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Orientations and motivations: Are you a "people person," a "thing person," or both?

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Abstract Previous theory and research suggests that individuals selectively orient primarily toward the social environment (people) or toward the physical environment (things). These orientations can be conceptualized as motivation-based complexes that influence personal preferences and interests, with consequences for important life choices. This paper examined differential orientation in two studies, one with university students and another with children. Person-thing Orientation showed sex differences and was related to occupational choices in both age groups. For university students person-thing interests were linked to academic majors, and retention within programs focused on things (e.g., science and engineering). Sex differences were greater for TO than PO, but not for students majoring in engineering. Sex differences in selective orientations to the social and physical environments were similar in children (3rd and 6th grade) and university students, suggesting processes may be underway early and may be consequential for sex differences in interests and career trajectories for STEM.

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Introduction

Most biological and behavioral scientists acknowledge that the environment can have potent influences on living organisms, which must continually adapt to survive, reproduce and prosper. Organisms that cannot respond adaptively to their environments will have difficulties in producing offspring and in putting their genes in the next generation. In comparing the behavior and adaptations of individuals across species, however, theorists observed that organisms are responsive to different aspects of their environments. Different species occupy different niches within the larger environment.

One way to parse the environment is in terms of social environments and physical environments. In humans, social environments involve other people (Kelley et al. 2003) and physical environments involve things. Of course, physical and social environments are related; some physical environments like fertile farm land support certain kinds of social environments (e.g., Henry 2009). Nevertheless, it is still possible that individual perceivers can be attuned selectively to the social and physical aspects of environments.

Person-thing Orientations was first noted by Thorndike (1911) in his book, *Individuality*. Thorndike regarded person- and thing orientation as part of a single continuum. Cattell and Drevdahl (1955) may have been the first researchers to examine Person-thing orientations empirically. They examined personality characteristics of 294 research scientists in Biological Sciences, Physics, and Psychology. They found that research scientists within each field differed from administrators and teachers within the same field. Cattell and Drevdahl noted that as a group,

the researchers showed "schizothymic preoccupation with things and ideas, rather than people" (p. 259). Their analyses were complicated, but Cattell and Drevdahl implied that being thing-oriented was negatively related to being people oriented. They may even be bipolar ends of a single dimension. This work by Cattell and his colleagues was conducted "bottom-up" (inductively, from data toward theory) before modern computer technology was available to aid statistical analyses. In light of serious computational errors found in some of Cattell's other inductive work (e.g., Digman and Takemoto-Chock 1981), conclusions by Cattell and Drevdahl require further corroboration.

Many years after the publication of Cattell and Drevdahl, Brian Little (1968, 1972, 1974) published theoretical papers addressing the fit between individuals and the environment. One of Little's (1999) insights was that similar niche-fitting processes at work between species may be at work within species, and specifically within people. Like Cattell and Drevdahl, Little focused on selective orientations towards the social environment/people and towards the physical environment/things. Individuals differ in how much they attend and respond to the people in the environment (Person Orientation), but they also differ in how much they attend and respond to the objects in the environment (Thing Orientation). These orientations are related to person-environment fit, to individual adaptation, and ultimately, to the capacity of organisms to exploit their environmental niche. In contrast to Cattell and Drevdahl, Little (1968, 1972) developed his Person-thing Orientation approach "top-down" (i.e., deductively, theory first, data later) as a vehicle for exploring his Specialization Theory. Little's research suggested that at least empirically, Person Orientation (PO) was not the bipolar opposite to Thing Orientation (TO). If this is true, then PO and TO may have different correlates, and even predict in a non-redundant way different kinds of behavior.

A third approach to Person-thing Orientation can be found in the literature on occupational choice. The Person-thing dimension is well established conceptually and empirically within Occupational Psychology (e.g., Prediger 1982), but what exactly are the occupational preferences the PO/TO dimension predict? In a comprehensive review of the literature on sex differences in dispositional vocational interests Su et al. (2009) specifically organized their analyses in terms of Prediger's (1982) two-dimensional conceptualization of occupational interests, namely People-Things and Data-Ideas. In this approach, PO is on a single continuum with TO. Su et al. (2009) examined the technical manuals for 47 interest inventories, yielding 503,188 respondents. They found that men preferred working with things and women preferred working with people. The effect size for the sex difference was large ($d = 0.93$) on the People-Thing dimension. Sex differences on the Data-Ideas dimension were negligible. In general, women were more interested in people-oriented occupations, whereas men were more interested in thing-oriented occupations.

Graziano et al. (2011) examined the structure of Person-thing Orientation (PO/TO) with a focus on Little's (1974) conceptualization and the bipolarity/orthogonality issue. Little's original work was based on a basic-science, top-down theoretical conceptualization, not on concerns with application or relations to external correlates. Consequently, it conceptualizes orientations in ways unconfounded by knowledge of external correlates like occupational preferences. Graziano et al. used converging methods of exploratory and confirmatory factor analyses and structural equation modeling in three large samples of university students. They found support for relative independence of PO and TO. Taken together, these analyses suggest that at least in self-report (a) PO is probably not a bipolar opposite of TO; (b) PO can be measured separately from TO; (c) PO may have a set of empirical correlates that are not a mirror image/inverse of those for TO.

Whether it is construed as a personality dimension related to extraversion (Cattell and Drevdahl 1955), as a general way of connecting to the environment (Little 1974), or an individual difference related to occupational choices (Su et al. 2009; Tay et al. 2011), differences in PO/TO have potential implications for motivation in general, and for the formation and expression of personal interests in particular. That is, individuals who are Person Oriented can be expected to develop more interests in topics dealing with the relations of people to each other, whereas individuals who are thing oriented will develop more interests in physical objects and how they work. At least in North America, students are expected, and even encouraged, to develop interests. Interests are one expression of individuality, and are presumed to have motivational force with consequences for choices (e.g., Savani et al. 2008; Schmidt 2011). Once options become explicit choices, motivational processes of psychological justification (e.g., cognitive dissonance) are activated, helping the chooser to resist temptations to defect to other options.

