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THE STEREOTYPED TASK ENGAGEMENT PROCESS: UNDERSTANDING FEMALES' MOTIVATION FOR AND PERFORMANCE IN COMPUTER SCIENCE

by

Jessi Lyn Smith

A dissertation submitted to the faculty of
The University of Utah
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

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THE UNIVERSITY OF UTAH GRADUATE SCHOOL

SUPERVISORY COMMITTEE APPROVAL

of a dissertation submitted by

Jessi Lyn Smith

This dissertation has been read by each member of the following supervisory committee and by majority vote has been found to be satisfactory.

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FINAL READING APPROVAL

To the Graduate Council of the University of Utah:

I have read the dissertation of Jessi Lyn Smith in its final form and have found that (1) its format, citations, and bibliographic style are consistent and acceptable; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the supervisory committee and is ready for submission to The Graduate School.

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ABSTRACT

This project integrated research from the stereotype threat, intrinsic motivation, and achievement goal disciplines to posit the Stereotyped Task Engagement Process (STEP) as a model for illuminating the factors that make up the females' experience in male-dominated fields such as computer science (CS). Study 1 directly examined the casual links between whether and how manipulating a stereotype threat led to differential achievement goal adoption. Fifty-nine females worked on a CS programming task under different stereotype threat conditions. Results revealed that participants higher in achievement motivation (HAMS) were likely to adopt performance-avoidance achievement (PAV) goals compared to performance-approach (PAP) goals when threatened by any performance stereotype, and were likely to adopt mastery goals only when the stereotype was rendered irrelevant to the CS task. In contrast, participants lower in achievement motivation (LAMS) were more likely to adopt PAP- goals compared to PAV- goals when threatened by any performance stereotype, and goal adoption was seemingly unaffected by the information that the stereotype was irrelevant to the task. Under gender-stereotype activated conditions, Study 2 manipulated both the type of achievement goal and the presence of an interest goal to examine how goal adoption affected performance and motivational processes and outcomes. A total of 106 females participated in Study 2, which employed an expanded version of the CS task used in Study 1. Goal manipulations did not significantly interact with each other. Importantly,

however, results did indicate that for LAMS, assignment of a PAV- goal resulted in more positive motivational processes and outcomes, especially compared to HAMS provided with the same PAV-goal. Assignment of an interest goal resulted in more positive motivational processes and outcomes for HAMS, compared to LAMS. Finally, participants' use of a chat room as an interest-enhancing strategy while performing the task was examined, and visits to the chat room were shown to be relatively low across all participants. Chat room visits, perceived competence, and task value were found to be the primary process variables contributing to the task experience, and this experience was found to be the mechanism through which the experimental conditions affected interest in the CS task.

To the strongest women in my life

For embracing success and failure alike

And showing me how much fun each can be

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With this start on my life's work, I attempted to build a bridge not only between literatures, but between people. I celebrate the relationships and perspectives I have forged, and I want to thank the entire Social Area for your passion to discover the important things. I also want to give a special thanks to my committee members Bert Uchino, Lisa Aspinwall, and Gale Sinatra for coming together to help me create and learn. Thank you also to Gina, Autumn, Heather, Kylee, Kristina and Sarah for helping collect and code data. And as always, I want to express my sincere gratitude for Angela Newman for her unbridled motivation and fountain of compassion for other people.

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INTRODUCTION

> Hispanics only represent 2.6% of full-time higher education instructional faculty and staff. -- as reported by the National Center for Education Statistics (1997)
>
> The percentage of doctorates in engineering awarded to African Americans is approximately 1.5%, a figure that is far less than the proportion of African Americans in the U.S. college-age population. -- as reported in Grandy (1994)
>
> Women make up 45% of the U.S. workforce, but they account for only 16% of employed scientists and engineers -- as reported in Alper (1993)

As noted in these statistics, members of a group are often noticeably absent from a given achievement context. What is more, in each of the above cases a performance-related stereotype exists about the "missing" group from the targeted domain. The focus of the present research was to investigate whether and how a performance stereotype about a group translates to that group's persistence in (indexed by immediate and future interest) domain-related activities. Bridging together the stereotype threat literature, the intrinsic motivation literature, and the achievement goal literature, the Stereotyped Task Engagement Process (STEP) is presented as a model for illuminating the factors that make up a performance-stereotyped group member's experiences and outcomes. The current project focused on the underrepresentation of females in computer technology development fields such as computer science (CS). Utilizing the computer technology domain provided for a compelling context that was replete with performance stereotypes, notable outcomes, and perhaps most importantly, escalating real-world consequences for the continued underrepresentation of females.

Our society has recently moved into the "information age." Many individuals have access to computers, and the initial digital gender divide has grown smaller (e.g., Daley, 1998). However, work demonstrating a decrease in the digital gender divide has tended to include all forms of technology use (e.g., email use, information searches, Ory, Bullock, & Burnaska, 1997). In the area of developing new technologies, however, females continue to be underrepresented, and the percentage of females earning technology-related degrees has been declining since 1986 (e.g., Carver, 2000). This is problematic not only because females should be represented at the developmental stage to ensure that female needs are met in the information age, but also because it is predicted that our society will experience a devastating technology labor shortage within the next decade (e.g., Carver, 2000; Freeman, & Aspray, 1999). Females represent an "untapped" resource for overcoming the predicted shortage. In general, however, females are not likely to persist in technology-related fields (e.g., Alper, 1993). For example, although females may enroll in introductory classes or initially select to major in technology-related fields, the "drop-out" rate is significantly higher for females than for males (Brainard, Metz, & Gillmore, 2000). The underrepresentation of females in CS specifically is important to understand because although graduates from a CS major represent the majority of workers in the information technology workforce, only 15.7% of BS degrees in CS were awarded to women in 1996-1997 (Freeman & Aspray, 1999, see also Alper, 1993). In fact, as few as 7.7% of females initially interested in CS persist in the major compared with 52.5% of males (Strenta, Elliot, Adair, Scott & Matier, 1993, see also Seymour, 1999). Although it has been noted by several researchers that

stereotypes are a prime factor in the attrition rates of females in fields such as CS (e.g., Alper, 1993; Seymour, 1999), the goal of the current project was to begin to understand why and how the stereotypes contribute to the problem.

Before any progress can be made in understanding the involvement of a performance stereotype in contributing to the underrepresentation of females in CS, it was first necessary to pinpoint the specific nature of the stereotype. Individuals who work in the CS domain are often stereotyped in general as "computer nerds" (Borg, 1999) and this stereotype encompasses several elements, including a specific academic element connecting CS to math proficiency. A common stereotype is that females are less proficient in math than are males (Spencer, Steele, & Quinn, 1999), and research suggests that computer tasks are perceived to be linked to math tasks (e.g., Carver, 2000; Hawkins, 1985). In a recent survey conducted by our laboratory (*pilot dataset 1*, n =69), this was confirmed. Male and female undergraduates were asked to rate the extent to which a number of statements described society's beliefs about individuals who work in CS and about the CS discipline itself, using a 0 to 10 Likert scale. Overwhelmingly, the consensus was that society believes that individuals working in CS are "math whizzes" ($\underline{M}$ = 8.26; one-sample t-test for a significant difference from the midpoint, $t(68)$= 15.15, $p < .001$) and that the discipline itself requires "strong math skills" (M = 7.58; one-sample t-test for a significant difference from the midpoint, $t(68) = 9.15$ $p < .001$).

Although it is the case that some proficiency in math courses is a necessary part of CS, the perception that CS is primarily math oriented may be unwarranted (e.g., Freeman & Aspray, 1999). Nevertheless, the math-CS link is important because decades of

research have found consistent[1] average differences favoring males in math-fact retrieval (Royer, Tronsky, Chan, Jackson, & Marchant, 1999), math GPAs (e.g., Grandy, 1994), and performance on standardized quantitative tests such as the SATs (e.g., Halpern, 1992 as cited in Neisser et al., 1996; AAUW, 1992) and the GREs (e.g., Grandy, 1994). As such, one hypothesis might be that the stereotype that females are not good at math simply reflects the reality that females do not have the necessary level of ability to succeed in math-related fields (Benbow & Stanley, 1980; 1983).

A Consideration of Stereotype Threat Research

Research by Steele and colleagues (e.g., Steele & Aronson, 1995) has demonstrated that it is the threat created by the performance stereotype that females are not good at math and not ability level that accounts for highly achieving females' poor performance in math. Their research has found that the threat that a stereotype creates triggers *something* that leads individuals who are targets of that stereotype to actually perform more poorly. Although unable to clearly demonstrate the mechanisms for stereotype threat (e.g., Spencer, Steele, & Quinn, 1999; see also Smith, 2002), the main finding that a performance stereotype leads to poor performance has been replicated for various stereotypes (e.g., those associated with race, SES status, age, gender) using a wide variety of tasks (e.g., sporting activities, verbal tasks, memory tests, math exams) (e.g., Aronson, Quinn, & Spencer, 1998; Croizet & Claire, 1998; Levy, Hausdorff, Hencke & Wei, 2000;

[1] The size of the female decrement in math compared to males has been the source of great debate in the literature. The reader is referred to Hyde and McKinley (1997) for a review.

Stone, Lynce, Sjomeling, & Darley, 1999). For example, Spencer et al. (1999, Study 2) found that high math identified females (e.g., females who scored at or above the 85th percentile on the SAT-math subsection, or received a grade of B or better in college calculus), who were told prior to taking a multiple-choice math exam that the test had shown stereotypical gender differences in the past, significantly underperformed compared to their male counterparts. In a follow-up study, Spencer et al. (Study 3) set out to demonstrate that the results were due to the impact of the stereotype and did not simply reflect actual ability. Prior to taking the math exam, highly identified male and female students were either told that the math test showed no gender differences (rendering the stereotype irrelevant), or were told no information about gender differences on the test. When the gender stereotype was explicitly made irrelevant to performance, males and females performed equally well.

The Spencer et al. (1999) study demonstrated the negative effects of stereotype threat on performance using a sample of participants who were high achieving math students. Indeed, stereotype threat effects seem to be particularly detrimental for certain individuals. Aronson et al. (1999) differentiated between individuals highly self-identified with math (i.e., indexed by enrollment in a "rigorous" year-long college calculus course, and reported agreement with the statement that math was important to the self-concept) and individuals moderately self-identified with math (i.e., indexed by enrollment in a "rigorous" year-long college calculus course, and relative disagreement with the statement that math was important to the self-concept). When these two groups of participants were subjected to explicit math stereotype threat conditions versus a control condition in which nothing was said about the stereotype, reverse performance

effects were found. That is, highly identified individuals tended to perform better when told nothing about the stereotype and performed worse when reminded about the stereotype, whereas moderately identified individuals tended to perform worse when told nothing about the stereotype and performed better when reminded about the stereotype. These findings suggest that knowing individuals' actual achievement levels might not be sufficient to predict for whom a performance stereotype will result in negative effects on performance. Rather, it is important to also know whether individuals care about achieving in general and/or achieving in the specific domain.

In sum, performance may suffer if a negative stereotype applies to an individual working on a stereotype relevant task, and this may be particularly true for certain individuals (e.g., those who are particularly talented in the task's domain). Thus, the perceived math-CS link, and the stereotype that females are presumed to be less proficient in math, prescribes that females should choose fields other than CS for which they are "better" suited. Females who do select to engage in CS tasks, therefore, may confront a unique challenge in the CS environment; they are constantly faced with the threat of confirming the stereotype of poorer performance to themselves and/or to others.

To get a feel for the type and range of reasons individuals give for choosing or not choosing a CS-related career, I conducted semistructured interviews with 12 individuals (7 female, 5 male) who varied in their actual or potential commitment to a CS related career (Smith, White & Morgan, 2002). One female considering CS as her domain of study summarized it best with: "I think I have a fear of math, because when I don't know that I am working directly with math I do really well..." (author's files). Stereotype threat effects, in short, can mask the individual's true ability, leaving the individual with the

perception that he or she does not have the skills needed to succeed. This perception, in turn, leads to a decrease in actual performance (e.g., Bandura, 1997) and decreased motivation to do the task in the future (cf., Deci, 1975). As theorized by stereotype threat research (e.g., Steele, 1997), when group members hold this perception, they will disengage (i.e., remove themselves) from stereotype-relevant domains (e.g., Crocker, Major, & Steele, 1998). Disengaging from the domain protects the individual from the negative view of the self that emerges from repeated poorer performance because achievement in the domain becomes no longer important to his or her self-esteem (Steele, 1992; see also Major, Spencer, Schmader, Wolfe, & Crocker, 1998). Thus, the math-gender stereotype as it relates to CS may be one reason females may not persist in CS. That is, females who select to participate in (male-dominated) CS tasks may perform poorly as a result of the stereotype, and in an effort to protect their self-esteem, may drop out from the domain entirely.

One potential shortcoming of this line of research is that it assumes that the major factor contributing to disengagement is (perceptions of and actual) poor performance triggered by the stereotype threat (see also Bandura, 1997). Although the perceptions that women might have regarding their (poor) capabilities may be an explanation for underrepresentation of women in CS (Zeldin, & Pajares, 2000), it is unlikely that poor performance is the only factor contributing to the attrition rates of females in CS. Research has documented that even females with comparable or higher grades than their male peers and/or their female peers in nontechnology majors also switch out of the major at higher rates than males (Seymour & Hewitt, 1997). That is, some female

students appear to have competence but are still not motivated to do similar tasks in the future (cf., Betz & Hackett, 1983). What other factors might also be important to consider?

A Consideration of Intrinsic Motivation Research

> "[Computer science] just doesn't interest me, and I don't like to do it. And math has always been hard and when I am doing it I just tense up and am not confident in my work at all, even if I know I am doing it right, I just... I'd rather be doing something I enjoy."
>
> – Female college student, undeclared major (Smith et al., 2002).

As the young woman's comment so clearly expresses, protecting self-esteem from poor (math) performance may motivate disengagement from a domain such as CS, but it is also possible that feelings of boredom are a motivating factor. In fact, most students who switch from a technology major cite "lack of interest" as their number one reason (Seymour & Hewitt, 1997). Although feelings of incompetence in a task can itself lead to lower interest in the task (Deci & Ryan, 1985), Steele (1992) posits that individuals *do not have to believe* they are less competent for disengagement to occur. Thus, even after accounting for competence factors, interest (or lack there of) may be the most proximal motivator for persistence in a domain (e.g., Sansone & Harackiewicz, 1996). To understand more fully the impact of stereotypes on domain persistence, therefore, it is also important to consider research in intrinsic motivation.

Although often considered an outcome variable, interest is also a process (Sansone & Smith, 2000). Interest is a phenomenological experience characterized by a very focused and intent line of attention and a general affective quality that is positive (Sansone & Harackiewicz, 1996; Smith, 2000). One possibility, then, is that there is something about

the typical CS domain that inhibits or discourages females from experiencing interest in domain-related tasks, and that females would be more likely to persist if something could be done to offset this negative effect on the phenomenological experience.

One possible way to create or enhance interest in a task might be to simply advise participants that a given task has interest potential. Sansone, Sachau, and Weir (1989) for instance, found that the description of a task impacted individuals' experience of interest and, in turn, future interest in the task. In Study 2, Sansone et al. manipulated the description of the task given to participants prior to engaging in an interactive computer game. In the initial description of the task, participants received a description of the task that emphasized that task as performance-related (i.e., participants were told to try and score as many points as possible on the computer game) or fantasy-related (i.e., participants were told to explore the area above and below the underground empire on the computer game). Compared to participants who were explicitly told that the task emphasis was performance-related, those who were told the task emphasis was fantasy-related reported significantly more "flow" (energetic, interested, excited) related experiences, which was (marginally) predictive of future interest in the task. These results suggest that a context that explicitly emphasizes the interest and exploration aspects of a task can have beneficial effects on motivation. Thus, one way to improve an individual's motivation for a stereotype-related task, such as CS, might be to characterize the task as affording interest and exploration. The current project tested this possibility.

It should be noted that the Sansone et al. (1989) task was an interactive computer game; a game that contained obvious interest-related features and options. It is possible that a stereotype-relevant task such as CS may not afford such obvious options. For

example, in the interviews I conducted, all of the females currently persisting in the field (n = 4) mentioned that one key factor to their persistence had been to create strategies for interacting with the task to make it more positive (e.g., one female described turning her work with CS into something that is "more meaningful and related to humans") (Smith et al., 2002). Indeed, research has demonstrated that individuals will often go to great lengths to experience interest in an otherwise boring task. Sansone, Weir, Harpster and Morgan (1992) found that an individual will strategically regulate his or her interest in a task by changing the task to be more interesting given three parameters: when the task is 1) boring 2) valued, and 3) includes opportunities (strategies) for regulation.

For example, Isaac, Sansone and Smith (1999) showed that highly interpersonal individuals altered a math-related task when another person was present by displaying interaction styles (e.g., sharing information) that elicited responses from the other person. The display of these styles and the resulting conversations appeared to change the activity to one that participants higher in interpersonal orientation enjoyed and wanted to do again in the future. Moreover, for these individuals these changes in the activity were unrelated to making math-errors while working. Thus, it is sometimes possible for individuals to create a more positive (or a less negative) phenomenological experience without cost to their performance by engaging in interest-enhancing strategies during the task (see also Smith, 2000).

A Consideration of Achievement Goal Research

Although self-regulation of interest is a possible response to a task, whether and how an individual regulates his or her interest depends on *what the individual is motivated for*

(i.e., the individual's goals) (Sansone & Smith, 2000). As such, when considering the impact of stereotypes on immediate and future interest in domain-related activities, one important question to examine is, what type of goal does an individual adopt when threatened by a stereotype? In the stereotype threat literature it is assumed that the stereotype will be threatening only when the stereotyped individual is "motivated to show good abilities in" the domain (Leyens, Deser, Croizet & Darcis, 2000). If demonstrating achievement is the primary goal for the stereotyped individual, then it is possible that experiencing interest does not emerge as an equally important goal or does emerge but the relevant strategies are seen as incompatible with demonstrating achievement. That is, females may be less likely to engage in strategies that increase interest if their goal is focused solely on achievement. Another potential explanation for why females are not persisting in CS domains, then, might be that the stereotype cues a certain type of achievement goal that then prevents the individual from regulating her interest.

Research on stereotype threat has yet to explicitly inquire about what the goals might be of the stereotyped individual when taking an achievement test. Yet, achievement performance goal research links well with the stereotype threat research: both emphasize competence concerns as a primary factor for negative performance outcomes. Indeed, it is likely that a stereotype (regarding math performance) might influence the type of achievement goal an individual (female) adopts in CS contexts.

Traditionally, achievement goal research posited a dichotomy between mastery goals and performance goals. *Mastery goals* can be defined as wanting to develop competence (e.g., I want to understand CS) and are rooted in an individual's need for achievement (Elliot & Church, 1997). Mastery goals have been found to have very beneficial effects

on long-term learning, as well as immediate and long-term interest in the task (e.g., Elliot & Dweck, 1988). *Performance goals* on the other hand, can be defined as wanting to demonstrate competence and have been associated with more negative outcomes (e.g., Ames, 1992). Indeed, similar to the stereotype threat findings, it was conventionally thought that all performance goals would result in poor performance (e.g., Utman, 1997). More recently, however, researchers have suggested that not all performance goals lead to negative outcomes (Barron & Harackiewicz, 2001; Elliot, & Church, 1997). Rather, it is necessary to carefully distinguish between performance *avoidance* goals and performance *approach* goals. A performance-avoidance goal (PAV-goal) is defined as wanting to avoid demonstrating incompetence (e.g., Pintrich, 2000) (e.g., I want to avoid failing the CS task), and is rooted in an individual's fear of failure (Elliot & McGregor, 2001). Performance-approach goals (PAP-goal) appear to be more of combination of both the PAV-goal and the mastery goal. A PAP-goal is defined as wanting to demonstrate competence (e.g., Pintrich, 2000) (e.g., I want to do the best on the CS task) and is rooted in both an individual's fear of failure and their overall need for achievement (Elliot & McGregor, 2001).

Elliot and colleagues (e.g., Elliot & Harackiewicz, 1996; Elliot, & McGregor, 2001) have successfully demonstrated the importance of this trichotomous achievement goal framework for both motivational and performance outcomes. For example, Elliot and Harackiewicz (1996) obtained evidence that giving participants a PAV-goal prior to task engagement (the puzzle task they were about to work on provides "the opportunity to demonstrate that you are not a poor puzzle solver") undermined motivation compared to giving participants a PAP-goal (the task provides "the opportunity to demonstrate that

you are a good puzzle solver"). Similarly, Elliot and McGregor (1999; see also Elliot & Church, 1997) demonstrated that psychology students' performance on an in-class performance measure (i.e., multiple-choice exam), as well as on a learning measure (i.e., short-essay exam), was associated with both types of performance goals; PAV-goals were negatively related to performance and learning whereas PAP-goals were positively related to performance and learning.

Similar to the stereotype threat research that showed that individual differences moderate stereotype threat effects on performance, research in achievement goal theory has also noted that individual differences are important. Unlike the relatively new area of stereotype threat research, however, achievement goal theory has a longer history of investigation, and as such has been able to clearly identify one central individual difference in the study of achievement goals, namely an individual's achievement motivation orientation. Achievement goal research has shown that to understand achievement goal adoption and their affects on performance and motivation, it is necessary to consider an individuals' general reaction to achievement goals (e.g., Harackiewicz & Elliot, 1993) and predilection for adopting certain achievement goals over others (e.g., Elliot & Church, 1997). Based on theories of need for achievement (e.g., McClelland, 1985; Murray, 1938) achievement motivation has been shown to be positively correlated with factors such as competitiveness, dominance, intelligence, and self-acceptance, and unassociated with factors such as extraversion, and emotional support seeking (Emmons, & McAdams, 1991; Jackson, 1974; Ryckman & Hamel, 1995). Achievement motivation appears to be conceptually similar among males and females (Spence & Helmreich, 1983). As an individual difference, then, achievement

motivation is a construct that has been identified as an important moderator of the effects of achievement goals on performance and motivational outcomes (e.g., Barron & Harackiewicz, 2001; Harackiewicz & Elliot, 1998).

By definition, individuals higher in achievement motivation are characterized as someone who "aspires to accomplish difficult tasks; maintains high standards and is willing to work toward distant goals; responds positively to competition; willing to put forth effort to attain excellence" (Jackson, 1974, p. 6). In contrast, individuals lower in achievement motivation are defined as "not characteristically oriented toward competition. They avoid ability assessment and competition whenever possible and are likely to experience performance anxiety in achievement settings" (Harackiewicz & Elliot, 1993, p. 906). Research has shown identified achievement motivation as an important predictor of the type of achievement goals (spontaneously) adopted in an achievement context, with individuals higher in achievement motivation being more likely to adopt any type of performance goal compared to individuals lower in achievement motivation (e.g., Elliot & McGregor, 2001; see also Sansone, 1986). When provided with the same performance goal, individuals higher and lower in achievement motivation often show different patterns of responses. For example, in one study Tauer and Harackiewicz (1999) assigned participants to a competition goal (i.e., to do better than another person) and found that individuals higher in achievement motivation enjoyed the task more than participants lower in achievement motivation. In contrast, when assigned to a noncompetition goal (i.e., to work on a puzzle), Tauer and Harackiewicz found the opposite pattern of results, such that participants lower in

achievement motivation enjoyed the task more than participants higher in achievement motivation.

Given this fundamental role of achievement motivation in understanding achievement goal adoption and effects, and its conceptual relevance to achievement task performance and motivation, it was examined as a moderator in the current project.

