Gender Differences in STEM Undergraduates' Vocational Interests: People-Thing Orientation and Goal Affordances

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Abstract

This study addressed why women have greater representation in some STEM (science, technology, engineering, and mathematics) fields compared to others by linking two theoretical approaches, *people-thing orientation* (PO,TO) and *role congruity theory,* which emphasizes occupation goal affordances associated with traditionally feminine and masculine roles. Vocational interest and goal affordance ratings (having a positive social impact, family, and occupation status) for occupations characterized as working with people or things were assessed in 1848 students (42% female; 81% white non-Hispanic) majoring in biology (gender balanced), non-biology STEM (male-dominated), and female-dominated health fields. Participant PO and TO interests were also collected. Results indicated that non-biology STEM majors showed lower PO and higher TO interests than biology and health majors. Non-biology STEM majors also endorsed PO and TO interests at similar levels, but the other two major groups indicated higher PO than TO. People Jobs were perceived to more likely afford goals related to family and positive social impact; whereas Thing Jobs were perceived to more likely afford status goals. Interest in People Jobs was similar for women in both STEM major groups. Female non-biology STEM majors were equally interested in People and Thing Jobs; whereas biology majors preferred People Jobs. PO, TO, and goal affordance ratings independently predicted interest in People and Thing Jobs, and gender accounted for very little additional variance. Taken together, the findings point to the importance of using both person-thing orientation and role congruity theory when explaining varied gender representations in different STEM fields.

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1. Introduction

Women receive university degrees and are entering the work force in greater numbers than ever; yet they remain significantly underrepresented in most science technology engineering and math (STEM) majors and careers (National Science Foundation, 2013). Exceptions are in biology and medical fields where women have been well represented in recent years (National Science Foundation, 2013). Previous research has paid less attention to this fact, and consequently, this study examines two different theoretical approaches to explain why women are well represented in some STEM fields, but not others.

One theoretical explanation is that gender differences in vocational preferences are related to interests in *people* and *things* (Graziano, Habashi, Evangelou, & Ngambeki, 2012; Graziano, Habashi, & Woodcock, 2011; Lippa, 2005, Su, Rounds, & Armstrong, 2009; Woodcock et al., 2013). An alternative explanation for gender differences across STEM fields is offered by *role congruity theory* (Diekman & Eagly, 2008), which proposes that STEM careers are not appealing to women, in part, because they are not perceived as affording typically feminine communal goals, such as helping people (Diekman & Steinberg, 2013). Based on this theory, the greater representation of women in some STEM fields should be related to the perceptions that these occupations are more likely to afford communal goals relative to other STEM fields.

The two explanations are similar in that they both rely on women's desire to interact with or benefit people; however they differ in that people-thing orientation (PTO) proposes that socialized *interests* are basis of gender differences, and role congruity theory proposes that socialized gender role norms that lead to gendered preferences for occupation *goal affordances*

accounts for the gender differences. These two explanations are not mutually exclusive. But the degree to which these two explanations might overlap is not clear (e.g., "people jobs" might also be ones that primarily help people). There is no research (to our knowledge) that has examined the relations between the two.

Grounded in PTO and role congruity theory, this study systematically examines four issues related to explaining the variable representation among women majoring in Biology, non-Biology STEM, and non-STEM female-dominated fields: 1) What are the relations between an individual's people orientation, thing orientation, gender, and major choice?; 2) How are major and gender related to interest in *occupations* that vary in their involvement with people or things?; 3) How do students associate goal affordances with occupations that vary in their involvement with people and things?; 4) What are the independent and combined predictive power of people orientation, thing orientation, and goal affordances in explaining vocational interests? Previous research on PTO and role congruity theory inform these objectives.

1.1 People-thing orientation

People-thing orientation captures the degree to which an individual prefers activities that involve impersonal tasks (e.g., dealing with machines) relative to tasks that involve interacting with people. Central to this perspective is the assumption that interests are dispositional in nature and fundamental to career decisions because people prefer to situate themselves in settings where they can act on their interests (Holland, 1966, 1997; Lee, Lawson, & McHale, 2015; Su et al., 2009; Tracey & Robbins, 2005). In their seminal review of gender differences in career interests, Su et al. (2009) noted that interests have been characterized as trait complexes (e.g., Armstrong, Day, McVay, & Rounds, 2008) and direct expressions of identity related to a person's goals, motives, and aspirations (e.g., Hogan & Roberts, 2000). As such, interests are viewed as the

"impetus for individuals to navigate and function effectively in their environment" (Su et al., 2009; p. 860).

Several models have been developed to explain gender differences in vocational interests. In Holland's (1997) well-known six-type circular RIASEC model, *Realistic-Social* interest paralleled people-thing interest and showed large gender differences consistently (Su et al., 2009; Tracey & Rounds, 1993). Prediger (1982) proposed two bipolar dimensions on interest, with one of them being People-Things dimension (i.e., working with people versus things), and the other Data-Ideas which does not typically evidence large gender differences. Lippa (2001) also proposed that femininity-masculinity as a bipolar trait overlaps substantially with the People–Things dimension of vocational interests. While using different terminologies and conceptual frameworks, many theorists agree that women generally manifest a greater people orientation than men, and it is possible that STEM occupations with a larger proportion of women are those that are perceived as being more people oriented (Su et al., 2009).

