely to be experienced by highly-identified individuals. Walton and Cohen (2003) concluded from their meta-analytical review that the effect of stereotype lift was more pronounced for identified individuals, because of their heightened concern to do well. Following the same reasoning as Steele (1997), that one needs to care about one's performance to come under stereotype threat, the choking under pressure effect should also be more likely for highly identified individuals. If individuals do not feel invested in the domain, it seems unlikely that they will be concerned with their performance in the domain, much in the same way as dis-identified women who do not experience stereotype threat (Steele, 1997).

Smith and Johnson (2006) examined the positive stereotype of men and mathematics, with a focus on identification. Interestingly, they argued that for individuals low in identification, the expectation of meeting the standards of the positive stereotype, along with the knowledge that they lack the skills necessary to confirm the stereotype, would result in a performance pressure, and therefore lead to under-performance. This was confirmed by an under-performance of low maths

identifiers when they were reminded of the positive stereotype associated with their group membership. This apparent choking under pressure for low identifiers was not replicated for highly identified individuals. Instead, Smith and Johnson expected a performance lift effect, which was also not obtained. Smith and Johnson's study is interesting for a number of reasons. First, high identifiers did not come under either stereotype lift or choking under pressure. This appears to conflict with previous research in which the evidence for both stereotype lift and choking under pressure has been observed with high identifiers (Cheryan & Bodenhausen, 2000). Second, low identifiers appeared to choke under the pressure of their positive group stereotype.

Although Smith and Johnson found a choking effect for low identifiers and no effect for high identifiers, no specific reference was made in the study to the actual level of maths ability of the individuals¹. Mathematics domain identification was measured, which resulted in the assignment of low and high identifiers. Therefore, it may be the case that these individuals did not represent the extremes of the spectrum. i.e., those who identify to such an extent that they choose to continue studying mathematics, and those who do not identify to such an extent that they choose to discontinue studying mathematics (disidentified). In order to fully test whether high or low domain identification leads to performance enhancement or detriment, it is arguably necessary to test a sample in which it is clear whether participants regard maths as important to them or not.

Therefore, the study reported here involved male students in the first year of AS-level examinations, who were either studying maths (identified) or were not studying maths (dis-identified). In the United Kingdom students are required to study

¹ 62.1% of the participants majored in Business, Humanities and Natural Science, no other information is given.

mathematics until the age of 16. If students continue their education until the age of 18 (A / AS-level examinations), they are free to choose their subjects of study. This allows the opportunity to compare male students who choose to study mathematics, with those who do not.

Presentation of an additional positive stereotype

As already discussed, choking under pressure is likely to occur when individuals are presented with two positive stereotypes. In addition to presentation of the positive stereotype associated for men and mathematics, male students were presented with a situation that highlighted their positive *school* membership. The added pressure of being compared not only in terms of their gender but also their school affiliation could lead to male participants choking under pressure due to performance anxiety.

There also appears to be some unresolved issues within the previous literature relating to whether the stereotype must be presented in a subtle or blatant fashion in order to result in choking under pressure. Cheryan and Bodenhausen (2000) use a reasonably blatant means of activating Asian American women's ethnicity and produce a choking under pressure effect, while Shih, Ambady, Richeson, Fujita and Gray (2002) use a more subtle manipulation and produce a stereotype lift effect (see Cheryan & Bodenhausen).

In order to assess this effect further the current experiment used a fairly subtle means to activate each stereotype. Participants were simply asked to circle their gender / school name before completing the maths questions. This was in order to assess whether the subtle activation of one positive stereotype would actually result in stereotype lift (as suggested by Shih et al., 2002), or alternatively whether the subtle

activation would not be strong enough to result in either stereotype lift or choking under pressure. It was hypothesised that only the subtle activation of two stereotypes (dual stereotype condition) would result in a choking under pressure effect.

Experiment

The experiment had a number of aims. The first was to examine whether a difference would exist between students who had chosen to continue studying mathematics (identified) and those who had not (disidentified). The second aim was to examine the effect of activating one vs. two positive stereotypes. Two conditions consisted of one of the two positively stereotyped categorizations; gender (women vs. men) and school affiliation (own school [positive performance] vs. rival college [negative performance]). The separate examination of the two stereotypes enabled their independent effect on performance to be established. The third condition formed the dual stereotype condition and consisted of a combination of both the gender and school affiliation manipulations.