One important question then, is whether stereotype threat information in the situation makes salient different types of achievement performance goals, and if this salience differs by an individuals' characteristic achievement motivation. Some initial support for the notion that stereotypes might lead to the adoption of performance-avoidance achievement goals comes from stereotype threat research (although any explicit mention of or link to achievement goals was overlooked). Brown and Josephs (1999) investigated the different "concerns" students have when taking a multiple-choice math exam. Their manipulation of "concerns" is very similar to the manipulation of performance-approach and performance-achievement goals by Elliot and colleagues described above (Elliot & Harackiewicz, 1996). After manipulating the description of the math exam as able to identify people who are "exceptionally strong" or "especially weak" in their mathematical reasoning abilities, Brown and Josephs found that females performed more poorly when they were concerned that the test could identity them as weak in math, compared to when they were concerned that the test could identify them as strong in math. Despite the fact that the Brown and Josephs study did not include any measure of or manipulation of stereotypes, they conclude that because their results are in line with the direction of society's stereotypes about gender and math, females must be concerned

about a "different end of the performance continuum *because of* their group's stigma" relative to males (p. 250, emphasis added).

Understanding the role of achievement goals, and their interaction with an individuals' achievement motivation, is important to consider because extant goal research suggests that individuals of all ability levels will interact with, experience and perform tasks differently depending on the type of goal they spontaneously adopt or are assigned to adopt (e.g., Barron & Harackiewicz, 2001). This potentially adds the missing mechanism piece to the stereotype threat puzzle (see Smith, 2002). Individuals who adopt PAV-goals take minimal risks, report low levels of interest in the task, and do not optimally perform on the task (e.g., Crowe & Higgins, 1997; Pintrich, 2000). Individuals with PAP-goals, in contrast, take higher risks, have higher levels of interest and perform better (e.g., Elliot, & McGregor, 1999; Linnenbrink, & Pintrich, 2000). In short, "each goal, in a sense, creates and organizes its own world – each evoking different thoughts and emotions and calling forth different behaviors" (Elliot & Dweck, 1988, p. 11).

Exploring the Mechanisms

If, as Elliot and Dweck (1988) posit, achievement goals lead to different behaviors, thoughts, affect and such, then the next question becomes, what is the specific nature of these various experiences associated with each type of achievement goal? If stereotype threat information in the situation leads certain individuals to adopt certain types of achievement goals, then identifying such phenomenological differences offers a first glance at the potential processes that may be responsible for how the stereotype translates to individuals not persisting in stereotype-relevant domains. To gain the most complete

picture of this process, both motivational and performance outcomes need to be taken into account.

Turning attention first to research on processes involved in motivational outcomes, how individuals internally experience a task is likely to be the most proximal motivator for immediate and long-term interest in the domain (Sansone & Harackiewicz, 1996; Sansone & Smith, 2000). The positive phenomenological experience can be defined as an internal "feeling like it," that is, the experience of interest. As Berlyne (1966) posited, rewarding internal states are motivating. As reviewed earlier, research by Sansone and colleagues (e.g., Isaac et al., 1999; Sansone et al., 1992) has demonstrated that individuals can and do behaviorally self-regulate their interest by altering the activity they are engaging in. Sansone and Smith (2000) outlined this self-regulation of interest process, highlighting the relationship between strategic initial and maintenance actions and the resultant experience of interest. Their research has found that use of an interest-enhancing strategy during task engagement mediates the relationship between task conditions and motivation. This work would suggest that interest-enhancing interactions with a (boring yet valuable) task are important for creating and maintaining optimal motivation. Thus, if task conditions somehow negate certain individuals (i.e., individuals higher and lower in achievement motivation) from engaging in interest-enhancing strategies, then it would be predicted that those individuals would not experience positive phenomenology. Interest-enhancing strategy use, therefore, is one potential explanation for how stereotype threat information in the situation and achievement goal adoption impact immediate interest (and consequently future interest) in domain-related activities. The current project explored this possibility.

The achievement goal literature has recently begun to map out potential mediators between goal adoption and key performance and motivational outcomes. Several theories have been put forward, such as differential information seeking (Butler, 2000) use of study strategies (Harackiewicz, Barron, Tauer, & Carter, 2000) and task involvement (e.g., Elliot & Harackiewicz, 1996). Elliot and McGregor (2001) for instance, found that students with PAV-goals were likely to use "disorganized" study strategies (e.g., not budgeting study time) and Harackiewicz et al. found that students with PAP-goals were likely to use "surface level" studying (e.g., rehearsal techniques). However, only self-reported disorganization as a study strategy has been shown to mediate the relationship between goal adoption (i.e., PAV-goal adoption) and performance (e.g., poor exam performance) (Elliot, McGregor, & Gable, 1999). Unfortunately, little research has been conducted on disorganization as a study strategy, and it remains unclear if the components involved in disorganization contribute to or are a consequence of self-reported PAV-goal adoption. Regardless, as Elliot et al. (1999) point out, it is likely that the observed mediational relationship between PAV-goal adoption and disorganization is a more "complex, multi-stage model of mediation" than the direct one they tested (p. 560). Given these uncertainties, therefore, study strategies were not examined in the current project.

Research investigating the mediational role of task involvement, on the other hand, has been more extensive. High task involvement often leads to good performance and an increase in future interest to perform the task; the epitome of which has been termed "flow" (Csikszentmihalyi, 1978). This suggests that to obtain positive motivational outcomes, task involvement ought to be high. Elliot and Harackiewicz (1996; see also

Harackiewicz & Elliot, 1993), for example, found that task involvement (defined as the extent to which a person's thoughts are focused on the task, cf., Sarason, 1980; Harackiewicz, Manderlink, & Sansone, 1984) predicted motivational and performance outcomes. Importantly, their findings revealed that task involvement depended on the goals adopted. Specifically, students adopting mastery goals and PAP-goals reported higher task involvement (e.g., more task-related thoughts) whereas students adopting PAV-goals reported low levels of task involvement (cf., Coats, Janoff-Bulman & Alpert, 1996). Another important question, then, for the current project was: how does adopting a PAV-goal when a stereotype is activated in the situation impact task involvement? It is possible that the stereotype information negates the effective use of skills and self-regulatory behavior on stereotype-relevant tasks through low task involvement because the individual is now focused on either the stereotype information itself, or the dysfunctional PAV-goal, rather than on what he or she might enjoy about the task (e.g., Bandura, 1997; Sarason, 1980). Lowered task involvement, in turn, may be another possible mechanism for why individuals drop out of domain-related activities when faced with a threatening performance stereotype. The current project also investigated this possibility.

The role of affect in mediating both motivational and performance outcomes has been studied within all of the relevant literatures, albeit the absence of one, consensual definition, of affect. With respect to motivational outcomes, it has been found that a positive phenomenological experience is often accompanied by self-reported positive

affect (cf., Carver & Scheier, 1990; Sansone, Sachau, & Weir, 1989).[2] As such, it was predicted that positive affect would mediate the relationship between task conditions and motivation.

Predicting relationships between other types of affect and the outcomes as a function of task conditions, as well as predicting affective mediation between task conditions and performance outcomes, however, is more difficult. Within the achievement goal research, it has been demonstrated that negative affective states such as worry and anxiety are differentially related to achievement goals (Elliot & McGregor, 2001), but may only mediate the relationship between PAV-goals specifically and performance outcomes (Elliot & McGregor, 1999). The stereotype threat research to date has not found a consistent relationship between stereotype threat conditions and their self-report measures of affect, or any complete affective mediation between stereotype threat and performance (Brown & Josephs, 1999; Spencer et al., 1999; Steele & Aronson, 1995). This may or may not be surprising given that stereotypes are by definition, without affect. That is, stereotypes are generalized *beliefs* a perceiver holds about a group. Nonetheless, for the target of the stereotype, it seems intuitive that the reminder of a stereotype will produce negative affect for that individual (cf., Clark, Anderson, Clark, & Williams, 1999) especially when engaged in the stereotype-relevant task.

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[2] It should be noted that affect has been indexed by measures other than self-report. For example, several cardiac and hemodynamic measures have been linked to the presence, absence and valence of affect, and these physiological measures have shown some relationship with motivation (e.g., Bradley, 2000) and performance outcomes (e.g., Blascovich, Mendes, Hunter, Lickel & Kowai-Bell, 2001). Although it is beyond the scope of the current study to consider this type of affect measure, it is likely that certain task conditions, such as stereotypes and goals, would share a mutual influence with the individual's physiological state (e.g., Cacioppo & Berntson, 1992).

Because the stereotype threat and achievement goal literature have often employed various definitions, representations, phases, and measures of affect, it may not be surprising that the role of affect in producing performance outcomes is unclear. For example, it may be necessary to distinguish between the presence of a positive feeling and the absence of a negative feeling (Aspinwall, 1998). More precisely, it is necessary to define what is meant by "affect." For the purposes of the current study, affect is herein defined as the "genuine subjective feelings and moods" at a particular point in time (Russell & Carroll, 1999) and is composed of two primary elements: valence (positive-negative) and intensity (activation-deactivation) (Yik, Russell & Feldman Barrett, 1999).

Using this definition of affect, it becomes reasonable to expect that Elliot and McGregor's (1999; 2001) measure of affect (i.e., ratings of worry and anxiety) collected prior to performance is fundamentally different from Brown and Joseph's (1999) and Steele and Aronson's (1995) measure of affect (i.e., completions of the words: dumb, flunk, idiot) collected following performance, on many of the outlined dimensions of affect (i.e., valence, intensity, measurement timing, scale). As such, the current study employed a more comprehensive self-report measure of the four possible dimensions of affect (Pleasant, Unpleasant, Activated, Deactivated, Feldman Barrett & Russell, 1998).

Combining Perspectives: The Stereotyped Task Engagement Process Model

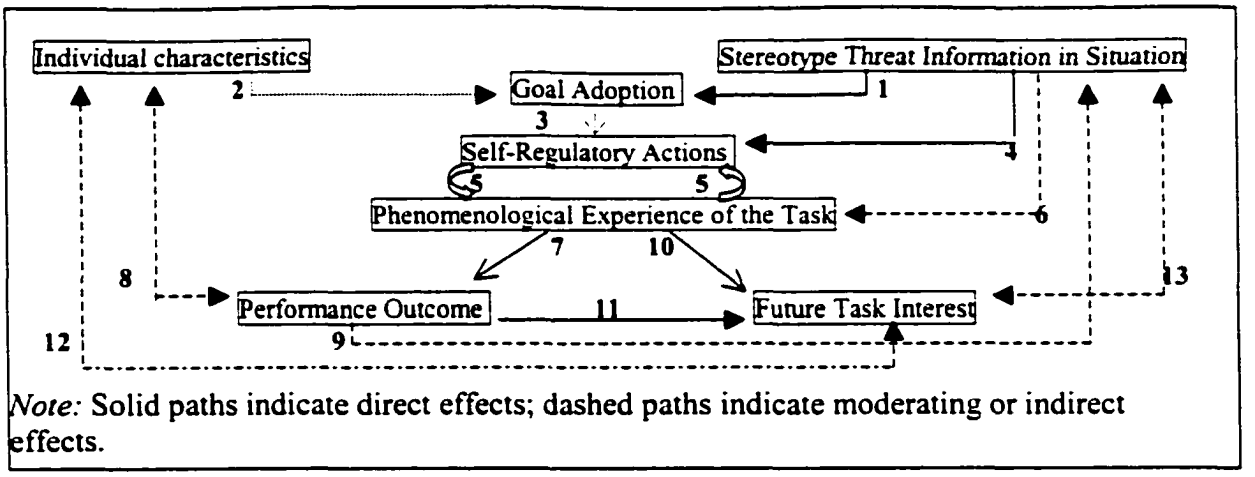
In addressing the question of how math gender stereotypes translate to interest and future interest in domain-related activities, it becomes clear that only partial answers are found within one single literature. The stereotype threat literature hypothesizes that

competence factors are key in explaining why members of stereotyped groups do not persist in certain domains, whereas the intrinsic motivation literature would hypothesize that the experience of interest is an essential element contributing to the problem. In explicating either hypothesis, however, it is necessary to take into account the goals guiding the individuals' behavior, articulated in the achievement goal literature. Developing a more comprehensive account, then, of the likely factors involved requires a merging of several literatures that have developed largely in isolation from one another.

Integrating the stereotype threat, achievement goal, and self-regulation of motivation literatures, I formulated the Stereotyped Task Engagement Process (STEP). This model was designed as a framework for investigating the novel possibility that stereotype information about poorer achievement leads stereotyped individuals to adopt different achievement goals for domain-related activities than they would if the stereotype were not present. Specifically, it was expected that females faced with the math-gender stereotype would adopt PAV-goals during CS tasks, and that this goal adoption would be moderated by individual differences in achievement motivation. It was unclear if individuals higher in achievement motivation (HAMS) would be more likely to respond to the stereotype as a challenge (and thus adopt PAP-goals) or as a potential threat to their self-worth as achievers (and thus adopt PAV-goals) (cf., Harackiewicz & Sansone, 2000; Molden & Dweck, 2000). Nonetheless, it was expected that for those likely to adopt PAV-goals under stereotype threat conditions, a PAV-goal (compared to a PAP-goal) would lead to poorer performance (by undermining perceptions of competence) *and* make the activity less interesting (by undermining use of interest-enhancing strategies), both effects contributing to an overall negative experience of the domain as a whole.

Outlined in Figure 1, I have presented the general model, designed to be theoretically informative across a wide variety of domains that contain negative stereotypes about a group of individuals engaging in a stereotype-relevant task (e.g., Blacks in academic positions such as professors, men in verbal domains such as English, the elderly in dexterity tasks such as driving).

As depicted by Arrow 1, the model suggests that negative stereotype information in the situation (whether explicitly or implicitly activated) can lead to the adoption of different achievement goals while performing the stereotype-relevant activity, depending on if the stereotype applies to the individual's group. Goal adoption will also be partially influenced by the individual's characteristic differences in interests, values, beliefs, etc (e.g., self-efficacy, Bandura, 1997; achievement motivation, Harackiewicz, & Elliot, 1993; hardiness and conscientiousness, Sansone, et al., 1999; identification with the domain, Smith & White, 2001a) as depicted by Arrow 2. Depending on the adopted achievement goal, the individual will be inclined to use a certain set of self-regulation strategies (including no strategy at all, e.g., performance-avoidance goals lead individuals to take minimal risks, e.g., Linnenbrink & Pintrich, 2000). Arrow 3 represents the impact of the adopted goal on whether and how the individual self-regulates. Furthermore, the model also points out by Arrow 4 that the stereotype information itself will also impact whether and how the individual self-regulates, such that the domain of the stereotype may dictate appropriate (e.g., work alone on computer tasks, Brainard, & Carlin, 1998) and inappropriate (e.g., asking of questions in a computer class, Brainard, et al., 2000; applying computer work to help others, Freeman & Aspray, 1999) regulation strategies that are available in the task.



Note: Solid paths indicate direct effects; dashed paths indicate moderating or indirect effects.

Figure 1.

Stereotyped task engagement process

Self-regulatory actions with the task influence the valence of the phenomenological experience by impacting task involvement (e.g., absorption in the task, Csikszentmihalyi, 1978), subjective feelings (e.g., feelings of interest, feelings of anxiety, Sansone & Smith, 2000) and/or physiological activity (e.g., cardiac and vascular activity, Tomaka, Blascovich, Kibler, & Ernst, 1997). In turn, the valence of the phenomenological experience leads to additional strategic actions with the task, which may then impact the phenomenological experience. Arrows 5 represent this feedback loop. Moreover, the phenomenological experience may be affected by the presence of the stereotype information, especially in its indirect effect on feelings of interest as a result of low task involvement engendered by the evaluative nature of the stereotype threat (e.g., Harackiewicz & Sansone, 2000), and/or the impact on the individual's physiological reactivity (e.g., Clark, et al., 1999), as shown by Arrow 6.

Performance attainment is one of the most important outcomes to consider when examining achievement domains (Elliot, & McGregor, 1999). As illustrated in the STEP model, performance on the task is likely to be influenced most directly by the individual's phenomenological experience of the task (e.g., Schiefele, 1991), as shown by Arrow 7. However, because the phenomenological experience is affected by whether and how the individual self-regulates, it should be pointed out that some regulation strategies may (e.g., Sansone et al., 1989; Wade, 1992) or may not (e.g., Isaac, et al., 1999) lead to a decrease in short-term performance. Thus, it is important to consider the nature of the strategy use and the potential trade-off between short-term performance and long-term motivation when assessing performance outcomes (Smith, 2000). Additionally, various individual characteristics are also likely to impact performance, and performance in turn,

is likely to inform the status of those characteristics, shown by Arrow 8. Importantly, the individual's performance on the stereotype-relevant task is likely to begin to bolster or undermine the individual's belief of the (in)validity of the stereotype, shown by Arrow 9.

Finally, the desire to do the task in the future is most proximally related to the phenomenological experience (Arrow 10) but is often positively related to performance (e.g., Deci, 1975) shown in Arrow 11. One the one hand, if the individual's overall experience is negative and he or she then does not engage in the stereotype-relevant task in the future, over time the absence of the domain from the individual's life should lead to the individual disidentifying the task from his or her personal characteristics (see Arrow 12). Similarly, as shown by Arrow 13, the less stereotyped individuals engage in stereotype-relevant tasks, the more likely it is that the stereotype will remain applicable. On the other hand, if the individual's experience is positive and he or she then engages in the task in the future, over time this repeated engagement should lead to the individual incorporating the task into his or her personal characteristics. Likewise, the more stereotyped individuals engage in stereotype-relevant tasks, the more likely it is that the stereotype will eventually be extinguished!

Project Overview

Consideration of the three literatures suggests that a competence-threatening stereotype triggers a performance-avoidance goal for the stereotyped individual even if they feel competent, and this goal adoption engenders low motivation outcomes and poor performance outcomes, depending on the individual's level of achievement motivation. The objective of the current project was to examine these effects. As suggested by the

STEP model, it was further predicted that these negative outcomes are due to the negative experiential process (i.e., lack of self-regulation of interest, low perceived competence, low task involvement, negatively activated affect). Thus, an additional aim of the proposed project was to begin to explore some of the aspects of the STEP model, including some of the potential processes involved in producing the predicted effects. Figure 2 illustrates the hypothesized negative effects and process for a female-stereotyped-in-math individual engaging in a computer science related task.

In two studies, various levels of the STEP model were manipulated within the computer technology domain to examine stereotyped individuals' goals, motivation and performance. It was first necessary to document whether and how the types of goals individuals spontaneously adopt differ under conditions of stereotype threat. This was important in order to understand goal origin as a function of stereotype threat. Specifically, Study 1 tested whether females adopt PAV-goals when explicitly threatened by a performance stereotype by manipulating the salience and validity of the stereotype information and measuring the nature of the adopted achievement goal. Importantly, it was also expected that achievement motivation would serve as a moderator of these effects (e.g., Barron & Harackiewicz, 2001). If goals were influenced by a performance stereotype, than it was possible that goals might be the more proximal mechanism that engenders negative stereotype threat effects. Next, Study 2 tested if, for certain individuals, adoption of a PAV-goal negatively impacted females' motivation for the task and performance on the task by manipulating the presence and type of goal adopted, under gender-stereotype salience conditions (cf., Brown & Josephs, 1999; Steele, James

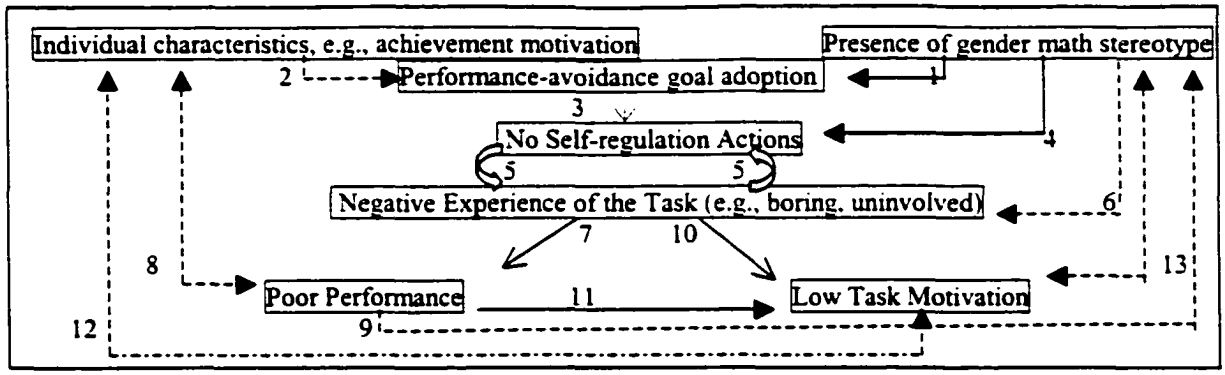


Figure 2.

The hypothesized negative STEP for females engaging in computer technology

& Barnett, 2002). Furthermore, Study 2 independently manipulated the presence of an interest goal to examine whether and how an interest goal might offset the expected negative effects of the PAV-goal on performance and motivation, and if this benefit extended to participants in the PAP-goal condition. In both studies, the potential processes involved in these outcomes were explored (i.e., perceived competence, task involvement, reported affect). Study 2 also measured the number of links clicked on in the optional chat room as a potential measure of interest-enhancing strategy use.

To best understand the factors related to the high attrition rate of females from CS-related domains, a task was created to emulate a CS classroom experience. A tutorial was designed to introduce participants to concepts and features found in CS programming tasks, to ensure that all participants would begin the CS task with the necessary information to perform the CS task. The CS task was entitled the "computing aptitude assessment tool" (CAAT), and was designed to simulate a CS homework assignment because assignments often afford students the most choice and control, elements that are often considered the "hallmark" of academic self-regulation (Schunk & Ertmer, 2000). The tutorial and the CAAT are described in detail in the materials section.

In summary, the aim of the current project was to help to map out the impact of performance stereotypes and achievement goals on females' motivation for and performance on a computer technology development task. This project also represented a first step in understanding the processes underlying these outcomes.

STUDY 1

Method

Participants

A total of 59 female participants enrolled in introductory classes (i.e., psychology, sociology, environmental science) were selected for participation in the study if they reported moderate levels of identification with the computer technology domain as determined in a mass testing session by the Domain Identification Measure (DIM, Smith & White, 2001a). Moderate levels of identification with the CS domain were determined by mean scores on the DIM falling between strongly identified (mean less than or equal to 4) and strongly disidentified (mean greater than or equal to 2). This selection criterion was important because it ensured that the participant viewed CS as at least moderately a part of their sense of self (Smith & White, 2001a) a key condition for demonstrating stereotype threat, and it ensured that the task experience could be better experimentally controlled because the participant might not yet possess a scripted protocol for their CS-related behavior (Abelson, 1982).

The majority of participants were recruited from introduction to psychology classes. Five participants were excluded from analyses for incorrect responses to the manipulation check. In addition, two Asian-American participants were excluded from analyses to ensure that the gender stereotype was not confounded with positive (math performance) race related stereotypes (Shih et al., 1999). Data from the remaining 52 participants

(approximately 13 participants per condition; 63.5% reported freshmen or sophomore status; 94% Anglo-American, 6 % Hispanic) are reported below. All participants received extra course credit for their participation.

Procedure

Participants were randomly assigned to 1 of 4 stereotype conditions. In small sessions, participants were met by a female experimenter, given a set of headphones, and then seated individually in front of a computer (separated by partitions). While the experimenter ostensibly waited for "one more participant" all participants completed the 16-item achievement motivation subscale of the Personality Research Form (Jackson, 1974). The experimenter then collected informed consent, demonstrated how to use the headphones, the playback device, and operate the computer mouse. The experimenter then moved to an adjacent table where she remained until the end of the study.