Gender differences are consistently found in PTO (Su et al., 2009), and the effect sizes are generally large (e.g., Lubinski, 2000; Su et al., 2009). Gender differences in interests are stable over childhood and span different ethnicities (e.g., Tracey & Robbins, 2005). Across a wide age range (10 to 25 years) gendered interests have been found to be related to similarly gendered career choices in early adulthood (Lee et al., 2015). Gender differences in interests are reliable, in contrast to those in science and math abilities, which are not consistently found (Ceci, Williams, & Barnett, 2009; Su et al., 2009). Importantly, the original conceptualization of people and thing interest as being opposite ends of a continuum has not been supported (Graziano et al., 2011); instead, they can be characterized as independent interest factors.

A small number of studies have examined PTO as a factor in college STEM students' career

interests and major choices. Recent work by Graziano et al. (2012) sets the stage for the current study. They examined people oriented (PO) and thing oriented (TO) interests among first year STEM and non-STEM college majors. Gender differences, regardless of major, emerged in the expected directions for both PO (women higher) and TO (men higher), but for STEM majors gender differences in TO were greatly reduced in comparison to those within non-STEM majors, where they remained large. Interestingly, women in STEM and non-STEM majors were similar on PO. Only TO distinguished women in STEM (higher scores) from non-STEM majors (lower scores). It is important to note that PO and TO are viewed as both characteristics of individuals and occupations. Consequently, Graziano et al. also examined students' interest in four careers that differed in PO (nursing and teaching) and TO (engineering and auto mechanics). They found that PO and TO had predictive power for career interest over and above gender. Following this research, we expected that students in STEM majors with greater numbers of women would be higher in PO than TO and that STEM careers that attract more women, such as fields in biology, would be perceived as being more people oriented than thing oriented.

1.2 Role congruity theory

Role congruity theory is an extension of social role theory (Eagly, 1987). Social role theory, as well as a number of other theories (e.g., Beach, 1990, 1993; Gottfredson, 1981; Mahalik, Perry, Coonerty-Femiano, Catraio, & Land, 2006; Thompson & Dahling, 2010), argues that different social expectations for men and women lead to their interest in different careers. At the heart of role congruity theory's explanation of gender differences in career choices is the tenet that women should be more attracted to caregiving and people oriented careers because these occupations are consistent with feminine gender roles and the goals associated with these roles (Diekman, Brown, Johnston, & Clark, 2010; Diekman, Clark, Johnston, Brown, & Steinberg,

2011; Diekman & Steinberg, 2013). STEM careers are generally not perceived as being helpful to others or as having a positive social impact, and this is seen as an obstacle in attracting women to these careers (also see Jones, Howe, & Rua, 2000). STEM and other masculine careers are generally associated with affording agentic goals related to power, success, and individualism that are attractive to men. In a series of studies with primarily Introductory Psychology students, Diekman and colleagues have shown that gender differences in interest in STEM careers are mediated by the importance placed on communal goals, rather than agentic goals (Diekman et al., 2010, 2011) and that women's interest in STEM careers is higher when the communal aspects of the careers are emphasized (Diekman et al., 2011). Similarly, women in STEM fields are often found to value life goals related to helping others more than their male counterparts (Barth & ASERT, 2013; Barth, Todd, & ASERT, 2010). Consistent with this, girls who continue in science often seek to use science in socially relevant ways (Jones et al., 2000; VanLeuvan, 2004), and women tend to enter scientific fields with a focus on helping people, rather than conducting pure research (National Council for Research on Women, 2001). More broadly, research based on image theory found that students who closely conform to feminine gender role norms are less likely to aspire to careers that afford high status (Thompson & Dahling, 2010).

Much of the research based on role congruity theory has focused on young college-aged students and communal goals related to having a positive social impact on society (e.g., Diekman et al., 2010, 2011), but feminine roles related to childrearing are also associated with post-baccalaureate women leaving the STEM workforce (Ceci et al., 2009, Mason, Wolfinger, & Goulden, 2013). The work-life typically associated with a STEM career (e.g., long work hours) is not viewed as being supportive of other feminine communal roles, especially wife and mother (Mason et al., 2013). Less attention has been paid to family related goals in undergraduate

college populations, and this study helps to fill this gap. Although gender role congruity theory would hold that women should value family related goals more than men, previous research on STEM college students has not consistently found this to be the case (Barth & ASERT, 2013; Barth et al., 2010). Thus, this study examines if more women enter some STEM fields than others because these careers are perceived as affording social impact and family related goals.

1.3 The present study

This study extends previous research on PTO (Graziano et al., 2012) and role congruity theory (Diekman et al., 2010, 2011) to address the question of the differential representation of women across STEM fields. Students majoring in Biology, which has a larger representation of women, were compared to students in other STEM majors that have a smaller representation of women (computer science, engineering, mathematics, and the physical sciences including physics, geology, and chemistry; CEMP). Furthermore, a comparison group of health related majors (e.g., nursing, nutrition, community health) that have a strong helping focus and are female-dominated was included. The inclusion of this group can contribute to the understanding of how women majoring in traditional helping professions compare to those in Biology and CEMP. Since Health majors take many of the same courses as Biology majors (e.g., anatomy and physiology), they provide a comparison group that differs less in their competence in biology, and more on their chosen career paths. The two theoretical frameworks are linked by examining how vocational interest is related to PTO and occupation goal affordances.

Four research questions are explored. First, how do men and women in different majors compare on PO and TO? This study should conceptually replicate the Graziano et al. (2012) findings for the three major groups in the sample: Although women overall are expected to be more people oriented and men more thing oriented, PO and TO differences between men and

women in the same major should be smaller. Graziano et al. found that TO, but not PO, distinguished students in STEM from other majors, and so it is hypothesized that a comparable pattern will be found across the three major groups in this study.

