Cognitive Appraisal Moderates Solo Status 1

Fail or Flourish? Cognitive Appraisal Moderates the Effect of Solo Status on Performance

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Abstract

When everyone in a group shares a common social identity except one individual, the one who is different from the majority has solo status. Solo status increases one's visibility and performance pressure (Kanter, 1977), which may result in stress. Stress has divergent effects on performance (Yerkes & Dodson, 1908), and individuals' response to stressful situations is predicted by their cognitive appraisal (challenge or threat) of the situation (Lazarus & Folkman, 1984). Two experiments test the hypothesis that cognitive appraisal moderates the effect of solo status on performance. Experiment 1 finds that at relatively high appraisal levels (resources exceed demands), solo status improves both men's and women's performance; at relatively low appraisal levels, solo status hurts performance. Experiment 2 replicates this effect for solo status based on minimal group assignment. Results suggest that for individuals who feel challenged and not threatened by their work it may help to be a solo.
When an individual is the only one of his or her social category in a group, he or she has solo status. The effects of solo status on performance are mixed. Sometimes solo status leads individuals to perform better (Craig & Rand, 1998; Fuegen & Biernat, 2002), while other times solo status leads individuals to perform worse (Crocker & McGraw, 1984; Inzlicht & Ben-Zeev, 2000; Sekaquaptewa & Thompson, 2003; Lord & Saenz, 1985; Saenz & Lord, 1989). These apparently inconsistent results point to the existence of one or more moderating variables that predict when solo status harms and when it helps performance. While there is evidence that group-level moderators such as group status (Sekaquaptewa & Thompson, 2002) and group stereotypes (Karakowsky & Siegel, 1999; Thompson & Sekaquaptewa, 2002) moderate the effect of solo status on performance, further research is needed to investigate individual-level moderators that predict when an individual solo will fail or flourish.

Because they stand out and are highly visible, solos experience increased performance pressure as well as social isolation and the belief that others will stereotype them (Kanter, 1977). An individual-level difference that may moderate solos' performance, therefore, is the ability to cope with the performance pressures associated with being a solo. One indicator of coping is cognitive appraisal (Lazarus & Folkman, 1984). A cognitive appraisal is an evaluation of the potential significance of a situation along with one's ability to control it. A positive evaluation results in a challenge appraisal, increased effort, and potentially improved performance. A negative evaluation results in a threat appraisal, a reduction of effort, and potentially worse performance (Drach-Zahavy & Erez, 2002). I propose that an individual solo's cognitive appraisal of performing the task at hand will predict the effect of solo status on his or her performance: high appraisals will predict better performance, and low appraisals will predict worse performance. Because solo status creates pressure to perform, the relationship between
cognitive appraisal and performance should be stronger for solos than for non-solos. This, in turn, will help to explain why solo status sometimes harms, yet sometimes helps, an individual's performance.

Solo Status Leads to Divergent Effects on Performance

Solo status is defined as being the only one of one's social category in the group (Sekaquaptewa & Thompson, 2002). Token status has also been defined by researchers in terms of group proportions (Kanter, 1977). Kanter documented three dynamics that occur when a group has skewed proportions, that is, when a minority social category makes up 15% or less of the group and a majority social category makes up the rest. First, those in the minority are highly visible, which leads to increased performance pressure for minority group members. Second, there is increased polarization between the majority and minority within the group, resulting in the social isolation of the minority group members. Third, minority group members are assimilated toward their group's stereotype in the minds of the majority group members. While Kanter was specifically describing tokens, these dynamics -- visibility and performance pressure, social isolation, and assimilation to stereotype -- have implications for solos as well. People randomly assigned to solo status in experiments have greater visibility (Lord & Saenz, 1985). Solos often express a desire to change the composition of their group, presumably to avoid being a solo (Cohen & Swim, 1995; Crocker & McGraw, 1984). Solos' behavior is more likely to be attributed to their social category than non-solos' behavior (Crocker & McGraw). Also, solos are more likely to report thoughts of being stereotyped (Fuegen & Biernat, 2002). There is thus evidence that solos in small groups experience the same stressful dynamics as tokens in the workplace.
Solo status can affect an individual's performance on a variety of tasks. In an experiment that tested recall for a group discussion, Lord and Saenz (1985) led participants to believe that members of their group, located in separate cubicles, would share opinions via closed-circuit television. During the discussion, participants saw either three male or three female group members who were actually pre-recorded on videotape. Participants who were solos (i.e., the only man or the only woman in their group) later recalled less of the discussion than non-solos. In another experiment, Saenz (1994) had women solve anagrams in a group with three other women who were described either as students at a rival school (solo status), or students at the participant's own school (non-solo status). Solos solved fewer anagrams than non-solos. Even in a small group of three or four, being the only member of one's social category can have consequences for an individual's performance.

Solo status can also contribute to stereotype threat (Steele & Aronson, 1995). Inzlicht and Ben-Zeev (2000) found that female solos performed worse on a math test than non-solos, but their performance did not suffer on a verbal test. Men's performance was unaffected by solo status. Even when they were assured that their math scores were to be kept private, solo status lowered women's math scores (Inzlicht & Ben-Zeev, 2003). Sekaquaptewa and Thompson (2003) investigated the relationship between solo status and stereotype threat and concluded that solo status alone affects performance, but that it can also cause stereotype threat which contributes independently to harm a woman's performance on a difficult math test.

Solo status also affects leadership in a small group. Crocker and McGraw (1984) found that solo females were less likely, but solo men were more likely, to be considered the leaders in their groups. Karakowsky and Siegal (1999) were able to reverse this effect by making the group task appear feminine. Female solos' leadership did not suffer, but male solos' did. When the same
task was perceived as masculine, the pattern was reversed. That would seem to suggest that
gender stereotypes are sufficient to predict the direction of solo status performance effects, at
least with respect to leadership. However, Fuegen and Biernat (2002) gave groups a survival task
that they described as "the NASA Decision-Making Problem," and said it had originally been
designed for use with Air Force cadets. Although they did not pretest it, it seems safe to assume
participants did not perceive this to be a particularly feminine task. Nevertheless, solo women
performed better and showed better leadership than non-solo women, while solo men did not
perform better. Similarly, Craig and Rand (1998) found that solo African American women were
more likely to be leaders in all-female groups, and their white female peers evaluated them more
favorably than non-solo African American women. These studies provide somewhat
contradictory evidence that solo status can sometimes hurt and yet sometimes improve
performance of an individual, even when he or she is a member of a negatively stereotyped
social category.