First, participants listened to a recorded tutorial by a male narrator explaining the upcoming Computer Aptitude Assessment while following along on the computer. After the tutorial, participants were asked to answer a post tutorial short-answer style questionnaire on the material presented in the tutorial. Next, participants in the explicitly activated math stereotype threat and nullified math stereotype conditions were directed to a one-page article (modeled after Benbow & Stanley, 1980) presented in a folder on their desktop, under the guise of providing more information on what the study was investigating. The article was used to explicitly remind the participants of the stereotype that males are superior to females in mathematics (cf., Steele, 1997). Participants in the nothing said about the stereotype condition were not directed to their folder (in fact, their

folder contained a blank sheet). The experimenter was unaware of the presence of the article. Half of the participants who were given the article then heard a narrator report that our own past investigations had found similar results in using the CAAT (i.e., males perform better than females on the CAAT; explicit math stereotype threat condition). The other half heard that our past results showed that there were no gender differences on the CAAT (i.e., males and females perform the same on the CAAT; nullified math stereotype condition).

Because there are many other stereotypes, in addition to gender, that are relevant to performance on computer science tasks (Borg, 1999; see also, Freeman & Aspray, 1999), a final condition was added to these traditional stereotype threat conditions. In this condition participants did not read the gender-math-stereotype article, but were told that "in a previous study with high school students in Utah, our lab has found no group differences on the CAAT. That is, the CAAT appears to be nonbiasing. The goal of the current study is to make similar assessments using a college sample instead of high school students." The addition of this condition provided a way to examine if nullification of all stereotypes could occur more generally with a broad statement that the test was found to be "nonbiasing" or if stereotype nullification only leads to better test performance when the nullification was specific to a stereotype relevant to an individual's group.

If the new condition did not act as a general nullification, it was also possible that broad statements about the test being nonbiased might actually lead to greater self-relevant threats (cf., Baumeister, 1998). In this case, the new condition might not only fail to defuse any negative effect of a specific stereotype, but remove the ability for

participants to attribute any negative outcomes to prejudice (Crocker & Quinn, 1998; also Crocker & Major, 1989) or some other external handicap (e.g., Greenberg, Pyszczynski, & Solomon, 1982).

In short, characterizing the test as non-biasing could serve to stamp out all relevant stereotypes, thereby acting as a general-stereotype nullification condition, and nullification has been shown to be related to better performance outcomes on the test (e.g., Aronson, et al., 1999). It was also possible that characterizing the test as non-biasing could suggest that the test was a "genuine test" of ability (Steele & Aronson, 1995), or a "natural" test of ability (Stone et al., 1999), and this characterization has shown to be threatening as indexed by lower performance outcomes on the test. Stereotype threat research assumes the presence of threat when performance suffers on a stereotype relevant task (e.g., Aronson et al., 1999; Osborne, 2001; Smith, 2002). Thus, it was predicted that if the new condition served as a *general-stereotype nullification* condition, performance on the CAAT would be better when compared to the explicit-math-stereotype condition, and better than or equal to the math-stereotype-nullification condition. On the other hand, it was predicted that if the new condition served as a *non-specific stereotype threat* condition, performance on the CAAT would be worse when compared to the gender-math-stereotype nullification condition, and worse than or equal to the explicit-math-stereotype condition. A stereotype threat replication analysis was used to examine these predictions.

In sum, participants were randomly assigned to one of four conditions (explicitly activated-math-stereotype threat vs. nullified-math-stereotype vs. nothing said about stereotypes vs the new condition) in a between-participants design. After the stereotype

manipulations, all participants listened to an overview of the CAAT describing algorithms and their different uses (such as games, text processing, simulation, modeling and data analysis) with the latter being the emphasis for their upcoming assessment task. This overview also included information to invoke participants' ego-involvement[3] (cf., Sansone, 1989). Participants were told that the CAAT was a tool designed to assess how effective people are at using math skills for computing tasks, which "are a necessary component for high tech, cutting-edge careers."

To measure anticipated performance, participants were asked to estimate on a scale of 1 (poor) to 8 (excellent) how well they thought they would do on the task after reading the task overview (Stangor, Carr, & Kiang, 1998). Participants were then given 15 min to complete the "fix the errors" section of the CAAT (described below). Participants did not receive any feedback regarding their performance on the CAAT. After time had expired, the narrator directed participants to a notebook on their desktop and asked them to complete several measures. The notebook contained the thought listing exercise first. Following that, participants completed the remaining measures in a counterbalanced order across participants. These included the affect measure, as well as the CAAT rating survey and the supplemental rating survey (which contain the self-report measures of interest, future interest, perceived competence, and task involvement). Items on the CAAT rating survey were presented in an interdispersed fashion. Participants had as

[3] Although Brown and Josephs (1999) conclude that negative stereotype threat effects on performance can be seen even when the task has "minimal practical consequences" an effort was made to ensure that the task was perceived to be valuable by participants to facilitate the conditions of self-regulation of motivation (Sansone & Smith, 2000).

much time as they needed to complete these items. At this point, the experiment ended, and participants were thanked and debriefed.

Research Materials and Measures

Tutorial

Modeled after Summit's (1997) lecture handouts in *C Programming*[4], and chapter one of *An Introduction to Computing* by Adams, Leestma and Nyhoff (1998), a tutorial was designed for all participants to receive in a Web style format prior to any experimental manipulations. Specifically, the tutorial was intended to represent an instructor's lecture on an introduction to programming. The tutorial included: a general overview of computing, a brief review of some mathematical concepts that are used in computing, several examples of how to write "code" for different data analysis functions, and illustrations on how to simplify and modify a program. A male[5] narrator audibly delivered the tutorial while participants read along with the material on the computer screen. Using an audio recording was chosen to best simulate the classroom lecture experience, and to control the amount of exposure to the material (see Barron & Harackiewicz, 2001). Following the tutorial, participants answered a short-answer style questionnaire about the material in the tutorial. Participants were allowed to review the

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[4] Permission from Mr. Summit to use verbatim portions of his handouts was granted to the author April 14, 2001.

[5] Although using a male narrator may make the gender stereotype more prevalent to all of the participants (even for those participants not in the stereotype threat condition), using a male voice does lend itself to experimental realism given that the typical instructor in a CS-related classroom is very likely to be male.

tutorial to answer the questions. This ensured that everyone had the same knowledge before receiving the manipulations and advancing to the CS task, an advantage to using this task.

Task

Modeled after chapter one of Graham's (1985) *Introduction to Computer Science* textbook, the CS task (called the computing aptitude assessment tool, CAAT) was designed to represent a homework assignment that an instructor might give, in which the students are to do two things: identify how a set of outputs was created, and identify errors in constructed programs. A description of this assignment was rated in pilot testing for several features by female (n = 60) students (62% psychology major, 18% health/pre-med major, 13% sociology major, 5% communication major, 2% other or undecided) and was found to be perceived as difficult (M = 4.16 on a 0 to 6 scale; SD = 1.33, $t(59)$ = 6.76, $p < .001$, one sample t-test for a significant difference from the midpoint) and uninteresting (interest M = 1.80, SD=1.39, $t(59)$ = -6.67, $p < .001$, one sample t-test for a significant difference from the midpoint) verifying that the assignment would be boring for most individuals, setting up one of the essential parameters to examine self-regulation (Sansone et al., 1989).

Achievement Motivation

To measure participants' achievement motivation orientation, Jackson's (1974) 16-item Achievement Motivation subscale of the Personality Research Form was administered. This scale uses a true/false response format and includes items such as "I

will not be satisfied until I am the best in my field of work," "I would work just as hard whether or not I had to earn a living," and "I have rarely done extra studying in connection with my work" [reversed scored]. This scale has been shown to have good test-retest reliability among college students (reliability coefficient = .80) and has been validated using a variety of convergent and discriminant scales (Jackson, 1974 see also Fiske, 1973). Using this scale, Jackson found that achievement motivation was conceptually distinct from the need for affiliation, negatively associated with the need for autonomy and positively associated with aggression. In the current project, the items on this achievement motivation measure were found to makeup one primary factor, and yielded a satisfactory inter-item reliability (reliability coefficient = .64). See Appendix A for a more detailed description of the scale's psychometrics as assessed in the current project.

Dependent Measures

Post tutorial survey. Five short-answer questions were constructed using question stems taken from quizzes and problem solving items listed on the websites of various introductory computer-related classes (e.g., Summit, 1997). Based on information provided in the tutorial, the items reflect information necessary for completion of the CAAT (see Appendix A).

Manipulation check. For participants in the explicit math stereotype condition and the nullified math stereotype condition, a manipulation check was administered at the end of the study to ensure that participants could correctly recall the gist of the article given to them at the beginning of the study.

Achievement goal adoption. [6] Participants were asked to "write any thoughts and feelings you are having or were experiencing before you were signaled to stop working on the CAAT." Following the guidelines articulated by Elliot and Sheldon (2002), these thoughts were coded by two judges (with 93.6% agreement, disputes were settled by the author) for the presence of PAV-related thoughts (e.g., "I kept getting nervous that I was writing the wrong code" and "I felt fearful I would answer wrong"), PAP-related thoughts (e.g., "I hoped I was doing the programming right" and "I started really wanting to do good on the test") and mastery-related thoughts (e.g., I felt "excitement that I 'got' something I'd never done before" and "It was fun to feel challenged"). Participants could list as many thoughts as they wished (although only six lines were provided on the page). This procedure of coding open-ended thought listings for the presence of achievement goals has been shown to yield results similar to those obtained with self-report measures of goals (e.g., Harackiewicz, Barron, Carter, Lehto & Elliot, 1997).

Immediate interest. To assess the impact of the experimental conditions on important motivational outcomes, a 7-point Likert scale "CAAT rating survey" modeled after the task ratings survey in Sansone et al., (1999) was administered. Embedded in this survey were three target questions to assess interest in the CAAT. Participants were asked to rate

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[6] Participants also completed the achievement goal measure constructed by Elliot and McGregor (2001). However, internal analyses failed to replicate the goal construct factors identified by the authors. A principal factors extraction was performed on the 12-item goal survey. Three factors meeting the eignvalue criterion (greater than or equal to 1) were extracted, with a fourth factor mapping onto the PAV- goal construct (eignvalue = .79). Moreover, following a varimax rotation, an examination of the scree plot showed the first component (PAP-goals, accounting for approximately 22% of the variance) was separate from the other components, with a drop (i.e., elbow) beginning with component two and all of the remaining components resting closely, and almost linearly, together.

the extent that they agreed with each of the following: "I would describe this task as very interesting" "I think this is a boring task and "This task is fun to do" (see Appendix B for the entire CAAT rating survey).

Future interest. The CAAT rating survey also included an item to assess reported willingness to take a CS related job in the future.

Performance. The computer recorded the participants' responses to the CAAT. Points were given for correct solutions to items (e.g., 1 point was awarded if the correct program was selected, and 1 point was awarded for correctly fixing each error identified in a program, up to 6 total points possible).

Perceived competence. A measure of perceived competence was constructed based on Harackiewicz and Elliott, (1993) and was embedded in the CAAT rating survey. This 4-item measure asked participants to use a 7-point Likert scale to rate the extent to which they agreed with the following: "I think I did very well on this task," "I am satisfied with my performance on this task," "This task was easy to understand," and "Overall, I perceived this task as very difficult" [reverse scored]. Although past research has found that perceived competence might not moderate immediate interest or future interest in a task (e.g., Elliott & Harackiewicz, 1996) it has been shown to be a partial mediator of task enjoyment (e.g., Elliott et al., 2000) and is often related to performance and learning outcomes (e.g., Wigfield & Eccles, 2000).

Task involvement. Given that task involvement is at the root of many definitions of interest, participants were also asked to complete the Task Involvement Index similar to Elliott and Harackiewicz, (1996; see also Harackiewicz & Eliot, 1993). Modeled after Sarason's (1980) Cognitive Interference Questionnaire, this three item index asked

participants to rate on a 7-point Likert scale the extent they agree with the following: "while working on the task I lost track of time" and "while working on the task, I was totally absorbed" and "while working on the task, I thought about things unrelated to the experiment" [reverse scored].

Self-reported affect. Participants were asked to complete the current mood questionnaire (CMQ, Feldman Barrett & Russell, 1998). This measure consists of four constructs (pleasant, unpleasant, activated, and deactivated) each with two response formats. This measure allowed for an examination of the full range of affective dimensions (e.g., Yik, et al., 1999) that might be important in understanding how the task conditions have their impact on motivational and performance outcomes.

Results

The means, standard deviations, and possible range for all of the variables measured in Study 1 are reported in Table 1. Table 2 presents the correlation matrix summarizing the relationships among the process and outcome variables across conditions. It is clear from the table that the variables were by and large positively related to each other. Importantly, however, performance-avoidance thoughts were negatively related to both perceived competence and reports of immediate interest, similar to past work by Elliot and colleagues (Elliot & Church, 1997; Elliot & Harackiewicz, 1996). Performance-approach thoughts were positively related to interest but unrelated to perceived competence and actual performance in this study. Past work has generally found a null relationship

Table 1.

Descriptive Statistics for Study 1 Variables

Variable	Possible range	*M*	*SD*
Achievement motivation	0-16	10.02	2.89
Domain identification	1-5	2.76	.45
Mastery-related thoughts	0-6	.17	.71
Performance-approach related thoughts	0-6	.85	1.21
Performance-avoidance related thoughts	0-6	.31	.61
Interest	1-7	3.27	1.37
Perceived competence	1-7	3.00	1.40
Task value	1-7	3.74	1.30
Task involvement	1-7	4.11	1.46
Affect	1-4		
Pleasant		2.61	.84
Unpleasant		2.20	.82
Active		2.07	.82
Deactive		2.71	.71
Anticipated performance	1-8	4.33	1.40
Actual performance	0-6	3.10	1.88
Future interest	1-7	2.56	1.49

Table 2

Study 1: Correlations among Goals, Process Variables, and Outcome Variables.

Variable	1	2	3	4	5	6	7
1 Performance-Avoidance Goal	-						
2 Performance-Approach Goal	-.24	-					
3 Mastery Goal	-.49**	-.04	-				
4 Perceived Competence	-.46**	-.11	.26	-			
5 Immediate Interest	-.45**	.34*	.33*	.65**	-		
6 Future Interest	-.14	.17	.25	.45**	.40**	-	
7 Performance	-.56**	-.28	.19	.42**	.12	.13	-

Note: * $p < .05$; ** $p < .001$

between PAP-goals and interest and a positive relationship between PAP-goals and performance (e.g., Elliot & Church, 1997) although these findings are not always consistent (cf., Barron & Harackiewicz, 2001, Study 2; Elliot & Harackiewicz, 1996).

The majority of analyses include the R^2 index of the proportion of the dependent variables' variance shared with the optimally weighted independent variables. As described by Cohen and Cohen (1983) this information is used in determining the effect size (ES) of the observed results (formula: $R^2/(1-R^2)$), thus R^2 itself is provided herein as an approximate estimate of the ES.

Covariates

Based on past research, several covariates were used in this study. Although domain identification was used as a selection variable, there remained enough variability in this study to justify using it as a covariate, similar to stereotype threat research by Smith and White (2001b). Anticipated performance was also used as a covariate in the analyses because variables like anticipated performance are "best portrayed as antecedents of achievement goals" (Elliot & Church, 1997; p. 219). Following recommendations by Judd and Kenny (1981), analyses were conducted to ensure that these covariates were not affected by the experimental conditions, and they were not (and this was consistent with past research, e.g., Harackiewicz et al., 2000).[7] Finally, actual task performance was also included as a covariate in the spontaneous goal adoption analyses because goals were assessed following performance.

[7] Conceptually, anticipated performance may appear similar to variables such as self-efficacy. However, measures of self-efficacy (e.g., math self-efficacy) often require

Stereotype Threat Replication Analysis

One purpose of this study was to test whether the CAAT as a task was able to replicate past stereotype threat effects (e.g., Aronson et al., 1999). Moreover, it was necessary to determine if telling participants that the CAAT was non-biased would serve as a general stereotype nullification or as a non-specific stereotype threat condition. Regardless, based on past stereotype threat work, it was expected that a linear pattern would emerge for performance such that performance would decline as the possible applicability of a relevant stereotype was made more salient (cf., Smith & White, 2001b; Steele & Aronson, 1995). To test this, an ANCOVA was performed to test the effect of stereotype condition on total correct, using anticipated performance and domain identification as the covariates (similar to Smith & White, 2001a). The effect of stereotype condition was marginally significant, $F(3,45) = 3.24$, $p = .06$, $R^2 = .17$. Examination of the means revealed the expected linear pattern. Importantly, participants who were told the CAAT was non-biasing performing the worst (but equal to the explicit-math stereotype condition) suggesting that this condition served as a *nonspecific stereotype threat*. Participants in the nullified math stereotype condition appeared to perform the best (see Table 3).

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extensive measurement (e.g., 52 items, Betz & Hackett, 1983) compared to the 1-item measure used here. Nevertheless, if anticipated performance was used as a proxy for self-efficacy it would still not be expected to be affected by or to mediate the condition effects on the outcome measures based on past research that has shown a null relationship between self-efficacy and stereotype threat effects on performance (e.g., Spencer et al., 1999). Although self-efficacy assessments might be useful to determine task selection (e.g., Betz & Hackett, 1983), the main purpose of the current project was to assess the task experience. Therefore, measures assessed prior to task engagement would not be informative of the experience because participants would not have any interactions on which to base their judgments.

Table 3

Descriptive Statistics for Actual Performance by Stereotype Threat Condition

Condition	*M*	*SE*
New Condition	1.95_{a}	.52
Explicit Math Stereotype Threat	$2.99_{a, b}$	.52
Nothing Said	3.38_{b}	.48
Nullified Math Stereotype Threat	3.95_{b}	.51

Note. Means are adjusted for anticipated performance and domain identification score.

Means not sharing a subscript differ at $p<.05$.

Because the new condition was found to be threatening to performance (similar to the explicit math stereotype threat condition), subsequent analyses conceptualized the new condition as a nonspecific stereotype threat. Given this conceptualization, several orthogonal contrasts were planned to investigate the effects of stereotype threat on the measured processes and outcomes (see Table 4).

Effects on Achievement Goal Adoption

The main focus of this study was to document the pattern of spontaneous achievement goal adoption as a function of the stereotype threat characteristics in the context. Recall that past research has consistently illustrated the importance of considering an individual's achievement motivation when looking at achievement goal adoption (e.g., Barron & Harackiewicz, 2001; Elliot & Church, 1997; Harackiewicz & Elliot. 1993), thus, participants' achievement motivation scores as assessed by the Personality Research From (Jackson, 1974) were included in this examination. Participants' score on the achievement motivation scale were then recoded using this sample's mean split (-1 = low in achievement motivation, LAMS; 1 = high in achievement motivation, HAMS). An overall multivariate analysis of covariance was conducted to test for any main effects of the Stereotype Threat conditions and possible interactions with achievement motivation on the pattern of goal-related thoughts. Domain identification score, anticipated, and actual performance served as the covariates, based on their function in past stereotype threat research (e.g., Smith & White, 2001a) achievement goal research (e.g., Harackiewicz et al., 1997) and intrinsic motivation research (e.g., Renninger & Hidi,

Table 4

Planned Orthogonal Contrast Coding for Stereotype Threat Condition

Stereotype Threat Condition				Contrast Label
Nonspecific	Explicit Math	Nothing Said	Nullified	
-1	-1	0	2	Any Threat
1	-1	0	0	Type of Threat
-1	-1	3	-1	Mentioned Threat

2002). The overall 2(high achievement motivation (HAM) vs low achievement motivation (LAM)) X 4(Stereotype Threat condition) did not yield any significant effects.To examine the hypothesis that individuals' pattern of goal adoption differs as a function of stereotype threat conditions, it was desirable to test if participants (higher and lower in achievement motivation) subjected to any type of threat (i.e., the nonspecific stereotype or the explicit math stereotype) had comparable patterns of goal-related thoughts as participants for whom the stereotype was nullified. It was unclear how to statistically create a multivariate contrast that would examine only these two group extremes, especially considering the within subject, unevenly distributed, nature of the measures of spontaneously cited goal-related thoughts. To address this issue, the *nothing said about the stereotype* condition was dropped from the analyses, and three separate 2(HAM vs LAM) X 2(any threat vs nullified threat) analyses of covariance were conducted, with the number of each of the three goal-related thoughts serving as the dependent variables. Domain identification score, anticipated, and actual performance again served as the covariates. In addition, to adjust for the possibility of capitalizing on chance from conducting the three goal analyses separately, a more conservative alpha level was adopted. Using a Bonferroni type correction, the standard level of alpha (.05) was divided by the number of dependent measures (3) resulting in alpha = .02. Tests of the between participants effects indicated that there were no main effects for any of the goal-related thoughts (p's >.02). However, a significant interaction among achievement motivation and threat extreme condition (the nonspecific stereotype or the explicit math stereotype (any threat) vs nullified math stereotype) was found for the number of PAV-related thoughts, $F(1, 30) = 6.51$, $p<.01$, $R^2 = .27$. Follow-up results (also with Bonferroni

corrections) revealed that HAM participants subjected to any threat spontaneously cited more PAV-related thoughts compared to LAMS in the same condition and HAMS in the nullified stereotype condition, which did not differ from each other. Examination of the means also showed that HAMS in the nullified stereotype condition were the only participants to spontaneously cite mastery-related thoughts. Table 5 gives the adjusted means for this interaction.

In an effort to discover and interpret the different patterns of goal-related thoughts, I next conducted a discriminant function analysis. This analysis used the three spontaneously cited goal-related thoughts to predict participants' membership in the four experimental groups (i.e., HAMS in the any threat; HAMS in the nullified threat; LAMS in the any threat; LAMS in the nullified threat). Three discriminant functions were calculated, with a combined X^2 (9) = 103.71, p<.001, accounting for 89% of the between group variability. After removal of this first function there still remained a strong association between the experimental groups and the number of goal-related thoughts, X^2 (4) = 30.03, $p < .01$, accounting for 59% of the between group variability. The third function was not significant. Table 6 gives the structure coefficients for the two significant functions.

As seen in the structure matrix, for the first function both types of performance-related thoughts were the best predictors of the group membership of the participants, but in different directions. Thus, this dimension was characterized by both greater number of avoidance thoughts and lower number of approach thoughts. The groups' discriminant function scores indicated that this function maximally separated the HAMS in the Any Threat condition (centroid = 2.33) from the LAMS in this same condition (centroid =

Table 5

Threat Extremes (any threat vs nullified math stereotype) X Achievement Motivation: Estimated Means for Number of Goal-Related Thoughts.

Achievement Motivation	Goal-Related Thoughts		
	PAV	PAP	Mastery
HIGH			
Any Threat	.40	.47	.00
Nullified Stereotype	.00	.53	.50
LOW			
Any Threat	.00	1.51	.00
Nullified Stereotype	.44	1.09	.00

Note. Values are adjusted for domain identification, actual and anticipated performance for individuals above the median (high) and below the median (low) in achievement motivation.

Table 6

Structure Coefficients for the Discriminant Functions Using Number of Goal-Related Thoughts to Discriminate Achievement Motivation X Any Negative Threat Contrast Condition Assignment.

Goal-Related Thoughts	Function 1: "Pressures of Task Performance"	Function 2: "Potential for Task-Mastery"
PAV-Related	.32	.88
PAP-Related	-.40	.13
Mastery-Related	.10	-.80

-4.36) (other centroids: HAMS in the nullified condition: centroid = 1.64; LAMS in the nullified condition: centroid = -0.09). This suggests that the first function separated the groups on the basis of the pressure felt to perform the task at hand, with HAMS experiencing the greatest amount of pressure to not underperform on the task and LAMS experiencing the least.

