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Why Don't Young Women Want to Pursue Male-Typed Occupational Aspirations?

A Test of Competing Hypotheses

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Abstract

We examined competing hypotheses (attitudes towards math and science, and lifestyle values) regarding why some young women cease to maintain occupational aspirations in male-dominated fields from late adolescence through young adulthood:. Data for this study (including 461 females and 250 males) are part of a longitudinal investigation, the Michigan Study of Adolescent Life Transitions, of adolescents from twelve low- to middle-income communities. For young women, negative feelings about math and physical science and high levels of traditionality were related to changing occupational aspirations out of male-dominated fields between high school and young adulthood. In addition, for young women, positive feelings about math and physical science and the importance of having a family-flexible occupation predicted changing from female-dominated or neutral occupational aspirations to male-dominated aspirations. Neither variable predicted change out of male-dominated occupational aspirations for young men. These results suggest that despite the women's movement and more efforts in society to open occupational doors for women, many young women are still being discouraged away from math and physical science careers and are still struggling with how they will balance career and family goals in adulthood.

Why Don't Young Women Want to Pursue Male-Typed Occupational Aspirations? A Test of Competing Hypotheses

Although women have been gradually making gains in entering traditionally male-dominated professions, gender differences persist in adult occupational pursuits (see National Center for Education Statistics, 1997; Oakes, 1990; Seymour & Hewitt, 1997 for reviews). Women and men now receive bachelor's degrees in equal numbers, but women are still underrepresented in many traditionally male-dominated occupational fields, such as engineering (10%), computer science (29%), chemistry (26%), and law (27%; Bureau of Labor, 1995, 1998; National Center for Education Statistics, 1997; National Science Foundation, 1994). Many women are still concentrated in traditionally "feminine" occupations with low status and low pay (Barrett, 1987; Ries & Stone, 1992).

Currently, not only are females less likely to choose mathematics, physical science, engineering, and computer fields, but when they do, they are more likely than males to "drop out" of them (Farmer, Wardrup, Anderson, & Risinger, 1995; Frazier-Kouassi et al., 1992; Hilton & Lee, 1988; Oakes, 1990; Office of Technology Assessment, 1988; Seymour, 1995; Seymour & Hewitt, 1997). At each successive educational level, girls are more likely than boys to opt out of math and science; this has been called the "leaky pipeline" (Eccles, 1989; Hilton & Lee, 1988; Oakes, 1990; Office of Technology Assessment, 1988; **Vetter?**) The underrepresentation of women in such male-dominated fields means that women who at one time aspired to careers in these fields, but did not achieve these aspirations, are not fulfilling their potential or their interests. This pattern is not only personally dissatisfying for women, but it has negative economic consequences for women and ultimately means a loss of talent for society (Oakes, 1990). For example, it has been argued that the gender segregation of the workforce into different fields is one of the reasons that women earn 75.5%

of what men earn (Bielby & Baron, 1984; England, 1992; Treiman & Hartmann, 1981; U.S. Department of Labor, 1997). At every level of educational and occupational status, female-dominated occupations pay less than male occupations, even controlling for occupational characteristics such as required skills, education, working conditions, and unionization (England, 1992b).

Competing Hypotheses.

Why don't women actually enter male-dominated fields after they have indicated an initial interest in these fields? During the last several decades, there has been much research interest in the issue of the lack of representation of women in traditionally male occupational fields, and several theories have been proposed to explain this phenomenon. Among such proposed explanations are: lack of encouragement from parents (Eccles & Harold, 1992), lack of "girl-friendly" instructional settings (e.g., AAUW, 1993; Casserly, 1980; Kahle, 1985), the "chilly climate" for women in non-traditional fields (Hall & Sandler, 1984; Seymour, 1995), low high school enrollment in math and science courses (Farmer et al., 1995; Sells, 1978), negative attitudes towards math (Eccles, 1994; Eccles [Parsons] et al., 1984), low self-perceptions of skills and future efficacy in math and science (Eccles, 1987; Eccles et al., 1985), and lifestyle and occupational values that are perceived to be incompatible with careers in male-dominated fields (Betz & Hackett, 1983; Eccles, 1987; Eccles, Jozefowicz, Barber, and Belansky, 1993; NCES, 1997). In this paper, we focus on two such explanations: attitudes towards math and science, and lifestyle values.

Lack of perception of ability or interest.

In terms of attitudes, some researchers have suggested that women's underrepresentation in male-dominated fields is due to the fact that women do not feel smart enough or are not interested in the areas of math and physical science. These ideas originate in theories that propose that self-concept of ability and values relate to behavioral intentions and behaviors (Bandura, 1977; Eccles et al., 1983).

For example, the Eccles et al. expectancy-value model (1983) proposes that both self-concepts of ability and interests predict achievement choices.

Research has also shown that self-perceptions of ability, and expectancies for success are related to achievement decisions made by students. Expectancies for success in math and self-concept of math ability are significantly related to intentions to take math courses and the number of math courses actually taken (Armstrong, 1985; Armstrong & Kahl, 1979; Eccles et al., 1983; Eccles et al., 1985; Feather, 1988; Lantz & Smith, 1981; Sherman, 1982; Updegraff et al., 1996). The higher a high school girl's self-concept of science ability, the greater the likelihood that she will aspire to a career in math or science (Hollinger, 1983). Sullins, Hernandez, Fuller and Tashiro (1995) found that expectancies and values in math and biology predicted college students' majors and intentions to take these courses in the future. Self-concepts of ability in sports, math, and English are related to the amount of free time spent in these activities (Eccles & Harold, 1992). Finally, Betz & Hackett (1981) found that self-efficacy in traditionally male occupations was related to interest in and consideration of these occupations.