In making a case for PO and TO as motivational variables, in no way do we intend to imply other cognitive and experiential variables like aptitudes and opportunities could not also affect choices. There are, of course, constraints on interests just as there are on choices and preferences. The student who is intensely interested in a career as a professional athlete or brain surgeon may lack requisite physical skills to be selected for training, much less be successful. Furthermore, constraints may be unrecognized because they are hidden beneath implicit norms, stereotype threat, and social expectancies like sex roles (Diekman et al. 2010; Jones et al. 2000; Ngambeki et al. in press; Rosnowski 1987; Schmidt 2011; Silvia 2006). The position advocated here is that PO/TO is part of a motivational

complex that contributes, but does not exhaustively determine, the expression of a wide range of cognitive and social activities.

In this research, we assessed Person-thing Orientation in children and university students. We then used differences in PO/TO to predict choices of academic courses and majors, and decisions to remain in one of the most thing-centered majors at a university, namely Engineering, after the first year. In Study 1, we compared university students majoring in Science, Technology, Engineering, or Mathematics (STEM) areas—especially engineering—with their peers majoring in Psychology. Based on these considerations, we expected orientations to influence "niche picking."

In general, we expected that students with higher TOs would gravitate toward majors like Engineering and Chemistry that emphasize things, whereas students with higher POs will gravitate toward majors like Psychology. It is possible that in choosing an academic major, students identified a thing-or person-oriented academic niche, and picked it because it fit their individual Person/Thing interests. Do students with higher interest in people, or lesser interest in things, gravitate away from engineering and physical sciences? If that is true, then within a major like Engineering or Psychology, sex differences reported previously (e.g., Little 1974) might be reduced considerably once they are adjusted for differences in PO and TO.

Within all majors, we explored differences in men and women in their PO and TO. Ackerman et al. (2001) asserted that the root of gender differences in achievement in STEM is partially determined by different interests in social closeness and femininity. Within the set of academic majors, engineering received special attention because it is presumably highly thing oriented, and is one of the STEM areas that has changed the least in attracting women and minorities, relative to Life Sciences and even Physical Sciences (Diekman et al. 2010; Snyder et al. 2009). Furthermore, Engineering provided a special opportunity to explore the potential undermining effects of PO. That is, PO may or may not be independent of TO, but in either case, a strong PO may be detrimental to persons seeking majors and careers in thing-oriented specialties.

Hypotheses

The first hypothesis was that STEM majors in Engineering, Physical and Life Sciences will be more thing oriented than non-STEM majors in Psychology, Education and Communication, who were expected to be more person oriented than Engineers and Physical and Life Science majors.

The second hypothesis was that male students would have higher mean levels of TO, but lower levels of PO than would female students. The third hypothesis qualifies the second: We propose that sex differences in PO and TO would be greatly reduced within academic majors. Women majoring in engineering will be more thing oriented, and more like their male Engineering peers in TO, than men majoring in Psychology. Men majoring in Psychology will be more person oriented, and more like their female Psychology peers in PO, than women majoring in Engineering.

The fourth hypothesis predicted congruence in PO and TO and planning for subsequent vocations that were person oriented or thing oriented. Specifically, we expected that students higher in TO would choose later vocations that involved working with objects rather than people. Students higher in PO would choose vocations involving working with people.

The fifth hypothesis explored a more complex possibility. If PO and TO are relatively independent dimensions, it is possible that academic majors differentially appeal to *configurations* of orientations. For example, some majors like Biology may be attractive to students whose orientation toward persons and things are relatively equal. Engineering may be most attractive to students high in TO but also low in PO. Engineering may seem less attractive to students high in both TO and PO.

Study 1: Person-thing orientation in University students

Method

Participants

Data were collected from First Year Engineering students ($N = 979$; 153 women) and Introductory Psychology undergraduates ($N = 716$; 310 women). The engineering students were admitted to Purdue University's College of Engineering and made an initial commitment to the Engineering major. The Introductory Psychology students were an unselected group of students enrolled in a large introductory course. Some individuals in the Introductory Psychology class could have been Engineering majors, but it was unlikely they were first year Engineering students because the first year curriculum is highly structured. Probability that our samples overlapped was low. Only a subset of participants ($N = 398$) completed the questionnaires related to occupational preferences. Therefore, all *occupation-focused* analyses will rely only on this subset.

Materials

Personality measures

Participants completed the Big Five Inventory (BFI, John and Srivastava 1999), a measure of traditional Masculinity-

Table 1 Items, means, standard deviations, and factor loadings for the adult person-thing orientation scale

Item	Scale	M	SD	b[a]	r_{pb}^{b}	α^{c}
1. Redesign and install a stereo sound system yourself	TO	2.07	1.46	0.691	0.70	0.86
2. Take apart and try to reassemble a desktop computer	TO	1.86	1.56	0.718	0.76	0.85
3. Stop to watch a machine working on the street	TO	1.67	1.33	0.715	0.61	0.88
4. Listen in on a conversation between two people in a crowd	PO	2.15	1.17	0.468	0.37	0.80
5. Remove the back of a mechanical toy to see how it works	TO	1.82	1.44	0.765	0.78	0.84
6. Strike up a conversation with a homeless person on a street	PO	1.33	1.22	0.480	0.43	0.80
7. Try to fix your own watch, toaster, etc.	TO	1.89	1.40	0.789	0.75	0.85
8. Listen with caring interest to an old person who sits next to you on a bus	PO	2.43	1.13	0.668	0.60	0.76
9. Notice the habits and quirks of people around you	PO	2.73	1.13	0.659	0.57	0.77
10. Make the first attempt to meet a new neighbor	PO	2.27	1.14	0.656	0.57	0.77
11. Attend a speech given by a person you admire without knowing the topic on the speech	PO	2.69	1.09	0.479	0.43	0.79
12. Attempt to comfort a total stranger who has had a disaster happen	PO	2.32	1.19	0.706	0.63	0.76
13. Gain a reputation for giving good advice for personal problems	PO	3.11	1.02	0.539	0.48	0.78

$N = 612$

[a] Factor loading for each item on its respective scale (i.e., person or thing orientation), [b] Point-biserial correlations between individual items and total scores with that item excluded. [c] Reliability score for each subscale with that item excluded (overall alpha for PO scale = 0.80, overall alpha for TO scale = 0.88)

Femininity (PAQ; Spence and Helmreich 1978), and Person Thing Orientation Scale (PO/TO), which consisted of 13 Likert-type items. For the PO/TO scale participants rated enjoyment of different activities on a 1 (strongly disagree) to 5 (strongly agree) scale. (For items and psychometric properties of the scale, see Table 1; For details of scale derivation and properties, see Graziano et al. 2011; For correlations between PO/TO and Big Five personality dimensions in the psychology pool subsample, see Table 2).