The structure coefficients for the second function showed that the function was characterized by a greater number of PAV-related thoughts and a lower number of Mastery-related thoughts. In contrast to the first function which served to separate HAMS and LAMS under performance threats, the second function served to maximally separate HAMS and LAMS in conditions when the threat was nullified (HAMS, centroid= -2.25; LAMS, centroid=.80) (other centroids: HAMS in the any threat condition centroid = .75; LAMS in the any threat condition centroid = -.01). In particular, this difference seemed to be carried primarily by the HAMS, who showed greater mastery-related thoughts and lower PAV-related thoughts in the nullified condition, compared to LAMS whose mastery- and PAV- related thoughts appeared less affected by the nullification information. This suggests that the second function separated the groups on the basis of the potential felt to master the task at hand, with HAMS experiencing the greatest amount of potential to master the task. Together, these analyses suggest that the presence of stereotype threat information, as well as its nullification, affected the type of goals participants adopted when working on the computer-programming task, particularly for those individuals who are characteristically oriented toward achievement. I next examined whether the stereotype information affected motivation and performance on the

task, and, if so, whether these effects were associated with their different pattern of goals as well as with other potential mediators.

Overview of Regression Analyses

What implications does this have for females higher in achievement motivation who are working in a computer-related domain? The above results suggest that the stereotype-threatening context is not likely to orient these females towards approaching success, but rather their working environment is likely to orient them towards avoiding failure.

Multiple regression analyses were used to examine all of the experimental conditions on the motivation and performance outcome variables. A basic model was created such that the orthogonal stereotype threat contrasts (see Table 4), achievement motivation (centered; measured continuously) and a series of interactions terms created to test for all possible interactions with achievement motivation, were entered simultaneously. Keeping in line with past research, identification with the computer technology domain and anticipated performance again served as the covariates (actual performance was not included as a covariate because it was tested as an outcome). All terms that were not significant in any analysis were trimmed from the model, resulting in a final basic model consisting of four terms: 2 main effects (achievement motivation, any threat contrast); 1 interaction (achievement motivation X any threat contrast) and 1 covariate (domain identification).

To demonstrate mediation three requirements must be met (Baron & Kenny, 1986). The first step must demonstrate a significant relationship between terms from the basic model and the outcome measure (interest, future interest, performance). The second step

has two parts: a) a significant relationship needs to exist between the hypothesized mediator(s) and the outcome measures, controlling for the terms from the basic model and b) a significant relationship needs to exist between the terms from the basic model and the hypothesized mediator(s). Third, the previously significant terms from the basic model that predicted the outcome measure should be reduced once the mediator(s) are controlled (with only partial mediation indicated if the effects still exert some significant effects).

The results from the multivariate analysis of covariance indicated that the any threat comparison interacted with achievement motivation to predict differential patterns of PAV-related and mastery-related thoughts for HAMS and LAMS. To follow up on these findings (which address step 2b for testing mediation), a Goal Effects model was created to test for possible effects of goal-related thoughts on the outcome variables. The main effects of goal-related thoughts, and the interaction between goal-related thoughts and achievement motivation were added to the basic model resulting in final Goal Effects model consisting of the 4 terms from the basic model, in addition to: 3 main effects (PAV- PAP- and Mastery-Related thoughts), and 3 interactions (each goal related thought X achievement motivation), resulting in a final Goal Effects model consisting of 10 terms.

To interpret any significant interactions from the regression equations, predicted values were generated using contrast codes for the condition contrast terms and achievement motivation scores one standard deviation above and below the mean for achievement motivation terms.

Effects on Immediate Interest

When Interest was regressed on the basic model, the model was significant overall $F(4,47) = 2.79, p < .05, R^2 = .16)$. Within this overall significant model, there was a significant main effect of the Any Threat Contrast (β=.30, = 2.16, $F(1,47) = 4.32, p < .05$) indicating that participants for whom the stereotype was nullified reported experiencing more interest compared to those who were subjected to any threat. This main effect was qualified by a significant interaction with Achievement Motivation (β =.29, $F(1,47) = 4.14, p < .05$), such that the effect was particularly true for individuals higher in achievement. Predicted values for the interaction are reported in Table 7. No other significant effects emerged.

When interest was regressed on the Goal Effects model, the overall model was marginally significant ($F(10,41) = 1.92, p = .07, R^2 = .32$), but did not account for significantly more variance than the basic model (p=.17). The main effect of the Any Threat Contrast remained significant (p<.05) and its interaction with achievement motivation remained marginally significant (p=.09). There was a marginal main effect for performance-approach related thoughts (β =.25, $F(1,41) = 3.56, p = .08$) suggesting that participants who reported more PAP-related thoughts also expressed more immediate interest in the task. No other main effects or interactions with goal-related thoughts approached significance.

Testing goals as the mediator between experimental conditions and immediate interest. Although the Goal Effects model yielded only a marginal effect for PAP-related thoughts on interest, an ancillary mediational analysis was carried out to examine the role of each individual goal in mediating this relationship. Analyses were next repeated

Table 7

Any Threat Contrast Condition X Achievement Motivation:

Predicted Values for Immediate Interest

Achievement Motivation	Immediate Interest
HIGH	
Any Threat	2.72
Nullified Stereotype	4.52
LOW	
Any Threat	3.10
Nullified Stereotype	2.85

Note. Values are predicted from Regression equations for individuals one SD above the mean (high) and one SD below the mean (low) on achievement motivation.

including the main effect for each goal separately. Results revealed that the goals individually accounted for some of the variance between the Interaction-interest relationship. Specifically, the resulting model including PAP-related thoughts rendered the overall model significant ($R^2 = .23$, $F(5,46) = 2.68$, $p < .05$), accounting for more variance in interest than the basic model ($\Delta R^2 = .07$, $\Delta F(1,46) = 3.96$, $p = .05$). PAP-related thoughts had a significant effect on interest ($\beta = .26$ $F(1,46) = 3.98$, $p = .05$), however the Interaction-interest regression coefficient remained significant, dropping slightly from $\beta = .29$, $p < .05$ to $\beta = .28$, $p < .05$. The resulting model including PAV-related thoughts was marginally significant overall ($R^2 = .12$, $F(5,46) = 3.71$, $p = .07$), however PAV-related thoughts did not have a significant effect on interest, indicating that it was not a significant mediator (the interaction regression coefficient remained significant, but nonetheless dropped from $\beta = .29$, $p < .05$ to $\beta = .27$, $p = .05$). Finally, the resulting model including mastery related thoughts was significant, ($R^2 = .21$, $F(5,46) = 2.45$, $p < .05$), and accounted for marginally more variance in interest than the basic model ($\Delta R^2 = .05$, $\Delta F(1,46) = 2.98$, $p = .09$). Although mastery-related thoughts had only a marginal effect on interest ($\beta = .25$, $F(1,46) = 3.44$, $p = .09$), the interaction term had only a marginal direct effect on interest, with the regression coefficient reduced from $\beta = .29$, $p < .05$ to $\beta = .24$, $p = .09$. These results suggest that mastery-related thoughts and PAP-related thoughts serve as at least indirect mediators of the relationship between the Any threat Contrast X Achievement Motivation interaction and immediate task interest.

It should be noted, however, that mastery related thoughts were reported only among HAMS in the nullified stereotype condition. As such, a new analysis was conducted using the mastery related thoughts, achievement motivation, and interest variables to

determine if mastery-related thoughts mediated the relationship between achievement motivation and immediate interest in the nullified stereotype condition only, and this was shown. That is, within the nullified threat condition, achievement motivation significantly predicted interest, (R^2 = .34, β = .63, F (1,11) = 7.13, p < .05). However, when controlling for mastery-related thoughts, achievement motivation no longer significantly predicted interest (ΔR^2 = .13, ΔF (1,10) = 2.26, p = .16), with the regression coefficient for achievement motivation dropping from β =.63, p<.05 to β =.45, p=.16.

Effects on Future Interest

Regressing future interest on the basic model failed to yield an overall significant model effect. Similarly, regressing future interest on the Goal Effects model also failed to yield a significant model effect. However, when next regressing future interest on the basic model, including interest, the model was significant, F(5,46) = 3.57, p < .05 R^2 = .33). Results revealed a main effect of the domain identification covariate (β =.27, F(1,46) = 4.30, p < .05) indicating that individuals with higher domain identification were more willing to take a CS-related job in the future. In addition, immediate interest in the task also significantly predicted future interest, (β =.44, F(1,46) = 6.76, p < .01) suggesting that participants who reported the task to be interesting, were more willing to consider taking a computer science related job in the future. Thus, although the stereotype threat information did not directly affect future interest in the computer science domain for either HAMS or LAMS, these results suggest that it may indirectly affect future interest through the effects on immediate interest. No other main effects or interactions approached significance.

Effects on Performance

Regressing actual performance on the basic model failed to yield an overall significant model effect. Similarly regressing actual performance on the Goal Effects model also failed to yield a significant model effect.

Additional Potential Process Measures

To examine other potential process measures, and to explore whether and how the patterns of adopted goals were associated with other processes proposed in the STEP model, the role of the process measures on the outcome measure of interest was explored. Where applicable, mediational analyses were conducted following the guidelines set forth by Judd and Kenny (1981). Several potential process measures were assessed in this study: feelings of task value, task involvement, affect, and perceived competence.

Direct Effects on Process Measures

Regressing each of the process measures on the basic model revealed only a significant overall model for perceived competence ($F(4,47) = 2.48$, $p = .05$, $R^2 = .17$). Results for perceived competence showed a main effect of the Any Threat contrast ($\beta = .33$, $F(1,47) = 4.80$, $p < .05$). Individuals for whom the stereotype was nullified reported greater perceived competence compared to individuals subjected to the two any threat conditions. No other overall models approached significance for the remaining process variables. These results suggest that of the four potential mediators tested, only perceived competence might serve as a potential mediator of the Any Threat main effect on interest.

Regressing each of the process measures on the Goal Effects model revealed only a trend for the overall model on the pleasant dimension of affect ($F(10,41) = 1.73, p = .10$, $R^2 = .30$). Results for reported pleasant affect showed an interaction between mastery-related thoughts and achievement motivation ($\beta = .33$, $F(1,41) = 4.62, p < .05$). Examination of the predicted values suggest that for participants higher in achievement motivation, the more mastery-related thoughts they reported the more pleasant affect they also reported. As noted previously, mastery goals were only cited in one of the conditions (i.e., by HAMS in nullified stereotype conditions), which may explain why terms from the basic model did not significantly predict reported affect. Although pleasant affect could not therefore serve as a mediator of the basic model effects on interest, this finding suggests that it may serve as an indirect route through which HAMS who adopt mastery goals experience greater interest.

Testing perceived competence as the mediator between experimental conditions and immediate interest. A series of standard and hierarchical regression analyses were used to test if perceived competence mediated the effects of the Any Threat main effect and the Any Threat X Achievement Motivation interaction on the experience of immediate task interest. According to guidelines previously discussed guidelines (Baron & Kenny, 1986), I regressed interest on the basic model to which perceived competence had been added. The resulting model was significant ($F(5, 46) = 8.55, p < .001$, $R^2 = .43$), and accounted for more variance than the basic model ($\Delta R^2 = .32$, $\Delta F\ (1,46) = 28.62, p < .001$). Perceived competence significantly predicted interest ($\beta = .63$, $F\ (1,46) = 10.70, p < .001$). The previously significant main effect of the Any Threat contrast was no longer significant ($\beta = .09$, $F\ (1,46) = 1.60, p = .43$), whereas the interaction with achievement

motivation remained marginally significant (β =.20, F (1,46)= 3.60, p =.08). Together, these results support perceived competence as a mediator of the Any Threat contrast on interest, such that the lower interest associated with the stereotype threat conditions for everyone may be due in part to the lower perceptions of competence in these conditions. However, perceived competence only partially mediated the interaction with achievement motivation.

Next, an interactional mediation analysis was conducted to test if the Any Type Threat X Achievement Motivation effect on immediate interest was mediated through the interaction between perceived competence and the Any Type Contrast. Following the procedures outlined by Judd and Kenny (1981), two new product terms were created: perceived competence X Any Type Threat Contrast and the three-way product term involving achievement motivation. The main effect of perceived competence and the two new product terms were added to the basic model using Hierarchical Regression Analysis procedures. Results indicated that neither of the interactional models (i.e., the three-way or trimmed two-way) were significant and did not account for significantly more variance than the basic model. Indeed, follow-up examination also revealed that neither of the interaction terms were significant, nor was the effect of the original Any Threat Contrast X Achievement Motivation interaction on interest reduced.

Supplementary Mediation Analysis for Performance

As reported previously, the basic model did not significantly predict participants' performance on the computer programming task. However, the initial Stereotype Threat replication analysis suggested that there were different patterns in performance. To

follow-up the replicated Stereotype Threat condition effects on actual performance on the task, a series of standard and hierarchical regression analyses was used to test if perceived competence served as the mediator between this stereotype-performance relationship. To test this, stereotype threat condition was treated as a linear variable increasing in "degree" of threat, coded as follows: Non-Specific Stereotype Threat=3; Explicit Math Stereotype = 2; Nothing Said = 1; Nullified Stereotype = 0). To test the first step in mediation, I regressed performance on this linear variable only, and this analysis was significant (R^2 = .11, $F(1,49) = 5.82$, $p < .05$; $\beta = .33$, $F(1,49) = 4.82$, $p < .05$), see also Table 2). The second step has two parts: a) a significant relationship needs to exist between perceived competence and actual performance, controlling for the Stereotype Threat Condition and b) a significant relationship needs to exist between the Stereotype Threat Condition and perceived competence. Perceived competence was able to significantly predict actual performance when controlling for Stereotype Threat Condition ($\Delta R^2 = .11$, $\Delta F(1,48) = 6.57$, $p < .01$; $\beta = .35$, $F(1,48) = 5.12$, $p < .01$), perceived competence was also significantly predicted by the Stereotype Threat Condition, (R^2 = .11, $F(1,50) = 6.30$; $\beta = .34$, $F(1,50) = 5.02$, $p < .05$). Finally, the relationship between Stereotype Threat Condition and actual performance needs to be eliminated or reduced when controlling for perceived competence, and this was shown ($\Delta R^2 = .03$, $\Delta F(1,48) = 2.08$, $p = .16$). The regression coefficient dropped from $\beta = .33$, $p < .05$ to $\beta = .20$, $p = .16$). Because all of the requirements were met, it may be concluded that perceived competence mediated the effects of stereotype threat on performance. Because perceived competence was assessed following task performance, however, it was necessary to test the alternative mediational model as well.

Testing actual performance as the mediator between stereotype threat condition and perceived competence. To test for this alternative, I regressed perceived competence on the linear variable of Stereotype Threat Condition, controlling for actual performance. The relationship between Stereotype Threat Condition and perceived competence was reduced when controlling for actual performance (from $\beta = .34$, $p < .05$ to $\beta = .25$, $p = .06$), although it was still marginally significant. Thus, although participants were not provided with any feedback regarding their performance, there does appear to be some evidence that performance itself might be a partial mediator of the effects of stereotype threat condition on perceived competence, although there was still variance left to explain.

Discussion

Results of this study provided evidence for the existence of stereotype threat effects as it applies to the computer-science domain. The female participants in this study appeared to perform best on the computer-programming simulation task (the CAAT) when a relevant gender stereotype was nullified. Although this effect was only marginally significant ($p = .06$), and the effect size was small (.17) according to standards set by Cohen and Cohen (1983), the practical magnitude of this effect is noteworthy. Because the current project deals with a real-world phenomenon (females who are potentially subjected to stereotypes in computer science domains), Rosenthal (1990) claims that the more useful index of the effect size is the Binomial Effect Size Display (BESD, computed by taking .50 plus one half of r and minus one half of r to compare two conditions). The BESD is a correlation coefficient illustrating the difference in outcome

rates between two groups that is standardized and therefore always sums to 100. Interpretation of the calculated BESD for this effect shows that the task performance of 42 out of 100 females who are subjected to any type of stereotype threat (BESD = 71) will suffer compared to females for whom the stereotype is nullified (BESD = 21). Clearly, the effect of being subjected to any type of stereotype threat in this computer science context is not small, especially for those who count themselves among the 42% whose performance is negatively affected.

For the first time, results also provided evidence for one potential mechanism of the stereotype threat-performance relationship (Smith, 2002). The stereotype threat effects on performance were mediated by the measure of perceived competence. Stereotype threat, then, appears to do its damage to performance by impacting a person's feelings of competence while working on the stereotype-relevant task. In addition to performance outcomes, this study was the first of its kind to demonstrate that reports of immediate task interest were also negatively affected by the stereotype information in the situation, which in turn predicted willingness to take a computer-related job in the future. The effect of the stereotype information was especially true for individuals higher in achievement motivation. Individuals lower in achievement motivation appeared relatively unaffected by the stereotype conditions.

Smith and White (2001b) found that under "normal" conditions (i.e., when nothing is said about a stereotype), performance was equally (negatively) affected by stereotypes (in this case, a stereotype that was "implicitly activated" by the situation). Contrary to these findings, results from the current study found that normal conditions led to better performance than the stereotype conditions. Optimistically, this finding suggests that the

performance stereotypes associated with computer science related domains might not always be activated or influential in every CS-related situation. However, the pattern of results showed that participants performed worse on the CAAT when told nothing at all, compared to when a stereotype was nullified, suggesting that at least for some people in this study a stereotype might have been salient. Thus, it seems possible that in so far as this laboratory CS situation was seen as "normal," the relevant performance stereotypes were distal enough to affect performance only for those participants who were concerned about "confirming the stereotype" (Steele & Aronson, 1995).

The main purpose of this study, however, was to document the pattern of achievement goal adoption as a function of important individual (achievement motivation) and situational (stereotype) characteristics. Contrary to predictions, the stereotype information itself did not show a direct effect on goals. However, as expected, it was important to consider the moderating influence of achievement motivation (e.g., Barron & Harackiewicz, 2001; Harackiewicz & Elliot, 1993). Indeed, the main hypothesis that participants higher in achievement motivation subjected to any stereotype threat in the situation would report more PAV-related thoughts compared to PAP-related thoughts was supported. In addition, it was found that compared to everyone else, participants higher in achievement motivation for whom the stereotype was nullified were the only ones to report mastery-related thoughts.

Importantly, the stereotype conditions associated with the most PAV-related thoughts for participants higher in achievement motivation were also the same conditions that showed negative process and outcome results. Participants subjected to any stereotype threat showed the lowest levels of: perceived competence, task interest, and actual task

performance. In contrast, the condition associated with the most mastery-related thoughts for participants higher in achievement motivation (i.e., the nullified math-stereotype condition) was also the same condition that showed positive process and outcome results.

The pattern of results for participants lower in achievement motivation, on the other hand, showed that they were not likely to report PAV-related thoughts in any of the conditions, and unlike HAMS, seemed to be unaffected by the nullified stereotype information. A preliminary test of the mediating role of goal adoption on immediate task interest, revealed that that each of the goals was able to somewhat reduce the relationship between the experimental conditions and interest, particularly PAP-related thoughts and mastery-related thoughts (although mastery related thoughts seemed to only play a role for participants higher in achievement motivation, who were actually the only ones to report mastery-related thoughts).

Given that it had been demonstrated that self-adopted goals were an important mechanism between experimental conditions and interest, it was desirable to begin to understand the higher-level aspects of the STEP model, namely to discover what next mediates the relationship between goals and interest. As warned by Judd and Kenny (1981), however, when the "mediating chain" is a long one, the likelihood of meeting all of the steps required to test for mediation is potentially jeopardized, and this was the case. Furthermore, the design of this study made it difficult to determine which process variable occurred first in time, perceived competence or goal adoption (cf., Elliot, Faler, McGregor, Campbell, Sedikides, & Harackiewicz, 2000). It is also important to recognize that these results were all correlational and the sheer number of self-reported measures raises the potential for a cumulative internal validity problem. To address this issue and

to flush out the effects of stereotyped induced goals on the processes proposed by the STEP model, Study 2 was designed to manipulate goal assignment (Elliot & Harackiewicz, 1996) and examine the possible independent and interactional effects of assigned goals on the process and outcomes variables (cf., Barron & Harackiewicz, 2001).

STUDY 2

The results from Study 1 suggested that stereotype threat information was related to different patterns of spontaneous goal adoption for females higher in achievement motivation, such that they become more likely to report PAV-related goals and less likely to report PAP-related goals under conditions of threat. Threat conditions were also associated with lower levels of interest, particularly for HAMS. However, as explained above, examining the relationships between the goals females spontaneously adopted and resulting interest was difficult for a number of reasons. Thus, a major purpose of Study 2 was to examine the relationship between performance goals and interest in the computer programming task, using a between participant's design. In this way, the manner in which HAMS and LAMS respond once encouraged to adopt particular achievement goals can be compared. In addition, Study 2 examined whether performance goals were associated with decreased interest because they were experienced as incompatible with interest goals, or whether the mere presence of performance goals made interest goals less likely to emerge. To test this, Study 2 also varied whether females were explicitly assigned an interest goal.

For this experiment, a different set of participants meeting the same criteria set forth in Study 1, were recruited for participation. Participants higher and lower in achievement

motivation were randomly assigned to conditions in a 3(provided with a PAV-goal vs. provided with a PAP-goal vs. no goal explicitly provided) by 2(interest goal provided vs not provided) between participants design.

Study 2 was also designed to allow participants the option of engaging in a relatively interesting off-task chat room. Visiting the chat room could then serve as a potential strategy to regulate interest while working on the computer programming task. The self-regulation of interest is an important process variable hypothesized here to contribute to the relationship between goals and the outcome variables. Mapping onto the approach/avoidance goal distinction demonstrated by Crowe and Higgins (1997) and predicted by Linnenbrink and Pintrich (2000), it was predicted that participants provided with a PAV-goal would click on the chat room links much less than participants provided with no performance goal, with participants provided with a PAP-goal falling in between the two. I also explored whether hypothesized achievement goal results for strategy use were offset or enhanced by the presence of the interest goal and or the participants' achievement motivation.

In addition to adding in a potential measure of self-regulation of interest, the outcome measures of future interest and performance were expanded in Study 2. Because Study 2 was the first of its kind to vary both achievement goals and interest goals, a number of the predictions was exploratory. For example, it was possible that the provided interest goal would enhance motivation outcomes across performance goal conditions, and no interaction would be found. In this case, the provided interest goal might be expected to augment the no goal provided condition, such that participants in this condition would

demonstrate the greatest levels of immediate and future interest for all participants because the only goal they would be operating under was the provided interest goal. It was unclear whether and how achievement motivation might moderate this effect.

Another possibility, however, was that the provided interest goal would enhance interest and future interest for everyone except those in the PAV-goal condition because interest as a goal would not be in match with the participants' avoidance focus (cf., Sansone, et al., 1989). In this case, it might be predicted that the positive effects of the provided interest goal would be attenuated by the performance-goal condition, such that unlike participants in the other conditions, participants provided with a PAV-goal would not obtain any benefit when provided with the interest goal. These results might be further attenuated by achievement motivation. For example, participants lower in achievement motivation who are given an explicit interest goal when the task parameters are in match with their individual orientation (i.e., a PAV-goal condition for LAMS) might be more likely to report higher levels of interest and future interest in the task (cf., Sansone & Smith, 2000).

Gender-stereotypes were made salient for all participants in the current study (Steele & Aronson, 1995) in order to integrate conclusions with Study 1, and to inform the STEP model. Consequently, it was possible that performance on the CAAT would be low for all participants. However, based on the achievement goal literature, a main effect of achievement goal on performance could be predicted such that participants given a performance-avoidance goal would demonstrate poor performance compared to participants given a performance-approach goal, with no goal provided participants performing in the middle (e.g., Harackiewicz et al., 2000). On the other hand, it was

possible that either type of performance goal would enhance performance compared to when no performance goal was provided, assuming that "success" on the task was possible to attain (Linnenbrink & Pintrich, 2000). Similar to the unknown interaction effects on motivation, no a priori predictions were made about the possibility of an interaction with interest goals, or the three-way interaction with achievement motivation. However, some tentative support for expecting no two-way goal interaction comes from research by Barron and Harackiewicz (2001) who documented no interaction between a provided PAP-goal and a provided mastery goal on performance. However, their manipulation of mastery-goal included an explicit focus on skills, whereas the interest goal in the current study did not. Another possibility, then, was that any positive effects of the provided interest goal would be attenuated by the performance-goal such that the provided non-skill focused interest goal would be out of match with the positive approach focus on performance afforded by the PAP-goal, and that this might be especially true for participants higher in achievement motivation who were already oriented towards performance (cf., Sansone et al., 1989). Finally, it was possible that any of these predictions would be true for only certain types of performance (e.g., Elliot & McGregor, 1999; Harp & Myer, 1997). To test this, the same guided error-fixing component that was used in Study 1 was again used here. In addition, an open-ended program building component was also included.