However, there are gender differences in self-concept of ability. For example, research has shown that from early adolescence through college, boys have higher self-concepts of ability in math than girls (Bornhold, Goodnow, & Cooney, 1984; Eccles, 1984, 1989, Eccles et al., 1983; Ecles et al., 1989, Jackson, Hodge, & Ingram, 1994, Marsh, Parker, & Barnes, 1985). However, it has been found that females tend to underestimate their abilities in math even when objective test scores show no differences in ability (Betz & Hackett, 1983; Eccles et al, 1983; Eccles, et al., 1985; Frazier-Kouassi et al., 1992; Frome & Eccles, 1995; Marsh, Smith & Barnes, 1985; Stevenson & Newman, 1986; Updegraff, Eccles, Barber, & O'Brien, 1996). Furthermore, women's self-concepts of their abilities often tend toward more traditional "feminine" fields, such as the helping or people-oriented

professions (Eccles & Hoffman, 1984; Eccles, 1987; Jozefowicz, Barber, & Eccles, 1993; Lips, 1992; Marini, 1978), whether or not these are accurate representations of their abilities. Thus, the stereotype that women are less skilled than men in math and science may have guided many talented women out of those fields (Eccles, 1987; Nash, 1979).

In addition, to the relation between expectancies for success and achievement choices, there is also a correlation between the valuing of academic areas and participation (or intent to participate) in those areas for math (Armstrong, 1985; Armstrong & Kahl, 1979; Eccles et al., 1983, Eccles, 1984, 1986; Eccles, Adler, Futterman, Goff, Kaczala, Meece, & Midgley, 1985; Feather, 1988; Lantz & Smith, 1981; Sherman, 1982), English (Feather, 1988), science (Ware & Lee, 1988), and biology (Sullins et al., 1995). Eccles (1986) found that college women's career goals relate significantly to their valuing of math. Ware and Lee (1988) found that a positive attitude towards math in high school was related to majoring in science in college.

There are also gender differences in value placed on different academic areas. Researchers have also suggested that girls show less interest than boys in math and science. Girls' ratings of how much they like math decrease throughout adolescence while boys' ratings do not decrease (Eccles & Harold, 1992). Compared to girls, high school boys more highly value work that involves math and computers (Jozefowicz et al., 1993; Spade & Reese, 1991). Twelfth grade boys report enjoying science more than 12th grade girls (although they reported similar levels of liking math, NCES, 1997).

Lifestyle Values.

Still other researchers focus on the perceived "cost" to women's lives of choosing career in male-dominated fields. For many women, occupational choice involves weighing the perceived costs and benefits to family life (Corder & Stephan, 1984; Novack & Novack, 1996). Lips (1992) found that young women place more importance than young men on combining career and family, and belief

in the compatibility of science careers and family roles was positively related to intention to study science in college (but was not related to intentions to study math in college, to career goals, or to college majors). And, compared to boys, high school girls are more likely to plan to make sacrifices in their professional life for the needs of their family (Jozefowicz et al., 1993).

Most girls plan to be employed and to have children in their adult lives (Catalyst, 1987; Herzog & Bachman, 1983; Machung, 1989), and it has been suggested that one reason why women choose traditionally "female" professions is that these occupations allow women to combine work and family roles more easily than do "male" professions (Sales and Frieze, 1984; Ware & Lee, 1988). Young women with more traditional beliefs about women's roles in the workforce (e.g. those who believe that a woman's career will negatively affect her children, or those who believe that a woman's career should be subordinated to her husband's career) may be less likely to aspire to occupations in male-dominated fields because occupations in female-dominated or neutral fields (such as teaching or nursing) may seem more flexible[1]. For example, Farmer (1997) found that women in the field of nursing chose that field because of its geographic flexibility and its flexibility of work hours more than because they thought their personal attributes fit a nursing career. Fassinger (1990) found that liberal sex-role attitudes about both work and family roles predicted nontraditional career choices. Ware and Lee (1988) found that female college students who placed a high priority on future family and personal life were less likely than their female peers to choose a major in science and were less academically oriented in general. The authors concluded that these women viewed scientific achievement and academic interests as incompatible with family life (Ware & Lee, 1988).

[1] Although some view traditionally female occupations as being more likely to allow for part-time work, flexible hours, and little travel, Corcoran, Duncan, & Ponza (1984) have criticized this view (Frieze & Olson, 1994). Corcoran et al. (1984) argue that if this were true, more women would drop out of male-dominated occupations because these jobs would not allow them to care for children as easily, but this was not found in their analysis of data from the late 1960s and 1970s.

In sum, females who realize that occupational flexibility is important when trying to combine a career with childcare may be less likely to aspire to a male-dominated occupation because of the association of those occupations with lack of flexibility. Society's expectations for women's adult lives, combined with many women's knowledge that they will be expected to be the primary caretaker of the home and children, may serve to funnel women into more flexible, "disposable" careers for the sake of family. ** **put in Corder & Stephan 1984**

Research on Changing Aspirations.

It could be that women's choosing not to go into male-typed professions reflects a general pattern of changing occupational aspirations among young people. Indeed, Slaney (1984) reports that between 40%-50% of college students change their expressed vocational interests over a 12-month period. The rates are 40% for engineering programs, 50% for physical and biological sciences, and 60% for mathematics (Seymour & Hewitt, 1997). Apparently, many students find that what they expected from science training is incongruent with what their college science courses are actually like (Farmer et al., 1995; Seymour & Hewitt, 1997). While some of this career choice switching can be attributed to normal developmental patterns, it is also likely that rates of switching vary by field and by sex. Such variations have not been adequately researched; therefore it is difficult to fully understand the reasons why women drop their male-typed occupational aspirations.

Although inconclusive when taken together, there are several exceptions to this dearth of research. For example, Rojewski (1997) found that adolescents who maintained stable occupational interests were more likely to choose high-prestige occupations than adolescents who were undecided. Surprisingly, a majority of female adolescents expressed high-prestige occupational aspirations, and females selected such occupations in greater proportions than their male peers. However, males were

four times as likely as females to choose moderate-prestige occupations, which the author suggests is more realistic (Rojewski, 1997); it seems the author is suggesting that females' high-prestige aspirations are unrealistically inflated. He also found that females with high prestige expectations had higher scores on a variety of predictors, including achievement, self-esteem, locus of control, work orientation, and likelihood of success, than females with less prestigious expectations. This suggests that maintaining stable occupational aspirations in high-prestige occupations is highly related to personal feelings of efficacy.