Group-level variables, including gender, group stereotypes and group status, certainly
moderate the effect of solo status on individual performance (Crocker & McGraw, 1984;
Sekaquaptewa & Thompson, 2002; Yoder, 1994). However, these alone are not a full
explanation for the divergent effects of solo status on performance. As noted above, sometimes
solo status affects men's and women's performance equally (Lord & Saenz, 1985), and
sometimes solo status helps women on masculine tasks (Fuegen & Biernat, 2002). Group-level
variables also cannot predict when solo status will help one particular individual while at the
same time hurting another. For that, we turn to consider an individual-level moderator.
Cognitive Appraisal of Emotion

There is scant empirical evidence on individual-level variables and solo status. Cohen and Swim (1995) examined the effect of task confidence on solos' expectations about an upcoming group interaction. Women who were confident about performing the task reported less distress and were less likely to want to change their group when they learned they were to be solos than less confident women. However, solos' task confidence did not predict their expectations of their own subsequent contributions to the group, nor did Cohen and Swim measure solos' actual performance in the group context. Rather, they suggested that an individual solo's ability to cope with the task demands while being a solo might predict how solo status would affect her performance. More recently, Inzlicht, Aronson, Good and McKay (2006) found that high self-monitors coped more easily with the pressures of solo status and did not show performance decrements to the same degree as low self-monitors. High self-monitors are people who easily adjust their behavior to give a desired impression; they can "fit in" and have no trouble being the center of attention (Snyder, 1987). Although self-monitoring is not a coping style per se, Inzlicht et al.'s results strengthen the expectation that an individual's ability to cope predicts how solo status will affect his or her performance.

One way to predict how an individual will cope with performance pressure is to assess his or her cognitive appraisal of emotion (Lazarus & Folkman, 1984). This appraisal consists of two parts. Primary appraisal is an assessment of the potential implications for the self, i.e., "Am I in trouble or being benefited, now or in the future, and in what way?" (Lazarus & Folkman, p. 31). A person makes a primary appraisal of stress when the encounter is believed to have potentially negative implications (even if they are not guaranteed to be negative). Secondary appraisal is an assessment of the ability to respond to the encounter to prevent harm and possibly
attain benefit, e.g., "What if anything can be done about it?" (ibid). If the situation holds the potential for a negative outcome, yet the individual believes he or she has the ability and resources to successfully cope, the resulting appraisal is that of challenge. A challenge appraisal is likely to lead to engagement, as the individual tries to cope, avoid harm and, if possible, secure gain. If, however, the individual feels unable to prevent the negative outcome, the resulting appraisal is that of threat. A threat appraisal is likely to result in an attempt to withdraw from the situation in order to avoid the perceived harm.

Two constructs are closely related to cognitive appraisal. Self-efficacy is a belief that one can produce specified actions (Bandura, 1977). Major, Richards, Cooper, Cozzarelli, and Zubek (1998) measured both cognitive appraisal and self-efficacy in a sample of women waiting to have abortions. Both predicted coping strategies, which in turn predicted post-abortion decision satisfaction. Performance expectancy is another similar construct. In their study, Cohen and Swim (1995) manipulated performance expectancies by giving participants false feedback on a pretest, and then asked "How confident are you about the upcoming group task based on what you have been told so far about it?" (1995, p. 879). Sekaquaptewa and Thompson (2003, p. 71) simply asked participants to rate how well they expected to perform on the upcoming task. Their results suggested that that performance expectancies might partially mediate the effect of solo status on performance. It would seem that cognitive appraisal, self-efficacy, and performance expectancy all measure aspects of the subjective experience of feeling confident about performing a given task or behavior. A positive judgment on any of these constructs predicts better performance. They differ in the extent to which they capture the contextual element of pressure. The only measure that specifically includes an assessment of the potential threat of the upcoming task is cognitive appraisal.
A review of research on challenge and threat appraisals links them to divergent performance outcomes (Lepine, Podsakoff, & Lepine, 2005). As an example, Drach-Zahavy and Erez (2002) give participants task instructions that lead them to make either a challenge or threat appraisal of the same difficult task. Those who make a challenge appraisal perform better than those who make a threat appraisal. Tomaka and Blascovich (1994) also found that participants with challenge appraisals perform better on a math test than participants with threat appraisals. The contrast of primary and secondary appraisal, then, is associated with either a challenge or threat response, which predicts whether stress will help or hurt performance (Blascovich, et al., 1999).

In Cohen and Swim's (1995) experiment, 62% of female solos indicated they would prefer to change the gender composition of their groups, presumably to avoid being a solo. While this is a clear majority, we must remember that the remaining 38% did not want to change groups. Although they recognized the implications for well-being, therefore, some individuals apparently believed they had sufficient resources to cope, and even to do well, performing the task as solos. If solo status has implications for well-being, then a solo's cognitive appraisal should predict the direction of solo status effects on performance. Two experiments were conducted to test the hypothesis that cognitive appraisal moderates the effect of solo status on performance. Specifically, I predicted that solos will perform better when cognitive appraisal is high than when cognitive appraisal is low.

EXPERIMENT 1

Experiment 1 examined whether cognitive appraisal would moderate the effect of solo gender status on performance. Participants performed two types of tasks. One was modeled on Lord and Saenz' (1985) group discussion as described above, in which both male and female
solos originally showed performance decrements. In that task, the dependent measure was a surprise recall test of a simulated group discussion. The other task was a difficult math test adapted from Inzlicht and Ben-Zeev (2000), a study in which only female solos showed performance decrements, consistent with a stereotype threat explanation. Experiment 1 thus tested whether cognitive appraisal would moderate the effect of solo status on performance in tasks that were quite similar to those used in previous research on gender solos. It was expected that solos would experience higher levels of emotional arousal than non-solos. Also, a Solo Status by Cognitive Appraisal interaction was predicted such that solos would perform better when their cognitive appraisal was high than when cognitive appraisal was low, and this relationship would be stronger for solos than for non-solos.

Method

Participants

One hundred and thirty-seven participants were recruited via email to take part in a study of group processes. Participants were drawn from an undergraduate population that was approximately 58% White, 14% Asian-American, 7% African-American, 6% Hispanic, 4% Native American, and 5% International. Before scheduling a session, participants' gender was unobtrusively ascertained using their given names, photographs and nicknames from the campus facebook. Groups were then scheduled that consisted either of one man and three women, or one woman and three men. For some sessions, a confederate took the place of a non-solo participant in order to keep the group size at four. Confederates were instructed to follow all study directions and complete all tasks. They differed from naïve participants only inasmuch as they knew their responses would not be included in data analysis. A male and a female experimenter took turns conducting the sessions. Participants were paid $15.
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Procedure and Measures

Participants arrived at the laboratory and were seated around a small table. To ensure that participants were aware of the gender composition of their group, as the researcher collected the consent forms, he or she walked around the table, coming to stand behind the solo as he or she said, "This is a study of group processes. Look around; these are the people you'll be working with today." After this, participants were instructed to take seats at a second round table. This table held four workstations, each equipped with a laptop computer, external mouse, ethernet card and cord, manila envelope labeled "ACME Investments: Do not open until instructed," pencil, pen, and a small pad of paper. Separating the workstations were 24" high table-top partitions designed so that participants could not see one another when they were seated. The instructions and all of the experimental measures and tasks, with the exception of the group chat (below), were programmed with MediaLab\textsuperscript{2} software. Participants were instructed to follow the directions on their laptop screens.