Method

Participants

A total of 106 female participants enrolled in introductory classes (i.e., psychology, sociology, environmental science) were selected for participation in the study if they

reported moderate levels of identification with the computer technology domain as determined in a mass testing session by the Domain Identification Measure (DIM, Smith & White, 2001). The majority of participants were recruited from the introduction to psychology classes. Ten participants were excluded from analyses because of large amounts of incomplete data (due to a computer error), and four participants were excluded due to incorrect responses on the manipulation check. In addition, five Asian-American participants were excluded from analyses to ensure that the sample was similar to Study 1. Data from the remaining 87 participants (approximately 15 participants per condition; 91% reported freshmen or sophomore status; 92% Anglo-American, 5% Hispanic descent, remaining 3% were self-described as "other") are reported below. All participants received extra credit in their courses for their participation.

Procedure

Similar to Study 1, participants (in groups of 1 to 4) were met by a female experimenter, given a set of headphones, and then seated individually in front of a computer (separated by partitions). Participants then listened to and followed along with the tutorial, and completed the post-tutorial questionnaire (identical to the procedure in Study 1). To induce gender-stereotype salience, participants were then asked to fill out a demographic survey, which instructed them to check off their gender by marking the appropriate box (similar to procedures by Steele & Aronson, 1995; see also Blanton, Crocker, & Miller, 2000). Participants in the no goal conditions then heard the same overview of the CAAT as in Study 1. Employing a slight variation on Elliot and Harackiewicz' (1996) manipulations of performance goals, and Elliot and Dweck's

(1988) manipulation of task focus, participants in the performance goal conditions then heard the same overview with the addition of: "The purpose of this project is to collect data on computing aptitude by comparing beginning college students to one another in their ability to use mathematics skills to do computing. This aptitude tool will really show what you can do". Participants assigned to the *PAV-goal condition* heard "In our work we have found that some students stand out because they do quite poorly on the CAAT. For instance, if you do worse on the computing aptitude assessment tool than a majority of University of Utah students, you will demonstrate that you have poor computing aptitude" whereas participants in the *PAP-goal condition* heard, "In our work we have found that some students stand out because they do quite well on the CAAT. For instance, if you do better on the computing aptitude assessment tool than a majority of University of Utah students, you will demonstrate that you have good computing aptitude."

Embedded within the remainder of the overview was the interest goal manipulation. Participants assigned to the *interest-goal not provided* condition were told nothing further whereas participants in the *interest-goal provided* condition read, "For your information, in our work we have [also] found that some students get a lot of enjoyment from the CAAT. This session will give you the opportunity to have fun and enjoy computing. This aptitude tool will really allow you to explore the different features of the task."

For all participants, the overview ended with a section describing an additional new "discussion chat room component" of the CAAT that the experimenters were testing. Participants were informed that were allowed to visit the chat room, but that it was not required. Furthermore, they were informed that whether or not they visited the chat room

would not be used in the results of the CAAT. Once the overview was complete, the narrator directed all participants to complete the instruction awareness survey and the anticipated performance item (similar to Study 1). Next, participants were told to click on a link that connects them to their assigned programming task. All participants then begin working on an extended version of the CAAT (described below, see Appendix B for a hardcopy of the CAAT.).

Participants were given 25 minutes to work on the CAAT. Although participants were informed that they had a "set amount of time" to complete the CAAT, they were not informed as to the exact duration (similar to Smith, 2000). This was necessary to ensure that any use of the chat room was strategic in nature. The narrator remained silent until the 25 minutes had expired, at which time, the narrator instructed the participant to stop working. The computer then changed screens and directed participants to an envelope located in the back of their notebook. The envelope contained a memo asking the participant if they would like to request any brochures. To reduce possible experimenter and subject demands, the participants were told that a secretary who was stationed in the "main office" would be filling the envelopes with their extra credit slips, a debriefing sheet, contact information for the School of Computing, and anything else they might want (i.e., extra brochures). Moreover, participants were instructed to put a mark of their choosing on the outside of their envelope so that only they could identify it, to reinforce that the requesting of the brochures was anonymous. Once all participants filled out the behavioral measure of future interest, the envelopes were then collected by the experimenter who left the room for several minutes to ostensibly take them to the "secretary." The request sheets were unobtrusively marked with a subject number to be

matched up with the participants' data (this procedure was modeled after Sansone et al., 1992; Smith, 2000).

While the experimenter was out of the room, all participants were instructed by the computer to fill out the remaining items in the notebook. The notebook contained the same items included in Study 1, with the addition of several items assessing participants' perceptions of the chat room and participants' ideas for interest-enhancing strategies. Upon the experimenter's return, all participants were given their envelopes, debriefed, thanked, and dismissed.

Task

The CAAT was identical to Study 1, with two notable exceptions. First, as seen in Appendix B, it was expanded to include a third performance section, which asked participants to build a working program to generate a set of outputs for three given variables (e.g., write the code to produce frequency counts on all three variables). A blank "programming screen" was displayed for participants to write their program.

Second, the expanded CAAT also included an interest-enhancing strategy option (one of the parameters essential to examine self-regulation). The interest-enhancing strategy appeared in the form of a hyperlink (titled "Visit the Discussion Chat Room") on a continuously visible sidebar. The hyperlink connected participants to a new (side-bar) web page that contained ostensible postings from past study participants. This strategy was selected based on past research showing that the presence of real (Isaac et al., 1999) or implied (Sansone & Smith, 2000) others can facilitate interest in a task (see also Smith et al., 2001). In addition, strategies related to interacting with other people were among

the most frequently mentioned in pilot testing (approximately 35% of responding females, $N = 60$) when students were asked to list three ways to make the described CS assignment more interesting.

Real participants had the option of clicking on and reading up to 3 postings, which were not titled. Each posting contained an exchange between three ostensible participants' discussion on computer-related issues (issues were not related to the CAAT or the study itself, e.g., blocking software). Each posting was 377 words and took approximately 1 minute 20 seconds on average to read (as determined in pilot testing). The content of the postings was chosen based on pilot data that demonstrated these three postings to be perceived as significantly interesting (as determined by a one-sample t-test testing the perceived interest level against the midpoint). However, each of the selected postings did not significantly differ from each other in interest level. Each posting was divided into three paragraphs (one paragraph for each ostensible participants' "response") and the paragraphs were arranged such that each posting contained first a neutral initial idea, followed by a negative reply, followed by a positive reply (as determined in pilot testing). See Appendix C for hard copies of the chat room postings.

Additional Dependent Measures

Instruction awareness check. A short survey (see Smith, 2000) was administered before the start of the CAAT to ensure understanding of the instructions (e.g., they have a set amount of time, they will not be asked questions about the discussion room, etc). For participants in the PAV-goal, PAP-goal, and interest-goal provided conditions, this measure also included a question assessing understanding of the goal manipulation.

Future interest. In addition to the self-report item used in Study 1, a behavioral measure of future interest in CS was observed. Participants were given an ostensibly "anonymous" opportunity to take home up to six brochures from the School of Computing Handbook (i.e., "A Road Map to Engineering" "A Major Deal: Becoming a Computer Science Major" "Career Services in Computing" " Instructional and Research Computing on Campus" "Computer Science Courses at the U" "Student Computing Organizations on Campus"). The specific titles of the brochures were selected based on pilot testing which demonstrated the selected titles to be perceived as "neutral" in interest level and importance (e.g., Smith, 2000).

The number of brochures requested was recorded. Responses to the self-report item and the number of brochures requested were then standardized (participant's scores were subtracted from the mean, and divided by the standard deviation) and summed to form a Total Standardized Future Interest score.

Performance. Points were again given for correct solutions for fixing the errors, and points were also awarded for the presence of a correct command used in the participants' programs (e.g., 1 point was awarded for including the word "FREQUENCIES" in their program). A total of 21 points was possible for the program-building syntax score. Points from both sections were also summed to form a cumulative Total Summed Performance score.

Chat room visits. The computer recorded the number of postings clicked on in the chat room (up to 3 links possible). The total number of links clicked on was calculated for each participant (ranging from 0 to 3) and submitted to analyses as an index of "strategy use".

Perceptions of the chat room. All participants were asked to fill out a "supplemental rating" survey. This survey (described in Study 1) also contained items to assess how distracting participants found the chat room, and if the participant visited the chat room, they were also asked to rate how interesting they perceived the chat room to be overall. All of these items used 7-point Likert scales (e.g., 1 (Not at all distracting) to 7 (Very distracting)). Participants were then asked to imagine that they had to do programming assignments like the CAAT on a regular basis, and to then list three things they would do to make it more interesting.

Results

The means, standard deviations, and possible range for all of the variables measured in Study 2 are reported in Table 8. Table 9 summarizes the correlations among the process and outcome variables across conditions. It is clear from the table that like Study 1, the variables were by and large positively related to each other. Similar to Study 1, the R^2 index was provided in all analyses as a gross estimate of the effect size of the overall model on the dependent variable.

Overview of Regression Analyses

Multiple regression analyses were used to examine the direct effects of the experimental conditions on the main dependent measures. A basic model was created such that a pair of orthogonal performance goal contrasts (performance goal present: PAV = .5, PAP = .5, none provided = -1; performance goal type: PAV = 1, PAP = -1, none provided = 0), the main effect of interest goal (interest goal provided = 1, interest goal not provided = -1),

Table 8

Descriptive Statistics for Study 2 Variables

Variable	Possible range	*M*	*SD*
Achievement motivation	0-16	10.78	2.33
Domain identification	1-5	2.85	.53
Interest	1-7	3.21	1.35
Number of links visited In the chat room	0-3	.67	1.09
Perceived competence	1-7	2.90	1.25
Task value	1-7	3.82	1.26
Task involvement	1-7	4.01	1.35
Affect	1-4		
Pleasant		2.55	.79
Unpleasant		2.20	.81
Active		2.19	.58
Deactive		2.62	.64
Anticipated performance	1-8	4.57	1.23
Actual performance			
Problem fixing (as measured in Study 1)	0-6	3.52	1.93
Program building syntax score	0-21	14.29	6.24
Total summed score		16.99	8.13
Future interest			
Number of sheets requested	0-6	.51	.98
Willingness to take a CS related job	1-7	2.49	1.66
Total standardized score		.001	1.00

Table 9

Study 2: Correlations among Process Variables and Outcome Variables.

Variable	1	2	3	4	5	6	7	8	9
1. Number of Links Clicked	-								
2. Chat room Interest	.48*	-							
3. Immediate Interest	-.18	-.01	-						
4. Involvement	-.18	-.16	.55**	-					
5. Perceived Competence	.02	-.12	.57**	.20	-				
6. Task Value	-.23*	-.03	.62**	.46**	.51**	-			
7. Pleasant Affect	.19	-.28	.39**	.08	.64**	.35**	-		
8. Future Interest	-.06	.44*	.32**	.25*	.12	.28*	.13	-	
9. Total Performance	-.09	-.01	.20	-.03	.39**	.23*.	.12	.06	-

Note: * $p < .05$; ** $p < .001$

the main effect of Achievement motivation (centered; measured continuously) and a series of interaction terms created to test for all possible interactions, were entered simultaneously. Similar to Study 1, anticipated performance served as a covariate to control for initial differences in pretask anticipated performance estimates, and was retained in the model when significant. Unlike Study 1, domain identification was not included as a covariate, because stereotype threat was not manipulated (Aronson et al., 1999).[8] All terms that were not significant in any analysis were trimmed from the model (including all higher-ordered interactions and all two-way experimental interactions) resulting in a final basic model that included eight terms: 4 main effects (performance goal type; any type of performance goal, interest goal, achievement motivation), 3 two-way interactions (performance goal type X achievement motivation; any type of performance goal X achievement motivation, interest goal X achievement motivation) and 1 covariate (anticipated performance). Predicted values were generated from the regression equations to interpret significant interactions, using scores one standard deviation above and below the mean Achievement Motivation to represent typical high and low scorers.

Effects on Immediate Interest

Regressing Interest on the *basic model* (F (8, 75) = 2.47, p <.05, R^2 = .23) yielded a significant main effect for anticipated performance (β= .26, F (1, 75) = 4.77, p <.05)

[8] To verify that including domain identification as a covariate was not necessary, all analyses were also run using both anticipated performance and domain identification as covariates. Domain identification was not found to be a significant covariate in most of the analyses, nor did its inclusion change the pattern of results.

suggesting that participants who anticipated doing better on the task, rated the task as more interesting. In addition, a marginally significant interaction emerged between type of performance goal and achievement motivation, (β = -.20, F (1, 75) =3.37, p =.09). As indicated by the predicted values (see Table 10) LAM participants reported greater immediate interest in the task when assigned PAV goals relative to PAP goals, whereas HAM participants showed a trend for the opposite pattern. The interest goal by achievement motivation interaction was significant (β = .27, F (1, 75) = 4.87, p <.05) suggesting that LAM participants reported more interest when not given an explicit interest goal, whereas HAM participants reported more interest when provided with the explicit interest goal (see Table 10). A pictorial summary is presented in Figure 3. No other significant effects emerged.

Effects on Future Interest

Regressing Standardized Future Interest on the *basic model* (F (8, 78) = 3.12, p <.01, R^2 = .26) yielded a significant main effect for anticipated performance (β = .36, F (1, 78) = 7.05, p <.01). Similar to the results for interest, participants who anticipated higher task performance expressed higher levels of future interest. Results also revealed a marginally significant main effect for achievement motivation (β = .20, F (1, 78) =3.61, p =.07) suggesting that compared to participants lower in achievement motivation, participants higher in achievement motivation expressed more future interest in computer science related activities. This main effect of achievement motivation was qualified by a marginally significant interest goal X achievement motivation interaction (β = .20, F (1, 78) = 3.79, p =.06). Similar to the pattern of results found for the experience of

Table 10

Goal Interactions with Achievement Motivation:

Predicted Values for Immediate Interest and Number of Visited Chat Room Links

Achievement Motivation	Immediate Interest	Number of Links Clicked
HIGH		
Performance Goal not Provided	2.89	.55
PAP-goal	3.48	.24
PAV-goal	3.38	.00
Interest Goal Provided	3.65	.32
Interest Goal not Provided	3.17	.27
LOW		
Performance Goal not Provided	3.18	.42
PAP-goal	1.92	1.07
PAV-goal	3.72	2.05
Interest Goal Provided	2.58	.47
Interest Goal not Provided	3.08	1.98

Note. Values are predicted from regression equations for individuals one SD above the mean (high) and one SD below the mean (low) on achievement motivation.

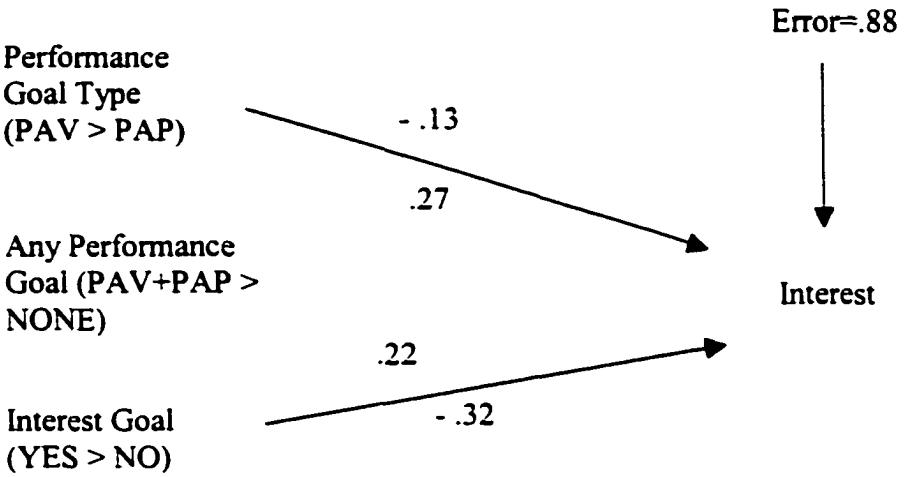


Figure 3

A diagram of the direction of the effects on interest. The direction effects are presented as a function of achievement motivation, with the path coefficients for participants higher in achievement motivation (HAMS) shown above the path and the path coefficients for participants lower in achievement motivation (LAMS) shown below the path. For clarity, the significant positive path for the anticipated performance covariate is not shown.

immediate interest, LAM participants expressed more future interest when not given an explicit interest goal, whereas HAM participants expressed more future interest when provided with the explicit interest goal. When next regressing future interest on the basic model, including interest (which was first centered), the model was also significant, $F(9,65) = 2.92, p < .01$ $R^2 = .29$). However, immediate interest in the task did not significantly predict future interest, ($\beta = .17, p > .10$), although the effect was in the expected direction. Because immediate and future interest were significantly correlated, these results suggest that part of that relationship was due to the common effects of the experimental variables on both. Thus, unlike Study 1 in which stereotype conditions interacted with achievement motivation to indirectly affect future interest through the effects on immediate interest, the results from Study 2 showed that the overall effects were more direct. No other main effects or interactions approached significance.

Effects on Performance

Regressing total performance on the *basic model* failed to yield a significant overall effect (F (7, 78) = 1.46, $p > .10$, $R^2 = .13$). Given that all participants were asked to mark their gender before beginning the task, this result may not be surprising because of a floor effect engendered by the salience of gender stereotypes (Steele & Aronson, 1995). However, to determine if error-fixing and program building components of performance were differentially influenced by the experimental conditions, the two performance measures were individually regressed on the basic model. Results showed that although program building syntax scores were not significantly affected (F (8, 73) = 1.13, $p > .20$, $R^2 = .12$), the overall model was marginally significant for error-fixing scores (F (8, 78) =

1.82, p=.09, R^2 = .17), yielding a significant main effect for the any performance goal contrast (β = .26, F (1, 78) = 4.67, p <.05). Results suggested that participants performed better when a performance goal was present (regardless of what type of performance goal it was) compared to when no performance goal was provided. However, because all participants were asked to work on the error-fixing component prior to the program building component, it was possible that program building syntax scores were affected by performance on the first component. Moreover, it was possible that if the variability was lower for each performance measure (i.e., if marked by floor effects), the power to detect any findings for performance goal assignment might be limited by the number of terms in the basic model (Judd & Kenny, 1981). To further explore these possibilities, exploratory analyses were conducted. The basic model was trimmed to include only the main effect of performance goal conditions. First, error-fixing scores were regressed on the trimmed model, and the overall model was significant (F(2,84) = 5.27, p < .01, R^2 = .11). Results again revealed a significant effect for presence of any type performance goal, and a marginal effect for type of performance goal condition (F(1,84) = 3.68, p = .07, β = .19), such that participants performed better on the error-fixing component in the performance-avoidance goal condition. Next, error-fixing scores were added to the trimmed model as a covariate, and program building syntax scores were regressed on the revised trimmed model, which was significant (F(3,78) = 12.02, p < .001, R^2 = .29). Results revealed a significant effect for the error-fixing scores (F(1,78) = 9.99, p < .001, β = .51) suggesting that participants who did better on the first component had higher program building syntax scores. In addition, a marginally significant effect for any type of performance goal emerged (F(1,78) = 3.40, p = .09, β= .17). Type of performance goal was not a

significant predictor. Although only exploratory, it should be noted that in contrast to results for the error-fixing scores which revealed a pattern for participants to perform better in the PAV-goal provided condition, examination of the means suggested a pattern or participants to perform better on the program building component in the PAP-goal condition (see Table 11).

Similar to Study 1, the role of the process measures in explaining the effects of immediate task interest was explored to begin to document the hypothesized stereotyped task engagement process. Where applicable, mediational analyses were conducted following the guidelines set forth by Judd and Kenny (1981) as explained in Study 1. In addition to the process measures assessed in Study 1, this study also included a measure of strategy use (i.e., number of links clicked on in the chat room).

Direct Effects on Process Measures

Effects on chat room visits. Regressing number of links visited in the chat room on the *basic model* (F (7, 77) = 2.59, p <.05, R^2 = .21) yielded a significant main effect for achievement motivation (β = -.32, F (1, 77) = 5.49, p <.01) such that participants lower in achievement motivation visited more chat room links than participants higher in achievement motivation. This main effect of achievement motivation, however, was qualified by a marginally significant interaction with type of performance goal (β = -.21, F (1, 77) = 3.59, p =.07). As was seen in Table 10, compared to all other participants, LAM participants provided with a PAV goal visited the highest number of chat room links. Among HAM participants, chat room visits were relatively unaffected by the type of performance goal manipulation. Regressing number of links visited in the chat room

Table 11

Descriptive Statistics for Performance Scores as a Function of Type of Performance Goals

Type of Performance Goal	Error-Fixing		Program-Building	
	M	*SE*	*M*	*SE*
PAV-goal	4.33	.34	13.99	1.04
PAP-goal	3.42	.36	16.14	1.03
No-performance goal	2.81	.33	12.88	1.03

Note. Means for the program-building syntax scores are adjusted for error-fixing scores.
Process Measures

on *basic model* also yielded a marginal main effect of interest goal condition (β = -.19, F (1, 77) = 3.48, p =.08) suggesting that participants provided with an explicit interest goal clicked on fewer links in the chat room compared to those not provided with an interest goal. This main effect of interest goal, however, was qualified by a significant interaction between achievement motivation and interest goal condition (β = .24, F (1, 77) = 4.29, p <.05), see Table 10. These findings are in line with the findings for immediate interest and future interest, such that LAM participants clicked on more links in the chat room when not given an explicit interest goal, whereas HAM participants' visits to the chat room seemed to be unaffected by the interest goal. A pictorial summary is presented in Figure 4. No other significant effects emerged.

Effects on perceived competence. Regressing perceived competence on the *basic model* (F (8, 75) = 2.41, p <.05, R^2 = .22) yielded a significant main effect for anticipated performance (β = .32, F (1, 75) = 5.88, p <.01). Similar to the results for interest and future interest, participants who anticipated doing better on the task reported higher levels of perceived competence. In addition, a significant interaction emerged between achievement motivation and interest goal condition (β = .30, F (1, 75) = 4.67, p <.05). These findings were in line with the findings for immediate interest, future interest, and number of links visited in the chat room, such that LAM participants reported more perceived competence when not given an explicit interest goal ($\hat{Y}$ = 3.35; provided with an interest goal condition $\hat{Y}$ = 2.08), whereas HAM participants reported more perceived competence when provided with the explicit interest goal ($\hat{Y}$ = 3.35; interest goal not provided condition $\hat{Y}$ = 2.86). Results also yielded a significant interaction between achievement motivation and type of performance goal (β = -.23, F (1, 75) = 3.87, p =.05).