Farmer and her colleagues (1995) found that 36% of women compared to 46% of men persisted in science careers over a 10 year period after high school, and that taking more science courses in high school predicted greater persistence in science careers for both sexes. For men, switching out of science careers was negatively related to high school science achievement and persistence in higher education. For women, interestingly, those who switched out of science careers reported greater career commitment ten years later. The authors suggest that women's career commitment crystallizes later than men's (Farmer et al., 1995); they may therefore predict more change in young women's aspirations than in young men's.

Both Rojewski's and Farmer et al.'s studies suggest that many young women aspire to prestigious and/or male-dominated fields, but also that many switch out. We believe that such women may not necessarily be inefficacious or unrealistic (furthermore, it is unclear what makes an occupation "unrealistically" attainable). In their study of why college women leave the sciences, Seymour (1995) found that the women disliked the "male" atmosphere of competition, isolation, and lack of encouragement in these classes. Even though girls often experience discouragement in math and science by parents and teachers who believe stereotypes that girls are not as able as boys in these subjects (Eccles & Harold, 1992), it seems from studies such as

Seymour's (1995; Seymour & Hewitt, 1997) that math and science fields continue to be less attractive to adult women not because they feel they aren't good enough, but because they do not want to go through the rituals of competition, independence, and toughness required to enter the male "fraternity" of the sciences. This would rule out the efficacy argument in favor of a content argument. More research is clearly needed on predictors of stability vs. change in high-prestige and male-dominated occupations for women.

Focus of this study.

In our study, we were interested in exploring competing hypotheses about why young women with male-dominated career aspirations "drop out" of these pursuits. We studied a group of females who aspired to male-dominated occupations in 12th grade. This is an important group to examine because as high school seniors, these young women showed enough of an interest and a belief in their ability in male-dominated fields to report that they would like to have occupations in these fields. While we are not proposing that male-dominated occupations are superior to female-dominated or neutral occupations, we do believe it is important to determine which factors may serve to constrict vocational options that young women perceive to be available to them, particularly because of the possible emotional, economic, and human capital losses associated with not fulfilling one's aspirations (Carr, 1997; Eccles, 1993; Hanson, 1994; Oakes, 1990). For example, Carr (1997) found that midlife women who had fallen short of their career goals showed lower levels of "purpose in life" and higher levels of depression than midlife women who had attained their earlier career goals, even after controlling for a variety of confounding factors.

We found that 65% of the females in our sample who had male-dominated occupational aspirations in 12th grade had switched to female-dominated or neutral occupational aspirations two years later (see Table 1 for a list of the occupational aspirations they originally chose and a list of the

occupational aspirations they switched to). Why do these young women switch out of male-dominated fields? Is it the math/physical science content that scares them away, or the potential interference of the demands of such occupations with their future roles as wives and mothers, or both? Within each of these competing hypotheses, we studied both personal belief elements and objective job-related elements. The personal belief elements include 1) feelings about math and physical science[2] (perception of one's ability and one's interest), and 2) the level of traditionality of beliefs regarding women's careers, and 3) the desire for an occupation with enough flexibility to easily mesh future work and family roles. The objective occupational elements include 1) the level of math/physical science content of the job to which they aspire, and 2) the actual demandingness (in terms of years of education required and average hours per week) of that job.

We compared the group of young women who switched out of male-typed occupations not only to young men, but also to young women who started off with aspirations in other types of occupational fields (female-dominated or neutral) and moved into male-dominated fields. First, we compared the relative influence of two belief systems on dropping out of a male-typed occupational aspiration: negative feelings about math and physical science, and concerns about combining a career and family (including both traditionality, and the desire for a family-flexible occupation). We hypothesized that for young women, both of these belief systems would predict dropping out, while for young men only negative feelings about math and physical science would predict dropping out. We also hypothesized that these beliefs would be positively related to change out of a male-dominated

[2] We include beliefs about physical science, but not biological science, because although women are underrepresented in high status biological science-related occupations (26% of physicians, 17% of dentists), they are overrepresented in mid-status occupations in those fields (87% of nurses, pharmacists, dietitians, and health therapists), and unlike engineering and physical sciences where the percentage of women earning degrees is usually under 30%, women usually make up over 30% of those earning degrees in biological and health sciences (ranging from 28% - 79%); National Center for Educational Statistics; 1996b).

occupational group, but would be negatively related to change out a female-dominated occupational group.

Our second set of hypotheses concern characteristics of the occupations themselves. We predicted that young women would be more likely to drop out of male-dominated occupations that contain a high level of math and physical science content and that are highly demanding in terms of educational requirements and average hours per week on the job.

Methods

The data were collected as part of a larger seven-wave longitudinal investigation (the Michigan Study of Adolescent Life Transitions) that focuses on the impact of the family and classroom environments on adolescent development. The first wave of data used here (referred to as "12th grade") was collected when the participants were in 12th grade. Questionnaires were filled out during a 90-minute session in the school auditorium or the cafeteria. The second wave of data used here was collected approximately two years after the first wave, when the subjects were on average 20 years old (referred to as "age 20"). The majority of these participants received questionnaires in the mail in the summer of 1992. Participants were paid $20 for completing the questionnaire.

Sample.

Participants were 461 females and 250 males from twelve low- to middle-income communities located within a 50-mile radius of a large Midwestern city. Ninety-two percent of the participants are European-American, 4% are African-American, and 4% are of other races/ethnicities. Sixty-six percent of the participants were full-time college students at age 20.

Measures.

At Time 1, participants were asked, "If you could have any job you wanted, what job would you like to have when you are 30?" At Time 2, participants were asked, "What job would you most like to have when you are 30?" These open-ended responses were coded according to the U.S. Census occupational codes. Each occupation was further coded as either male-dominated, neutral, or female-dominated based on the percentage of incumbents of that occupation that were female according to the 1990 Census. Occupations that were made up of 30% or fewer women were categorized as "male-dominated", occupations that were made up of 31%-69% women were categorized as "neutral", and occupations that were made up of 70% or more women were categorized as "female-dominated." See Table 2 for the distribution of occupational aspirations in these three categories in our sample.