*Emotion.* Participants first completed the short form of the Positive/Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS consists of five positive (*alert, determined, enthusiastic, excited, inspired*) and five negative (*afraid, upset, nervous, scared, distressed*) emotional adjectives. Participants rated each adjective according to how they felt "right now" on five-point Likert scales (1 = *not at all*; 5 = *extremely*). These were averaged to create scores for positive and negative emotion.

*Recall of group discussion.* The group discussion was adapted from a shared cognition task called ACME Investments (McLeod, Baron, Marti, & Yoon, 1997). The instructions stated that participants were to read short summaries of three different companies, and then decide as a group which of the three best fit the given profile of a promising acquisition target. After eight
minutes' preparation time, participants were simultaneously logged into a group electronic "chat" to discuss the decision. The chat lasted four minutes. In order to control for the length and content of other group members' contributions to the chat, the software was programmed to simulate a real-time interaction. In fact, the posts that each participant saw on his or her screen during the chat included his or her own contributions and a series of entries taken from a previous pilot study of the task, which were timed to appear at 15-second intervals. No identifiers appeared with any posts. Because of the table-top partitions, the 15-second delay, the resulting asynchrony of the posts, and the brief task duration, participants were not expected to realize that they were not really exchanging messages with other group members. Cued recall for the group chat was tested with an 18-item multiple choice test. None of the statements contained information that had appeared in the participants' own materials. True items (e.g., Company C is family-owned) had appeared onscreen during the group chat. False items had not appeared. Participants chose either "was mentioned," "was not mentioned," or "I don't know" for each statement.

Math test. The math test was a difficult 16-item multiple-choice math test adapted from Inzlicht and Ben-Zeev (Inzlicht & Ben-Zeev, 2000). Participants had 10 minutes to work on the math test.

Cognitive appraisal. Cognitive appraisal was assessed separately for the group task and the math test, just prior to each task after the specific task instructions had been presented. Cognitive appraisal was taken to be the difference between primary appraisal, How threatening do you expect the upcoming [task] to be? and secondary appraisal, How able are you to cope with the [task]? each measured on a 7-point scale (1 = not at all; 7 = extremely). The difference
score captured the extent to which resources to cope exceeded or fell short of what was required (e.g., Major et al., 1998).

Other measures. After completing the group task and the math test, participants completed a manipulation check, gave demographic information (age, gender, English as a second language) and responded to the following items asking about visibility, performance pressure, and feeling of being stereotyped during the study: *I felt like the only woman [man] in my group, I thought about being categorized, and seen as a woman [man] rather than as a unique individual, by the other participants, I felt I was being watched, and I felt my performance was being evaluated.* These were recorded on 7-point scales (*1 = strongly disagree, 7 = strongly agree*).

At the conclusion, participants were fully debriefed as to the purpose of the experiment and the nature of the chat and asked to comment on their experience in the study. No participant claimed to know the chat was fake. They were then thanked, paid and dismissed.

Results

Preliminary analyses

Overview. Data from nine participants had to be excluded from analysis, either because their computers malfunctioned and their responses were not completely recorded (n = 6), they reported at the end of the session that had not received the necessary materials for the group task (n = 2), or they asked that their responses be excluded from the experiment (n = 1), leaving a total of 128 participants, 66 men and 62 women who completed the experimental tasks in 39 groups of four. Age ranged from 17 to 23, \( M = 19.06, SD = 1.27 \). Fourteen participants (9 non-solos and 5 solos) reported that English was their second language. Neither age nor English as a second language were significantly correlated with performance on the recall or math tests, so
both variables were excluded from further analyses. While members of groups sat at close quarters, participants worked individually.

Multilevel analysis. The design of the experiment was a 2 (solo status, non-solo status) by 2 (participant gender) factorial design, with both factors crossed by cognitive appraisal, a continuous moderator variable. Because individuals were nested in groups during the experimental sessions, I used the MIXED procedure of SPSS to estimate fixed effects such as the effect of solo status, cognitive appraisal, and gender, and random effects such as variance within groups (the residual covariance parameter) and variance between groups (the intercept covariance parameter; Hox, 2002; Peugh & Enders). The factors of solo status and gender were effect coded with values of -.5 (non-solo; male) and +.5 (solo; female), and the linear variable of cognitive appraisal was mean-centered. In all tests, the unstandardized coefficient $b$ and its significance test are reported. The Satterthwaite approximation is used to estimate the degrees of freedom. An alpha of .05 was used for all tests.

Manipulation check. Post-task, participants responded to the item During the study today, I felt like the only man[woman]. This response was submitted as the dependent measure to the MIXED procedure with Solo Status, Gender, and the Solo Status X Gender interaction as fixed effects, a random intercept for groups, and with individuals nested in groups. The effect of solo status was significant, \( b = 3.95, SE = .30, t(92.25) = 13.16, p < .001 \). Solos (\( M = 5.41, SD = 2.20 \)) felt more like the only man or woman in their group than non-solos (\( M = 1.48, SD = 1.18 \)). No effect associated with gender, \( b = -.04, SE = .30, t(92.25) = -.14, p = .89 \), and no Solo Status X Gender interaction, \( b = .22, SE = .66, t(47.55) = .34, p = .74 \), were observed. Solos (\( M = 2.59, SD = 2.06 \)) also agreed more with the statement During the study today, I thought about being categorized, and seen as a man/woman, rather than as an individual, by the other participants,
than non-solos ($M = 1.53, \ SD = 1.05$), $b = .95, \ SE = .27, \ t(94.65) = 3.50, \ p < .001$, a measure of stereotype assimilation. On average, women agreed more with this statement than men, $b = .65, \ SE = .27, \ t(94.65) = 2.37, \ p = .02$, but there was no Solo Status X Gender interaction, $b = .46, \ SE = .58, \ t(51.35) = 0.80, \ p = .43$. Solos did not report feeling more visible or evaluated, $ts < 1$.