Using the present data to explore the issue of the bipolarity of PO and TO, we correlated scores for the two orientations. If the two orientations were opposites, bipolar, or mutually exclusive, the sign of the correlation between PO and TO will be negative. This was not the case. The zero-order correlation between PO and TO was generally positive, but stronger in men, $r(262) = 0.26$, $p < 0.01$, than in women, $r(138) = 0.04$, *ns*, $z = -2.14$, $p < 0.04$.

We also conducted a principal components analysis. Consistent with outcomes based on analyses of the three previous samples reported in Graziano et al. (2011), one Person Orientation (PO) factor and one Thing Orientation (TO) factor emerged ($r[633] = 0.35$; using principal components analysis with oblique rotations), with Eigenvalues of 3.46 (26.62% of variance) and 3.39 (26.05% of variance), respectively.[1]

Perhaps PO and TO are simply proxy measures for traditional forms of femininity and masculinity, respectively. To explore discriminant validity and possible links among traditional sex roles, PO and TO orientations, we computed correlations with measures of masculinity and femininity. In the introductory psychology sample, PO was positively related to both masculinity, $r(713) = 0.16$, $p < 0.001$, and femininity, $r(713) = 0.42$, $p < 0.001$. In contrast, TO was related (inversely) only to femininity, $r(714) = -0.20$, $p < 0.001$. There was no evidence of a relation between TO and traditional masculinity, $r(714) = 0.04$, $p < 0.31$.

A subset of participants ($N = 398$) rated their interests in careers varying in PO and TO (adapted from Lippa 1991). Participants rated how much they would enjoy doing a certain job, regardless of training, on a 1 (strongly dislike) to 5 (strongly like) scale. Occupational interest scores were created by taking an average of interest in certain types of careers. The P oriented career interest score was a combined measure of interest in Nursing and Teaching. The T oriented career interest score was a combined measure of interest in Engineering and Auto Mechanics.

Results

Categorical variables

Participants were categorized into STEM or non-STEM majors. STEM majors were identified as majors within Science, Technology, Engineering, Agriculture, and Mathematics (Mathematics majors are included in the College of Liberal Arts, but was included as a STEM major) ($N = 163$). Non-STEM majors were identified as majors within Liberal Arts, Nursing, Medical Services,

[1] We conducted an identical factor analysis with the full sample ($N = 1{,}624$) and found similar results. Two factors emerged, one PO and one TO with eigenvalues of 5.26 and 2.56, respectively. The correlation between PO and TO in this larger sample, $r(1{,}623) = 0.33$, was also similar to the present correlation, $r[633] = 0.35$.

Table 2 Intercorrelations between person and thing orientation and big five personality dimensions in college psychology sample ($N = 556$)

	1	2	3	4	5	6	7
1. Person orientation	0.78						
2. Thing orientation	−0.07	0.87					
3. Extraversion	0.32**	0.17**	0.87				
4. Agreeableness	0.24**	0.14**	0.12**	0.76			
5. Conscientiousness	0.04	0.05	−0.17**	0.29**	0.80		
6. Neuroticism	0.06	0.19**	−0.16**	−0.21**	−0.21**	0.82	
7. Openness	0.23**	0.21**	0.14**	0.08	0.03	−0.07	0.79

Number across the diagonal represent internal consistency for each scale

* $p < 0.05$, ** $p < 0.01$

Business, or Education ($N = 235$). Technically, Psychology fits under the STEM umbrella, but on most university and college campuses in North America, Psychology is housed separate administratively from colleges of science and technology, typically within colleges of liberal arts (APA 2011). Furthermore, whether it is true or not, perhaps in response to stereotypes, in surveys students believe Psychology is more focused on people than other science areas. (See Woodcock et al. 2011). Only a subset of participants completed occupational scales, so in the interest of analyzing a more comprehensive set of variables all subsequent occupational-focused analyses reported here were based only on this smaller sample ($N = 398$).

The first hypothesis was that STEM majors will be more thing oriented than non-STEM majors, who were expected to be more person oriented than engineers and physical and life science majors. To examine differences in PO/TO by major and sex, a 2 (STEM vs. non-STEM major) × 2 (men vs. women) ANOVA was conducted. There was a significant main effect of major on TO, $F(1, 398) = 49.53$, $p < 0.001$, $\eta = 0.33$, but no evidence of differences in PO, $F(1, 398) = 0.94$, *ns*. STEM majors were higher in TO ($M = 2.58$, SD = 1.08) than non-STEM majors ($M = 1.51$, SD = 1.01).

The second hypothesis was that male students would have higher mean levels of TO, but lower levels of PO than would female students. Results revealed a sex main effect on both TO, $F(1, 398) = 84.96$, $p < 0.001$, $\eta = 0.42$, and PO, $F(1, 398) = 10.19$, $p = 0.002$, $\eta = 0.16$. Collapsing across academic majors, men were higher in TO ($M = 2.42$, SD = 1.03) than women ($M = 1.07$, SD = 1.04). Women, however, were higher in PO ($M = 2.58$, SD = 0.65) than men ($M = 2.31$, SD = 0.74).