Although researchers often group math and science together, we measured feelings about math using a separate scale from feelings about physical science. According to both Eccles' et al. (1983) expectancy-value model and Bandura's (1977) self-efficacy model, expectancies for success vary by domain and their influence on behavior will be domain-specific (Byrne, 1994). We use separate measures of feelings about math and physical science because research has suggested that these two disciplines are seen differently. First, mathematics is seen as one area while science is made up of many areas; second, there are different patterns of gender-related achievement and enrollment in the two fields (for example, math course enrollment relates to gender differences in math standardized test scores, whereas this is not true for the sciences); and third, math is perceived as more useful than science (Kahle, Parker, Rennie, & Riley, 1993).

Feelings about math were measured on a three-item scale at both timepoints (12^{th} grade alpha = .87, age 20 alpha = .93). Feelings about physical science were also measured on a three-item scale at

both timepoints (12^{th} grade alpha = .90, age 20 alpha = .91). These scales measure how much the participants like math/physical science, their self-concept of ability in math/physical science, and their expectancies for success in math/physical science. All items were answered on a 7-point Likert scale (see Appendix A for actual items).

We used two scales to measure beliefs about the combination of career and family. These two scales were created after a factor analysis identified them as independent factors. The first, traditionality, was measured by an 8-item scale (12^{th} grade alpha = .79, age 20 alpha = .77). These items tap into beliefs about the effect of a woman's career on her family, the effect of her family on her career, beliefs about the relative importance a woman should place on her career relative to her family, and beliefs about the relative importance of a husband's career and a wife's career. The second, importance of a family-flexible occupation, was measured by a 5-item scale (12^{th} grade alpha = .78, age 20 alpha = .80). These items tap into the value the respondent places on having a career that accommodates fulfilling family responsibilities, such as a flexible working schedule or being able to take time off for family responsibilities. All items were answered on a 7-point Likert scale (see Appendix A for actual items).

To code the content of math/physical science in an occupational aspiration, the aspirations were divided into three groups. The first group includes occupations where one's key or central tasks involve math, engineering, or physical science, the second group includes occupations where one's central tasks do not involve math, engineering, or physical science, but where one may perform tasks in these areas from time to time or where training for this occupation involves coursework in these areas; the third group includes occupations where one's central tasks do not involve math, engineering, or physical science, and where training for this occupation does not involve coursework in these areas. The occupations were coded by four

coders who had an average percent agreement of 90% with the final codes. Occupations were coded based on the agreement of three coders. For occupations for which at least three out of the four coders did not agree, the first author decided the code either by checking the actual answers of the participants to see the specific occupation they listed or by looking at the description of the occupation in the Occupational Outlook Handbook (Bureau of Labor Statistics, 1998-1999). One occupation, "computers, general" was coded as missing data, since it is not known if this response refers to computer programming, or computer use, such as word processing.[3] See Table 1 for the coding of these occupations.

Job demandingness was measured on a 3-item scale (12^{th} grade alpha = .81, age 20 alpha = .75). The first item in the scale is the average number of annual hours worked by year-round, full-time, occupational incumbents, according to the 1990 Census. Since this information was given in categories divided by gender and age groups, we used the averages given for women age 30-34 who are likely to have young children.[4] The second item in the scale is the normative amount of education held by occupational incumbents, according to the 1990 Census. For each occupation, the mode for level of education of the incumbents in each occupation (regardless of gender or age) was coded (1 = less than high school, 2 = high school, 3 = some college, 4 = bachelor's degree, 5 = PhD or professional degree). The final item in the job demandingness scale is a socioeconomic index score for each occupation. These scores are from Nakao and Treas (1992) and represent a combination of the educational attainment and income of job incumbents (Entwisle & Astone, 1994).

[3] Females' occupational aspirations were originally coded for another paper (Frome, 1998); 39 additional occupational aspirations reported by males were coded separately for this paper with the same method. The average percent agreement for these 39 occupation codes is 74%

[4] This age group was chosen instead of women in their 20s in order to include women who have delayed having children until after establishing themselves in a career.

Results

The main focus of this study is the subsample of 151 young women with male-dominated occupational aspirations in the 12th grade (other participants are used for comparison purposes). This main subsample was divided into two groups, the "stable" group (those young women who continued to have male-dominated occupational aspirations at age 20) and the "change" group (those young women who had male-dominated occupational aspirations in their senior year of high school but who switched their occupational aspirations to female-dominated or neutral by age 20).

First we examined gender differences in the rate at which students aspired to occupations in male-dominated fields. Results showed that, as expected, young women were less likely than young men to aspire to occupations in male-dominated fields in 12th grade (33% vs. 69%, $\chi 2 = 105.23$***). Young women were also more likely than young men to change their aspirations out of the male-dominated occupational category (65% vs. 27%, $\chi 2 = 46.43$***). In order to rule out the alternative hypothesis that the young women's "change" group had more to do with flux in females' aspirations at this time of life than with leaving male-dominated occupations per se, we also tested whether young women were more likely to "drop out" of male-dominated occupational aspirations than to "drop out" of neutral or female-typed aspirations. We found that compared to 65% of young women who "dropped out" of male-dominated occupational pursuits, only 44% "dropped out" of neutral occupational pursuits, and only 28% "dropped out" of female-typed occupational pursuits. These differences were statistically significant ($\chi 2 = 36.14$***).

Personal Beliefs.

We used logistic regression, which regresses a dichotomous outcome variable on continuous independent predictors, to test the predictive ability of young women's math, science, traditionality, and lifestyle beliefs on their group status (change vs. stable). See Appendix B for the correlation matrices of the scales used in each model.

Both logistic regressions (time 1 and time 2) significantly predicted which of the young women who aspired to male-dominated occupations at time 1 continued to aspire to these occupations at time 2. At both timepoints, having positive feelings about physical science predicted continuing to aspire to a male-dominated occupation, but positive feelings about math had no effect (see Tables 3 & 4).[5] In addition, at time 2, traditionality predicted changing one's occupational aspirations out of a male-dominated field, but the importance placed on having a family-flexible occupation was not a significant predictor. However, at both timepoints the differences between the two groups on math and the importance of a family-flexible occupation were in the expected direction.