**Emotion.** Positive and negative emotion were submitted as dependent measures to separate MIXED procedures, as described above. Solos' reported positive emotion ($M = 2.82, \ SD = .72$) was not significantly greater than non-solos' ($M = 2.60, \ SD = .84$), $b = .24, \ SE = .16, \ t(96.23) = 1.46, \ p = .15$. There was no difference in negative emotion between solos ($M = 1.50, \ SD = .55$) and non-solos ($M = 1.51, \ SD = .59$), $b = -.01, \ SE = .11, \ t(94.66) = -.08, \ p = .94$. No effects associated with gender or the Solo Status X Gender interaction were observed. Because solos did not report greater levels of emotional arousal, no further test of the mediating role of emotion on solos' performance was performed.

**Cognitive appraisal.** Two measures of cognitive appraisal were assessed, one for the math test and one for the group decision task. In each case, primary and secondary appraisal were each measured with a single item. The mean primary appraisal (*how threatening...*) scores were $M = 1.86 (SD = .91)$ for the math task and $M = 1.89 (SD = .89)$ for the group task. The mean secondary appraisal (*how able to cope...*) scores were $M = 3.81 (SD = 1.04)$ for the math task and $M = 3.81 (SD = .82)$ for the group task. Cognitive appraisal was computed to be the difference between secondary and primary appraisal (resources to cope minus perceived threat). Cognitive appraisals for the math test ranged from -2 to 4, $M = 1.95, \ SD = 1.71$. Cognitive appraisals for the group decision task ranged from -2 to 4, $M = 1.92, \ SD = 1.43$.

To determine whether cognitive appraisals differed between solos and non-solos, or between men and women, both the math and group decision task appraisals were entered as
dependent measures in separate MIXED procedures as described above. Cell-by-cell means appear in Table 1. Women had significantly lower appraisals for the math test, \( b = -.76, SE = .34, t(124) = -2.22, p = .03 \), and marginally lower appraisals for the group decision task, \( b = -.49, SE = .27, t(94.68) = -1.79, p = .08 \). However, there was no significant effect of solo status on either appraisal, nor were the Solo Status X Gender interaction terms significant. While the direction of the means suggests that solo status may have raised appraisals of the math test, that effect was not significant, \( b = .50, SE = .34, t(124) = 1.47, p = .15 \). Also, while it appears that solo status may have raised men's and lowered women's appraisals of the group decision task, that interaction was also not significant, \( b = -1.00, SE = .63, t(49.68) = -1.58, p = .12 \). Finally, the variances between solos and non-solos did not differ significantly.

Cognitive Appraisal as a Moderator

*Math score.* Scores on the math test ranged from 1 to 14, \( M = 6.35, SD = 2.41 \). To test whether cognitive appraisal moderated the effect of solo status on performance, math score was submitted as the dependent variable in the MIXED procedure with cognitive appraisal for the math test, solo status, gender, and all two- and three-way interactions between solo status, gender, and cognitive appraisal as fixed effects, a random intercept for groups, and individuals nested in groups. Because men had higher appraisals than women, cognitive appraisal was mean-centered within gender. The results are summarized in Table 2. Cognitive appraisal significantly predicted math scores. This main effect was qualified by the predicted Solo Status X Cognitive Appraisal interaction, \( b = .98, SE = .30, t(118.28) = 3.27, p = .001 \). Women also scored significantly lower than men. Of the remaining variance in scores, virtually all was associated with residual differences between individuals in groups. There was no main effect of solo status, and no Solo Status X Gender interaction.
To illustrate the predicted Solo Status X Cognitive Appraisal interaction, I followed Preacher's (2003) step-by-step instructions for computing simple slopes for solos and non-solos, based on Aiken and West (1991). As illustrated in Figure 1a, based on endpoints of plus and minus one standard deviation, cognitive appraisal predicted math score for both solos, \( b = 1.39, SE = .28, t(119.89) = 4.99, p < .001 \), and non-solos, \( b = 0.40, SE = .11, t(116.60) = 3.54, p < .001 \), but significantly more for solos.

*Recall score.* Scores on the recall test ranged from 1 to 8 for correct recall of "true" items, \( M = 5.23, SD = 1.51 \), and 0 to 9 for correct rejection of "false" items, \( M = 7.63, SD = 1.90 \). The frequency of scores on false items was quite skewed, with most people (89, or 70%) correctly rejecting at least 8 of the 9 false items. True and false scores were not correlated, \( r(128) = -.03, p = .77 \). To test whether cognitive appraisal moderated the effect of solo status on performance, separate analyses were conducted for true and false scores. Each was submitted as the dependent variable in the MIXED procedure with cognitive appraisal for the group decision task (centered within gender), solo status, gender, and all two- and three-way interactions between solo status, gender, and cognitive appraisal as fixed effects, a random intercept for groups, and individuals nested in groups. The results for correct identification of true items (true score) are summarized in Table 2. The only significant fixed effect was the predicted Solo Status X Cognitive Appraisal interaction, \( b = 0.26, SE = .11, t(39.62) = 2.29, p = .03 \). Of the remaining variance in scores, virtually all was associated with residual differences between individuals in groups. For correct rejection of false items (false score), no fixed effects were significant.

To illustrate the Solo Status X Cognitive Appraisal interaction, simples slopes were computed for solos and non-solos (Aiken & West, 1991). As illustrated in Figure 1b, the slope
for solos was significant, $b = .48, SE = .20, t(120) = 2.40, p = .02$, but the slope for non-solos
was not significant, $b = -.04, SE = .11, t(120) = -.39, p = .70$.

**Discussion**

Experiment 1 found support for the hypothesis that cognitive appraisal moderates the
effect of solo status on performance. At high levels of cognitive appraisal an individual's
performance appeared to benefit from solos status, while at low levels of appraisal performance
seemed to be harmed by solo status. This interaction was observed for performance on a difficult
math test and for recall of information presented during a simulated computer-mediated chat, two
distinct types of tasks in which solo status performance decrements have previously been
observed. There was no support for the hypothesized mechanism for this interaction, in other
words solos did not report increased emotional arousal. In post-hoc tests, solos did report feeling
more alert. But there was no evidence that solos had higher levels of negative affect.

The manipulation check showed that solos were well aware of their status, although they
completed their tasks behind privacy partitions. Consistent with previous research, solo gender
status increased thoughts of being stereotyped. However, solos did not report two other
subjective feelings associated with token status: they did not report feeling highly visible, nor did
they feel their performance was being evaluated. This could be a consequence of the experiment
protocol, although previous research found performance decrements even when solos were told
their performance would be private (Inzlicht & Ben-Zeev, 2003).

In contrast to previous studies (Inzlicht & Ben-Zeev, 2000, 2003; Lord & Saenz, 1985;
Sekaquaptewa & Thompson, 2003), there were no overall performance decrements associated
with solo status. An examination of the results, especially as depicted in Figure 1, suggests that
performance decrements might have been observed had more participants made threat appraisals
of the tasks. In addition, no Solo Status X Gender interaction was observed. For the group task, this is consistent with Lord and Saenz' original study. They found no differences between male and female solos on recall for a group discussion. For the math task, this is consistent with earlier work only if we assume female solos did not experience stereotype threat in Experiment 1. This could be the case, because the math test was presented as auxiliary to the main purpose of the study, which was the cooperative group task.