Second, how are college students' gender and major choices related to interest in occupations that differ in people and thing characteristics? Men and women in different majors should evidence different patterns of career interests that align with their orientation: CEMP majors should be more interested in thing jobs; whereas Biology and Health majors should be more interested in people jobs. Importantly, in this study the measure of career interest includes occupations in both biology and non-biology fields, and within each field, half are people oriented and half thing oriented occupations. Unconfounding STEM domain from people and thing occupation characteristics allows for a better test of the hypothesis and helps address an important practical issue, specifically, if women's interest in STEM careers that have an under-representation of women could be increased by emphasizing the people aspects of the career.

Third, how are communal and agentic goal affordances associated with occupations that vary in their involvement with people and things? Participants rated the occupations described below with respect to how likely they would afford two communal goals, making a positive impact on society and having time for a family, and one agentic goal, achieving high social status and power. These goals were chosen because, as described above, they are the ones most commonly attributed to explaining the gender gap in some STEM occupations. People occupations should be viewed as more likely to afford positive impact goals and less likely to afford status goals compared to thing occupations. The analysis of family goal affordance is exploratory in this age group, and no predictions are made.

Finally, how do students' PTO and perceptions of occupation goal affordances combine to

predict interest in different occupations? In a series of regression equations, the relative and combined power of PTO and goal affordances in predicting interest in people and thing occupations are examined. These analyses provide a connection between the two theoretical explanations and examine their overlapping and independent contributions.

This study extends and improves upon previous research in one other important way. Prior research has relied extensively on Introductory Psychology students, who are primarily in their first year. This study samples students enrolled in a range of post-introductory level STEM courses. As a result, the sample is more representative of the larger STEM college population and taps into a sample with a greater commitment to their major.

2. Method

2.1 Participants

The sample initially included 2139 undergraduate students (53.9% Male) recruited from STEM courses at two different public universities in the U.S., one in the Southeast (73%) and the other in the Midwest. The classes were those typically taken by STEM majors (e.g., computer science, mathematics, engineering, physics, geology, biology, and chemistry). The classes were non-introductory undergraduate courses, generally geared for second and third year students. The majority of the respondents were non-Hispanic White (80.4%), but they also included 9.6% African American or Black, 3.4% Asian, and 1.5% Latino. Participants were at various stages in college, with 28.3% in the first year, 30.1% in the second, 20% in the third, and 21.5% in the fourth year or more. With respect to age, 18.4% were 18 years or younger, 28.7% were 19, 20.3% were 20, 14.4% were 21, and the remainder were 22 years or older.

Only students who specified a STEM or health major were included in this study. To indicate their major, students either selected from a list of majors or specified their major when it was not

included in the list. Students were grouped into four major groups: a) CEMP (computer science, engineering, mathematics, and physical sciences which included physics, geology, geography, and chemistry), b) Biology, c) Health (nursing, nutrition, community health, and athletic training) and d) all other majors. Only students in CEMP, Biology or Health majors were included in the current analyses. Students double majoring across more than one of these categories (e.g., Engineering and Biology) were also excluded from the analyses. The final sample for the study included a total of 1848 students, which included 1072 CEMP majors (26.8% female), 485 Biology majors (58.1% female), and 291 Health majors (75.6% female). These students were similar to the larger sample with respect to race/ethnicity (81.2% non-Hispanic White, 9.7% African American or Black, 3% Asian, and 1.4% Latino), year in school (27.9% first year, 30.6% second year, 19.4% third year, and 21.7% in the fourth year or more) and age (17.8% were 18 years or younger, 29.2% were 19 years, 19.9% were 20 years, 14.3% were 21 years, and the remainder were 22 years or older). Sample sizes varied across each analysis because some participants failed to complete all measures.

2.2 Procedure

After obtaining the approval from the university Institutional Review Board and the permission of course instructors, two procedures were used to recruit this sample. First, researchers went to STEM class sessions to administer the questionnaire. The researchers gave a brief overview of the purpose of the study and asked students to read consent information. Students wishing to participate stayed after class to complete the questionnaire at their own pace. For the second procedure, students were emailed from course enrollment lists and provided with comparable information as in the face-to-face condition. Ten percent of the students were recruited in this way. Including sample site and recruitment procedures in the analyses described

below had very little impact on the findings, consistently yielding effect sizes less than 1%. Consequently, for the sake of parsimony these factors were not included in the analyses.

Students completed the questionnaire at their own pace, taking approximately 15 min. The questionnaire included several measures related to gender roles, life goals, and career interests; however, only measures pertinent to the current research questions are described below. Participants also reported their gender, age, and race, choosing from categories provided on the questionnaire.