The third hypothesis was that sex differences in PO and TO would be reduced within academic majors. The omnibus sex X STEM interactions for TO and PO were not significant (F values < 2.00, *ns*.). Given the large main effects found for sex and for STEM found in examining Hypothesis 2, however, we examined more closely sex differences in PO and TO, conducting separate, focused analyses for men and women (See Table 3 for more details). For women a main effect of major was found on TO, $F(1, 137) = 22.04$, $p < 0.001$, $\eta = 0.37$. Women in STEM majors were higher in TO ($M = 1.81$, SD = 1.22) than women in non-STEM majors ($M = 0.868$, SD = 0.89). Consistent with Hypothesis 3, differences in TO between men and women in STEM was still significant, but smaller [$t(165) = 4.64$, $p < .001$, $\eta^2 = 0.11$] than the difference between men and women in non-STEM majors [$t(233) = 9.80$, $p < 0.001$, $\eta^2 = 0.29$]. Not consistent with Hypothesis 3, there was no evidence sex differences in PO were related to STEM major choices. Sex differences in PO favoring women were comparable for STEM and non-STEM majors. There was no evidence that women in STEM and non-STEM majors differed in PO, $F(1, 137) < 1.00$, *ns*. For men we found a main effect of major on TO, $F(1, 261) = 34.24$, $p < 0.001$, $\eta = 0.34$. Men in STEM were higher in TO ($M = 2.76$, SD = 0.97) than men in non-STEM majors ($M = 2.06$, SD = 0.96).

The fourth hypothesis predicted congruence in PO and TO and planning for subsequent vocations that were person oriented or thing oriented. To examine whether PO and TO differences were linked to differences in the direction of career interest, we conducted a regression analysis. Predictors included sex, PO and TO, with P and T oriented career interests as the criteria. Overall, women reported more interest in P oriented careers (e.g., lawyer, nursing, teaching) than men, $b = -0.77$, $p < 0.001$, whereas men reported more interest in T oriented careers (e.g., engineering, astronomy, auto mechanics) than women, $b = 0.38$, $p = 0.01$. Even with sex included in the regression, however, individual differences in PO were positively related to interest in P oriented careers, $b = 0.29$, $p < 0.001$, but negatively related to interest in T oriented careers, $b = -0.25$, $p = 0.01$. Individual differences in TO were positively related to interest in T oriented careers, $b = 0.54$, $p < 0.001$, but negatively related to interest in P oriented careers, $b = -0.15$, $p = 0.01$.

It is one thing to pick a STEM major like Engineering, and another to persist in it after taking coursework. To examine the role that PO/TO plays in persistence in STEM majors, the previously described sample of first-year Engineering students ($N = 909$) rated the current condition of their Engineering major. Included in this self-appraisal

Table 3 Mean person- and thing orientation by university students' major and sex

	Thing orientation		Person orientation	
	Men	Women	Men	Women
STEM	2.76	1.81	2.24	2.58
	0.97	*1.21*	*0.75*	*0.83*
	N = 137	*N = 30*	*N = 137*	*N = 30*
Non-STEM	2.06	0.87	2.39	2.59
	0.96	*0.89*	*0.72*	0.60
	N = 126	*N = 109*	*N = 126*	N = 109

Numbers in cells are means on top line, standard deviations in italics, and number of individuals in group, respectively

were rated intentions to continue or to drop out of Engineering. Individuals who intended to remain an Engineering major were significantly higher in TO (chosen specific concentration within Engineering $M = 3.68$, SD = 0.87; not chosen specific concentration within Engineering, $M = 3.70$, SD = 0.78) than individuals who were leaving Engineering ($M = 2.88$, SD = 0.91) or undecided about leaving Engineering ($M = 3.11$, SD = 0.77), $F(1, 905) = 21.37$, $p < 0.001$, $\eta = 0.26$.

The fifth hypothesis explored the possibility that academic majors and careers would differentially appeal to *configurations* of PO and TO. To examine whether different configurations of PO and TO were related to different interests in careers for men and women, we conducted a centered cross-product regression analysis using procedures recommended by Aiken and West (1991). A significant Sex × TO × PO interaction emerged on interest in T oriented careers, $b = -0.095$, $p = 0.04$. Follow-up analyses revealed a marginally significant PO × TO interaction for men, $b = -0.105$, $p = 0.09$. As depicted in Fig. 1, men high in TO, but low in PO, report the highest level of interest in T oriented careers. There was no evidence that PO and TO interacted to predict interest in T oriented careers for women, or P oriented careers for both men and women.

Given the significant effects for sex and STEM major, for descriptive purposes we plotted the configural distribution of individual students in terms of each students PO and TO scores in Fig. 2. Z-scores were computed for PO and TO separately for the entire sample. The X axis represents PO scores in z-score terms, and the Y axis represents the corresponding z-scores for TO, with the origin at (0, 0). Each