One limitation of this experiment was that cognitive appraisals of the tasks were measured after the group had come face-to-face, and participants knew the group's gender composition and whether they were solo or non-solo. Although solo status did not significantly affect the mean or the variance of individual cognitive appraisals, it is possible that solos' appraisals were affected by their status in such a way as to bias the results. In order to rule out this alternative explanation, a second experiment was conducted.

EXPERIMENT 2

Experiment 2 was designed to replicate the finding that cognitive appraisal moderates the effect of solo status on performance, and to ensure that the independent variables of solo status and cognitive appraisal would be uncorrelated. Experiment 2 used a minimal group paradigm to randomly assign participants to solo or non-solo status after cognitive appraisal was measured. In order to make the minimal group identities salient, and to ensure that solos were actually visible, participants were not given privacy shields in this experiment. Accordingly, the group task from Experiment 1 was not included because it would have been obvious to participants that the electronic chat was not real. Experiment 2 also used multi-item measures of primary and secondary appraisal (Blascovich & Mendes, 2000). It was expected that cognitive appraisal of the math test would moderate the effect of minimal group solo status on performance for both
men and women. Specifically, I predicted that solos would again perform better when cognitive appraisal was high than when cognitive appraisal was low and that the relationship between cognitive appraisal and performance would be stronger for solos than for non-solos.

Method

Participants

Ninety-one undergraduates (34 male, 57 female) were recruited via email to take part in a study of group processes. As before, participants' gender was unobtrusively ascertained before they were scheduled for a session, but this time it was to ensure that participants in a session were either all male or all female. Twenty-one groups of three and seven groups of four participants were run. (No confederates were used in Experiment 2, because it might have been obvious to participants.) A male and female experimenter took turns conducting the sessions. Participants were paid $15.

Procedure and Measures

Participants arrived at the laboratory and were instructed to take a seat at any one of four identical workstations arranged around a small table. Each workstation had the same laptop computer and mouse, pad of paper, pen and pencil, as in Experiment 1. In addition, next to each computer was a small memo stand with a card indicating 1, 2, 3, or 4. The instructions and all of the experimental measures and tasks were programmed with MediaLab software. Participants were instructed to follow the directions on their laptop screens. The instructions stated that participants would complete some individual tests of skills that would be diagnostic for a group task, which was to come later in the session. Then the instructions for the math test were presented, and cognitive appraisal measured, before minimal group identities were assigned.
Cognitive appraisal. Cognitive appraisal was assessed immediately after the task instructions had been presented. Four items measured primary appraisal: *The upcoming math test is threatening*, *My performance in the math test matters to me*, *The math test will be difficult*, and *The math test outcome will have an impact on me*. Four items measured secondary appraisal: *I am prepared to deal with the math test*, *I have the skills and abilities needed to be successful in the math test*, *I am able to rise up and meet the demand of the math test*, and *I will do the best I can to deal with the math test*. These items were measured on scales from 1 (not at all) to 7 (extremely).

Solo status manipulation. The “dot estimation task” was used to assign participants to solo or non-solo social categories with which they had no previous experience (e.g., Galinsky & Moskowitz, 2000). Participants were instructed to estimate the number of dots on each of six slides. Each slide was presented for one second. For half of the sessions, the participant at Station 3 received feedback that he/she was an "overestimator" while other participants received feedback that they were "underestimators." For half the sessions, the participant at Station 3 was the only "underestimator." (To ensure that someone sat at Station 3 when only three people were present, a jacket left casually on the chair at Station 4 discouraged anyone from taking that seat.) Participants first received the feedback on their laptop screens, but before they could proceed with the study the experimenter approached the group and announced that it was important to find out "what kind of a group we have today." Beginning at Station 4 (if someone was there), the experimenter asked each participant whether he/she was an overestimator or underestimator, and handed them a corresponding large label which they were instructed to insert into their memo holder. In this way, the experimenter went around the table, coming to stand behind the person at Station 3, who always identified him or herself as a solo. There was a flipchart set up
just behind Station 3, with an empty *Persons* by *Tasks* grid written on it. Gesturing to the flipchart, the experimenter reminded participants that first they would complete individual tests, that would help them to allocate responsibilities for the group task and then gave them the password to proceed.

*Emotion, math test, and other measures.* Participants completed the PANAS (Watson et al., 1988), the math test, and the same additional measures as in Experiment 1. At the conclusion, participants were fully debriefed, thanked, paid and dismissed.

Results

Preliminary analyses

*Overview.* The data consisted of responses from 90 participants who completed the experimental tasks in groups of three or four. Responses from one participant were excluded because she told the experimenter at the end of the session that she had participated in Experiment 1 earlier. Age ranged from 17 to 22, \( M = 19.46, \ SD = 1.28 \). Seventeen participants (4 solo, 13 non-solo) reported that English was their second language. Neither age nor English as a second language were significantly correlated with the dependent measure of math performance, so both variables were excluded from further analyses. Group size was not correlated with math score, but was retained as a covariate because solo and non-solo status could be defined in terms of group proportions. While members of groups sat facing each other, participants worked individually.

*Multilevel analysis.* The design of the experiment was a 2 (solo status, non-solo status) by 2 (male groups, female groups) factorial design, with both factors crossed by cognitive appraisal, a continuous moderator variable. The results were analyzed with the MIXED procedure in SPSS. The full design for preliminary analyses was solo status, gender, the Solo Status X Gender
interaction, and group size entered as fixed effects, a random intercept for groups, and with individuals nested in groups. As in Experiment 1, the factors of solo status and gender were effect coded with values of -.5 (non-solo; male) and +.5 (solo; female), and the linear variable of cognitive appraisal was mean-centered. In all tests, the unstandardized coefficient \( b \) and its significance test are reported. The Satterthwaite approximation was used to estimate the degrees of freedom. An alpha of .05 was used for all tests.

*Cognitive appraisal.* The four items measuring primary appraisal had an alpha of .62. The items measuring secondary appraisal had an alpha of .76. Follow-up analyses showed that no subset of items from either scale yielded a higher alpha. The four items from each scale were averaged. Primary appraisal scores ranged from 1.00 to 6.50, \( M = 3.65, SD = 1.15 \). Secondary appraisal scores ranged from 2.50 to 7.00, \( M = 5.82, SD = .94 \). Primary appraisal was subtracted from secondary appraisal to compute cognitive appraisal, which ranged from -3.25 to 6.00, \( M = 2.18, SD = 1.63 \).