2.3 Instruments

2.3.1. People and thing orientation

People and thing orientation was measured by an adapted version of *People-Thing Orientation* scale (Graziano et al., 2011). Participants rated how much they enjoyed different activities that involved people or things on a 5-point scale, 1 = not enjoy at all to 5 = enjoy very much. We reduced the number of items on this measure so that a wide range of constructs could be evaluated in a short period of time on the survey. Eight items with the highest factor loadings on the original 13-item measure (Graziano et al., 2011) were selected in the present study (Appendix 1), including four items on PO (e.g., "Make the first attempt to meet a new neighbor") and four items on TO (e.g., "Stop to watch a machine working on the street") respectively. In a factor analysis with the original instrument, Graziano et al. (2012) reported that PO explained 26.62% variance and TO explained 26.05% variance. The correlation between PO and TO was also low, $r(633) = .35$, and Cronbach's alpha for PO and TO was .80, .88 respectively. In this study, factor analysis of the shortened instrument confirmed two factors underlying the measure, People Orientation (PO, 24.9% variance explained) and Thing Orientation (TO, 38.5% variance explained). The correlation between PO and TO was low, $r(1832) = -.028$, consistent with the

Graziano et al. (2011, 2012) findings that PO and TO are independent scales. An additional follow-up study with a portion of this sample indicated a one year test-retest correlation of $r(318) = .82$, and .67, for PO and TO respectively. The estimated internal consistency reliability of PO and TO abbreviated scales was .66 and .89 respectively. One explanation for the modest reliability coefficient for the abbreviated PO scale is that the sample for this study is not representative of students with a wide range of majors and career interests, as was the case for the original scale development.

2.3.2. Occupation ratings

Participants were presented with eight occupation descriptions, half were People Jobs and half were Thing Jobs. Within each job type, half were in a biology-related field, and half were not. Exemplary occupations included "Human Factors Engineer: Part of a team that evaluates industrial processes so that people perform their best at their work" (People, Non-Biology); "Aerospace Engineer: Designs, constructs and tests aircraft, missiles and spacecraft" (Thing, Non-Biology), "Nutritionist: Assists clients by applying knowledge of nutritional research to plan and develop nutritional programs" (People, Biology); and "Bio-Technician: Sets up, operates, and maintains laboratory equipment" (Thing, Biology). The other four occupations were pharmacist (People, Non-Biology), prosthetist (People, Biology), accountant (Thing, Non-Biology), and environmental engineer (Thing, Biology). The classification of occupations into people and thing occupations was validated in a separate survey of 10 upper level students and faculty in STEM or STEM-education fields. Participants in this study were provided a brief definition of "people" and "thing" jobs and then rated the same occupation descriptions on a 4-point scale: 1= definitely a person job, 2 = probably a person job, 3 = probably a thing job, and 4 = definitely a thing job. A *t-test* comparing the ratings for the four People Jobs ($M = 2.15$, $SD =$

.3162) with the four Thing Jobs (M = 3.85, SD = .2108) was significant and confirmed the *a priori* categorization scheme, $t(9) = 12.75$, $p < .001$, $d = 6.33$.

Two types of ratings were conducted with the eight occupations, interest and goal affordance (Status, Family, and Social Impact). Participants indicated their interest in each of eight occupations on a 7-point scale ranging from 1 = not interested at all to 7 = interested very much. Goal affordances for occupations were assessed by adapting a measure developed by Evans and Diekman (2009). Participants rated the extent to which each of the same eight occupations mentioned above would help them achieve one of the three life goals: a) high status ("have a great deal of money, power, or influence, gained by running a company or an organization"), b) time to take care of a family ("helping with cooking or laundry, arranging play dates for your children"), and c) social impact ("make a positive impact in the world around you, helping affect positive change in the world around you—making a difference"). All questions were answered on a 7-point scale ranging from 1 = not at all to 7 = very much.

3. Results

All analyses were conducted using SPSS package Version 22 (IBM, 2013). The correlations among all variables for each gender are provided in Table 1. Findings are organized around the four research questions. For the first three questions repeated measures ANOVA's were conducted and regression was used for the fourth question. To decompose significant ANOVA effects, Bonferroni and Games-Howell corrections were used. Games-Howell correction is appropriate when there are large inequities in sample sizes across cells and was used to decompose major and gender x major effects.

3.1. How do men and women in different majors compare on PO and TO?

A 2 (Gender) x 3 (Major: Biology, CEMP, Health) x 2 (Orientation: PO, TO; within subjects

factor) ANOVA was conducted on People-Thing Orientation scores. Table 2 presents the means. This research question was addressed by considering the Major x Orientation interaction, which was significant, $F(2, 1814) = 210.71$, $p < .001$, Wilk's $\lambda = .811$, $\eta_p^2 = .189$. Comparisons among the three majors on PO revealed that CEMP majors scored significantly lower than Biology majors, $p < .001$, and Health majors, $p < .001$, but that the difference between Biology and Health majors was not statistically significant. Conversely, comparisons among the three majors on TO revealed that CEMP majors scored significantly higher than Biology majors, $p < .001$, and Health majors, $p < .001$. In addition, Biology majors scored higher than Health majors, $p < .001$. Additional comparisons within majors revealed that CEMP majors did not differ in their scores on PO and TO, but Biology and Health majors did, both scoring higher on PO, $p < .001$.

Other significant effects for Orientation included the main effect, $F(1, 1814) = 545.73$, $p < .001$, Wilk's $\lambda = .769$, $\eta_p^2 =$. 231 (PO > TO), and the Orientation x Gender interaction, $F(1, 1814) = 332.18$, $p < .001$, Wilk's $\lambda = .845$, $\eta_p^2 = .155$. Follow-up comparisons revealed that men scored higher on TO and lower on PO than women, *p's* < .001. The Orientation x Gender x Major interaction was not significant. To summarize, although a gender difference in PO and TO were found in the expected directions, there was no evidence that these differences were smaller within a major, giving only partial support for our prediction. Each major differed from the other in levels of TO, but CEMP had lower levels of PO than the other two majors, partially inconsistent with our prediction because PO was hypothesized to be similar across the three majors.