For young men, the logistic regression testing the predictive ability of their beliefs on their group status was not significant at either timepoint.[6] However, at time 2, there was a trend for positive feelings about physical science to predict continuing to aspire to a male-dominated occupation.

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[5] As a singular predictor at time 1, feelings about math significantly predict group membership. However, feelings about math and feelings about physical science are significantly correlated, and the physical science variable is a stronger predictor of group membership, so when both variables are in the equation together feelings about math becomes an insignificant predictor.

[6] Although, for young men at time 1, when feelings about math and feelings about physical science are entered in the first step, and the two career/family beliefs are entered in the second step, the first step is significant, with positive feelings about physical science predicting continuing to aspire to a male-dominated occupation. This is also true for time 2, but at time 2 there was a high correlation (.72**) between feelings about math and feelings about physical science among young men. To ensure that the effects were not underestimated due to multicollinearity, the feelings about math scale and the feelings about physical science scale were combined for young men at time 2. As at time 1, time 2 results showed that when feelings about math and physical science are entered in the first step, and career/family beliefs are entered in the second step, the first step is significant, with positive feelings about math and physical science predicting continuing to aspire to a male-dominated occupation.

We also conducted the same logistic regressions with young women who originally aspired to female-dominated or neutral occupations to rule out the possibility that, for young women, these beliefs predict general change in aspirations, not specifically changing out of male-dominated aspirations. The results supported the hypothesis that these beliefs would be positively related to change out of a male-dominated occupational group, but would be negatively related to change out a female-dominated occupational group. At both timepoints, positive feelings about physical science were positively related to changing one's aspiration to a male-dominated occupation for young women who originally had a female-dominated or neutral occupation (see Tables 5 & 6). In addition, at both times placing importance on having a family-flexible occupation was negatively related to changing one's aspiration into a male-dominated occupation.

Job Characteristics.

The objective characteristics of the occupations that young women aspired to were also significantly related to changes in their aspirations. Both young women at time 1 and young men at times 1 and 2 who aspired to occupations with higher math content were more likely to continue to aspire to occupations in male-dominated fields at time 2 (see Tables 7, 9 & 10). In addition, for young women who originally aspired to male-dominated occupations, aspiring to a less demanding occupation at time 2 was associated with aspiring to a female-dominated or neutral occupation at time 2 (see Table 8). For young women who at time 1 aspired to a female-dominated/neutral occupation, aspiring to a more demanding occupation at time 2 was associated with changing their aspiration to a male-dominated occupation at time 2.

Discussion

As predicted, young women who aspired to occupations in male-dominated fields in 12th grade had higher rates of "dropping out" of those fields than young men. They also had higher

rates of "dropping out" of the original field to which they aspired than young women who aspired to occupations in female-dominated or neutral fields in 12th grade. Furthermore, also as predicted, negative feelings about physical science and traditionality of sexrole beliefs were related to young women's changing their occupational aspirations out of male-dominated fields. However, these factors were not related to young men' changing aspirations out of male-dominated fields. In addition, among young women who aspired to occupations in female-dominated or neutral fields, negative feelings about math and science, and desire for a family-flexible occupation were related to young women continuing to aspire to an occupation in these fields as young adults

Switching out of a male-dominated occupation has real consequences for these young women. At age 20, young women who had changed their aspirations from male-dominated to female-dominated or neutral fields aspired to occupations with significantly lower socioeconomic status compared to young women who continued to aspire to occupations in male-dominated fields, although there had been no differences in the socioeconomic status of the aspirations of these two groups in 12th grade (see Table 12). These results show that we need not only to increase the percentage of young women who aspire to occupations in male-dominated fields, but also to increase the percentage of young women who maintain aspirations in occupations in male-dominated fields as they enter young adulthood. Thus, it is important to discover factors that contribute to young women maintaining male-dominated occupational aspirations after high school. In this discussion, we will first address the math and physical science-related predictors (attitudes towards math and physical science and aspiring to a math/physical science-related occupation), and will then address the family/career-related

predictors (traditionality, importance of a family-flexible occupation, and demandingness of occupational aspiration).

What are the factors that lead to young women maintaining their aspirations? We found that for young women who aspire to male-dominated occupations in 12th grade, both beliefs about physical science, as well as beliefs regarding women in the workforce, played a role in maintaining those occupational aspirations.

At both timepoints, positive feelings about physical science, but not math, were predictive of young women maintaining male-dominated aspiration. This finding makes sense in light of the fact that a majority of the occupations that these young women aspired to in 12th grade involve physical science/math. The young women who like physical science more and who had high expectations for success in a career requiring physical science skills are the ones most likely to maintain aspirations in these types of male-dominated occupations.

These results support previous research that has found that girls' confidence about their math and science abilities are related to their aspirations to enter into math- and science-related vocations (Baker, 1987; Hollinger, 1983), and that girls who value mathematics less were less likely to enroll in advanced mathematics courses (Eccles, Adler, & Meece, 1984). These results also emphasize the importance of girls being given the opportunity to have positive experiences with physical science and math so that they will not choose other careers based on lack on interest in or low expectations for success in science careers. Strategies that have been suggested for keeping girls in the "science pipeline" include educating young girls to develop more independent modes of learning, decision-making, and self-assessment of their abilities that are more compatible with the "male" culture of math and physical science fields, and creating

substantial changes in the traditional style of pedogogy in science, math and engineering fields to support more interactive and cooperative styles of learning (Seymour, 1995).

For both young women and young men who aspired to a male-dominated occupation at time 1, the higher the level of the math/physical science content of their occupational aspiration at time 1, the more likely they were to continue to aspire to an occupation in a male-dominated field (this was true for young men at time 2 also). Thus, it seems that specifically aspiring to a math/physical science occupation (e.g., engineer) in 12th grade acts as a protective factor, keeping students in such male-dominated fields. It may be that by 12th grade, students who aspire to occupations in math and physical science have already made a commitment to those fields by choosing upper level high school courses in those field, since they know that completing those courses are necessary to be successful in college courses in those fields. However, students who aspire to a male-dominated occupation that is neither in math nor in physical science might not have had to make a commitment to those careers by 12th grade. For example, one does not necessarily have to take difficult high school courses to prepare for a career as a lawyer or a CEO, although such courses will help one get into college and subsequently onto such a career path.

