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The other side of the coin: Vocational interests, interest differentiation and annual income at the occupation level of analysis ☆

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A R T I C L E   I N F O

A B S T R A C T

This research examined the effects of vocational interest levels and differentiation on annual income. Following the environmental perspective, we investigated whether relationships existed at the occupation level of analysis. Using data from 665 occupations in the U.S. obtained from U.S. Bureau of Labor Statistics and O*Net, we demonstrated that certain vocational interests – namely investigative, enterprising, and realistic interests – were most critical in predicting annual income for occupations. Controlling for interest levels, differentiation not only positively predicted annual income but also moderated each interest's relationship with income. In addition, occupations' education and training requirement partially mediated the effects of interest profiles on income. Our findings reveal the need for a better understanding of how characteristics of an occupation's interest profile may shape the experiences of its workers.

Vocational interest assessment has been widely used for many years to gauge and guide one's career path and match individuals to jobs (Perdue, Reardon, & Peterson, 2007; Savickas, 2011). Not only can vocational interests predict vocational choices (Austin & Hanisch, 1990; Humphreys, Lubinski, & Yao, 1993), but they also serve as a critical lens to understand issues in various areas of psychology, including individual differences (Lubinski, 2000), individual development (Low, Yoon, Roberts, & Rounds, 2005), sex difference in work preference (Su, Rounds, & Armstrong, 2009), and more recently, job performance and turnover (Nye, Su, Rounds, & Drasgow, 2012; Van Iddekinge, Putka, & Campbell, 2011; Van Iddekinge, Roth, Putka, & Lanivich, 2011).

As the predominant approach to measuring and understanding vocational interests, Holland's (1997) framework identifies six general interest dimensions: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (RIASEC). The RIASEC enables comprehensive assessment of interests for an individual or an occupation. Much of the research on vocational interests has focused on the RIASEC at the individual level, as indicated by meta-analyses linking individuals' RIASEC levels to personality traits (Barrick, Mount, & Gupta, 2003; Larson, Rottinghaus, & Borgen, 2002), self-efficacy (Rottinghaus, Larson, & Borgen, 2003), and performance and turnover (Van Iddekinge, Roth, et al., 2011). In contrast, occupations' RIASEC levels are often assessed peripherally, primarily examined on route to studying person-occupation congruence. A lacuna in research exists regarding how the RIASEC interests of an occupation may affect occupational outcomes. In particular, it remains unknown whether an occupation's RIASEC profile predicts annual income, which represents the value and importance that organizations and society as a whole attach to employee productivity and performance (Abowd, Kramarz, & Margolis, 1999; Smeeding, 1983). The study of the interest–income relationship at the occupation level is practically important: it not only affords individuals additional considerations for career decision and development, but also provides key information for job seekers as unemployment hovers at a high rate and job searching remains

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difficult and challenging (Parker, 2012; Uchitelle, 2009). Theoretically, an explication of the interest–income association may provide occupational interests as a lens to understanding income-related psychological phenomena, such as occupational attainment (Judge, Klinger, & Simon, 2010), perceived job stress at work (DeVoe & Pfeffer, 2011), financial strain (Judge, Hurst, & Simon, 2009), and pay satisfaction (Berkowitz, Fraser, Treasure, & Cochran, 1987).

Thus, the goal of this paper is to cast new light on the understanding of an occupation's interest profile by linking that profile to annual income. Aside from focusing on the *levels* of RIASEC interests associated with a given occupation's interest profile, we also aim to measure and involve the *differentiation* across interest dimensions as an important characteristic that indicates how well-defined an interest profile is (Holland, 1997). Simply put, a differentiated interest profile has high interest scores on some dimensions and low interest scores on other dimensions, whereas an undifferentiated interest profile has interest scores that are similar across RIASEC dimensions. Despite its theoretical relevance, differentiation remains "a weak construct" (p. 148) with a "checkered research career" (p. 172, Holland, 1997). Inconsistent findings regarding the main effects of interest differentiation on certain outcomes have led to a decline in research in this area in recent years (Nauta, 2010). Instead of continuing the search for the main effects of differentiation on vocational outcomes, we focus on the extent to which differentiation *moderates* the effects of the RIASEC.

In the sections that follow, we provide the theoretical foundations for four core hypotheses and introduce three general research questions. We test for the hypotheses and research questions with data pooled from the U.S. Bureau of Labor Statistics and O*Net for 665 different occupations in the U.S., and discuss the implications of those results as well as avenues for future research.