3.2. How are college students' gender and major choices related to interest in careers that differ in PO and TO characteristics?

Vocational interest ratings were analyzed in a 2 (Job Orientation: People or Thing Jobs) x 2

(Gender) x 3 (Major: CEMP, Biology, or Health) mixed design ANOVA, with Job Orientation as the within subjects factor (Tables 3 and 4). To address this question, the Major x Job Orientation interaction was examined first followed by the Major x Job Orientation x Gender interaction.

The Job Orientation x Major interaction had the largest effect size, suggesting that career interest was predominantly affected by these factors. Post hoc comparisons indicated that CEMP majors were less interested in People Jobs compared to Biology and Health majors, p's < .001. Biology and Health majors did not significantly differ. For Thing Jobs, the three majors differed significantly from each other (CEMP > Biology, p < .001; CEMP > Health, p < .001; Biology > Health, p = .002). Not surprisingly, CEMP majors were more interested in Thing Jobs than People Jobs, p < .001, whereas Biology and Health majors were more interested in People Jobs than Thing Jobs, p's < .001.

To investigate the Job Orientation x Major x Gender interaction, comparisons were first made separately for men and women across majors for interest in People and Thing Jobs. For men, the pattern of differences among the majors for interest in People Jobs was similar to that reported above: CEMP majors reported less interest compared to Biology and Health majors, p's $\leq$ .001, but Biology and Health majors did not differ. For women, CEMP majors did not differ from Biology and Health majors in their interest in People Jobs, but Health majors expressed greater interest than Biology majors, p = .023. For Thing Jobs, the pattern of differences among the majors for men and women was similar to the sample as a whole: Male and female CEMP majors had greater interest than their counterparts in Biology and Health majors, all p's < .001. The comparison between Biology and Health majors for Thing Jobs was significant for men, p = .023, but not significant for women, p = .105 (although the difference was in the same direction).

Additional comparisons between interest in People and Thing Jobs within each of the three

majors were conducted separately for men and women. Male CEMP majors were more interested in Thing Jobs than People Jobs, $p < .001$; however female CEMP majors did not differ in their reported interest in Thing and People Jobs. For both men and women, Biology and Health majors were more interested in People Jobs than Thing Jobs, all *p's* < .001.

To summarize, the three major groups differed in their interest in Thing Jobs, with CEMP majors showing the greatest interest, followed by Biology, and then Health majors. Generally, this pattern seemed to hold for both men and women. The pattern for interest in People Jobs was affected by both gender and major. For men, CEMP majors evidenced less interest in People Jobs compared to Biology and Health majors, who did not differ from each other. However, female CEMP majors did not differ from the other major groups in their interest in these jobs. In addition, female CEMP majors stood out from the other gender x major groups in that they showed an equivalent interest in People and Thing Jobs.

3.3. How are communal and agentic goal affordances associated with occupations that vary in their involvement with people and things?

A 3 (Goal: Status, Family, or Social Impact) x 2 (Job Orientation: People or Thing) repeated measures ANOVA was conducted on goal affordance ratings. It was expected that People Jobs would be seen as affording Family and Social Impact goals more than Thing Jobs; whereas Thing Jobs would be seen as affording Status goals more than People Jobs. To address these hypotheses, the significant interaction between Goal and Job Orientation was considered, $F(2, 1808) = 592.24$, $p < .001$, Wilk's $\lambda = .604$, $\eta_p^2 = .396$. Means are presented in Table 5. Post hoc comparisons indicated that People Jobs were rated as affording Family and Social Impact goals more than Thing Jobs, and Thing Jobs were rated as affording Status goals more than People Jobs, all *p*'s < .001, confirming expectations. (It should be noted that including gender and major

as between-subjects factors in this analysis did not alter the pattern of findings, except that Health majors rated People and Thing Jobs as affording similar levels of Status.)

3.4. How do students' PO, TO, and perceptions of occupation goal affordances combine to predict interest in different occupations?

To address this question, two independent sets of regression analyses were conducted for People and Thing Jobs. A multiple regression analysis was employed to estimate the unique contribution of TO or PO (step 1), occupation goal affordance ratings for Status, Family, and Social Impact (step 2), gender (male =1, female = 0; step 3), and the four gender interaction terms (with PO or TO and with each goal affordance [Status, Family, and Social Impact]; step 4).

The regression analysis on interest in People Jobs indicated a significant increase in variance for step 1 (PO, 4.4%) and step 2 (Goal Affordances, 14.2%), but not for step 3 (Gender, 0.1%) or step 4 (interaction terms, 0.3%). See Table 6 for results for the first two steps. An occupations' association with Status and Social Impact goals was positively related to interest in People Jobs.

The regression analysis on interest in Thing Jobs (Table 7) revealed that each step added a significant increase in the variance explained. The first step, which included TO, explained the greatest amount of variance, nearly 20%. In step 2, each goal affordance was a significant, positive predictor. However, Family goal affordance was somewhat weaker by comparison to Status and Social Impact, and it was no longer significant in the final model. In the third step, gender was a significant positive predictor, indicating that men were more interested in these jobs than women. In the final step, the Gender x TO interaction was a negative predictor, and the Gender x Status goal affordance interaction was a positive predictor.