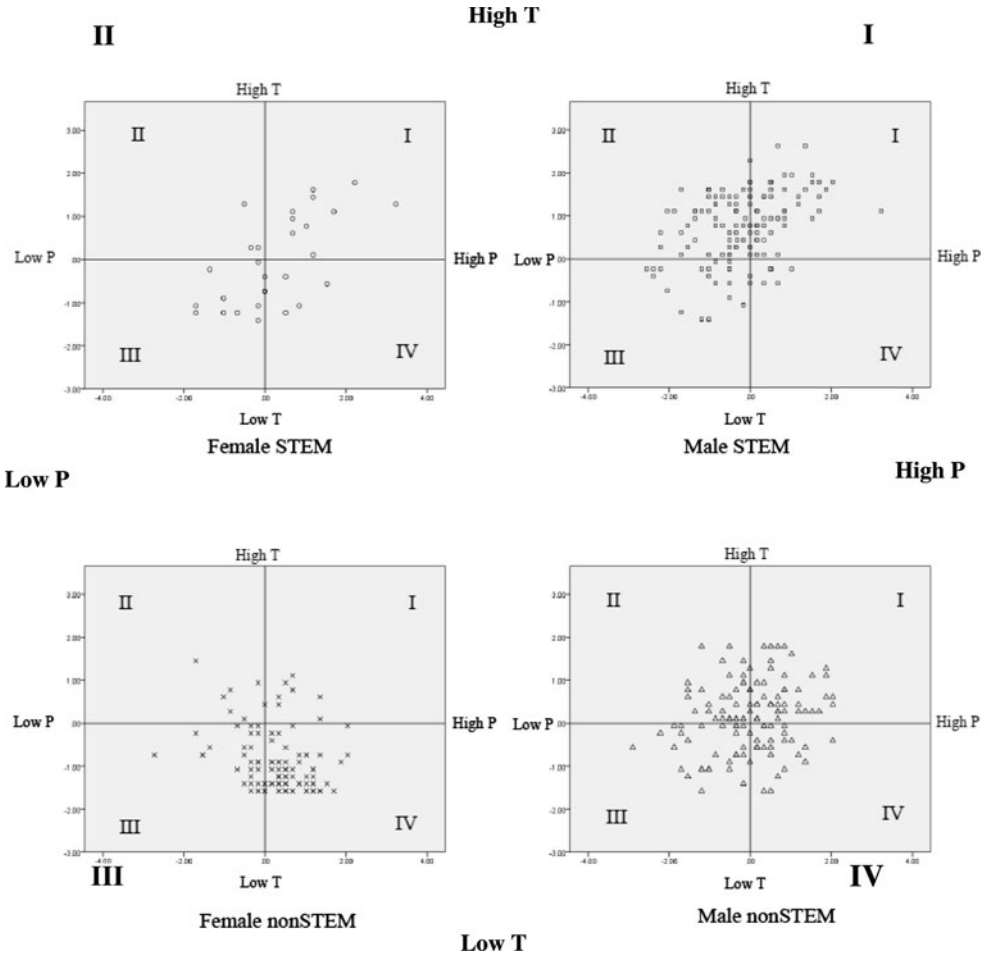

Fig. 1 Distribution of person- and thing orientation as joint standardized Z-scores for University students majoring in STEM and Non-STEM. *Note* For purposes of exposition, axes are presented as if the two dimensions are perfectly orthogonal. In this sample, they are slightly oblique

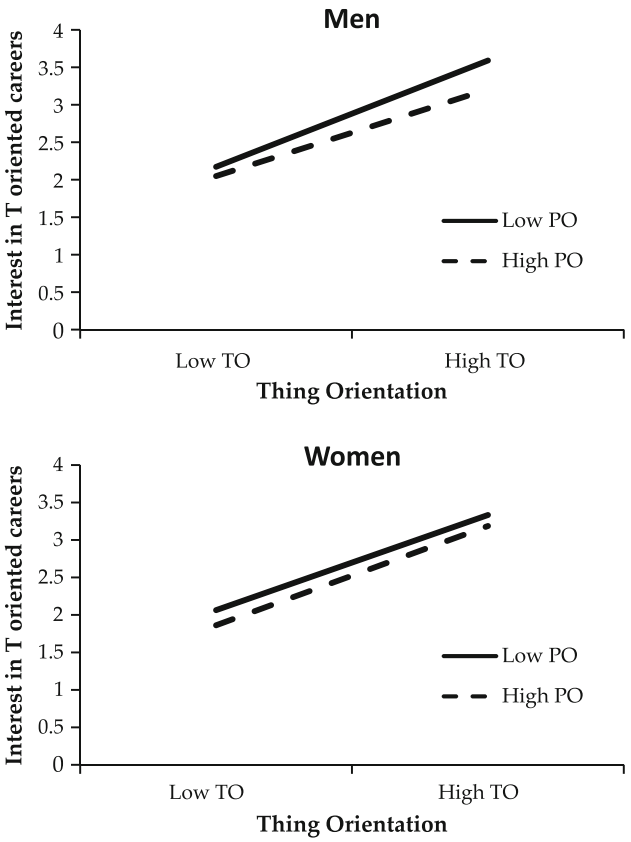

Fig. 2 Interest in thing oriented careers as a function of sex, person orientation, and thing orientation

student was then plotted in terms of a joint PO/TO z-score pair. Figure 2 showed that more women majoring in STEM appear in Quad I than in Quad IV, whereas women majoring in Non-STEM majors appear in Quad IV. The figure also showed the distribution, with women students majoring in STEM not restricted to Quad I but actually appearing at least once in each of the four quadrants.

Taken together, these outcomes suggest that university students (a) differ in their selective orientations towards persons and things in the environment; (b) PO need not be conceptualized as a bipolar opposite of TO; (c) PO and TO are related to choices of educational niches in picking academic majors; (d) PO and TO are probably not simply proxies for traditional sex roles of femininity and masculinity, respectively; (e) PO and TO have the hallmarks of motivational variables not only because they are related to interests, but because they appear to influence the direction, intensity and persistence of academic/educational behaviors.

Discussion

Study 1 had several limitations. First, outcomes were based solely on self-report. Probably no one has a better understanding of personal interests than the person her/himself, but confidence in conclusions could be enhanced with converging data from ratings by persons who knew the students well, archived academic records, or overt behavior. Second, university students are a select subpopulation of persons in many respects. They have already been screened for academic achievement and perceived potential for success. Confidence in generality of conclusions about PO and TO could be enhanced with converging information from other, less selected samples. Third, different orientations to the environment are probably acquired through teaching and learning of content in courses. When does this happen? What are the developmental origins of PO and TO? When do they begin to take a coherent form in students? In Study 2, we begin to address these issues.\

Study 2: Person-thing orientation in children

Children's interests in persons and things

STEM interests decline in middle childhood, and sex differences in STEM interests appear (e.g., Patton and Porfeli 2007). Given this finding, we explored the specific onset period in which the decline takes place. Studies suggest the decline is underway by 6th grade, so a plausible window would extend downward from 6th grade to 3rd grade (e.g., Jones et al. 2000). There are many differences between 3rd and 6th grade children, including cognitive development differences and the "instructional ecology" in which they live (e.g., Eccles 2007; Higgins and Eccles-Parsons 1983). Our goal was to establish a preliminary age link before probing explanatory hypotheses.

Participants

Data were collected from suburban Indiana (USA) children in third ($N = 130$; 59 girls) and sixth grade ($N = 103$; 55 girls) at the students' community-based public schools. All students assented to participation after parental permission was obtained. In addition, each student provided personal assent to participate.

Inferences based on self-report from young children about their covert psychological states can be problematic (e.g., Graziano et al. 1998; Tobin and Graziano 2011; Vaillancourt 1973). To obtain converging evidence from persons who knew the children well, we asked "knowledgeable informants" for their evaluations. Classroom teachers (15) rated their students (203) (For correlations between teacher and self-rated PO & TO see Table 4).