Age 20 beliefs that a woman should focus on her family first and her career second (traditionality) were predictive of changing one's aspiration from a male-dominated to a female-dominated or neutral category. Interestingly, having these same career/family beliefs in 12th grade did not predict changing one's aspiration out of a male-typed field. There are two possible explanations for this finding. One is that this result relates to changes in young women's priorities between 12th grade and age 20, with their career plans becoming less important and their family plans becoming more important.

A second explanation relates to changes in young women's beliefs about the ease of combining male-dominated careers with a family. As young women get older, they might be more likely to conclude that it is harder to place a career in a male-dominated field second to a family than a career in a female-dominated or neutral field. They may begin to feel the very real pressure of society's expectations for their adult lives as they continue to make choices about their courses and career paths (Novack & Novack, 1996; Spade & Reese, 1991; Subotnik & Arnold, 1996). Gathering information (both accurate and inaccurate) on the hours of work required for a job, the educational requirements for a job, the attitudes of supervisors and coworkers towards one's family responsibilities, the flexibility of a job schedule, and the geographic flexibility of a job (which is important if one is planning on subordinating one's career to one's husband's career), may make young women begin to realize that combining work and family will be difficult (Gottfredson, 1981; **other refs**?). In the case of either of these explanations, it is unfortunate that even among such a recent cohort of young women, traditional beliefs about making career sacrifices in order to raise a family still circumscribe occupational aspirations (see also Alfeld-Liro, Frome, & Eccles, 1996; Frome, 1998; Novack & Novack, 1996; Seymour, 1995; Subotnik & Arnold, 1996). **should we put something in here about policy needs (addressing quality, affordable child care, either gov. or employer-subsidized?) so girls don't have to make these choices? who is a good reference for this?**

The results also supported the hypotheses by negating an alternative hypothesis that high concerns about combining a career and a family would be positively related to *any* change in career aspirations, not just change out of a male-dominated field. Among young women who originally aspired to a female-dominated or neutral occupation, the more importance she placed on having a family-flexible occupation, the less likely she was to change her occupational

aspiration into a male-dominated field. Thus, more traditional gender role beliefs predicted dropping a male-dominated occupational aspiration, while more liberal gender role beliefs predicted changing into a male-dominated aspiration. In addition, positive feelings about physical science predicted changing one's aspirations into a male-dominated field.

Why is it that traditionality significantly predicted change for the young women who originally aspired to male-dominated occupations, while the importance of a family-flexible occupation predicted change for the young women who originally aspired to female-dominated or neutral occupations? This difference may be due to differences in plans to have children. At both timepoints, young women who originally aspired to male-dominated occupations were less likely to plan to have children compared to other young women (see Table 13). One would most likely desire a family-flexible occupation to be able to take care of children, thus for those young women who plan to have children, the family-flexible variable should be important. However, the traditionality variable reflects both beliefs that are not related to having children (such as that a wife's career should be subordinate to her husband's career, and that a woman's career has a negative effect on her relationship with her husband) as well as beliefs related to having children (such as the effect of a woman's career on her children). Thus, it makes sense that among young women who report being less likely to have children, the traditionality variable would be the better predictor, while among young women who report being more likely to have children, the flexibility variables would be the better predictor.

The lack of predictive effects of career/family beliefs on changes in young men' occupational aspirations supports the hypothesis that young women's career aspirations are more likely to be influenced by career/family issues than are young men' career aspirations.

The results of analyses examining the effects of job characteristics also supported the hypothesis that young men are less likely than young women to consider family demands when choosing an occupational aspiration. For young women only, at time 2, aspiring to a less demanding occupation is associated with having changed one's aspiration from a male-dominated to a female-dominated or neutral occupation. For young women who originally aspired to a female-dominated or neutral occupation, aspiring to a more demanding occupation is associated with having changed one's aspiration to a male-dominated field

Since aspiring to a less demanding occupation at time 2 was associated with having changed one's aspiration out of a male-dominated field, it is likely that as these young women became older a less demanding occupation became more desirable.

In sum, we have found continuing circumscription of occupational aspirations for the sake of family among a more recent cohort of young women than has been studied in the past (e.g., Gottfredson, 1981; Angrist & Almquist??). In the long term, our further research will examine the socioeconomic and mental health consequences of these compromises; if these young women do not receive support in household and childcare duties from their employers and spouses in the future, they may be less likely to fulfill their occupational aspirations in male-dominated fields. In the short term, we suggest that interventions with young women in high school and beyond focus on encouraging girls to take high level courses in math and physical sciences (Eccles refs, Ware & Lee?) and teach these subjects in both secondary and post-secondary schools in ways that allow girls to learn to feel efficacious when doing this type of work (Seymour, 1995). In addition, we suggest that interventions with young men focus on taking equal responsibility for childcare and household responsibilities. We also encourage parents and educators who are concerned about the consequences of these circumscribed

aspirations to raise not only adolescents', but also employers' and policymakers' awareness of the need for sharing in childcare responsibilities. This is the only way that women will be able to achieve both their family and their career aspirations.

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Table 2. Categorization of Occupational Aspirations.

Females: 12th Grade Occupational Aspiration	Aspire to a female-dominated occupation at age 20	Aspire to a neutral occupation at age 20	Aspire to a male-dominated occupation at age 20
108 female-dominated	78	25	5
202 neutral	62	113	27
151 male-dominated	48	50	53
Males: 12th Grade Occupational Aspiration			
4 female-dominated	1	2	1
73 neutral	3	47	23
173 male-dominated	11	36	126

Table 3. Females -Logistic regression Time 1-predicting changing out of male-dominated job aspiration.