To determine whether cognitive appraisal differed between men and women, or solos and non-solos, it was entered as a dependent measure in the MIXED procedure, as above. Cell-by-cell means and standard deviations appear in Table 3. There were no significant effects of gender, solo status, or a Solo X Gender interaction, \( ts < 1 \).

*Manipulation check.* Solos (\( M = 5.63, SD = 2.04 \)) agreed more than non-solos (\( M = 1.75, SD = 1.36 \)) with the statement *During the study today, I felt like the only over/under estimator*, \( b = 3.88, SE = .37, t(59.70) = 10.63, p < .001 \). There was no interaction with gender, \( t < 1 \). Solo did not report increased visibility, performance pressure, or thoughts of being stereotyped as an overestimator or as an underestimator, \( ts < 1 \).
Emotion. Emotion was measured immediately after status (solo, non-solo) had been assigned. Means from the positive and negative emotions from the PANAS (Watson et al., 1988) were submitted as dependent measures to separate MIXED procedures, as described above. Solos' reported positive emotion \((M = 2.52, SD = .75)\) was not different from non-solos' \((M = 2.78, SD = .81)\), \(b = -.26, SE = .19, t(85) = -1.37, p = .17\). Solos' reported negative emotion \((M = 1.67, SD = .66)\) was not different from non-solos' \((M = 1.57, SD = .56)\), \(b = .08, SE = .14, t(60.56) = 0.42, p = .68\). No effects associated with gender or the Solo Status X Gender interaction were observed for positive or negative emotion.

Cognitive Appraisal as a Moderator

Math test. Scores on the math test ranged from 0 to 14, \(M = 6.31, SD = 2.72\). To test whether cognitive appraisal moderated the effect of solo status on performance, math score was submitted as the dependent variable to the MIXED procedure with group size, cognitive appraisal, solo status, gender, and all two- and three-way interactions between solo status, gender, and cognitive appraisal as fixed effects, a random intercept for groups, and individuals nested in groups. Because men and women did not significantly differ, cognitive appraisal was mean centered within the entire sample, not within gender. The results are summarized in Table 4. Cognitive appraisal significantly predicted math score as in Experiment 1. This main effect was qualified by the expected Solo Status X Cognitive Appraisal interaction. Women again scored significantly lower than men. Of the remaining variance in scores, 91% was associated with residual differences between individuals in groups.

To illustrate the Solo Status X Cognitive Appraisal interaction, I computed simple slopes for solos and non-solos (Aiken & West, 1991; Preacher, 2003). As illustrated in Figure 2,
Cognitive appraisal predicted solos' scores, $b = 1.00, SE = .39, t(80.78) = 2.59, p = .01$, but not non-solos' scores, $b = .10, SE = .21, t(80.58) = 0.46, p = .65$.

Discussion

Experiment 2 replicated the result from Experiment 1 that cognitive appraisal of a math test moderates the effect of solo status on performance. Solos with high levels of appraisal performed better than solos with low levels of appraisal. The relationship between appraisal and performance was stronger for solos than for non-solos. In Experiment 2, an appraisal was first made of taking the math test in a group context, and solo status was introduced for some participants afterwards. Experiment 2 thus rules out the possibility that the effect is observed because solo status makes people more accurate or more extreme in their appraisals.

Experiment 2 shows that even minimal group solo status can have an impact on an individual's performance. Because the minimal group identity is neither enduring nor meaningful, the effect may have been smaller than we would expect with real group solos. On the other hand, these results are consistent with previous work finding that solo status has an impact on performance in situations when the basis of categorization is not a demographic category like race or gender (Saenz, 1994). The fact that the effects appeared to be consistent for solos whether they are in all-male groups or all-female groups suggests an underlying phenomenon that occurs simply because solos are different from other group members. Even without the effects of group-level factors such as status and stereotypes, solo status itself has implications for an individual's subjective experience and performance in a group. Unlike Experiment 1, in which gender solos reported they felt more likely to be stereotyped, the minimal group solos in Experiment 2 did not feel they would be stereotyped as an overestimator or an underestimator. However, they were just as likely to report that they felt like a solo--the
only one of their category in the group. And while they did not report feeling more visible, the manipulation and the placards inserted in memo holders ensured that they were in fact perceptually visible to the other group members.

GENERAL DISCUSSION

Two experiments found support for the hypothesis that the cognitive appraisal of emotion (Lazarus & Folkman, 1984) moderates the effect of solo status on an individual's performance. The relationship between cognitive appraisal and performance is stronger and more positive for solos than for non-solos, and this helps explain why solo status leads some individuals to perform better and others to perform worse. In Experiment 1, the effect of solo gender status on the recall of a group discussion, and on a difficult math test depended on the level of the individual's cognitive appraisal of the task. In Experiment 2, cognitive appraisal moderated the effect of minimal group solo status on performance on a math test, and ruled out any influence of solo status on appraisal by measuring appraisal before solo status was assigned. Thus, a persistent effect was observed across two types of solo status, and across two types of tasks.

Solos did not show performance decrements on average. Instead, only individuals with relatively unfavorable appraisals performed worse as a consequence of solo status. Individuals with relatively positive appraisals performed better as a result of being a solo. These results are consistent with the past literature taken as a whole. As we have seen, solo status sometimes helps and sometimes hurts performance. Group-level factors such as gender and stereotypes help to explain the divergent effects of solo status on performance, but they are not sufficient. Cognitive appraisal is an individual-level moderator that predicts when solo status will help and when it will hurt an individual's performance.
There were no differences in the way that solo status affected men and women in these experiments. Whereas solo status has traditionally been linked to minority identity, changing demographics in the United States suggest that in the future anyone, e.g. a young white male, is equally likely to be a solo (Fulbright, 2007). Group size does not appear to be an important factor, since the effects were observed here in groups as small as three or four people. What does seem to matter is being visibly different, having one's solo status visible or made public to others, even if one's performance will not be made public (Inzlicht & Ben-Zeev, 2003). The implication is that anyone, with any type of solo status, could be subject to the same effect.