Table 4 Correlations among student and teacher ratings of person orientation and thing orientation as a function of children's grade

	3rd graders				6th graders			
	1.	2.	3.	4.	1.	2.	3.	4.
1. Self-rated PO	*0.60*				*0.61*			
2. Self-rated TO	0.25**	*0.68*			−0.04	*0.76*		
3. Teacher-rated PO	0.21*	−0.05	*0.90*		0.15	-0.21^{+}	*0.90*	
4. Teacher-rated TO	0.03	0.30**	0.22*	*0.93*	−0.21*	0.27*	-0.21^{+}	*0.92*

Numbers in italics on diagonal denote ICC reliability

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Materials

Data were collected on laptop computers. Children completed a child-appropriate version of the PO/TO scale, which consisted of 8 items (4 PO and 4 TO; For items and psychometric properties of the scale, see Table 5). Responses were made on a Likert-type scale ranging from 1 (not at all like me) to 5 (very much like me). Principal components analysis (with oblique rotations) revealed two factors, TO and PO, with Eigenvalues of 2.34 (29.20% of variance explained) and 1.75 (21.88% of variance explained), respectively. The study was also designed to explore parallel versions of the hypotheses examined among the university students. Consequently, children completed abbreviated, age-appropriate measures assessing interest in STEM- and non-STEM related classes and careers.

Results

Categorical variables

To examine sex differences and age differences in PO/TO a series of 2 (sex) × 2 (3rd vs. 6th grade) factorial ANOVAs were conducted. Boys were significantly higher in self-reported TO ($M = 3.33$, SD = 0.94) than girls ($M = 2.66$, SD = 0.87), $F(1, 229) = 31.42$, $p < 0.001$, $\eta = 0.35$. Girls were higher in PO ($M = 4.21$, SD = 0.57) than boys ($M = 3.90$, SD = 0.71), $F(1, 229) = 16.44$, $p < 0.001$, $\eta = 0.26$. Correlations between self-reported PO and TO was always positive and comparable in boys, $r = 0.19$, $p < 0.05$, and girls, $r = 0.27$, $p = 0.01$, $z = -0.69$, *ns*.

Third graders were higher in PO ($M = 4.14$, SD = 0.66) than sixth graders ($M = 3.95$, SD = 0.65), $F(1, 229) = 6.71$, $p = 0.01$, $\eta = 0.17$. There was no evidence that level of TO differed across third and sixth graders, $F(1, 229) = 1.39$, *ns*. A marginally significant Sex × Grade interaction on TO was also found, $F(1, 229) = 2.64$, $p = 0.106$, $\eta = 0.10$. Girls in sixth grade were lower in TO ($M = 2.50$, SD = 0.78) than girls in third grade ($M = 2.83$, SD = 0.92), $F(1, 112) = 4.38$, $p = 0.04$, $\eta = 0.19$. There was no evidence that TO in boys differed between third and sixth grade, $F(1, 117) < 1.00$, *ns*.

For purposes of descriptive comparison between university students and these children, we constructed a z-score based figure presenting the joint plot of self-report or teacher ratings PO and TO distributions for children (See Fig. 3).

Table 5 Items, means, standard deviations, and factor loadings for the child person-thing orientation scale

Item	Scale	M	SD	b[a]	r_{pb}^{b}	α^{c}
1. Set up a CD player by yourself	TO	3.27	1.15	0.667	0.44	0.69
2. Try to listen with care to a person you just met	PO	3.85	1.16	0.699	0.43	0.51
3. Take apart and try to put back together a computer	TO	2.74	1.48	0.814	0.56	0.62
4. Make the first try to meet a new neighbor	PO	3.57	1.08	0.640	0.37	0.55
5. Remove the back of a toy to see how it works	TO	3.17	1.29	0.635	0.43	0.70
6. Try to make a person feel better who has had a bad thing happen	PO	4.44	0.807	0.741	0.43	0.52
7. Try to fix your own watch or toaster	TO	2.80	1.28	0.811	0.59	0.60
8. Help set up a Halloween party	PO	4.30	0.93	0.635	0.34	0.57

$N = 203$

[a] Factor loading for each item on its respective scale (i.e., person or thing orientation), [b] Point-biserial correlations between individual items and total scores with that item excluded. [c] Reliability score for each subscale with that item excluded (overall alpha for PO scale = 0.61, overall alpha for TO scale = 0.72)