1. Vocational interests and occupational outcomes

Over the past two decades, Holland's (1985, 1997) RIASEC framework has become the most popular tool used to study the vocational interests of people as well as work environments (Woods & Hampson, 2010). The underlying assumption of this framework is that people and work environments can be described with regard to their level of interest in six dimensions, each of which are associated with certain types of work tasks and requirement. The six interest dimensions are: Realistic (R), investigative (I), artistic (A), social (S), enterprising (E), and conventional (C). Holland suggested that people with certain levels of these interests tend to seek out work environments with parallel tasks and requirements. For example, people with strong interests in realistic, investigative, and enterprising categories fit well into engineering positions characterized by practical, hands-on work (R); problem-solving (I), and project management (E).

Much research supports the importance of RIASEC profiles for individuals, particular in the domain of career decision-making. For example, a number of studies have evidenced the ability to predict an individual's occupational choice from their RIASEC scores (e.g., Betz, Borgen, & Harmon, 2006; Hansen & Dik, 2005). However, relatively less is known about the potential value of RIASEC profiles at the occupation (work environment) level of analysis (Nauta, 2010). If occupations' interest profiles are of theoretical and practical import, the RIASEC characteristics of occupations should enable the prediction of occupational outcomes. In the current research, we seek to directly address this issue by examining relationships among levels of RIASEC interests – as well as differentiation across interests – and a clear indicator of the value placed on occupations: annual income.

To date, little research has investigated this issue. Reardon, Bullock, and Meyer (2007) conducted one relevant study, in which they applied the Holland occupational codes to occupations in the U.S. census to describe annual income at the occupation level. The occupations were categorized based on their highest interest dimension (i.e., the first letter of a Holland code). For instance, if an occupation's realistic interest score is higher than the other five interest scores, this occupation will be categorized into the Realistic type. According to Reardon et al. (2007), the Investigative type received the highest income ($48,592) in the year 2000, followed by Conventional ($33,223), Artistic ($32,724), Social ($32,506), with Realistic ($27,215) and Enterprising ($26,109) types receiving the lowest income. However, no inferential statistical test was conducted to discern the difference across types of occupations. More importantly, occupations were coarsely characterized with the primary Holland interest category, while the actual level on each RIASEC dimension was ignored. A comprehensive evaluation is in order to understand the effects of occupations' RIASEC interest levels.

Among the RIASEC dimensions, investigative interests appear to have the most clear positive influence on income. First, research evidence suggests that investigative interests correlate positively with cognitive ability (Ackerman & Heggestad, 1997). Indeed, investigative interests positively predicted the performance of army soldiers even when the jobs did not require such interests (Van Iddekinge, Roth, et al., 2011). At the occupation level, occupations that emphasize investigative interests have a stronger need for cognitive processing and trained skills (Anthoney & Armstrong, 2010) and thus can be quite selective in filling the jobs. Individuals with greater investigative interests may be driven to acquire greater subject matter knowledge through education (Rottinghaus, Lindley, Green, & Borgen, 2002; Schmitt, Oswald, Friede, Imus, & Merritt, 2008) and thus become well qualified for the jobs.

Second, the development of the information economy has led to an increased focus on talented and highly skilled workers (Castells, 2000). In such an economy, workers who are curious, problem-driven, and investigative are more likely obtain higher levels of knowledge and skills and thus receive greater opportunity to advance, and subsequently afford to acquire more knowledge in return (Garicano & Rossi-Hansberg, 2006). With the aid of computers, workers nowadays are faced with increased demand to perform nonroutine cognitive tasks (Autor, Levy, & Murnane, 2003). Investigative interests can predispose individuals to pursue the nonroutine cognitive tasks that are valued in the information economy. Therefore,

Hypothesis 1. Investigative interests will be positively associated with annual income at the occupation level.

Enterprising interests are positively associated with the preference and acceptance of leadership positions (Chan, Rounds, & Drasgow, 2000). Given its moderately large positive correlation with extraversion (Barrick et al., 2003), a personality trait associated with both leadership emergence and leadership effectiveness, one can expect enterprising interests to predict leadership as well. Furthermore, research has indicated that individuals with higher enterprising interests are more likely to pursue a managerial career (Hill & Hansen, 1986; Sedge, 1985) and to undertake financial risks to start and manage a business (Schmitt-Rodermund, 2004). Taken together, it is likely that occupations that emphasize leadership, management, and entrepreneurship will have incumbents who score high on enterprising interests. As these positions often occupy the higher level of organizational hierarchy and thus are well compensated, we can expect a positive relationship between enterprising interests and income.

Hypothesis 2. Enterprising interests will be positively associated with annual income at the occupation level.