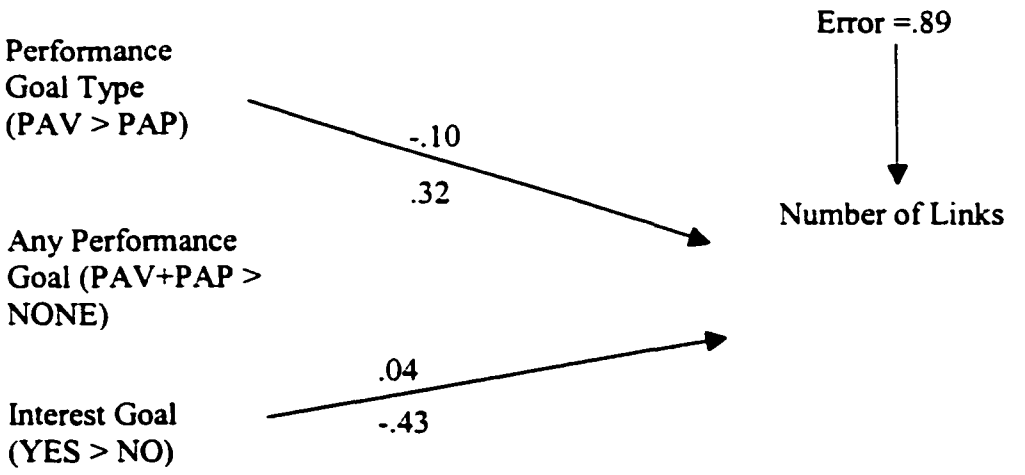


Figure 4

A diagram of the direction of the effects on number of links clicked on in the chat room. The direction effects are presented as a function of achievement motivation, with the path coefficients for participants higher in achievement motivation (HAMS) shown above the path and the path coefficients for participants lower in achievement motivation (LAMS) shown below the path.

As illustrated in Table 12 the pattern of results was similar to those found for immediate interest, among the HAMS the highest levels of perceived competence was reported for those in the PAP goal condition. In contrast, among the LAMS the highest levels of perceived competence was reported for those in the PAV goal condition. No other significant effects emerged. A pictorial summary is presented in Figure 5.

Effects on task involvement. Regressing task involvement on the *basic model* showed a trend for the significance of the overall model (F (7, 75) = 1.78, p =.10, R^2 = .16). Exploratory examination of the follow-up tests, however, revealed a marginal main effect of the any performance goal present contrast on feelings of involvement (β = -.19, F (1, 75) = 3.37, p =.09) such that participants who were provided with any performance goal reported lower levels of task involvement than participants who were not provided with a performance goal. Exploratory results also revealed a significant interaction between achievement motivation and type of performance goal on feelings of involvement (β = -.24, F (1, 75) = 3.94, p <.05). As shown in Table 12, LAM participants reported greater task involvement when assigned PAV goals relative to PAP goals, whereas HAM participants tended to show the reverse pattern. The task involvement results were similar to the immediate interest results among LAM participants (who reported the lowest levels of task involvement when provided with a PAP goal) and among HAM participants, (whose task involvement seemed to be relatively unaffected by the type of performance goal manipulation). A pictorial summary is presented in Figure 6.

Effects on affect. Each of the affect variables (activated, deactivated, pleasant, unpleasant) was regressed on the basic model. The overall model was only significant for

Table 12

Type of Performance Goal X Achievement Motivation:

Predicted Values for Affected Process Variables

Achievement Motivation	Perceived Competence	Task Involvement	Pleasant Affect
HIGH			
None Provided	2.37	4.82	2.43
PAP-goal	3.31	4.24	2.65
PAV-goal	2.97	3.63	2.14
LOW			
None Provided	1.92	3.72	2.28
PAP-goal	2.40	2.83	2.73
PAV-goal	3.89	4.62	3.32

Note. Values are predicted from regression equations for individuals one SD above the mean (high) and one SD below the mean (low) on achievement motivation.

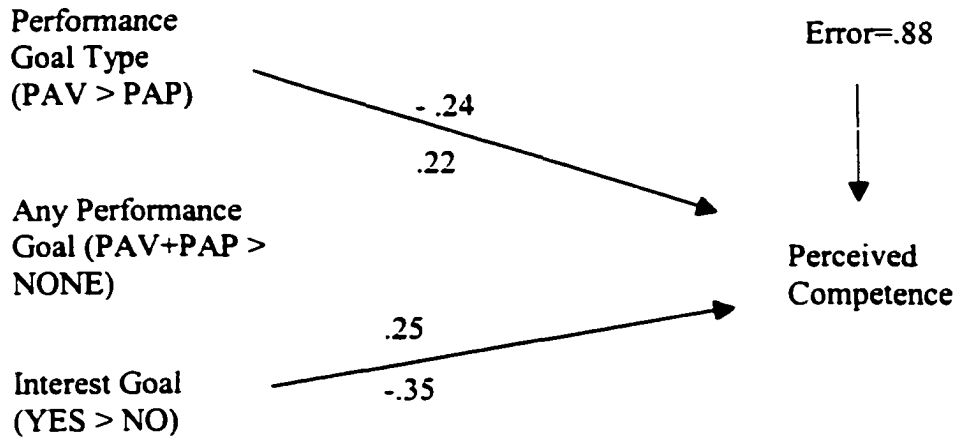


Figure 5

A diagram of the direction of the effects on perceived competence. The direction effects are presented as a function of achievement motivation, with the path coefficients for participants higher in achievement motivation (HAMS) shown above the path and the path coefficients for participants lower in achievement motivation (LAMS) shown below the path. For clarity, the significant positive path for the anticipated performance covariate is not shown.

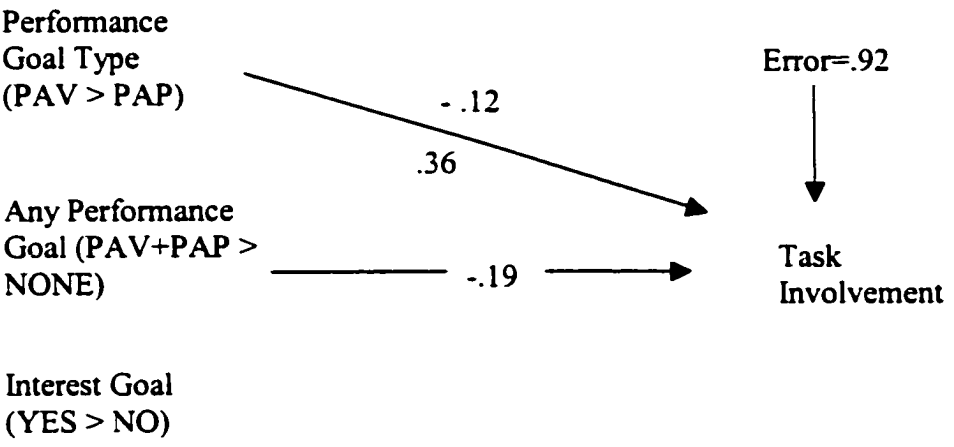


Figure 6

A diagram of the direction of the effects on task involvement. The direction effects are presented as a function of achievement motivation, with the path coefficients for participants higher in achievement motivation (HAMS) shown above the path and the path coefficients for participants lower in achievement motivation (LAMS) shown below the path. Achievement motivation did not interact with the any performance goal contrast, thus only the main effect path coefficient is reported.

the pleasant dimension, (F (8, 78) = 3.15, p <.01, R^2 = .26) revealing a main effect for pretask anticipated performance (β = .41, F (1, 78) = 7.96, p <.001), and a marginal main effect for achievement motivation (β = -.21, F (1, 78) = 3.76, p =.06). These results suggest that participants reporting higher levels of anticipated performance experienced more positive affect compared to participants reporting lower levels of anticipated performance. In addition, participants lower in achievement motivation also reported experience higher levels of pleasant affect, compared to participants higher in achievement motivation. Finally, a significant type of performance goal X achievement motivation interaction (β = -.25, F (1, 78) = 4.39, p <.05) was also found (see Table 12). HAMS reported greater pleasant affect when assigned PAP goals relative to PAV goals, whereas among LAMS pleasant affect seemed to be relatively unaffected by the type of performance goal manipulation. No main effects or interactions were found for the remaining affect variables. A pictorial summary is presented in Figure 7.

Effects on task value. Regressing reported task value on the *basic model* (F (7, 75) = 2.58, p <.05, R^2 = .21) yielded a main effect for achievement motivation (β = .30, F (1, 75) = 5.26, p <.01) such that participants higher in achievement motivation reported the task as more valuable than participants lower in achievement motivation. This main effect of achievement motivation, however, was qualified by a marginally significant interaction with any performance goal (β =.21, F (1, 75) = 3.75 p =.06), such that HAM participants provided with any performance goal rated the task to be especially valuable compared to all other participants. Likewise, a marginally significant interaction between achievement motivation and interest goal condition also emerged, (β = .21, F (1, 75) = 3.80, p =.06). In line with the results from the other variables in which this interaction

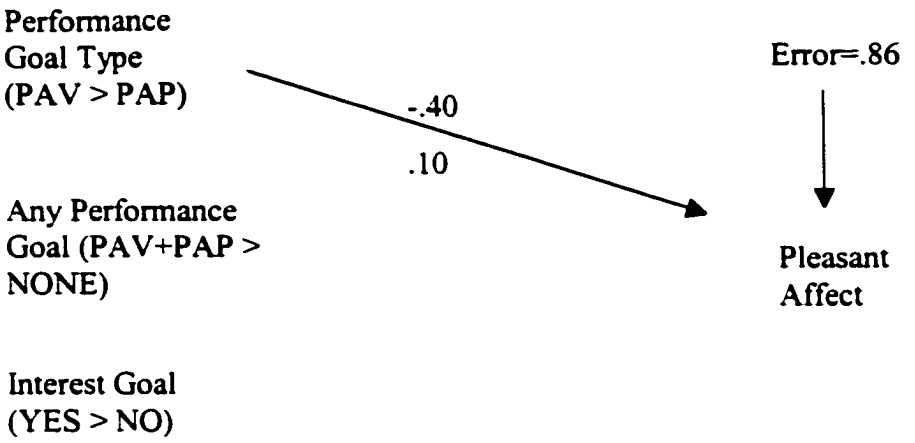


Figure 7

A diagram of the direction of the effects on positive affect. The direction effects are presented as a function of achievement motivation, with the path coefficients for participants higher in achievement motivation (HAMS) shown above the path and the path coefficients for participants lower in achievement motivation (LAMS) shown below the path. For clarity, the significant positive path for the anticipated performance covariate is not shown.

emerged, results showed that LAM participants reported more task value when not given an explicit interest goal, ($\hat{Y}$ = 3.28; LAMS with interest goal, $\hat{Y}$ = 2.84) whereas HAM participants reported more task value when provided with the explicit interest goal ($\hat{Y}$ = 4.69; HAMS not provided with an interest goal, $\hat{Y}$ = 4.15). No other main effects or interactions were found. A pictorial summary is presented in Figure 8.

Overall Mediational Analysis

The above results illustrate the outcomes associated with different goal assignments. The implication thus far is that compared to females lower in achievement motivation, higher achieving females working on a stereotype-relevant task (such as a computer program) will experience lower motivation in contexts that engender performance-avoidance orientations, which we know from Study 1 are elicited by the presence of a threatening stereotype.

One of the main purposes of Study 2 was to examine the processes involved in stereotyped task engagement as a function of goals and achievement motivation. As such, it was desirable to examine all of the process variables together to evaluate their contribution to the relationship between the experimental conditions and immediate task interest. Given the sometimes marginal overall model effects but significant individual effects for certain process variables, it was necessary to avoid capitalizing on chance by selecting only those process variables that a) resulted in overall significant models or b) resulted in significant effects with $p < .006$ (alpha adjusted by dividing alpha by the number of terms in the basic model). Using these criteria, task involvement was not included in the analyses. Thus, to test for the relative contribution of the process variables

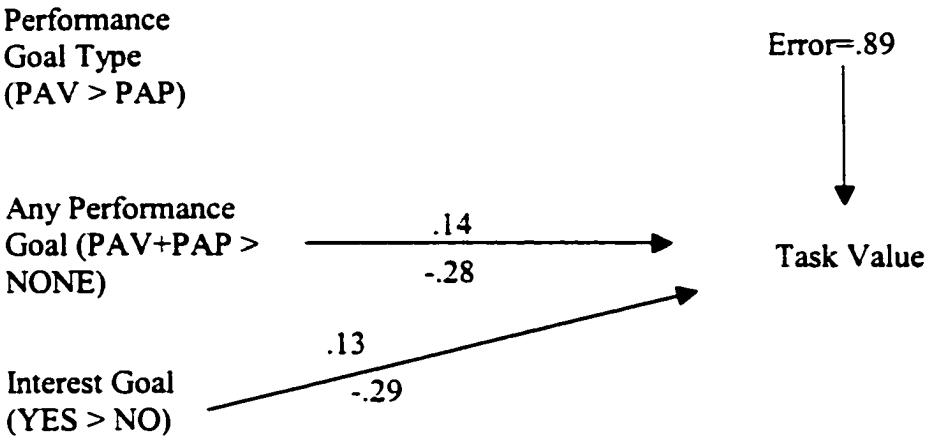


Figure 8

A diagram of the direction of the effects on task value. The direction effects are presented as a function of achievement motivation, with the path coefficients for participants higher in achievement motivation (HAMS) shown above the path and the path coefficients for participants lower in achievement motivation (LAMS) shown below the path.

in mediating the relationship between the basic model and interest, the four main effect terms of the remaining process variables (number of links, pleasant affect, perceived competence, and task value) were all simultaneously entered into a hierarchical regression analysis, following the 8-term *basic model* (Judd & Kenny, 1981). The resulting 12-term *process variable model* was significant overall, $F(12,62) = 6.99, p<.001$ and accounted for significantly more variance than the *basic model,* ($\Delta R^2 = .35$, $\Delta F(4,62) = 12.68, p <.001$. Perceived competence, task value, and number of links were significant in this model, whereas pleasant affect was not significant. The type of performance goal X achievement motivation effect on interest was no longer significant (from $\beta = -.24$ to $\beta = -.14, p = .15$), and the interest goal X achievement motivation effect on interest was now only marginally significant, (from $\beta = .27$ to $\beta = .16, p = .09$). Examination of the beta coefficients revealed that among the significant process variables, number of links clicked on in the chat room accounted for the least amount of variance in interest, (perceived competence, $\beta = .33, p < .01$; number of links $\beta = -.22, p < .05$; task value $\beta = .32, p < .01$; pleasant affect, $\beta = .04, p = .78$).

Next, an interactional mediation analysis was conducted to test any of the effects on immediate interest were mediated through the interaction between any of the process variables and achievement motivation. Following the procedures outlined by Judd and Kenny (1981), four new product terms were created involving each of the process measures crossed with achievement motivation. The new product terms were added to the 12-term *process variables model* from above using hierarchical regression analyses procedures. Results indicated that the 16-term *process variable interactional model* did not account for significantly more variance than the 12-term *process variables model.*

To examine the individual role of each process variable in mediating the relationship between the experimental conditions and interest, separate analyses were conducted (see Appendix D). In line with the overall analyses, results of the individual analyses showed perceived competence and task value as individually significant mediators. In contrast to the overall analyses, however, chat room visits were not found to individually account for the variance in the interest relationship whereas both task involvement and pleasant affect were found to account for a significant amount of the variance between experimental conditions. High correlations between the process variables are one potential reason for these differing findings. A pictorial summary of the final mediation model is presented in Figure 9.

Supplemental Analyses

Less than 34% of all participants visited the chat room. Moreover, visiting the chat room did not appear to serve as an interest-enhancing strategy for the majority of participants who did visit. To clarify these results, internal analyses were performed on perceptions of the chat room and ideas for other types of interest-enhancing options.

Perceptions of chat room presence as distracting. Regressing chat room distraction on the *basic model* used in prior analyses, failed to yield significance for the overall model ($F < 1$). Examination of the mean for this item ($M = 2.73$, $SD = 1.91$, using a 1 (not at all distracting) to 7 (very distracting) scale) suggests that across participants the mere presence of the chat room was not viewed as distracting.

Perceptions of chat room interest. Participants that did visit the chat room were asked to report how interesting they viewed the chat room postings. Regressing chat room

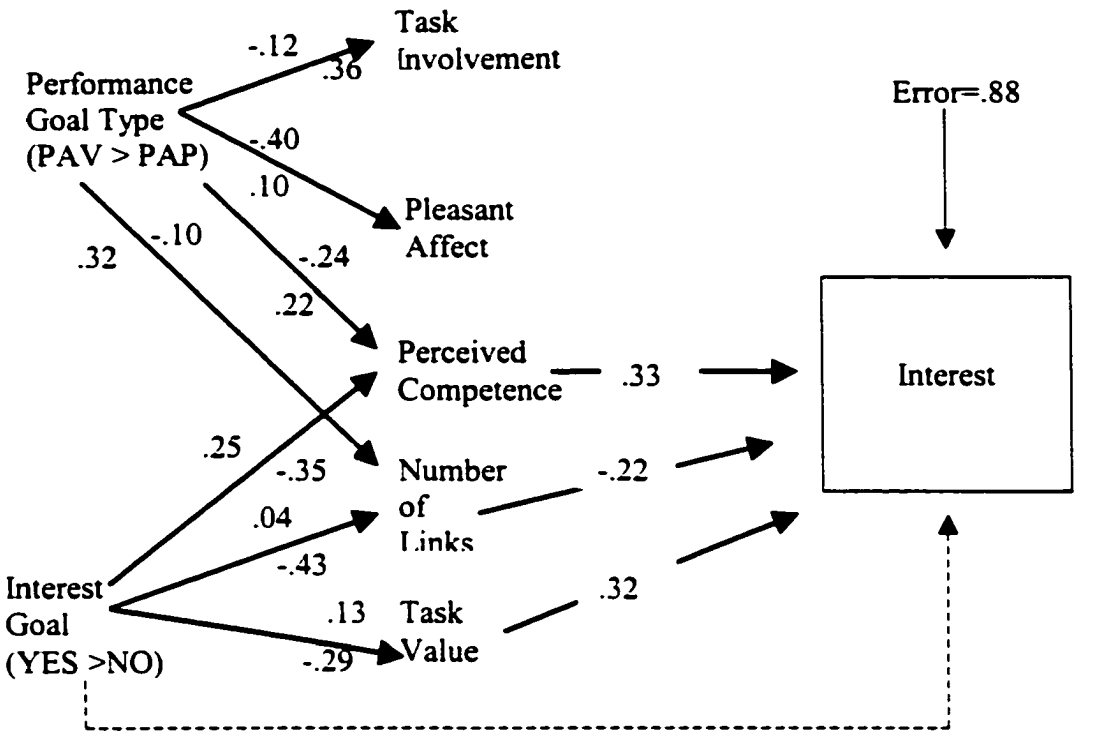


Figure 9

Final mediation model for the effects of the experimental manipulations X achievement motivation on immediate task interest. The dashed path denotes the remaining marginal effect of the interest goal interaction with achievement motivation on interest ($\beta = .16$, $p = .09$). Path coefficients for HAMS are located above the paths, whereas path coefficients for LAMS are located below the paths. For presentation clarity, neither the significant positive path for the anticipated performance covariate on the process measures, nor the effects of the interaction between any type of performance goal (versus no performance goal) and achievement motivation on task value are shown (see Figure 8).

interest on the *basic model* failed to yield significance for the overall model (F (7, 15) = 2.09, p> .10). Examination of the mean for this item (M = 3.46, SD = 1.96, using a 1 (not at all interesting) to 7 (very interesting) scale) suggests that for participants who did visit the chat room, the postings were viewed as only moderately interesting. This finding is in contrast to pilot testing which found the chat room postings to be perceived as highly interesting. In the context of actually working on the CAAT, then, it appears that for most participants who selected to visit the chat room, the postings may not have been sufficiently interesting once they clicked on them. Nevertheless, for those participants in this study who did visit the chat room, the more they perceived the posting to be interesting, the greater their expressed future interest in computer science (see Table 12).

Perceptions of chat room as task extrinsic. Research by Lepper and Cordova (1992) and Isaac et al. (1999) found that it was important that an interest-enhancing strategy be viewed as a part of the task (i.e., task intrinsic) to lead to positive motivational and performance outcomes. To test if viewing the chat room as task intrinsic or extrinsic helped explain the pattern of chat room visits, correlations were first computed to examine whether and for whom the number of links visited in the chat room were used as an interest-enhancing strategy. Based on the regression analyses, chat room visits were differentially related to interest for individuals higher and lower in achievement motivation as a function of the goal conditions. As shown in Table 13, it appears that visiting chat room links were used as an "interest enhancing strategy" only among participants lower in achievement motivation provided with a PAV-goal. Number of links visited in the chat room positively predicted immediate interest for these participants only

Table 13

Correlations between Variables and Number of Visited Chat Room Links by Experimental Conditions

Achievement Motivation	Immediate Interest	Performance
HIGH		
Performance goal Not Provided (n=13)	-.47*,c	.02
PAP-goal (n=11)	-.03	-.40
PAV-goal (n=11)	-.45 c	-.59**a,c
Interest goal Provided (n=15)	-.04	-.28
Interest goal Not Provided (n=19)	-.53*	-.17
LOW		
Performance goal Not Provided (n=14)	-.22	-.30
PAP-goal (n=13)	-.38	.15 d
PAV-goal (n=14)	.23 d	.19b
Interest goal Provided (n=22)	.15	-.26
Interest goal Not Provided (n=19)	-.31	.10

Note. Values are correlation coefficients for individuals above the mean (high) and below the mean (low) in achievement motivation.
* $p<.10$
** $p < .05$
[a,b] Correlations within measure differ at $p<.05$
[c,d] Correlations within measure differ at $p<.10$

(and this was the condition associated with the highest levels of reported immediate interest for LAMS). This positive chat room visiting-immediate interest relationship for LAMS was significantly different from the negative relationships found for HAMS not provided with any performance goal, or provided with a PAV-goal. And recall that among HAMS these were also the two conditions that were associated with the lowest levels of immediate interest.

To examine the possibility that these opposing chat room visiting-immediate interest relationships were due to participants higher in achievement motivation viewing the chat room as more "task extrinsic" than participants lower in achievement motivation, correlations were next computed between number of links visited and total performance (cf., Isaac et al., 1999). As seen in Table 13, when provided with any performance goal, participants higher in achievement motivation performed worse the more links they clicked on in the chat room, particularly if the goal provided was a performance-avoidance goal. In contrast, for participants lower in achievement motivation who were provided with any performance goal, performance appeared to be unaffected by visiting chat room links. Indeed, the difference between HAM participants provided with a PAV-goal and LAM participants provided with any performance goal was significant.

Ideas for interest-enhancing strategies. Following task completion, all participants were asked to list up to three self-generated ideas for making the CAAT more interesting to do on an everyday basis. Counter to pilot research (which demonstrated "working with other people" as the primary strategy that females would reportedly use to enhance interest of the CAAT) less than .03% of all the ideas generated across participants (N = 175 ideas) mentioned working with other people. Instead, participants recommended

making the data "more personally relevant" (30% of all ideas) and "listening to music" while working on the task (13% of all ideas) as interest-enhancing strategies. In this study, participants were explicitly told that the chat room was not part of the task. One possible explanation for these findings, then, is that although working with other people may match the interpersonal goals of many females (Smith, Morgan, & Sansone, 2001), working with other people did not match the inherent scripted protocol for behavior on this type of task (Abelson, 1982; Smith, 2000). Thus, one direction for future research is to explore ways to overcome individuals' preconceptions that working with other people is not a viable option when working on a CS-related task (cf., Borg, 1999). Another, albeit less positive possibility, is that off-task strategy use of any kind may not be seen as compatible with achievement tasks in general. More research is needed to examine these possibilities.

Discussion

This study was designed to test the effects of goals in the stereotyped task engagement process by providing explicit achievement and interest goals to female participants (all under gender-stereotype-salient conditions, e.g., Steele & Aronson, 1995) before participating in a computer science task. The results of this study showed that none of the manipulated goals were optimal for all participants. Rather, similar to past work, optimal goal assignment depended on the participant's level of achievement motivation (e.g., Barron & Harackiewicz, 2001), and assigning multiple goals did not appear to strengthen or attenuate these effects (cf., Harackiewicz et al., 2000).