As previously discussed, studying sixth-formers allowed the comparison to be made between students who studied mathematics and those who did not. In line with the previous findings related to highly identified individuals it was expected that male maths students (identified) would be more likely to choke under the pressure of an additional stereotype, compared to non-maths students (disidentified). Therefore, it was expected that male maths students in the dual stereotype condition would experience choking under pressure, and therefore under-perform, compared to the non-maths students who would not.

Method

Participants and design

Seventy-five male students at a British secondary school participated in the study. The participants were in the lower-sixth form (mean age = 16; SD = .36), and were allocated to one of three conditions (gender vs. school affiliation vs. dual). The experiment took the form of a 2 (maths student vs. not maths student) x 3 (condition: gender vs. school affiliation vs. dual) design.

The school itself was situated in an affluent area (The Office for Standards in Education [Ofsted] Report, 2001) with only 5.5% of students eligible for free school meals (national average 16%), and a very low percentage of ethnic minority students (0.8%). This was reflected in the sample used in the study (which included only two non-White students). Recent league-tables (The Guardian, 2005) placed the school as the top-166th comprehensive school for GCSEs and the top-168th comprehensive school for A-levels. Ofsted described the school as “a very good school. Standards are well above average and pupils achieve well” (Inspection Report, p. 1). This positive attitude towards the school and the reflection on the students as considered to be high performers was reflected by the students themselves (see Results section).

Procedure

The experiment took place in a school period which was put aside on a weekly basis for an outside speaker. On arrival at the school, the female experimenter was presented to the participants as a researcher from the Psychology department of the University of Birmingham. The students were then informed that the purpose of the visit was to help the researcher in the design and development of a new test. The participants were then asked to sign consent sheets, which were explained in detail, and informed that their results on the test would remain anonymous, as at no point would they be required to write their name on the actual test booklet. Prior to arriving at the

experimental situation, the participants had been informed that they were to be split into three groups. It was explained that the groups did not reflect the ability of the students, but that it was to allow the participants more space to carry out the test. In actuality, it was necessary to use three separate rooms to avoid any suspicion that may have been aroused if participants became aware that other students had different manipulations to themselves.

Before participants moved to their separate locations, the experimenter explained the experiment step-by-step. They were first asked not to begin or even to glance over the test booklet until the teacher they were with instructed them to do so. They were then informed that the test consisted of three stages; first they would be required to complete some information which was printed on the front page (the experimental manipulation), second they would be given ten minutes (timed), to complete a maths test, and finally they would be required to answer some further non-mathematical questions. They were informed that they were to remain under exam conditions the whole time that they had the test booklet, i.e., in silence and without any collaboration with other students. They were also asked not to turn to the following section of questions until they were asked to do so by the teacher, and also not to turn back and complete the maths questions after the designated ten minutes. The participants were then split into three groups and sent to their assigned room. The experimenter was not present in any of the rooms during the testing procedure, instead a female teacher in each room led participants through the test booklet, following written instructions given by the experimenter. Also present in each of the rooms were one additional female teacher and one male teacher. A double-blind procedure was in place, with the teachers administering the test unaware of the nature of the experiment,

including not knowing that the booklets were different for each group and the experimenter unaware as to which test booklet was administered in which room, and to which group of students.

On receiving the test booklet, the participants were instructed to ‘read through the information on the front of the booklet and to circle the appropriate choice’. Participants in the gender condition read; ‘This test is concerned with comparing the mathematics performance of *males* and *females*. Please circle your gender;’ They were then required to circle either ‘Male’ or ‘Female’. Participants in the school affiliation condition read; ‘This test is concerned with comparing the mathematics performance of students in different *types of further education*. Please circle where you are currently studying’. Participants in this condition were then either required to circle their school sixth-form (i.e. the name of the school was printed) or the local college where AS-levels could also be studied (i.e. the name of the college was printed). In the dual stereotype condition, participants read; ‘This test is concerned with comparing the mathematics performance of *males* and *females*. Also this test is concerned with comparing the mathematics performance of students in different *types of further education*. Please circle your gender; (required to circle ‘Male’ or ‘Female’) Please circle where you are currently studying; (required to circle institution)’.