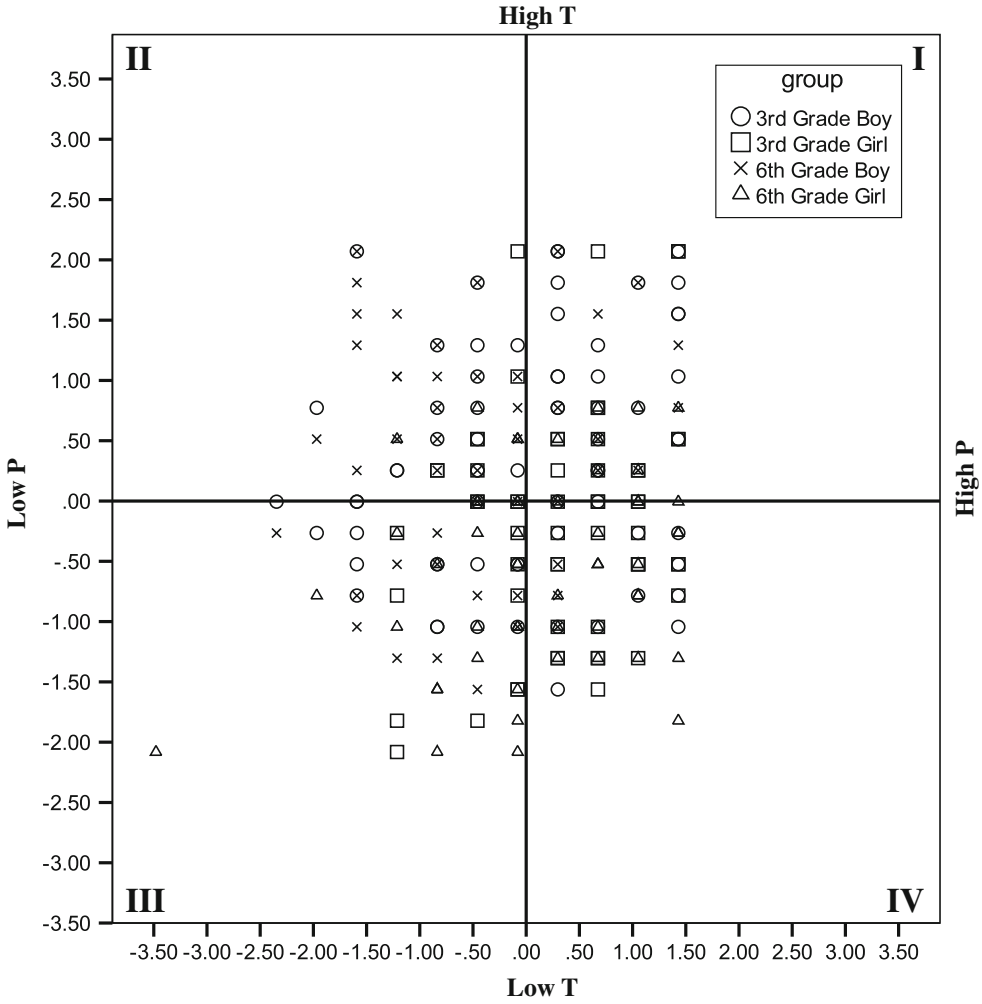

Fig. 3 Distribution of person- and thing orientation as joint standardized Z-scores for 3rd and 6th grade students

To examine the role PO/TO plays in motivating career interests, regression analysis was conducted on self-reported PO and TO. Our data suggest PO/TO interests are predictors of career interest as early as third grade, but these relationships differ in boys and girls. In third grade, in boys neither TO nor PO emerged as significant predictors of career interest. For third grade girls, both TO and PO were related to career interests. In third grade girls, TO was related to interest in T oriented careers, $b = 0.32$, $p = 0.01$, but was related only marginally to less interest in P oriented careers, $b = -0.19$, $p = 0.08$. PO was related to greater interest in P oriented careers, $b = 0.40$, $p = 0.05$, but was related only marginally to less interest in T oriented careers, $b = -0.37$, $p = 0.07$. In sixth graders there was no evidence that PO emerged as a predictor of interest in careers for either boys or girls (all p values > 0.10). For 6th grade boys and girls, however, TO was related to interest in both T- and P oriented careers. TO was related to interest in T oriented careers in boys, $b = 0.30$, $p = 0.05$, and girls, $b = 0.49$, $p < 0.001$. TO was also related (marginally) to less interest in P oriented careers in boys, $b = -0.22$, $p = 0.09$, and girls, $b = -0.26$, $p < 0.05$.

Teacher perceptions of PO/TO in children

A main effect of sex was found on both teacher rated TO, $F(1, 199) = 129.91$, $p < 0.001$, and P orientation, $F(1, 199) = 29.37$, $p < 0.001$. Teachers rated boys higher in TO ($M = 2.59$, SD $= 0.82$) than girls ($M = 1.28$, SD $= 0.83$). Teachers rated girls as higher in PO ($M = 2.61$, SD $= 0.84$) than boys ($M = 1.95$, SD $= 0.85$). There was no evidence that teachers rated third and sixth graders differently on TO or PO, $F(1, 199) < 1.00$, *ns*.

Regression analyses indicated that teacher ratings of student's PO and TO were related to student self-rated interest in P and T oriented careers. Teacher ratings of 3rd graders PO/TO emerged as stronger predictors of students' self-rated interest in P- and T oriented careers than students' self-ratings of PO and TO. This pattern was reversed for 6th graders. That is, 6th grade students' self-ratings of

Table 6 Summary of regression analysis for variables predicting children's self-rated interest in careers

	3rd graders						6th graders					
	Person oriented careers			Thing oriented careers			Person oriented careers			Thing oriented careers		
	Overall	Boys	Girls	Overall	Boys	Girls	Overall	Boys	Girls	Overall	Boys	Girls
Self-rated person orientation	0.33**	0.20	0.30^{+}	−0.41**	−0.26	−0.40*	0.50**	0.13	0.33^{+}	−0.42**	−0.34	−0.16
Self-rated thing orientation	−0.12	−0.18	0.04	0.23*	0.21	0.20^{+}	−0.40**	−0.29*	−0.28^{+}	0.53**	0.31^{+}	0.48**
Teacher-rated person orientation	0.24**	0.11	0.02	−0.14	0.11	0.04	0.22**	0.08	0.21	−0.21^{+}	−0.22^{+}	−0.11
Teacher-rated thing orientation	−0.49**	−0.17	−0.27*	0.48**	0.07	0.17	−0.29*	0.10	−0.09	0.21^{+}	−0.13	0.06

Standardized regression coefficients are presented to allow for interpretation of prediction strength across student and teacher ratings. Larger standardized regression coefficients indicate stronger effects

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

PO and TO were better predictors of self-rated interest in careers than teacher ratings of student PO and TO. (For details see Table 6). Similar to past research on interest in children (Jones et al. 2000), these results point to the conclusion that interests begin to steer career interests somewhere between 3rd and 6th grade. Before 6th grade, students may not be able to identify this link clearly.

General discussion

Two studies, one with university students and the other with children, explored selective orientations toward the social and physical aspects of the environment. The selectivity was described in terms of basic interests in persons and in things. The interests are consequential because they are related to educational niche picking and academic preferences. In university students, they are linked to choices of academic majors in general, to persistence in engineering in particular, and to career goals (See also Woodcock et al. 2011). In the second study of a less selected group of young children, PO and TO were related to still-developing notions of employment. Sex differences in PO and TO were apparent in both children and university students. The sex differences were not small. Outcomes of these two studies suggest that differential interests in persons and in things show the hallmarks of motivation in that they are related to the direction, intensity and persistence of behavior.