Compared to Study 1, this study included broader measures of performance (adding a program development component) and motivation (adding a behavioral measure of future interest). Because all participants completed the CAAT under gender-stereotype salient conditions, performance was expected to be low for everyone (similar to Study 1 results; see also Steele & Aronson, 1995). However, it was possible that providing different types of performance goals would enhance performance for some participants, but this was not shown. Ancillary analyses revealed a pattern for performance to be better in conditions that matched the type of performance set afforded by the nature of the task (PAV-goal participants performed better in the fix the errors portion of the task where as PAP-goal participants tended to perform better in the build a program portion of the task, when controlling for error-fixing scores). Although exploratory, these results suggest that the match between the orientation afforded by a performance goal and the nature of a task's characteristics can promote better performance (cf., Crowe & Higgins, 1997; Smith et al., 2001) for females under gender-stereotype salient conditions.

The broader conceptualization of future interest used in this study was found to be predicted by most of the same conditions that predicted interest in the task. As such, it appears especially important to understand the goal conditions and processes involved in affecting interest for participants engaging in a stereotyped task. In Study 1, results showed that stereotype conditions affects participants higher in achievement motivation, whereas participants lower in achievement motivation were relatively unaffected. In Study 2, however, participants higher and lower in achievement motivation tended to have reverse reactions to the experimental conditions. For example, assigning a performance-avoidance goal versus a performance-approach goal tended to engender

reverse effects for participants higher and lower in achievement motivation. For LAMS, receiving a PAV-goal versus a PAP-goal tended to promote higher levels of perceived competence, task involvement and immediate task interest, whereas for HAMS, receiving a PAV goal versus a PAP goal tended to result in lower levels of perceived competence, task involvement, and immediate task interest. Possible explanations for these opposing patterns of responses and potential areas for future research with achievement motivation are discussed in the general discussion.

The results from Study 1 suggested that HAMS were more likely than LAMS to spontaneously adopt PAV related goals under conditions of stereotype threat. The present results suggest that when both HAMS and LAMS are explicitly assigned PAV goals under conditions of gender-stereotype salience, it is primarily HAMS who show negative effects. In fact, even though LAMS rarely adopted PAV goals spontaneously in Study 1, Study 2 results suggest that if they do, the PAV goals may have positive effects. This may help to explain why negative effects for stereotype threat tend to occur primarily for high achieving students, who may be characteristically oriented toward achievement (cf., Smith & White, 2001a).

Effects of providing an interest goal also tended to engender reverse effects for participants higher and lower in achievement motivation. For LAMS, receiving an interest goal tended to promote lower levels of perceived competence, task value, and immediate interest, relative to not receiving an interest goal, whereas for HAMS, receiving an interest goal versus no interest goal tended to result in higher levels of perceived competence, task value, and immediate interest. One purpose for including an interest goal manipulation in this study was to examine whether in a stereotyped task

engagement situation interest goals were incompatible with performance goals, or if interest goals did not emerge in the presence of performance goals. Results supported this second hypothesis because interest goals and performance goals appeared to yield independent effects in this context. Although interest goals appeared to be additive to the performance goals effects, counter to predictions, this additive effect was actually negative for participants lower in achievement motivation. For participants higher in achievement motivation, an interest goal did tend to add more positive effects, but did not appear to be able to offset the negative effects of PAV-goals or to enhance the positive effects of PAP-goals.

Study 2 extended the results of Study 1 by demonstrating that a number of these measured process variables were important in predicting interest, albeit under different conditions. For example, assigning a performance-approach goal or a performance-avoidance goal seemed to affect motivation through their impact on participants' perceived competence. In contrast, interest goal assignment tended to affect motivation through its impact on participant's feelings of task value. The overall process of task engagement was characterized by perceived competence, task value, and chat room visits. Similar to Study 1 and other research, perceived competence was shown to be an important mediator of interest overall for this achievement task (Deci, 1975; Elliot et al., 2000; Sansone, 1986). Specifically, it was found that the effects of type of performance-goal and the effects of an interest goal on immediate task interest were mediated primarily by perceived competence such that providing a PAP-goal to LAMS or an interest goal to HAMS, increased perceived competence and this increase in perceived competence led to greater feelings of immediate task interest. On the other hand,

providing a PAV-goal to HAMS or an interest goal to LAMS resulted in lower perceived competence and this decrease led to lower levels of immediate task interest. In addition to perceived competence, task value was also one of the process variables influential in the effects of goal assignment on interest. Assigning an interest goal to LAMS resulted in lower feelings of task value, and these feeling in turn led to lower levels of interest, whereas assigning an interest goal to HAMS tended to increase feelings of task value, leading to greater levels of interest.

Finally, this study further extended the Study 1 results by exploring the use of chat room links as a potential strategy for regulating interest during task engagement. Although HAMS' visits to the chat room did not seem to be influenced by goal assignments, for LAMS being provided with a PAV-goal led to more links being clicked on in the chat room whereas being provided with an interest goal led to less links being clicked on in the chat room. These findings were important because number of links clicked on in the chat room was found to be one of the important mediators of the relationships between goal assignment and task interest, such that increased chat room use resulted in lower levels of task interest.

Nevertheless, results found that visits to the chat room were low in general, and several explanations for this finding were posited. For example, it was possible that visiting the chat room was viewed as task intrinsic for some participants and task extrinsic to others. If this were the case, participants who viewed the chat room as a part of the task (as intrinsic), should be more likely to find visiting the chat room as a viable option during task engagement, and in turn should be more likely to use the chat room to regulate interest. On the other hand, participants who viewed the chat room as separate

from the task (as extrinsic) should be more likely to find visiting the chat room to come at a cost to other aspects of task engagement. In support of this possibility, supplemental analyses demonstrated that compared to HAMS provided with a PAV-goal, among LAMS provided with a PAV-goal the number of links clicked on was significantly more positively related to interest. Indeed, HAM participants were the least likely to visit the chat room and for those that did, this appeared to come at a cost to performance (Isaac et al., 1999).

GENERAL DISCUSSION

The purpose of the current project was to develop and test a conceptual framework for investigating the stereotyped task engagement process. In the context of a computer science (CS) programming task, two studies were conducted to examine the influence of a stereotype (i.e., that women are not good at math-related tasks) on achievement goal adoption, and the subsequent influence of this goal adoption on performance and motivational processes and outcomes. Direct effects of the manipulated stereotype (Study 1) and manipulated goals (Study 2) were observed on performance and motivation, and most of these effects were moderated by achievement motivation. Study 1 results showed that the effects of any stereotype threat on goal adoption depended on the individual's characteristic achievement motivation. That is, when any stereotype threat was present in the situation, participants higher in achievement motivation (HAMS) were more likely to adopt PAV-goals compared to PAP-goals, whereas LAMS showed the reverse pattern. When the stereotype was nullified and made irrelevant to the CS task, HAMS were more likely than any other participants to adopt mastery goals.

This pattern of goal adoption was important, because as seen in Study 2 the impact of assigning these goals to individuals higher and lower in achievement motivation affected the process of task engagement. The effects of the manipulated performance goals on the phenomenological experience and outcome measures were independent from the manipulation of a situational interest goal. The effects of either assigned goal (i.e., type of

performance goal or interest goal) however interacted with individuals achievement motivation orientation to predict immediate interest in the CS task through perceived competence, feelings of task value, and visiting the chat room.

Table 14 reports the pattern of spontaneously adopted goals for HAMS and LAMS under varying conditions of stereotype threat as found in Study 1. Combining the results from Study 1 and Study 2, Table 14 further illustrates the process and outcomes associated with the goals for HAMS and LAMS respectively. Results found for goal assignment in Study 2 were used to predict the processes and outcomes as a function of the type of spontaneously adopted goal in Study 1. All main effects (e.g., stereotype threat) and interactions with achievement motivation were represented.

Summarizing across studies, LAMS were unlikely to spontaneously adopt PAV-goals under any stereotype threat conditions. However, compared to assigning a PAP-goal, when a PAV-goal was assigned, LAMS demonstrated positive motivational processes (task involvement, perceived competence, clicking on links in the chat room). In contrast, HAMS were most likely to spontaneously adopt PAV-goals under any stereotype threat conditions, and when assigned, a PAV-goal was associated with more negative process effects (task involvement, pleasant affect, perceived competence, and clicking on links in the chat room), compared to when a PAP-goal was assigned. The overall phenomenological experience (driven primarily by perceived competence) in turn mediated the effect of performance goals on interest. Thus, these results suggest that for participants higher and lower in achievement motivation, any situational stereotype threat can have simultaneously positive and negative effects, through the contrasting effect of PAV- and PAP-goals.

Table 14

Integrating Study 1 and Study 2 Results:

Predicting Processes and Outcomes of Stereotype-Induced Goals

	Any Stereotype Threat		Nullified Stereotype	
	High Achievers	Low Achievers	High Achievers	Low Achievers
Self-Set Goals	Higher PAV Lower PAP No Mastery	No PAV Higher PAP No Mastery	No PAV Higher PAP Higher Mastery	Lower PAV Higher PAP No Mastery
PROCESS				
Perceived Competence	Low	Not Affected	High	Not Affected
Pleasant Affect	Low	Not Affected	High	Not Affected
Chat Room Visits	Not Affected	Not Affected	Not Affected	Not Affected
Task Involvement	Not Affected	Not Affected	High	Not Affected
OUTCOME				
Motivation	Low	Not Affected	High	Not Affected
Performance	Low	Moderate	High	Moderate

It was thought that adding an explicit interest goal would either attenuate or augment the effects of the performance goals. However, Study 2 found that for this stereotyped task an assigned interest goal interacted with the individual's characteristic orientation toward achievement such that providing an interest goal seemed to leave HAMS relatively unaffected but resulted in an additive (negative) effect for LAMS. That is, for LAMS, adding an explicit interest goal to the stereotyped achievement task appeared to be counterproductive to the experience of the task (perceived competence, task value, clicking links in the chat room), whereas for HAMS, adding an explicit interest goal tended to enhance the task experience (although for HAMS clicking on links in the chat room was not affected by the interest goal). The overall phenomenological experience (driven primarily by perceived competence and task value) in turn mediated the effect of interest goal assignment on immediate task interest. These results held true regardless of the mere presence of or specific type of performance goal provided.

Although the presence or absence of an explicit interest goal was manipulated in Study 2, it should be pointed out that it is unlikely that the assigned interest goal included all of the same components of the self-set mastery goal (e.g., competence concerns, see Sansone 1986). A mastery goal necessarily includes an interest goal by definition, and is often associated with the most positive motivational outcomes (Ames, 1992). It was clear from Study 1, however, that most participants did not spontaneously report adopting mastery-related goals while working on the CS task, with one notable exception. Participants higher in achievement motivation (who are likely to enjoy performance tasks, e.g., Tauer & Harackiewicz, 1999) for whom the stereotype was nullified were the only participants to adopt mastery goals. Mastery-goal adoption, in turn, was related to

pleasant affect (e.g., Turner et al., 2002). Complimenting these findings, results from Study 2 demonstrated a positive motivational effect when an interest goal was assigned to HAMS. Indeed, it is also important to point out that all of the assigned goals in Study 2 were assigned under a stereotype salient condition, which as implied in Study 1 was likely to result in a predictive pattern of self-set goals. These points bring to light several intriguing questions: what is the possible difference between self-set goals and assigned goals in general (Barron & Harackiewicz, 2001)? Do goals interact to form multiple goals (e.g., Harackiewicz et al., 1997) and/or does an assigned goal "over-ride" a self-set goal?

To begin to address the first question, it is necessary to make two assumptions: first, self-set goals are adopted and operate at a more nonconscious level (which may account for why they are difficult to measure, Smith, et al., 2001) and second, assigned goals are adopted and operate at a more conscious level. Using these assumptions, then, research by Bargh and his colleagues (e.g., Bargh, Gollwitzer, Lee-Chai, Barndollar & Trotschel, 2001; Chartrand & Bargh, 2002) suggests that whether a goal is consciously (assigned) or nonconsciously (self-set) activated, it will have the same effects on mood and behavior.

Past work looking at two different self-set goals or two assigned goals has found little evidence for an interactional effect (e.g., Harackiewicz, et al., 1997; Turner, et al., 2002), and results from the current project support these findings. However, what about the effects of two goals that are activated through different processes? Chartrand and Bargh posit that a goal can become "nonconsciously activated within (a) situation, independently of the individual's conscious purpose at that time" suggesting that there may be interactional effects if the self-set goal and the assigned goal are different (p. 15). Indeed, in our own work testing the congruency hypothesis we have shown that

motivation is optimal when an individual's self-set goals (e.g., interpersonal goals) are in match with the assigned situational goals (working with another person) and motivation is less optimal when the goals are not in match (Isaac et al., 1999; Sansone & Smith, 2000; Smith, Morgan & Sansone, 2001; see also Freitas, Liberman, Salovery & Higgins, 2002; Harackiewicz & Elliot, 1998). To date, however, it remains equivocal whether one goal actually over-rides another goal (and if so, the factors that determine which goal will dominate), although the results from Study 2 suggest that this does in fact occur. Ideally, future research should use identical conditions to assess self-set goals and assigned goals to more clearly address this question.

Nevertheless, self-set goals and assigned goals in this project and in others have shown to affect motivational and performance outcomes in important ways (e.g., Elliot & McGregor, 2001). For example, exploratory analyses revealed that performance in Study 2 tended to depend on the nature of the performance task and the type of performance goal assigned. Specifically, it was found that performance on the error-fixing portion of the task was enhanced when participants were assigned a PAV-goal whereas performance on the program-building portion of the task was enhanced when participants were assigned a PAP-goal, controlling for error-fixing scores. Thus, it appears that congruency between goals and the nature of the task set may also be important. Recent work by Freitas et al. (2002) partially supports this notion. In their study, it was found that participants with prevention goals (conceptually similar to PAV-goals, Linnenbrink, & Pintrich, 2000) reported wanting to work on anagrams that had prevention worded instructions before anagrams that had promotion worded instructions.

The Freitas et al. (2002) study also examined interest as a motivational outcome. Their results indicted that immediate task interest was not affected by the presence of a prevention or promotion goal or by the task instructions, and as such interest was subsequently dropped from their investigation. However, Freitas et al. may have inadvertently washed out any effects on interest by collapsing their results across all participants. Indeed, the current project also did not detect any direct effects of type of performance goal on immediate task interest. Rather, it was shown that providing a PAV-goal relative to a PAP-goal enhanced interest for LAMS, whereas for HAMS the reverse pattern was found. Achievement motivation as an individual difference, then, was a key moderator of motivational effects (e.g., Elliot & Church, 1997; Sansone, 1986; Tauer & Harackiewicz, 1999).

There are a number of potential explanations for why achievement motivation influenced the motivational outcomes assessed in the current project. For example, it is possible that achievement motivation is similar to domain identification and results in "ironic" effects (e.g., Aronson et al., 1999; Crocker et al., 1998; Smith & White, 2001a). That is, HAMS might buckle under an explicit achievement or evaluative pressure, because they worry about not meeting expectations. Individuals higher in achievement motivation might become "preoccupied" with trying to suppress the source of the pressure or evaluation (e.g., a relevant performance stereotype, a PAV-goal) (e.g., White, Smith & Sorrow, 2002) and might subsequently have fewer resources available to work on the task (e.g., Smart & Wegner, 2000). On the other hand, LAMS might feel liberated by the explicit achievement pressure or evaluation because they do not have to worry about not meeting expectations (i.e., both personally and externally success was not

expected from them) thus benefiting from the PAV-goal (cf., Sorrow, Smith & White, 2002; see also Jones, & Berglas, 1978).

Another possibility for why achievement motivation moderates motivational outcomes in this project is that the congruence (or lack thereof) afforded by the situational characteristics enhances or decreases the value of task participation. For instance, Sansone (1986) found HAMS were more affectively responsive and concerned about participation when they worked on a trivia task and received positive performance feedback. In contrast, LAMS were more affectively responsive and concerned about participation when they worked on the same trivia task but received negative performance feedback. Participants in her study, then, appeared to value participation (cf., Blanton et al., 2000) as a function of the match between the individual's characteristics (HAM or LAM) and the valence of the feedback. In the current project, the matching parameters for participants who enjoy achievement settings and aspire for achievement excellence (HAMS, Jackson, 1974) were with a nullified performance stereotype (that says, in this task you can achieve) or a PAP-goal (that says, in this task you might succeed). The matching parameters for participants who do not enjoy achievement settings and do not aspire for achievement excellence (LAMS) were with a relevant performance-stereotype (that says, in this task you can not achieve) or a PAV-goal (that says, in this task you might fail). Although the current project did not look at reports of value of participation explicitly, compared to those parameters that were not in match, those that were in match were associated with more positive motivational processes and outcomes.

Finally, another possibility for why achievement motivation moderated motivational outcomes in this project was it was related to changes in the meaning of the situation during task engagement. Molden and Dweck (2000) discuss that an individual develop different orientations for interpreting what a situation means for his or her sense of self. Individuals are likely to shift into an avoidance of failure orientation when task performance has implications for self-worth. Molden and Dweck point to individuals who vary along a continuum of an entity/incremental view of intelligence to support their claim, but it is likely that individuals higher in achievement motivation are also more personally vested in, and have self-worth ties to achieving. If this is so, than it is possible that a situation that includes awareness of a stereotype or a PAV-goal may have a different meaning (one that implicates the self) for HAMS compared to LAMS (see Aronson, Fried, & Good, 2001; Crocker & Quinn, 2000).

All of these explanations may be useful for understanding why achievement motivation moderated motivational outcomes in the current study. More than likely, some combination of these factors is important at different points during the task engagement process. The notion that a task is fluid and that change (e.g., in how goals match, in task meaning, in cognizance of evaluation) can take place during task engagement is pivotal to understanding the outcomes associated with (stereotyped) task participation (Sansone et al., 1992; Sansone et al., 1999; Sansone & Harackiewicz, 1996; Sansone & Smith, 2000; Smith et al., 2001). One specific aim of Study 2 was to document whether and how participants changed the task by visiting an interesting, off-task chat room while working on the CS task. One hypothesis was that participants in Study 1 did not experience interest in the CS task when working under stereotype threat conditions because there

were no options available to them to make the task more interesting (e.g., Sansone et al., 1992). To examine this possibility, an optional chat room that participants could visit was added to Study 2.

Results illustrated that for participants who did visit the chat room, the more interesting they found the contents, the more they reported having a future interest in CS. Importantly, the patterns of chat room visits and the relation between those visits and interest differed as a function of participants' achievement motivation and assigned goal condition. Participants lower in achievement motivation were more likely to visit the chat room when assigned a PAV-goal, and number of links clicked on in the chat room for these participants was positively related to interest in the task, and unrelated to performance on the task. In comparison to these LAM participants, for HAMS in the same PAV-goal condition the relationship between chat room visits and interest was significantly more negative. Moreover, for HAMS, when assigned a PAV-goal the number of links visited in the chat room was negatively related to performance, suggesting that visiting the chat room might have been viewed as extrinsic to the task (Isaac et al., 1999; Kruglanski, Riter, Amitai, Margolin, Shabtai, & Zaksh, 1975; see also Wade, 1992).

One interpretation of these findings is that for LAMS and HAMS under stereotype threat conditions (which led to PAV-goals for HAMS and PAP-goals for LAMS) interest as a goal did not emerge. For LAMS who were explicitly assigned to a PAV-goal under stereotype salient conditions, however, the addition of the chat room offered participants an interest-enhancing strategy to self-regulate their interest. In contrast, for HAMS visiting the chat room under any goal conditions did not benefit interest, and in fact was

negatively related to performance. Thus, for HAMS not only did interest as a goal not emerge, but it appears that an interest goal was also incompatible with performance goals in this context.

These results appear to add to the recent findings by Freitas et al. (2002) who found that when doing a prevention-framed task, participants just want to get the task "over with" as soon as possible, and as determined here, this may be primarily (or only) true for individuals higher in achievement motivation. Yet somewhat contrary to this notion is that by definition HAMS should be likely to enjoy working on an achievement task and therefore want to prolong the experience. As such, another possibility is that interest as a goal did emerge for these participants, but the "need" to regulate interest by visiting the chat room was not as great because these participants by definition were more likely to enjoy working on achievement tasks. This is conceptually similar to my past work, which found evidence for the different starting levels of interest hypothesis showing that males working on a science-related task had less of a need to regulate interest in the task compared to females, because males' interest in science was greater than females' to begin with (Smith, 2000).

It should be reiterated that visits to the chat room were relatively low overall, perhaps rendering the "differences" in chat room visits discussion somewhat negligible. The finding from Study 2 that females did not explore the new features of the CS task extends recent work by Turner et al. (2002) who found that elementary school students, particularly girls, avoid novel ways of solving problems in a math class. Thus, in male-dominated areas such as CS (as well as science, Smith, 2000; and math, Turner et al., 2002), it is likely that HAM females working with a PAV-goal orientation, don't find

these tasks interesting because they are not likely to take "risks" by self-regulating their interest (cf., Crowe & Higgins, 1997).

Limitations and Implications for Future Research

The current project was unsuccessful in discovering the conditions that would facilitate HAMS to self-regulate their interest when assigned a PAV-goal, the goal they were most likely to spontaneously adopt under stereotype conditions in Study 1 (the same conditions that produced the lowest levels of interest and performance). However, careful steps were taken to ensure that participants knew that visiting the chat room was separate from doing the CS task. It is possible that this emphasis on the chat room as "off-task" deterred participants from visiting regardless of the assigned goal. Yet, other research has documented that while engaged in a reading task, students are not likely to visit links that were clearly identified as containing additional on-task (interesting) information (Hidi, Berndorff, & Kennedy, 2002). Hidi et al. concluded that readers make choices. Thus, one of these choices seems to be to stay on-task when engaging in an achievement task, and do so at the bare minimum required to complete the task.

In both Hidi et al. (2002) and the current project, it is worth noting that it only one type of strategy was examined (clicking on links that are content specific). It is possible that clicking on links, or the content of the links, may not be in match with the script that students have for working on the type of achievement task that these studies provided (e.g., Alper, 1993). For example, Smith and Sansone (2001) found that on an explicitly "on-line learning" computer task, participants were likely to click on off-task links as a self-regulatory strategy as a function of how well the content of the links (interpersonal or

non-personal) matched the participant's interpersonal orientation (as indexed by gender) and the task description (as an interpersonal helping task). Thus, the current study does not conclusively rule out the possibility that the *type* of strategy made available in the CS achievement task used in the current project accounted for the overall minimal off-task behavior.

Future research can be informed by the supplemental analyses conducted in Study 2, which examined the participants' own suggestions for off-task behaviors that would make the CS programming task more interesting if they had to do the task on a regular basis. The majority of participants' suggestions included listening to music and/or giving the program (or variables) a more "personally applicable" context (Cordova & Lepper, 1996). It is certainly plausible to give future participants the option of determining the names of the variables that they are programming and/or to listen to their favorite CD while working on the task.

Just as the activity (Sansone & Smith, 2000) and feelings of interest (Schiefele & Naceur 2002) can change during task engagement, perceived competence can also change during task engagement. In Study 1, perceived competence was found to mediate the negative effects of a stereotype on performance, such that perceived competence decreased as a result of the stereotype, and this decrease in perceived competence led to lower task performance. Perceived competence was also affected by the goal assignment interaction with achievement motivation in Study 2. The resulting feelings of perceived competence were found to be one of the most important variables influencing the task experience, and this task experience mediated the relationship between goals and interest in the task. In both Study 1 and Study 2, perceived competence was measured after task

engagement, and it was suggested that this might have confounded perceived competence with actual task performance. Perceived competence at the outset of task engagement, during task engagement, and following task completion, however, can be distinct variables (e.g., Butler, 1998; Harackiewicz et al., 1997; Molden & Dweck, 2000). Therefore, it was necessary that in both Study 1 and Study 2 perceived competence was measured post-task to allow for clearer comparisons of the mediating role of perceived competence in the stereotyped task engagement process and subsequent outcomes.