The experiments in this paper add to recent research on the role of individual-level factors in predicting how people will react to solo status (Inzlicht et al., 2006). They also extend previous work by Cohen and Swim (1995) who suggested that ability to cope would predict how individuals would perform as solos. The role of cognitive appraisal in moderating the effects of solo status on performance is consistent with previous research that has found that solo status harms members of low status groups and not members of high status groups (Sekaquaptewa & Thompson, 2002). Having high status with respect to other group members does not change female solos' perceptions of being highly visible or being stereotyped, but it does make them more confident and comfortable, and have more positive expectations about an upcoming group interaction (McDonald, Toussaint, & Schweiger, 2004). Members of high status groups would be expected to have less at stake and to have more available resources to cope with the stress of performing as a solo than members of low status groups. Moreover, status could influence the attributions an individual makes about why he or she is a solo, and these attributions could in turn influence cognitive appraisal. High status solos (e.g., male nurses; Floge & Merrill, 1986) might assume they have little to fear from and much to contribute to their groups, whereas solos
from a low status group (e.g., female firefighters; Yoder & Berendsen, 2001) might assume their situation was potentially threatening and that they had little to contribute to the group. The results of these experiments are also consistent with an interpretation of solo status performance effects as a phenomenon similar to social facilitation (Blascovich, et al., 1999; Zajone, 1965). Solos essentially perform before an audience.

Limitations and Future Research

These experiments measured cognitive appraisal, but did not address the underlying antecedents of a positive (challenge) or negative (threat) appraisal. One variable that did emerge as predictive of cognitive appraisal at least in the tasks used in these experiments was gender. In the mixed groups in Experiment 1, men had higher appraisals than women. Other group-level factors that are linked with gender, such as group status and stereotypes (Thompson & Sekaquaptewa, 2002) might have more direct effects and should be examined in future research. A second limitation in these experiments was that participants on average made challenge appraisals on all tasks. Few made actual threat appraisals. The means for primary and secondary appraisal in these studies shows that participants felt very able to cope with the demands of the tasks. This suggests that if appraisals on average are either very high or very low in a particular sample, there may be an overall main effect associated with solo status. Whereas on one hand, the results obtained in the present experiments may not generalize across all levels of cognitive appraisal, on the other hand this may be interpreted as a strength of the current research, in that effects were found despite a restricted range of values for cognitive appraisal.

Conclusion

Solo status is a fact of organizational life for many individuals. Whether solo status helps or hurts an individual's performance depends on the individual as well as situational factors.
Because individual-level moderators predict the effect of solo status on performance, self-selection could bias observations of solos' performance in the “real world.” It is possible, perhaps likely, that individuals who accept solo status tend to be those who appraise working on the relevant tasks as a solo as challenging, and believe they have the ability and resources to cope with the performance pressures associated with being a solo.
References


Floge, L., & Merrill, D. M. (1986). Tokenism reconsidered: Male nurses and female physicians in
a hospital setting. *Social Forces, 64*, 925-947.


Yerkes, R. M., & Dodson, J. D. (1908) The relation of strength of stimulus to rapidity of habit-formation. *Journal of Comparative Neurology and Psychology, 18,* 459-482.


Footnotes

1 Whereas solo and token are both defined for experimental research in terms of proportions, the term token is often associated with policies of tokenism, appointing someone to represent their minority social category in the group, often in response to pressure from outside the group to show that group members are not prejudiced and/or value diversity for its own sake. This paper focuses only on the effects of group proportions.

2 MediaLab is a trademark of Empirisoft Research Software.

4 Post-hoc tests on individual positive emotions showed that solos reported feeling more alert (solos $M = 3.47, SD = .93$; non-solos $M = 2.95, SD = 1.06$), $b = .55, SE = .21, t(97.23) = 2.61, p = .01$, and determined (solos $M = 3.41, SD = 1.02$; non-solos $M = 2.95, SD = 1.10$), $b = .46, SE = .22, t(124) = 2.10, p = .04$. However, once the alpha levels for these tests was adjusted (using the Bonnferoni method of dividing the .05 alpha by 5), only the post-hoc test for alert was significant.

5 Separate analyses were conducted with the primary and secondary appraisals as moderators, centered within gender. The parameter estimate for Solo Status X Primary Appraisal interaction for the math score was $b = -1.08$, $SE = .55$, $t(120) = -1.95$, $p = .05$. The parameter estimate for Solo Status X Secondary Appraisal interaction for the math score was $b = 1.00$, $SE = .47$, $t(117.09) = 2.13$, $p = .04$.

6 Separate analyses were conducted with the primary and secondary appraisals as moderators. The parameter estimate for Solo Status X Primary Appraisal interaction for the recall score was $b = -.89$, $SE = 36$, $t(120) = -2.48$, $p = .02$. The parameter estimate for Solo Status X Secondary Appraisal interaction for the recall score was $b = .60$, $SE = .41$, $t(118.61) = 2.21$, $p = .14$. 
Post-hoc tests were computed as in Experiment 1 but solos did not differ significantly on any individual positive emotions.

Separate analyses were conducted with the primary and secondary appraisals as moderators. The parameter estimate for Solo Status X Primary Appraisal interaction was $b = -.84$, $SE = .54$, $t(74.54) = -1.55$, $p = .12$. The parameter estimate for Solo Status X Secondary Appraisal interaction was $b = 1.03$, $SE = .77$, $t(80.23) = 1.34$, $p = .18$. 

7 Post-hoc tests were computed as in Experiment 1 but solos did not differ significantly on any individual positive emotions.

8 Separate analyses were conducted with the primary and secondary appraisals as moderators.
Table 1  
Cognitive Appraisal and Performance by Solo Status and Gender, Experiment 1

<table>
<thead>
<tr>
<th></th>
<th>Non-solo</th>
<th>Solo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men (n=52)</td>
<td>Women (n=42)</td>
</tr>
<tr>
<td>Cognitive appraisal of math test</td>
<td>2.06 (1.87)</td>
<td>1.60 (1.74)</td>
</tr>
<tr>
<td>Math score</td>
<td>6.90 (2.17)</td>
<td>5.31 (1.92)</td>
</tr>
<tr>
<td>Correlation between math appraisal and score</td>
<td>.52***</td>
<td>.19 (1)</td>
</tr>
<tr>
<td>Cognitive appraisal of group task</td>
<td>1.90 (1.55)</td>
<td>1.90 (1.32)</td>
</tr>
<tr>
<td>Correct recall of true items</td>
<td>5.54 (1.42)</td>
<td>4.95 (1.51)</td>
</tr>
<tr>
<td>Correlation between group appraisal and recall</td>
<td>-.14</td>
<td>.03 (1)</td>
</tr>
</tbody>
</table>

*Note. Numbers in parentheses are standard deviations. Correlations are within-cell Pearson product-moment correlations.*