	B	Wald	Exp(B)	Mean Stable Group	Mean Change Group
Feelings about math	-.19	1.91	.83	4.88	4.18
Feelings about physical science	-.39**	7.35	.68	4.88	3.73
Importance placed on family-flexible occupation	.07	.19	1.08	5.14	5.39
Traditionality	.31	1.71	1.36	2.58	2.94
N=134				46	88

Overall model Chi-Square = 30.04***,successfully categorized 72% of cases (0=stable group, 1=change group).

Table 4. Females -Logistic regression Time 2-predicting changing out of male-dominated job aspiration.

	B	Wald	Exp(B)	Mean Stable Group	Mean Change Group
Feelings about math	.07	.31	1.08	4.55	4.09
Feelings about physical science	-.43**	7.82	.65	4.67	3.62
Importance placed on family-flexible occupation	.27	2.15	1.30	4.70	5.17
Traditionality	.49*	4.38	1.63	2.58	3.05
N=134				46	88

Overall model Chi-Square = 20.87***,successfully categorized 72% of cases (0=stable group, 1=change group).

Table 5. Females -Logistic regression Time 1-predicting changing into male-dominated job aspiration.

	B	Wald	Exp(B)	Mean Stable Group	Mean Change Group
Feelings about math	.03	.04	1.03	3.91	4.20
Feelings about physical science	.32*	5.76	1.38	3.40	4.29

Importance placed on family-flexible occupation	-.43**	6.22	.65	5.61	4.93
Traditionality	-.24	1.39	.79	3.02	2.62
N=279				250	29

Overall model Chi-Square = 17.22**,successfully categorized 90% of cases (0=stable group, 1=change group).

Table 6. Females -Logistic regression Time 2-predicting changing into male-dominated job aspiration.

	B	Wald	Exp(B)	Mean Stable Group	Mean Change Group
Feelings about math	-.02	.02	.98	3.69	4.46
Feelings about physical science	.48**	7.58	1.61	3.24	4.43
Importance placed on family-flexible occupation	-.70***	13.55	.49	5.29	4.30
Traditionality	.21	.84	1.24	2.90	2.77
N=279				250	29

Overall model Chi-Square = 29.78***,successfully categorized 90% of cases (0=stable group, 1=change group).

Table 7. Females-Logistic regression Time 1- moving out of male-dominated occupations

	B	Wald	Exp(B)	Mean Stable Group	Mean Change Group
Aspires to math/physical science/engineering job	-.87***	11.21	.42	1.94	1.53
Job Demandingness	.25	1.79	1.29	.58	.68
N=145				50	95

Overall model Chi-Square = 12.41**,successfully categorized 70% of cases (0=stable group, 1=change group).

Table 8. Females-Logistic regression Time 2- moving out of male-dominated occupations

	B	Wald	Exp(B)	Mean Stable Group	Mean Change Group
Aspires to math/physical science/engineering job	-.42[t]	3.17	.66	1.96	1.68
Job Demandingness	-1.49***	23.12	.23	.77	-.20
N=145				50	95

Overall model Chi-Square = 42.24***,successfully categorized 81% of cases (0=stable group, 1=change group).

Table 9. Males-Logistic regression Time 1- moving out of male-dominated occupations

	B	Wald	Exp(B)	Mean Stable Group	Mean Change Group
Aspires to math/physical science/engineering job	-.59*	5.76	.56	2.05	1.53
Job Demandingness	.13	.32	1.14	.21	.68
N=126				88	95

Overall model Chi-Square = 6.24*,successfully categorized 70% of cases (0=stable group, 1=change group).

Table 10. Males-Logistic regression Time 2- moving out of male-dominated occupations

	B	Wald	Exp(B)	Mean Stable Group	Mean Change Group
Aspires to math/physical science/engineering job	-.86***	10.83	.42	2.11	1.68
Job Demandingness	-.50^{t}	2.78	.61	.31	-.20
N=126				88	95

Overall model Chi-Square = 18.88***,successfully categorized 63% of cases (0=stable group, 1=change group).

Table 11. Females-Logistic regression Time 2- moving into male-dominated occupations

	B	Wald	Exp(B)	Mean Stable Group	Mean Change Group
Aspires to math/physical science/engineering job	.50^{t}	3.14	1.64	1.51	1.83
Job Demandingness	2.13***	26.51	8.44	-.27	.74
N=289				259	30

Overall model Chi-Square = 52.66***,successfully categorized 93% of cases (0=stable group, 1=change group).

Table 12. T-test comparing the socioeconomic status of the occupational aspirations of Females who maintain their occupational aspirations in male-dominated fields over time vs. those who change their aspirations to female-dominated or neutral fields

	Mean Stable Group	Mean Change Group	T
Socioeconomic Status of 12th Grade Occupational Aspiration	83.50	83.86	-.14
Socioeconomic Status of Age 20 Occupational Aspiration	83.27	70.40	5.40***
N	45	92	

Table 13. T-tests comparing plans to have children

	Mean of Females with male-dominated occupational aspirations in 12th grade	Mean of Females with female-dominated or neutral occupational aspirations in 12th	

		grade	T
12th grade plans to have children (1=very unlikely, 7=very likely)	5.51	5.95	-2.38*
Age 20 plans to have children (1=I would prefer not to have children at all, 4=I would like to have children fairly soon, 5=I already have children)	2.46	2.76	-2.14*

Appendix A

Feelings About Math – 12th Grade

How much do you like doing math? 1 "a little" … 7 "a lot"
How good at math are you? 1 "not at all good" … 7 "very good"
How good do you think you would be in a career requiring good math skills? 1 "not at all good" … 7 "very good"

Feelings About Physical Science – 12th Grade:

How much do you like doing physical science? 1 "a little" … 7 "a lot"
How good at physical science are you? 1 "not at all good" … 7 "very good"
How good do you think you would be in a career requiring good physical science skills? 1 "not at all good" … 7 "very good"

Feelings About Math – Age 20:

How much do you like doing things that involve each of the following? using advanced math 1 "not at all" … 7 "a not"
How good would you be in a career or job that required you to do each of the following? use math 1 "not at all good"…4 "about average"…7 "very good"
Rate how well you think you would do in each of the following college/university courses or programs (asked of full-time students only). 1 "I would not do well at all"…4 "I would do average"…7 "I would do very well" taking math courses