The function of the perceived competence variable in the stereotyped task engagement process merits additional research. For example, the current project did not provide participants with any indicators of performance at any time during the session. Participants' own feelings of competence post-task, however, predicted how interesting they found the task and how well they performed on the task. Perhaps providing artificial feedback to participants on their performance might serve as another avenue (compared to nullifying the specific stereotype) to decrease stereotype threat effects on performance. The nature of the feedback could come in the form of providing normative standards (e.g., Sansone et al., 1989), praising intelligence versus effort (e.g., Aronson et al., 2001; Molden & Dweck, 2000) or interpersonal versus non-interpersonal feedback (e.g., Vohs & Heatherton, 2001; Tauer & Harackiewicz, 1999). Another avenue for future research with perceived competence and the stereotype task engagement process includes explicating the process and outcomes associated with the many other variants of perceived competence such as competence-valuation (e.g., Elliot et al., 2000; Harackiewicz & Elliot, 1998; Sansone, 1986) and self-efficacy (e.g., Bandura, 1997; Renninger & Hidi, 2002).

It should not be overlooked that the effects and emergence of these process variables all depended on the goal(s) of the person and the goals afforded by the situation (Sansone 1986; Sansone et al., 1989). The current project only examined performance and interest goals. Other types of goals may also be important to consider (e.g., interpersonal goals, Smith et al., 2001). For instance, it is possible that women who do persist in male dominated areas such as computer technology and math (e.g., Hess & Miura, 1985; Steele, James, & Barnett, 2002) do so at the expense of interacting with other women in the male-dominated field, receiving social support from other women in the field, or forming an attachment with other women in the field. Deprivation of any of these factors has shown to be related to a number of undesirable psychological and physiological effects (e.g., Aspinwall & Taylor, 1992; Barbieri & Light, 1992; Baumeister & Leary, 1995; Cross & Vick, 2001; Uchino, Cacioppo, & Kiecolt-Glaser, 1996). Perhaps women in male-dominated areas do not affiliate with other women in the field for fear of being implicated by a negative gender stereotype association (cf., Kaiser & Miller, 2001; Smart & Wegner, 2000). It is unclear what the actual level of participation is in organized women's groups (e.g., the Society for Women Engineers). However, intervention programs (such as the Women in Engineering Initiative) that recruit and consistently make contact with women in male-dominated fields appear to provide a safe and structured environment for women to interact, and consequently enhance field retention rates (e.g., Brainard & Carlin, 1997). An intriguing area for future research, then, is in understanding the influence of interpersonal goals, the various ways that women in male-dominated areas can met those goals, and how those goals might impact the phenomenological experience.

In Closing

This project presented the first test of the notion that depending on an individual's achievement motivation, the effects of a negative performance stereotype can influence achievement goal adoption and these goals in turn influence the variables that make up the task engagement process, which in turn mediates important motivational and (to a lesser extent) performance outcomes. The present research not only established the stereotyped task engagement process as an important model for understanding the effects of goals and stereotypes, but also points to opportunities for real-world applications. Certainly, this line of research is in its infancy. The early indication, however, is that to help ease or offset the negative effects of any stereotype threat on performance and motivational processes and outcomes, it is necessary to first identify the individual as being lower or higher in achievement motivation. Next, for those lower in achievement motivation faced with a stereotyped task, providing an explicit performance-avoidance goal (that matches their general achievement tendency) may lead to more positive performance and motivational outcomes. For individuals identified as higher in achievement motivation faced with a stereotyped task, providing an explicit interest (or mastery) goal may enhance their performance on and motivation for the task.

In short, the current project highlighted the need for considering stereotyped task engagement as a process, and will hopefully encourage other researchers to return to their paradigms with this in mind. As a case in point, Aronson, Fried, and Good (2001) note their "striking results" that when statistically factoring out SAT scores, (compared to Caucasians) African American college students have lower grade point averages, and lower levels of interest in academics. They conclude that "some other factor not captured

by SAT or our measures of stereotype threat (experiences) were operating to depress African Americans' grades relative to those of Whites" (p. 121). As the current project makes clear, however, it is unlikely that any one "other" factor will be able to completely account for the stereotyped individual's experiences (Smith, 2002). To understand phenomena such as why women might drop out of male dominated fields such as computer science, or why minorities might not excel at academics, it is important to consider the individual, the situation, and the outcomes as a fluid, dynamic process (e.g., Sansone & Harackiewicz, 1996). The current investigation let us place the body of prior work in stereotype threat, achievement motivation and goals, and intrinsic motivation into an integrative context. The results of the investigation might have us also consider and integrate work in psychophysiology, cognitive capacity, and task design. After all, just like the stereotyped task experience, research is a process.

APPENDIX A

ACHIEVEMENT MOTIVATION SCALE PSYCHOMETRICS

To examine the psychometrics of this scale in the current project, responses were first pooled across studies to increase the number of cases (N=127). Results showed that this scale had an overall mean = 10.44 (*SD* = 2.88). Observed scores ranged from 2 to 16, and although somewhat negatively skewed, did appear to be normally distributed as illustrated in Figure 10. A principal components analysis was conducted using the scale items, revealing six factors meeting the eignvalue criterion (greater than or equal to 1). However, one main factor (eignvalue = 2.71) emerged accounting for approximately 17% of the variance. An examination of the scree plot showed that this factor was separate from the other components, with an elbow beginning with this factor, and all the remaining factors resting closely, and almost linearly, together.

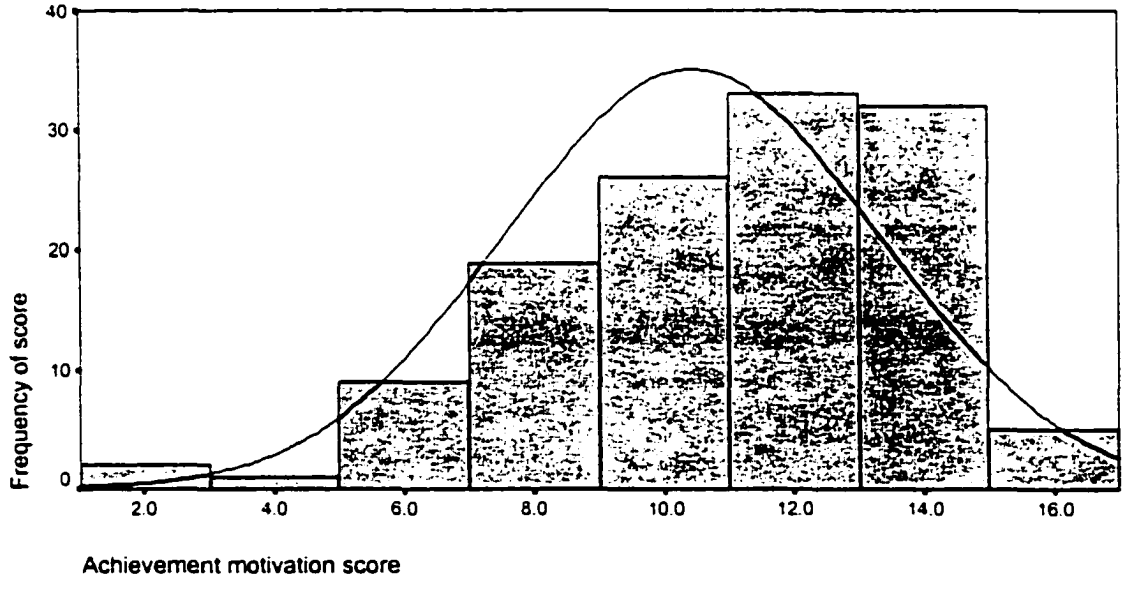


Figure 10

Histogram and normal curve of achievement motivation scores

APPENDIX B

CAAT (EXPANDED VERSION)

COMPUTING APTITUDE ASSESSMENT TOOL

There are a three different aspects to computing that are important to include in a computing aptitude assessment tool. First, it is important to be able to use computing logic to look at something, such as output, to try and determine what types of codes were used to produce that output. Second, it is important to be able to use that same logic to figure out why a program doesn't work, sometimes called "de-bugging." Third, it is important to be able to apply that logic to creating a program to do what you want it to do.

Programming Tip Guide

with examples

Below are examples of programming codes that you may use as a guide while working on the CAAT. There are several codes available to the programmer. Note, that it is not necessary to understand the meaning of any of the statistics or the output your program creates, as long as you are able to use them appropriately.

PROGRAMMING OBJECT: TO TAKE RAW DATA AND TRANSFORM INTO MEANINGFUL SUMMARIES

PRIMARY PROGRAMMING CODE:

FREQUENCIES VARIABLES = variablename

TWO EXAMPLES THAT PROVIDE DIFFERENT KINDS OF SUMMARIES AND DIFFERENT WAYS OF SHOWING THE RESULTS:

EXAMPLE 1:

```
FREQUENCIES
 VARIABLES= income
 /NTILES = 2
 /STATISTICS=MEAN MEDIAN SKEWNESS SESKEW
 /HISTOGRAM  NORMAL
 /ORDER  ANALYSIS.
```

EXAMPLE 2:

```
FREQUENCIES
 VARIABLES=race religion
 /FORMAT=DFREQ
 /STATISTICS=MODE
 /BARCHART  FREQ
Execute.
```

PROGRAMMING OBJECT: TO TAKE RAW DATA AND SORT INTO DIFFERENT ORDERS

PRIMARY PROGRAMMING CODE:

```
SORT CASES BY variablename
```

TWO EXAMPLES THAT SHOWS DIFFERENT KINDS OF SORTING

EXAMPLE 1:

```
SORT CASES BY gender
Execute.
```

EXAMPLE 2:

```
SORT CASES BY religion (D)
Execute.
```

BEGIN CAAT ITEMS

1) Identify the code below that produced the given output.(Hint: you may want to begin by identifying the names of the variables being used)

You are to pick the one program below that created the given output. The output is located after the 4 choices, starting where it says "BEGIN" output file and ending where it says "END" output file. You may need to scroll down to see the complete output file.

FREQUENCIES VARS = sibs /FORMAT = DVALUE /STATISTICS = mean mode /HBAR Execute.	FREQUENCIES VARIABLES = sibs region /STATISTICS = MINIMUM MEAN MODE /BARCHART FREQ Execute.
FREQUENCIES VARIABLES = sibs /FORMAT = AVALUE /STATISTICS = MINIMUM MAXIMUM /HISTOGRAM NORMAL Execute.	FREQUENCIES VARIABLES=sibs /FORMAT=DVALUE /STATISTICS=MINIMUM MAXIMUM MODE /BARCHART Execute.

BEGIN OUTPUT

Frequencies

Statistics
Number of Brothers and Sisters

N	**Valid**	1505
	Missing	12
Mode		2
Minimum		0
Maximum		26

Number of Brothers and Sisters

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**26**	1	.1	.1	.1
	21	1	.1	.1	.1
	18	1	.1	.1	.2
	17	2	.1	.1	.3
	16	1	.1	.1	.4
	15	3	.2	.2	.6
	14	5	.3	.3	.9
	13	9	.6	.6	1.5
	12	11	.7	.7	2.3
	11	22	1.5	1.5	3.7

	10	34	2.2	2.3	6.0
	9	47	3.1	3.1	9.1
	8	58	3.8	3.9	13.0
	7	81	5.3	5.4	18.3
	6	80	5.3	5.3	23.7
	5	118	7.8	7.8	31.5
	4	209	13.8	13.9	45.4
	3	236	15.6	15.7	61.1
	2	276	18.2	18.3	79.4
	1	236	15.6	15.7	95.1
	0	74	4.9	4.9	100.0
	Total	1505	99.2	100.0	
Missing	**NA**	8	.5		
	DK	4	.3		
	Total	12	.8		
Total		1517	100.0		

END OF OUTPUT

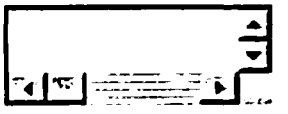
Back to top of Question 1

Back to Programming Tip Guide

2) Debug the following program by identifying the errors in the code that lead to the error messages shown.(Hint: you may want to begin by looking over the programming tip guide for examples of proper code).

SORT CASES
race(A)
/STATISTICS = MINIMUM MAXIMUM MEAN
FREQUENCIES
VARS = date team
/FORMAT = double
/FORMAT = dfreq
BARCHART
Execute

Please write the de-bugged code below:



When the above program was ran, several error messages were produced. Although most of the code is written correctly, you are to examine the error messages below and determine how to fix the parts of the program that are not working. You should write the de-bugged program in the space provided above.

ERROR! VARS is not a recognized code

ERROR! "Statistics" code out of order, cannot run sequence

ERROR! Missing "BY" extension code. Cases will not be sorted

ERROR! Chart command starter not entered

ERROR! Missing program terminator. Program will not run

Back to Question 1

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3) Write a program (hint: you may want to begin by reviewing the codes

used in the previous questions).

PROGRAMMING OBJECT: The data base has been provided by a local University and will assist in the creation of job placement programs that meet the needs of a wide variety of college students. Your assignment is to write a program that meaningfully organizes and summarizes the data base for the University.

The data base is a partial survey of graduating students at a local University. The students responses to the survey now need to be summarized, particularly 3 variables named:

- **income**
- **religion**
- **job**

"income" is coded as the student's current income in thousands, "religion" is coded as the name of the religion, and "job" is coded as the domain of their desired occupational field.

Each variables has certain properties. Specifically, current income is a continuous variable, whereas religion and desired occupational field are categorical variables.

You will be required to use codes to create a program that produces tables of frequency counts and percentages for the values of each of the three variables described below using the provided data base. Although the program you will write has four parts, you will write one long program containing all the parts. **PLEASE NOTE: The task does not require you to format the results in any particular way. Thus, you are free to vary how you format the output, if you wish.**

You will write the code in the blank program screen located to the right of this window.

Write a program

1. Using the blank program screen, write the code to sort the cases by "religion"

2. Write the code to produce frequency counts on all 3 variables

3. Write the code to create a histogram with a superimposed normal distribution for the "income" variable

4. Write the code to display only the following statistics for each of the 3 variables: mode and skewness.

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WAIT! Once you are instructed to do so, please click on the arrow to continue. 

APPENDIX C

CHAT ROOM POSTINGS

Posting rw375
Computers and programs can certainly make life better but of course there is the whole issue that people always talk about, you know that the children of today are becoming desensitized to violence cuz of all the computer programs and games, etc. But you know, there's nothing really illegal in producing a game that depicts tons of violence. In fact, there is a large market for these games not just among kids, but adults. I mean, the games are typically clearly labled as containing this violence. I don't really think that computer programmers should have to be the moral police, you know?

Reply
OK, I agree that computer programmers are not the moral police, but kids ARE being desensitized...in the games you pick up a gun and start shooting. You never really hear the screams, see or smell the blood. You never have to try and stop someone from bleeding to death in your hands or see your baby sister or brother standing there as they cart you away. The children of today don't FEEL the fear of having a gun shoved in their face or a knife held to their throats. Take the computer games off the market altogether!!!! Sorry for ranting but that's how I feel.

Reply
I think it boils down to the notion that PARENTS should take an active role in the education of their children. If mom or dad don't like the games, then they should not let them into the house. Teach your kids why you think these games are bad. If you don't want your kids to smoke, you teach them the results of smoking (a subject I take very much to heart). Violence in computer games (and on TV, and in music lyrics, and in books, and in....etc etc.....) is very much the same. You have to sit down with your kids, get involved with their lives, and really teach them the difference between right and wrong. And if in your case, you deem these kinds of games to be wrong, then that's totally fine and acceptable! But be sure you are ready to tell your kids something other then "Because I say so" it's best to really talk to them and be honest. Hope that helps!

Posting In140
Initial Posting So Forbes magazine says that once again, Bill Gates is the richest man in the WORLD! Something like 60 billion. The technology boom has been very good to him I would say. Or maybe he even made the "boom" possible I don't know. Doesn't he live in Seattle? I think I read that he uses more water for his home than 70 normal houses put together. Curious given that it rains a lot there. Maybe he will figure out how to program a computer to either rig the meter that measures the water so no one will know he is a water-hog, or better yet program the computer to get water from the ocean, make it fresh, and then pump it to his swimming pool, all for under $1 and with a really fast connection.

Reply
That is a crazy amount of money, for a man who figured out how to put windows on all computers by looking at the apple computer... technology has been created to meet Bill's computer needs, and to make him a buck. Trying to turn out computer products all of the time, pushing the programmers to write new stuff all of the time... equals technology that is full of bugs and crashs all the time. So then you have to buy a different product programmed by someone else who works for Bill to fix the problem. As soon as you do they come out with an entirely NEW software that wont work with your old one, that if you don't buy no one will be able to download or read your files.

Reply
Well, I love windows, and other microsoft products. Technology is so wonderful today, because of him... he deserves every penny. His software makes life as we know it today possible! The irony, I think is that the people who criticize his products and technology in general as TAKING OVER the world, are typing Microsoft Word memos about how bad Microsoft is... and them emailing them using MSN hotmail or something. Nowadays, computer programmers are like celebrities, with Bill Gates at the forefront. The same people who criticize Bill Gates, are the same ones that should be grateful to him for glamorizing and improving their life.

Posting ct001
I cant think of anything to say, except that I did see this article recently that talked about blocking software (where you can stop someone from going to certain web sites). Not sure how I feel about this. I remember the AOL/Breast Cancer debacle... Many libraries put in blocking software hoping kids (or bored college students....) wouldn't be able to surf for porn anymore, which is OK, but that also means that sometime you can't access the information you need because a legitimate site is blocked. I am pretty sure even the public library downtown still has this blocking thing...

Reply
At this moment, I can go down to the downtown library, rummage through the card catalog (or online database, take your pick), wander through the racks, and leave with about 10 or so books that describe, in painstaking detail, how to make a bomb. I could probably find out how to make various drugs as well. This information is readily available to anyone with a library card. I doubt they'd "card" me either to get me age (I don't look over 21 that's for sure!). The problem with "censorware" or government regulations is that you are now accepting that someone elses moral standards will be enforced regardless of wether or not they comply with yours. It really pisses me off that people are so dependent that they don't want to think for themselves!

Reply
I've had a very religious "sheltered" life very much in the past and found it to be very reassuring to grow up and find out how selective and careful my parents were with my freetime. (I did not have control of my own TV watching, and when I was in elementary my mother refused to let me watch The Jefferson's, which all my friends would talk about.) I think parents can protect their kids that way. Computer screening, or whatever, is a great help to parents! It is amazing what the computer industry comes up with to help parents. Things like "parental ratings" on games, and locks on certain web sites might only help a little, but it is a start and I am thankful these things are available to me for when I have kids one day.

APPENDIX D

INDIVIDUAL MEDIATIONAL ANALYSES FOR STUDY 2

Chat Room Use

Based on past self-regulation of interest research (e.g., Sansone, Wiebe, & Morgan, 1999), it was possible that visiting the chat room mediated the effects of the interaction between achievement motivation and the interest goal manipulation (referred to as Interaction Term). To test this possibility, a series of standard and hierarchical regression analyses were used as described in Study 1 (see also Judd & Kenny, 1981). Recall, that this interest goal X achievement motivation Interaction Term significantly predicted immediate task interest as well as chat room use. Indeed, chat room visits was also able to significantly predict immediate interest when controlling for the basic model ($\Delta\beta$ =-.34, F (1, 65) = 5.95, p <.01). Although the chat room model accounted for significantly more variance in interest than the basic model (ΔR^2 = .09, ΔF (1, 65) = 8.87, p <.01), for mediation to occur, the relationship between the Interaction Term and immediate interest needs to be eliminated or reduced, and this was not shown . The regression coefficient actually increased slightly (from β =.27, p<.05 to β =.35, p<.01). Thus, it appears that visiting the chat room did not serve as an individual mediator through which the interest goal affected interest for participants higher and lower in achievement motivation. It was also possible that chat room use served as a mediator between the type of performance goal X achievement interaction and immediate interest, however this was not shown (β = -.24 remained unchanged in the new chat room model).

Task Involvement

There was little evidence for an interest goal X achievement motivation effect on task involvement. However, based on past intrinsic motivation research (e.g., Elliot &

Harackiewicz, 1996; Voisard, 1988) it was still possible that task involvement served to indirectly impact the relationship between the interaction and interest. It was also possible that task involvement served as an individual mediator between the type of performance goal X achievement interaction and immediate interest. Following the mediational test guidelines outlined previously, this was shown. That is, when including task involvement in the model, the new model was significant ($R^2 = .37$, $F(1, 66) = 5.93$, $p < .001$) and accounted for significantly more variance in interest than the basic model, ($\Delta R^2 = .22$, $\Delta F(1, 66) = 26.21$, $p < .001$). Task involvement was a significant predictor of interest, $\beta = .51$, $F(1, 66) = 10.24$, $p < .001$, and although the regression coefficient for the interest goal X achievement motivation interaction remained unchanged, the type of performance goal X achievement motivation interaction term was no longer significant, dropping from $\beta = -.24$ to $\beta = -.07$, $p = .47$. Thus, it appears that task involvement serves as an individual mediator through which the type of performance goal affected interest for participants higher and lower in achievement motivation.

Pleasant Affect

Similar to task involvement, there was reason to believe based on past research that pleasant affect served to indirectly impact the relationship between the interest goal X achievement motivation interaction and interest (e.g., Sansone, et al., 1989), even when considering the little evidence for a interest goal X achievement motivation effect on pleasant affect. Following the mediational test guidelines outlined previously, partial support for this hypothesis was shown. Pleasant affect was able to significantly predict immediate interest when controlling for the basic model ($\beta = .38$, $F(1, 66) = 6.55$, p

<.01). The new pleasant affect model was significant (R^2 = .25, F (1, 66) = 3.71, p <.01) and accounted for significantly more variance in interest than the basic model, (ΔR^2 = .11, ΔF (1, 66) = 10.74, p <.001). The interest goal X achievement motivation Interaction term remained significant, with the regression coefficient for the interaction term dropping only slightly from β = .27, p= .02 to β = .23, p = .03. Importantly, however, pleasant affect was identified as an individual mediator of the effects on interest by the type of performance goal X achievement motivation interaction, as evidenced by the now non-significant interaction term, dropping from β = -.24 to β = -.10, p = .37.

Perceived Competence

Unlike task involvement and pleasant affect, the interest goal X achievement motivation interaction did significantly predict perceived competence. As such, it was expected that perceived competence would serve as a mediator of this relationship, and this was shown. Controlling for the basic model, perceived competence significantly predicted interest (β =.53, F (1, 66) = 10.30, p <.001). The new perceived competence model was highly significant (R^2 = .37, F (1, 66) = 5.98, p <.001) and accounted for significantly more variance in interest than the basic model, (ΔR^2 = .22, ΔF (1, 66) = 26.55, p <.001). Perceived competence was identified as an individual mediator of the relationship between the interest goal X achievement motivation interaction and immediate task interest, as evidenced by the now non-significant interaction term, dropping from β = .27 to β = .13, p = .19. Likewise, perceived competence was found to be an individual mediator between the type of performance goal X achievement

interaction and immediate task interest, as evidenced by the now non-significant interaction term, dropping from $\beta = -.24$ to $\beta = -.08$, $p = 46$.

Task Value

Results of previous regression analyses revealed that the interest goal X achievement motivation interaction did marginally significantly predict task value. As such, a mediational test was conducted to test task value as the mechanism between this interaction term and immediate task interest. Controlling for the basic model, task value significantly predicted interest ($\beta = .57$, $F(1, 66) = 11.22$, $p < .001$). The new task value model was highly significant ($R^2 = .41$, $F(1, 66) = 6.69$, $p < .001$) and accounted for significantly more variance in interest than the basic model, ($\Delta R^2 = .25$, $\Delta F(1, 66) = 31.51$, $p < .001$). Task value was identified as an individual mediator of the relationship between the interest goal X achievement motivation interaction and immediate task interest, as evidenced by the now non-significant interaction term, dropping from $\beta = .21$ to $\beta = .14$, $p = 13$.

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