After circling the appropriate choice(s), the teacher informed the participants that they had ten minutes to complete as many maths questions as they could, they were then asked to open the test booklet and were timed for ten minutes. After the ten minutes, the participants were asked to stop writing and to turn to page eight of the booklet where the additional questions were printed, they were reminded not to turn back to continue answering the maths questions. On completion of these questions they

returned to the original room where the experimenter fully debriefed them and thanked them for their participation.

Dependent measures

The test consisted of 30 mental arithmetic problems, which were based on the questions used in Rosenthal and Crisp (2006) and Rosenthal, Crisp and Suen (in press), for example: *The pass mark for an exam was 40%. The exam had 80 questions worth 1 mark each. To pass the test, how many questions had to be answered correctly?*. The questions following the maths test asked participants to state which AS-level subjects they were currently studying and some additional multiple-choice questions, which included two relating to their positive group memberships: *generally, who are seen as better at maths?* (Choice: *males; females; both the same*); *who do you think will do better on this test?* (Choice: *their own school [name of school]; rival institution [name of college]; both the same*).

Results and discussion

Maths task

Three participants failed to complete all of the relevant information (i.e., subjects studied) and were excluded from the analysis. Due to the mathematical nature of physics, physics students were included as maths students ($N = 33$)².

A 3 (condition: gender vs. school affiliation vs. dual) x 2 (AS-level: maths student vs. not maths student) ANOVA was computed on the number of correct maths items, revealing a significant main effect of maths student, $F(1,67) = 20.65, p < .001$, with maths students completing a greater number of maths questions correctly ($M = 12.79$) than non-maths students ($M = 7.90$). There was no significant main effect of

² This increased the number of maths students from 29 to 33. The pattern of results were highly similar, regardless of whether the analysis pertained to both maths and physics or to maths students only.

condition $F(2,67) = 1.99$, $p = .145$ ($M_{\text{gender}} = 11.48$; $M_{\text{school}} = 9.92$; $M_{\text{dual}} = 8.88$), however, the condition x gender interaction was significant, $F(2,67) = 3.56$, $p = .034$.

The same ANOVA was computed for accuracy (number correct / number attempted), again revealing a significant main effect of maths student, $F(1,67) = 7.64$, $p = .007$ ($M_{\text{maths}} = .831$; $M_{\text{non-maths}} = .735$), no main effect of condition, $F(2,67) = 1.99$, $p = .145$ ($M_{\text{gender}} = .802$; $M_{\text{school}} = .759$; $M_{\text{dual}} = .773$) and a significant two-way interaction, $F(2,67) = 4.88$, $p = .011$.

Due to the significant two-way interaction and the hypothesis that the participants' identification with maths (i.e. whether they were a maths student or not) would affect their results on the maths test, the participants were divided based on their maths student status (see Table 1), with further ANOVAs carried out for each of the participant groups.

Analysis of each student group

It was expected that identified students would experience choking under pressure when two positive group memberships were made salient. A one-way ANOVA revealed a marginally significant difference for number correct, $F(2, 30) = 3.34$, $p = .058$. Orthogonal contrasts supported the choking under pressure hypothesis, with a significant difference found between the dual condition and both the gender and school conditions (gender +1, school +1, dual -2), $t(30) = 2.50$, $p = .018$. Additionally, no significant difference was found between the gender and school conditions (gender -1, school +1, dual 0), $t(30) = .117$, $p = .908$.

This pattern of results was replicated for accuracy, with a significant ANOVA, $F(2, 30) = 6.25$, $p = .005$, and contrast analysis again supporting the choking under

pressure hypothesis, (gender +1, school +1, dual -2), $t(30) = 3.26, p = .003$; (gender -1, school +1, dual 0), $t(30) = 1.70, p = .100$.

Also as expected, for number correct no significant difference was found for non-maths students, as shown by both the ANOVA, $F(2,37) = .720, p = .493$, and the orthogonal contrasts, (gender +1, school +1, dual -2), $t(37) = -.660, p = .513$; (gender -1, school +1, dual 0), $t(37) = -.958, p = .344$. This pattern was repeated for accuracy, $F(2, 37) = 1.71, p = .194$; (gender +1, school +1, dual -2), $t(37) = -1.17, p = .251$; (gender -1, school +1, dual 0), $t(37) = -1.36, p = .182$.