* p < .10
* * p < .05
* ** p < .01
* *** p < .001
Table 2
Results of SPSS MIXED with Math Score and Recall Score as Outcome Variables, Experiment 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient(^a)</th>
<th>SE</th>
<th>(t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimates of fixed effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>6.29</td>
<td>.22</td>
<td>29.21***</td>
</tr>
<tr>
<td>Gender</td>
<td>-1.53</td>
<td>.42</td>
<td>-3.68***</td>
</tr>
<tr>
<td>Cognitive appraisal (math test)</td>
<td>0.90</td>
<td>.15</td>
<td>5.95***</td>
</tr>
<tr>
<td>Solo status</td>
<td>0.25</td>
<td>.42</td>
<td>0.62</td>
</tr>
<tr>
<td>Solo X Gender</td>
<td>0.31</td>
<td>.86</td>
<td>0.37</td>
</tr>
<tr>
<td>Solo X Appraisal</td>
<td>0.98</td>
<td>.30</td>
<td>3.27**</td>
</tr>
<tr>
<td>Gender X Appraisal</td>
<td>-0.34</td>
<td>.30</td>
<td>-1.15</td>
</tr>
<tr>
<td>Solo X Gender X Appraisal</td>
<td>0.13</td>
<td>.60</td>
<td>0.22</td>
</tr>
<tr>
<td>Estimates of covariance parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual</td>
<td>3.75</td>
<td>.58</td>
<td>6.50***</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.11</td>
<td>.35</td>
<td>0.32</td>
</tr>
<tr>
<td>Recall score (true items)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimates of fixed effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>5.14</td>
<td>.15</td>
<td>32.77***</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.22</td>
<td>.31</td>
<td>-0.69</td>
</tr>
<tr>
<td>Cognitive appraisal (group task)</td>
<td>0.22</td>
<td>.11</td>
<td>1.91</td>
</tr>
<tr>
<td>Solo status</td>
<td>-0.18</td>
<td>.31</td>
<td>-0.58</td>
</tr>
<tr>
<td>Solo X Gender</td>
<td>0.71</td>
<td>.63</td>
<td>1.14</td>
</tr>
<tr>
<td>Solo X Appraisal</td>
<td>0.52</td>
<td>.23</td>
<td>2.29*</td>
</tr>
<tr>
<td>Gender X Appraisal</td>
<td>0.12</td>
<td>.23</td>
<td>0.53</td>
</tr>
<tr>
<td>Solo X Gender X Appraisal</td>
<td>-0.09</td>
<td>.45</td>
<td>-0.19</td>
</tr>
<tr>
<td>Estimates of covariance parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual</td>
<td>2.21</td>
<td>.34</td>
<td>6.45***</td>
</tr>
<tr>
<td>Intercept(^b)</td>
<td>0.00</td>
<td>.20</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note. Gender (-0.5 = male; 0.5 = female); Cognitive appraisal (individual's cognitive appraisal of either math test or group task, mean-centered within gender); Solo status (-0.5 = non-solo; 0.5 = solo).

\(^a\)Unstandardized regression coefficients for fixed effects. Numbers for covariance parameters are variances.

\(^b\)The variance of group intercepts was estimated to be 0.

\(^t\) \(p < .10\)

\(*\) \(p < .05\)

\(**\) \(p < .01\)

\(***\) \(p < .001\)
Table 3
Cognitive Appraisal and Math Score by Solo Status and Gender, Experiment 2

<table>
<thead>
<tr>
<th></th>
<th>Non-solo</th>
<th></th>
<th>Solo</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men (n=24)</td>
<td>Women (n=39)</td>
<td>Men (n=10)</td>
<td>Women (n=17)</td>
</tr>
<tr>
<td>Cognitive appraisal</td>
<td>2.13 (1.31)</td>
<td>2.17 (1.97)</td>
<td>2.45 (1.20)</td>
<td>2.10 (1.52)</td>
</tr>
<tr>
<td>Math score</td>
<td>7.50 (2.02)</td>
<td>5.46 (2.62)</td>
<td>8.50 (2.64)</td>
<td>5.29 (2.66)</td>
</tr>
<tr>
<td>Correlation between appraisal and score</td>
<td>.10</td>
<td>.08</td>
<td>.51</td>
<td>.46*</td>
</tr>
</tbody>
</table>

*Note. Numbers in parentheses are standard deviations. Correlations are within-cell Pearson product-moment correlations. p < .10*
Table 4  
Results of SPSS MIXED with Math Score as Outcome Variable, Experiment 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercepts</td>
<td>6.65</td>
<td>.31</td>
<td>21.25***</td>
</tr>
<tr>
<td>Group gender</td>
<td>-2.55</td>
<td>.63</td>
<td>-4.07***</td>
</tr>
<tr>
<td>Group size</td>
<td>1.08</td>
<td>.62</td>
<td>1.73</td>
</tr>
<tr>
<td>Cognitive appraisal</td>
<td>0.55</td>
<td>.23</td>
<td>2.44*</td>
</tr>
<tr>
<td>Solo status</td>
<td>0.17</td>
<td>.28</td>
<td>0.62</td>
</tr>
<tr>
<td>Solo X Gender</td>
<td>-0.69</td>
<td>1.11</td>
<td>-0.62</td>
</tr>
<tr>
<td>Solo X Appraisal</td>
<td>0.90</td>
<td>.43</td>
<td>2.09*</td>
</tr>
<tr>
<td>Gender X Appraisal</td>
<td>-0.20</td>
<td>.45</td>
<td>-0.44</td>
</tr>
<tr>
<td>Solo X Gender X Appraisal</td>
<td>-0.36</td>
<td>.86</td>
<td>-0.42</td>
</tr>
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</table>

Estimates of covariance parameters

<table>
<thead>
<tr>
<th></th>
<th>Z</th>
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</thead>
<tbody>
<tr>
<td>Residual</td>
<td>5.25</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Note. Gender is a group-level variable (-0.5 = male group; 0.5 = female group); Group size (3 or 4, mean-centered); Cognitive appraisal (individual's cognitive appraisal of math test, mean-centered); Solo status (-0.5 = non-solo; 0.5 = solo).

*aUnstandardized regression coefficients for fixed effects. Numbers for covariance parameters are variances.

* p < .05
** p < .01
*** p < .001
Figure Captions

Figure 1a
Solo Status X Cognitive Appraisal Interaction, Experiment 1

Figure 1b
Solo Status X Cognitive Appraisal Interaction, Experiment 1

Figure 2
Solo Status X Cognitive Appraisal Interaction, Experiment 2
Math score

Low cognitive appraisal  High cognitive appraisal

Note. Simple slopes computed with one standard deviation above and below the mean of cognitive appraisal, centered within gender (\(M = 0.00, SD = 1.69\)).

*** \(p < .001\)
Correct recall of true items from group discussor

Low cognitive appraisal     High cognitive appraisal

Note. Simple slopes computed with one standard deviation above and below the mean of cognitive appraisal, centered within gender ($M = 0.00, SD = 1.43$).

* $p < .05$
Note. Simple slopes computed with one standard deviation above and below the mean of cognitive appraisal, centered within gender ($M = 0.00$, $SD = 1.63$).

* $p < .05$