To decompose the two significant gender interaction terms, the first two steps of regression model were run separately for men and women. Comparing across the models, TO predicted

interest in Thing Jobs better for women than for men, which explains the Gender x TO effect (step 1 ΔR^2 = .258, .074; β's = .508, .272 for women and men, respectively). Status goal affordance predicted interest in Thing Jobs better for men than women, which explains the Gender x Status effect (step 2 ΔR^2 = .041, .087; β's = .091, .187, for women and men, respectively. Furthermore, comparing the variance explained for the final model for men and women revealed that the full model explained considerably more variance for women, 29.9%, $F(4,752) = 80.17$, $p < .001$, compared to men, 16.1%, $F(4, 1025) = 49.20$, $p < .001$.

To summarize, both PO/TO and goal affordance ratings were significant predictors of interest in People and Thing Jobs. Gender explained less than 1% the variance in interest ratings for both types of jobs. However, for Thing Jobs there were differences in the predictive power of TO and Status goal affordance for men and women.

4. Discussion

The overarching purpose of this study is to advance the understanding of factors that contribute to the differential representation of women across STEM fields. Grounded in previous research on gender role congruity theory and people-thing orientation, this study is one of the first to examine the two theories together. Collectively the findings suggest that gender differences in thing orientation and the degree to which occupations are perceived to afford Status and Social Impact goals might partially explain why there is a gender gap in some STEM majors and fields but not others. Each of the four research questions contributed to drawing this conclusion.

The first research question concerned gender and major differences in PO and TO. Findings were consistent with the hypothesis that STEM fields that have greater representation of women attract students who are relatively less thing oriented and more people oriented. Interestingly,

male-dominated STEM fields might attract students who are more balanced in their orientation toward people and things. Although findings for gender differences in PO and TO replicated previous research, Graziano et al. (2102) found no difference between STEM and non-STEM majors on PO and that men and women in the same major were similar in PO and TO, inconsistent with this study. The difference in findings might be accounted for by the relative heterogeneity of the non-STEM majors in the Graziano et al. study compared to this study. Specifically, their non-STEM group included majors within Liberal Arts, Nursing, Medical Services, Business, and Education, which vary in their gender composition and whether the occupations aligned with the major are people or thing oriented.

The second research question examined vocational interests for men and women in different majors. In contrast to male CEMP majors, female CEMP majors evidenced similar interest in People Jobs as female Biology and Health majors. For both genders, interest in Thing Jobs was greatest for CEMP majors, followed by Biology, and then Health majors. However, female CEMP majors stood apart from the other five gender x major groups in showing no difference in their interest in People and Thing jobs.

Together the findings support the idea that, similar to women in health fields, women who enter into STEM fields may be interested in a people oriented career (Jones et al., 2000; NCRW, 2001; VanLeuvan, 2004). Importantly, the findings suggest that this may be true for women in STEM fields that are both male dominated (CEMP) and gender balanced (Biology). Where women in STEM fields seem to differ is in their thing orientation and interest in Thing Jobs.

This has important practical implications: When promoting STEM careers to women, the people side of the STEM professions should be emphasized, regardless of whether a field is male-dominated or gender balanced. However, emphasizing the people aspects of STEM careers

alone may not be sufficient because women who are interested in things are most likely to go into male-dominated STEM fields. Consequently, increasing women's interest in things would be beneficial toward reaching a goal of gender equity across STEM fields. Interventions early in education will be important because gender differences in interests are fairly stable over development (Lee et al., 2015; Tracey & Robbins, 2010).

A richer understanding of the characteristics of People and Thing Jobs was provided by examining their goal affordances. As predicted in the third research question, People Jobs were seen as more likely to afford communal goals related to family and positive social impact than Thing Jobs, which were seen as more likely to afford the agentic status goal. This is consistent with previous studies indicating that undergraduates do not perceive male-dominated STEM fields as affording altruistic communal goals (Diekman & Steinberg, 2013) and extends it to family goals.

Findings from the three previous research questions provided the backdrop for the fourth question: How do students' PO, TO, and perceptions of occupation goal affordances combine to predict interest in different occupations? Interest in People and Thing Jobs was predicted by PO and TO, respectively, and Status and Social Impact goal affordance ratings. Although gender differences were evident in interest in People and Thing Jobs in previous analyses, after accounting for PO/TO and goal affordances, gender was not a significant predictor of interest in People Jobs and a relatively weak predictor of interest in Thing Jobs.

Based on these findings, a major conclusion of this study is that the socialization of gendered interests and the social roles that align with occupation goal affordances are key factors contributing to women's greater interest in some STEM occupation more than others. In addition to emphasizing the people-side of the STEM professions, demonstrating the societal impact (i.e.,

communal aspects) of STEM professions could also increase women's interest and potentially attract and retain more women in STEM fields (Diekman & Steinberg, 2013). Importantly, these results suggest that this is true for men as well. In addition, and somewhat inconsistent with role congruity theory, an occupation's Status goal affordance was also associated with both men's and women's interest in People and Thing Jobs, although it was a stronger predictor of interest in Thing Jobs for men than women. It is possible that the stereotypical differences in values placed on agentic and communal goal affordances are less prevalent among STEM majors who made up the majority of the sample. In support of this, in previous studies few gender differences were found in the importance that STEM students placed on career success and making money (Barth & ASERT, 2013; Barth et al., 2010). Finally, in predicting interest in Thing Jobs, the significant Gender x TO interaction suggests that TO might be a more important predictor for women than men, but that Status goal affordances might be a more important predictor for men than women. It should be noted that these effect sizes are small relative to other factors in the equation and need further exploration before strong conclusions can be drawn.