These findings suggest that when a second positive stereotype is introduced identified maths students choke under pressure and under-perform compared to identified students only confronted with one positive stereotype. In contrast, no difference was observed between conditions for dis-identified individuals.

Knowledge of the stereotypes

A proviso of the choking under pressure effect is that the positive stereotype must be known for the individual to experience performance apprehension. Two questions were asked after completion of the maths test in order to establish whether the school and mathematics stereotypes were actually known to the participants. The first question specifically asked the participants: *Who do you think will do better on this test?* With a choice of *[name of own school] students; [rival college] students; both the same*. The responses were coded as own school = +1; both the same = 0; rival college = -1. One sample t-tests (test value = 0) revealed that the positive stereotype was known for both identified students, $t(32) = 17.89, p < .001$ and disidentified students, $t(39) = 8.06, p < .001$.

The second question involved engaging the maths related stereotype by asking *generally, who are seen as better at maths?*, with the choice of *males, females* or *both the same*. As above, the responses were recoded as males = +1; both the same = 0; females = -1. Interestingly, while the stereotype was known by the identified students, $t(32) = 2.35, p = .025$, it was not acknowledged by the disidentified students $t(39) = -.183, p = .855$.

General Discussion

The study presented here examined whether the presentation of two positive stereotypes would have a detrimental effect on performance for domain identified participants. Male students studying mathematics (identified) presented with two positive stereotypes (dual condition) experienced a detrimental effect on performance, compared to identified students who were presented with one positive stereotype (gender and school affiliation conditions). This can be seen as a result of the individuals choking under pressure, due to the added apprehension of conforming to an additional positive stereotype. For male non-maths students (disidentified) no difference was found between conditions, which is in line with disidentified individuals in the stereotype threat literature (Steele, 1997).

Interestingly, this result appears to conflict with the findings of Smith and Johnson (2006) who found that low identifiers experienced choking under pressure, while no such effect was found for high identifiers. As discussed in the introduction, the divergence of these results may concern the mathematics level of the participants. Here, participants studying mathematics were defined as identified, and those who had discontinued their maths studies were defined as disidentified. Smith and Johnson defined their high and low identifiers in terms of a median split identification scale,

with no reference made to the level of mathematics study. It may well be that the identified and disidentified students used here may have actually been low maths identifiers in terms of Smith and Johnson's scale.

If instead of subtle manipulations more blatant manipulations were used it may be the case that choking under pressure would be observed with the manipulation of just one stereotype (either gender or school affiliation). However, the current finding supports the arguments of Cheryan and Bodenhausen (2000) who suggest that choking occurs only when the manipulation is blatant. This is the effect we find here when two salient stereotypes are activated. The added pressure of two stereotypes appears to act much in the same way as a single blatant stereotype. Unlike Shih et al. the use of a single subtle stereotype did not result in stereotype lift.

The results of this study suggest that there is perhaps an optimum level of stereotype activation which would result in stereotype lift (perhaps slightly more blatant than our subtle manipulation), but that anything beyond this level has the unfortunate performance detrimental effect of choking under the pressure of a positive stereotype. This optimum level of stereotype activation is certainly something which future research needs to address.

As far as we are aware, there is no single study to date which finds stereotype threat, stereotype lift and choking under pressure effects. As stereotype lift and choking under pressure appear to be the effects of differing levels of performance pressure, it would be interesting to empirically test this within one study.

Conclusion

In the study presented here, we attempted to examine the effect of two positive stereotypes on domain identified individuals. The results offer support for the notion

that increased levels of performance pressures can result in a choking under pressure effect, and consequential performance detriment. While identified individuals underperformed when presented with two positive stereotypes, no such effect was found for disidentified individuals, suggesting that individuals need consider the domain to be important to come under the effect.

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Table 1*Number correct and accuracy as a function of condition*

		School		Gender		Dual	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Number correct	Maths	14.67	6.34	14.38	6.34	9.36	3.50
	Non-maths	7.07	3.10	8.33	3.26	8.46	3.86
Accuracy	Maths	.909	.081	.839	.107	.758	.093
	Non-maths	.668	.179	.762	.172	.786	.184