Given its potential importance for both theory and application, it is surprising how little empirical research has focused on PO/TO. Several basic questions are still open. First, is a TO conceptually opposite, or even negatively related, to PO? In some theories, PO/TO was presented as a single dimension (e.g., Prediger 1982; Thorndike 1911) or assumed to be a single dimension for applied purposes (e.g., Su et al. 2009). Other theorists (e.g., Cattell and Drevdahl 1955; Little 1972) were less sure about a single underlying dimension. At the measurement level, our data suggest that PO and TO are largely independent of each other, and if anything, are slightly positively (not negatively) correlated. Outcomes of the present studies are more consistent with recent work (Graziano et al. 2011; Tay et al. 2011) suggesting that TO need not be conceptualized as a bipolar opposite of PO, or even on a single common dimension with it. If this is true, then new avenues of motivation-based research come open. This empirical finding suggests that our apparently simple question about conceptual opposites becomes more complex on closer inspection. It is conceivable that the relation between PO and TO changes with development. For example interest in things and people in children may be correlated positively because they both index a common variable of general interest (or lack thereof) in the environment. With more schooling and exposure to a wider range of ideas and teaching, the two orientations may differentiate into separate dimensions.

Second, moving from the empirical to the conceptual level, the nature of the PTO complex requires construct elaboration. Ackerman et al. (2001) asserted that the root of gender differences in achievement in STEM is partially determined by motivation-related variables like different interests in social closeness and femininity. Is it true that masculinity is associated with orienting towards things, whereas femininity is associated with orienting towards people? Across sex, PO was positively related to both traditional masculinity ($r = 0.16$) and traditional femininity ($r = 0.42$). In contrast to PO, TO was related weakly to both masculinity ($r = 0.04$) and (negatively) to femininity ($r = -0.20$). These data suggest that students—both male and female– with a high PO are interested in interpersonal relationships. They are not necessarily less interested in

things. What remains obscure is the nature of TO. It seems to be related to important outcomes like choice of academic majors, subsequent vocational aspirations, and dropping out or persisting in programs of study. Yet TO seems not to be related to major personality variables like the Big Five dimensions. Perhaps this missing link speaks to the hidden biases in psychological research toward POs of various kinds and away from those who orient primarily toward things.

Contrary to predictions, we found no evidence that PO was related to major (STEM vs. Non-STEM) among university students. Furthermore, in study 2 we found no evidence that PO predicted career interests for either boys or girls in the 6th grade. It seems that in the PO/TO motivational complex, TO is carrying all of the predictive punch. At this point, we can offer only speculation. Perhaps we stacked the deck against PO in classifying academic majors along a STEM/Non-STEM axis that lies closer to an underlying TO fault line. Perhaps a more refined differentiation of academic majors (e.g., Medical service oriented majors vs. Engineering vs. Language and Literature) might have given more room for PO to express itself. It is possible that PO operates as a moderator. Given comparable aptitudes and abilities, students higher in PO may receive greater social support from faculty and peers, including selection for leadership roles. On the other hand, students higher in PO may perceive more (or different) options for their personal and occupational lives. Moving to a higher conceptual level, given how important social relationships are to the human species, it is implausible that PO plays no role in life outcomes or academic choices. Once research begins to examine PO and TO as separate dimensions, the distinctive contribution of PO will be easier to see.

Third, conceptual analysis of the PO/TO complex could be related to better understanding of situational influences on behavior, and to the nature of situations themselves. Precisely what is a "situation?" One way to parse situations is in terms of variations in interdependence among people (Kelley et al. 2003), but another is variations in physical objects. One inference from the present studies is that persons may differ in their perception of nature of situations, with some more attuned to interpersonal variations and others more attuned to things. Furthermore, persons may choose to enter or avoid certain situations based on their orientations. Self-selection of situations can be expressed as motivation in terms of selection of directions for behavior (e.g., picking an academic major), intensity of behavior (e.g., involvement), or persistence (e.g., remaining or leaving a major).

For university students, TO predicts plans for quitting an Engineering program in the first year, but PO does not. This pattern holds for both men and women. For children, TO predicts the kinds of careers/employment they envision for themselves, and what their teachers envision for them. From a developmental perspective, TO probably contributes to self-socialization by influencing choices of recreational activities, reading, and hobbies, contributing to a subsequent choice of STEM major and STEM-related career (e.g., Sodano and Tracey 2007).

Implications and future directions

Research reported here was cross-sectional, not longitudinal, and was entirely correlational. The term "prediction" was used in the restricted sense of data fitting. This form of prediction is preliminary and waits for corroboration in other independent samples. Causal inferences from such data are not justified.

Despite these limitations, these two studies offer provocative, if preliminary, information about differences in motivation underlying academic niche picking and educational choices. In future research students could be followed prospectively and longitudinally, yielding data that could be analyzed with more sophisticated procedures of causal modeling. This approach would permit exploration of beliefs and expectancies as mediators between motivational variables like thing-orientation at one end and research career plans at the other end. Future research should also examine research-related beliefs and expectancies in the faculty, graduate students and advisers who presumably shape students into the next generation of researchers (Woodcock et al. 2011).

If a goal is to retain more students in STEM (i.e., "hold" interest vs. "catch" interest; Durik and Haraciewicz 2007; Sansone and Thoman 2005), then it may be important to recognize that many of these students have personal interests not only in things, but also in persons as well. Interests in persons need not be inimical to a major in STEM. A new question becomes how person interests can be harnessed to promote skills in STEM. If the two orientations are related only weakly, then it is possible to identify students in a 2 (PO: Low vs. High) $\times$ 2 (TO: Low vs. High) configuration matrix. It is possible that success in STEM is related primarily to variation on TO, independent of PO.

Recent years have seen the decline of students graduating from Engineering programs and STEM fields more generally (National Science Foundation 2006). One way to reverse the decline is to identify processes that contribute to it (National Academy of Engineering 2008). Psychologically, Engineering needs to be "repositioned" (the committee's first recommendation). The goal of repositioning is to appeal more effectively to the hopes and dreams of those who could become scientists and engineers, as well as to those who support potential students.

Rather than attempting to change basic interests, instruction could redirect existing interests through social influence. It is widely believed (see National Academy of Engineering 2008) that recruitment and instruction in engineering and STEM fields could make more efficient use of students' interest in people to discuss the person-relevant aspects of engineering. When instructors describe careers and jobs to students, they could place greater emphasis on the implications of the STEM activities for improving the human condition. A recent study found that many students believed engineering to be low in PO, seeing it as mainly involving work done on computers with little interpersonal contact (National Academy of Engineering 2008). The study also found that persuasive messages were those which emphasized the potential of STEM to improve people's lives. Here is a potential opportunity for a valuable contribution to a pressing practical problem using psychology-based research.

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