It is interesting that the amount of variance that goal affordances explained for People Job interest was over three times that of PO; but for interest in Thing Jobs, TO explained more than three times of the variance compared to goal affordance ratings. The lack of symmetry between predictors of People and Thing Jobs suggests a need to build more complexity into theoretical explanations of women's interest in STEM careers. Both individual interests and occupation goal affordances must be considered within the larger context of gender role socialization.

With respect to theoretical contributions, this study provides a connection between two explanations for gender disparities in STEM career interests, suggesting that they each make independent contributions in explaining STEM career interest. The results present some

challenges for role congruity theory in that both Social Impact and Status goals were important for men's and women's career interests. Importantly, the sample in this study is different from previous studies in its strong representation of a range of STEM majors and the inclusion of students beyond the first two years of college, which may account for the difference. We consider this a strength of the study and suitable for our goals, but at the same time recognize that findings may not generalize to a different group of college students with different majors.

4.1 Limitations

There are a few limitations to this study. First, for every broad generalization about gender and major differences there are sure to be many exceptions. There are a multitude of factors that determine college majors and occupation choices, such as aptitude, grades, family factors, and social support, and this study only examined a few factors. Second, in order to achieve an adequate number of women in non-Biology STEM majors, participants in a range of majors were purposefully combined together. It is possible that CEMP majors could be further divided into other theoretically interesting groups that show distinct patterns of vocational interest. However, for the theories that were examined and our research questions, it made sense to group majors based on their relative representation of women. Third, the occupation ratings only included four People and four Thing Jobs. That said, the numbers of both People and Thing Jobs were purposefully increased in comparison to Graziano and his colleagues (2012), where only two People (nursing and teacher) and two Thing Jobs (auto mechanic and engineer) were used. More importantly, the STEM domains (Biology or Non-Biology) were not confounded with people and thing characteristics when manipulating the occupations. Preliminary results from a one year follow-up of this sample (available from authors) largely support the findings presented here, suggesting that despite the small number of items, the findings are reliable. Fourth, the People-

Thing Orientation scale was adapted from the one originally presented by Graziano et al., (2011), and although the psychometric properties of the scale were comparable in many ways to the original measure, caution should be taken in using this version without further study of its validity and reliability on a broader sample of college students with full range of majors.

4.2 Future directions and conclusions

By examining gender role congruity theory and people-thing orientation together, this research provides more insight into factors that explain why women are better represented in some STEM fields. Future research might consider if the importance of PTO and occupation goal affordances change as students progress through college. Closer to graduation it is possible that students reconsider the value of affordances relate to family life because starting a family may seem more likely in the near future. It is also important to conduct qualitative research on this topic in the future to triangulate findings from the current study. Furthermore, this study only focused on three goal affordances that are aligned with gender differences (status, family, and social status), future studies should also consider other goals that are not necessarily related to gender differences but may determine interests in STEM majors and occupation choices. This study lays the groundwork for future research for both theories and suggest that it will be fruitful to consider both PTO and role congruity theory in explaining women's underrepresentation in STEM.

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Table 1

Correlations among Measures for Men and Women

	Women									
Men	1	2	3	4	5	6	7	8	9	10
1. TO	-	.060	.508***	.132***	.027	-.056	.024	-.014	-.004	-.070
2. PO	.161***	-	-.004	.137***	.087*	.094**	.100**	.140***	.125***	.204***
3. Thing Jobs	.268***	.108***	-	.519***	.152***	.095**	.085*	.040	.184***	.070
4. People Jobs	-.030	.220***	.551***	-	.061	.305***	.084*	.035	.164***	.263***
5. Status-T	.122***	.140***	.295***	.171***	-	.678***	.112**	.164***	.391***	.277***
6. Status-P	.051	.194***	.210***	.422***	.676***	-	.137***	.077*	.296***	.360***
7. Family-T	.111***	.128***	.156***	.148***	.212***	.240***	-	.700***	.208***	.214***
8. Family-P	.035	.083**	.065*	.076*	.214***	.127***	.693***	-	.252***	.245***
9. Impact-T	.113**	.223***	.258***	.176***	.461***	.336***	.208***	.200***	-	.691***
10. Impact-P	.109***	.240***	.173***	.291***	.380***	.430***	.261***	.260***	.651***	-

* $p < .05$. ** $p < .01$. *** $p < .001$.

Note. Entries in the upper triangle are for women (N = 783) and those in the lower triangle are for men (N=1048). TO = Thing Orientation, PO = People Orientation; Thing Jobs and People Jobs refer to scores on the interest ratings; Status, Family, and Impact refer to ratings on goal affordance measure and T indicates ratings on Thing Jobs and P indicates ratings on People Jobs.

Table 2

Means and Standard Deviations for People and Thing Orientation

Major	People Orientation			Thing Orientation		
	Males	Females	Total	Males	Females	Total
CEMP	3.35	3.73	3.45	3.94	3.19	3.74
	(0.7858)	(0.7256)	(0.7878)	(0.8444)	(1.0585)	(0.9661)
	780	286	1066	780	286	1066
Biology	3.54	3.82	3.70	3.12	2.12	2.54
	(0.7326)	(0.7182)	(0.7371)	(0.9246)	(0.9642)	(1.0675)
	200	277	477	200	277	477
Health	3.68	3.82	3.79	3.00	1.98	2.23
	(0.7628)	(0.7255)	(0.7360)	(0.9418)	(0.9270)	(1.0276)
	68	209	277	68	209	277
Total	3.41	3.79	3.57	3.72	2.48	3.20
	(0.7806)	(0.7235)	(0.7797)	(0.9425)	(1.1299)	(1.1963)
	1048	772	1820	1048	772	1820

Note. For each entry, means are presented on top, standard deviations are in parentheses and *N* is on the bottom. Scores ranged from 1 to 5, with 5 indicating higher interest.