Feelings About Physical Science - Age 20:

How much do you like doing things that involve each of the following? using physical science 1 "not at all" … 7 "a lot"
How good would you be in a career or job that required you to do each of the following? use physical science or technology 1 "not at all good"…4 "about average"…7 "very good"
Rate how well you think you would do in each of the following college/university courses or programs (asked of full-time students only). 1 "I would not do well at all"…4 "I would do average"…7 "I would do very well" taking physical science or engineering courses

Traditionality:

1 "strongly disagree" … 7 "strongly agree"
Having a career takes away from a woman's relationship with her husband.
A preschool child is likely to suffer if the mother works (age 20 add "outside the home").
A working mother can establish just as warm and secure a relationship with her children as a mother who does not work (reverse coded).
It is much harder for a woman to be a success at her career if she has children.
A wife's relationship with her husband is better if she doesn't place too much importance on her job.
If someone's career needs to suffer for the family, it should be the wife's and not the husbands.
It is usually better for everyone involved if the man is the achiever outside the home and the woman takes care of the home and family.
A man is less likely to marry a woman who plans to pursue a career (age 20 says "who plans to devote a good deal of energy to her career).

Importance of a Family-flexible Occupation:

1 "not at all" … 7 "a lot"
Please indicate how much you would like a job with each characteristic.
"has a flexible working schedule you can adjust to meet the needs of your family"
"does not require you to be away from your family"
"leaves a lot of time for other things in your life"
"allows you to be at home when you children are out of school (like teaching)"
"makes it easy to take a lot of time off for family responsibilities"

Appendix B

W6 Correlations for Females who have male-dominated aspirations at wave 6

	1	2	3	4
1. 12th Grade Feelings About Math				
2. 12th Grade Feelings About Physical Science	.32***			
3. 12th Grade Importance of a Family-flexible Occupation	.07	-.18*		
4. 12th Grade Beliefs About Women in the Workforce	-.04	-.25**	.19*	
5. Change/Stable Group- w6=maletyped	-.22**	-.34***	.10	.19*
N=139				

W7 Correlations for Females who have male-dominated aspirations at wave 6

	1	2	3	4
1. Age 20 Feelings About Math				
2. Age 20 Feelings About Physical Science	.53***			
3. Age 20 Grade Importance of a Family-flexible Occupation	-.12	-.20*		
4. Age 20 Beliefs About Women in the Workforce	-.04	-.15^{t}	.25**	
5. Change/Stable Group- w6=maletyped	-.12	-.30***	.20*	.24**
N=139				

W6 Correlations for Males who have male-dominated aspirations at wave 6

	1	2	3	4
1. 12th Grade Feelings About Math				
2. 12th Grade Feelings About Physical Science	.34***			
3. 12th Grade Importance of a Family-flexible Occupation	.04	.20**		
4. 12th Grade Beliefs About Women in the Workforce	-.07	.05	.16*	
5. Change/Stable Group- w6=maletyped	-.05	-.21**	-.09	-.06
N=157				

W7 Correlations for Males who have male-dominated aspirations at wave 6

	1	2	3	4
1. Age 20 Feelings About Math				
2. Age 20 Feelings About Physical Science	.72***			
3. Age 20 Importance of a Family-flexible Occupation	.21**	.19*		
4. Age 20 Beliefs About Women in the Workforce	.01	-.01	.19*	
5. Change/Stable Group- w6=maletyped	-.11	-.18*	.00	-.11
N=157				

W6 Correlations for Females who have female-dominated/neutral aspirations at wave 6

	1	2	3	4
1. 12th Grade Feelings About Math				
2. 12th Grade Feelings About Physical Science	.20***			
3. 12th Grade Importance of a Family-flexible Occupation	-.09	-.11^{t}		
4. 12th Grade Beliefs About Women in the Workforce	.06	-.11^{t}	.19***	
5. Change/Stable Group- w6=maletyped	.06	.18**	-.18**	-.11^{t}
N=279				

W7 Correlations for Females who have female-dominated/neutral aspirations at wave 6

	1	2	3	4
1. Age 20 Feelings About Math				
2. Age 20 Feelings About Physical Science	.61***			
3. Age 20 Importance of a Family-flexible Occupation	-.11^{t}	-.16**		
4. Age 20 Beliefs About Women in the Workforce	-.06	-.13*	.28***	
5. Change/Stable Group- w6=maletyped	.01	.10	.24**	.17*
N=278				

W6 Correlations for Females who have male-dominated aspirations at wave 6

	1	2	3	4
1. Level of math/physical science in job aspiration				
2. Job Demandingness	.24**			
3. Change/Stable Group- w6=maletyped	-.27***	.05		
N=145				

W7 Correlations for Females who have male-dominated aspirations at wave 6

	1	2	3	4
1. Level of math/physical science in job aspiration				
2. Job Demandingness	.11			
3. Change/Stable Group- w6=maletyped	-.16*	-.49***		
N=145				

W6 Correlations for Males who have male-dominated aspirations at wave 6

	1	2	3	4
1. Level of math/physical science in job aspiration				
2. Job Demandingness	.20*			
3. Change/Stable Group- w6=maletyped	-.21*	.00		
N=145				

W7 Correlations for Males who have male-dominated aspirations at wave 6

	1	2	3	4
1. Level of math/physical science in job aspiration				
2. Job Demandingness	.17^{t}			
3. Change/Stable Group- w6=maletyped	-.34***	-.22*		
N=145				

W6 Correlations for Females who have female-dominated/neutral aspirations at wave 6

	1	2	3	4
1. Level of math/physical science in job aspiration				
2. Job Demandingness	.27***			
3. Change/Stable Group- w6=maletyped	-.01	.11†		
N=145				

W7 Correlations for Females who have female-dominated/neutral aspirations at wave 6

	1	2	3	4
1. Level of math/physical science in job aspiration				
2. Job Demandingness	.16**			
3. Change/Stable Group- w6=maletyped	.14*	.42***		
N=145				