Table 3

ANOVA: Job Orientation x Major x Participant Gender for Interest Ratings

Effect	F^1	Wilk's λ	$p \leq$	η_p^2
Job Orientation	210.43	.896	.001	.104
Gender	4.46	-----	.035	.002
Major	5.63	-----	.004	.006
Job Orientation x Gender	51.55	.972	.001	.028
Job Orientation x Major	186.57	.829	.001	.171
Major x Gender	8.57	-----	.001	.009
Job Orientation x Major x Gender	5.23	.994	.008	.006

1. Degrees of freedom are 1, 1814 for all analyses except those that include Major where degrees of freedom are 2, 1814.

Table 4

Means and Standard Deviations for Vocational Interest Ratings

Major	Job Type					
	People Jobs			Thing Jobs		
	Male	Female	Total	Male	Female	Total
CEMP	2.65	3.12	2.78	3.29	3.06	3.23
	(1.2945)	(1.2845)	(1.3083)	(1.1671)	(1.1728)	(1.1725)
	777	286	1063	777	286	1063
Biology	3.30	3.06	3.16	2.84	2.29	2.52
	(1.2659)	(1.2900)	(1.2840)	(1.1502)	(1.0870)	(1.1459)
	200	279	479	200	279	479
Health	3.32	3.37	3.36	2.41	2.06	2.15
	(1.2905)	(1.2198)	(1.2353)	(1.2496)	(1.1894)	(1.2112)
	68	210	278	68	210	278
All Majors	2.82	3.17	2.97	3.14	2.51	2.87
	(1.3187)	(1.2740)	(1.3110)	(1.1969)	(1.2228)	(1.2476)
	1045	775	1820	1045	775	1820

Note. For each entry, means are presented on top, standard deviations are in parentheses and *N* is on the bottom. Scores ranged from 1 to 7 and higher scores indicated greater interest.

Table 5

Mean Goal Affordance Ratings for People and Thing Jobs

Goal Affordance	People Jobs	Thing Jobs
Status	4.59	4.86
	(1.0787)	(1.1063)
Family	4.97	4.37
	(0.9510)	(1.0381)
Social Impact	5.48	5.01
	(0.9920)	(1.0197)

Note. Means are presented on top with standard deviations below. $N = 1810$. Scores range from 1 to 7, and higher scores indicate that an occupation is more likely to afford a particular goal.

Table 6

Regression Predicting Interest in People Jobs from People Orientation, Goal Affordances, and Gender

Predictor	ΔR^2	Step β	Step *F*
Step 1	.044***		$F(1, 1794) = 81.89$
People Orientation		.209***	
Step 2	.142***		$F(3, 1791) = 104.01$
People Orientation		.116***	
Goal affordance:			
Status		.316***	
Family		-.016	
Social Impact		.133***	

Note. Gender was entered as 1= male, 0 = female. Gender (step 3), and the four gender interactions terms (step 4) did not add significant variance to the model. For the full model, $F(9, 1786) = 46.14$, $R^2 = .186$, $p < .001$.
*** $p < .001$

Table 7

Regression Predicting Interest in Thing Jobs from Thing Orientation, Goal Affordances, and Gender

Predictor	ΔR^2	Step β	Step *F*
Step 1	.199***		$F(1, 1785) = 447.57$
Thing Orientation		.447***	
Step 2	.054***		$F(3, 1782) = 42.64$
Thing Orientation		.442***	
Goal affordance: Status		.129***	
Family		.051*	
Social Impact		.126***	
Step 3	.003**		$F(1, 1781) = 7.27$
Thing Orientation		.408***	
Goal affordance: Status		.134***	
Family		.052*	
Social Impact		.129***	
Gender		.065**	
Step 4	.014***		$F(4, 1777) = 8.40$
Thing Orientation		.525***	
Goal affordance:			
Status		.082**	
Family		.032	
Social Impact		.135***	
Gender		.058*	
Thing Orientation x Gender		-.158***	
Status x Gender		.079*	
Family x Gender		.027	
Social Impact x Gender		.006	

Note. Gender was entered as 1= male, 0 = female. For the full model, $F(9, 1777) = 72.97$, $R^2 = .270$, $p < .001$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Appendix

Person-Thing Orientation-Adapted

The reference for the original 13 items scale is:

Graziano, W. G., Habashi, M. M., & Woodcock, A. (2011). Exploring and measuring differences in people-thing orientations. *Personality and Individual Differences, 51*, 28-33.

To adapt this measure, the eight items with the highest factor loadings on the People- and Thing- Orientation factors as presented by Graziano et al. were included. Participants rated how much they enjoyed different activities on a 5-point scale, 1 = not enjoy at all to 5 = enjoy very much.

1. Redesign and install a stereo system yourself. (Thing)
2. Make the first attempt to meet a new neighbor. (People)
3. Listen with caring interest to an old person who sits next to you on a bus. (People)
4. Stop to watch a machine working on the street. (Thing)
5. Notice the habits and quirks of people around you. (People)
6. Remove the back of a mechanical toy to see how it works. (Thing)
7. Try to fix your own watch, toaster, etc. (Thing)
8. Attempt to comfort a total stranger who has had a disaster happen. (People)