The influence of realistic and conventional interests on income may stem in part from computer technology, industrial automation, and global economy. Conventional, routine tasks and realistic, manual tasks can be automated and substituted by computers and machines (Acemoglu & Autor, 2011; Autor et al., 2003), leading to a relative reduction in the value placed on employees in these occupations. For example, occupations that emphasize realistic and conventional interests may involve routine tasks while providing limited opportunities for creativity and managerial decision-making, which are generally valued more by organizations. Furthermore, conventional and realistic jobs may face competition from overseas companies with lower labor costs (Acemoglu & Autor, 2011) and thus may need to reduce pay accordingly.

Hypothesis 3. (a) Realistic and (b) conventional interests will be negatively associated with annual income at the occupation level.

It is less clear how social interests will relate to occupational income. Although it may seem desirable to have high social interests in the U.S., a society that has a strong cultural and behavioral norms for extraverted behaviors (Den Hartog, 2004; McCrae & Terracciano, 2005), preference for social interactions and activities may cover a wide range of jobs in an organization's hierarchy. In addition, the orientation toward serving and helping others (Holland, 1997) exemplified in social interests may lead to lower earning, as suggested by the negative association between agreeableness and individual income (Judge, Livingston, & Hurst, 2012). Indeed, when employees spend time helping others, they have less time and fewer resources available to focus on their own performance (Barnes et al., 2008).

Likewise, the artistic dimension may not be a clear predictor of occupational income. Individuals' creative achievement is associated with creative ability (von Stumm, Chung, & Furnham, 2011) and engagement in creative behaviors (Helson & Srivastava, 2002; Silvia, Wigert, Reiter-Palmon, & Kaufman, 2012). At the occupation level, the same artistic occupation, such as actor and fine artists may include individuals with a wide range of artistic ability, experience, and achievement. Thus, the level of artistic interests may not pose a strong influence on income.

Research Question 1: What are the associations between (a) social and (b) artistic interests with annual income at the occupation level?

Because each occupation can be characterized using the RIASEC interests, it is meaningful to examine the simultaneous effects of all six RIASEC factors on income at the occupation level, as the influence of one dimension may be accounted for by other
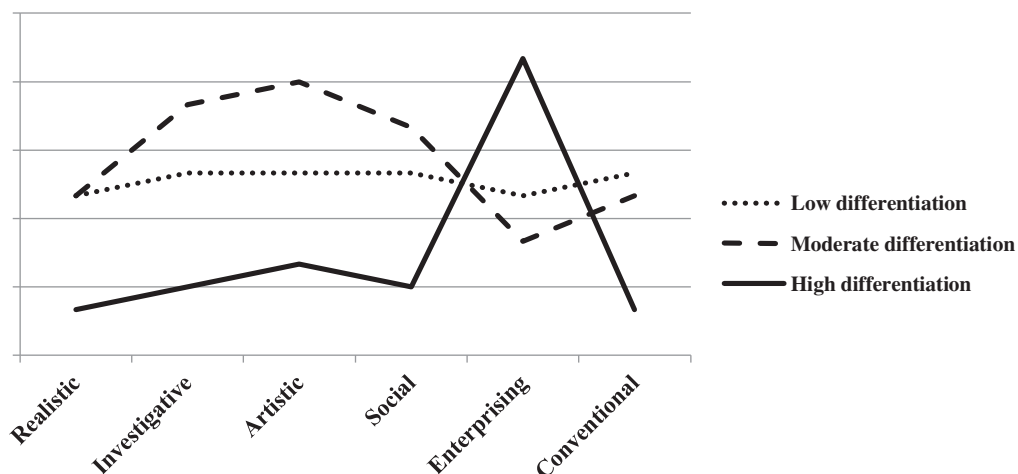

Fig. 1. Illustrative vocational interest profiles with low, moderate, and high differentiation.

dimensions. For example, if the cognitive processing component is a critical driver for income, it is likely that investigative interests may account for other interests' effect on income. Furthermore, it is practically meaningful to identify the relatively important predictors of income. For example, people may consider developing certain interest dimensions if they have stronger implications for future income.

Research Question 2: What are (a) the simultaneous effects and (b) the relative importance of RIASEC interests in predicting annual income at the occupation level?

2. Vocational interests and differentiation

While a substantial literature exists supporting the importance of overall amounts of interest in each of these dimensions, relatively fewer efforts have focused on interest differentiation (Kieffer, Schinka, & Curtiss, 2004). When considering an interest profile, the amount of variation across interest dimensions represents the profile's *differentiation* (Holland, 1997). If a profile includes much greater interest in one or a few dimensions relative to others, then it is highly differentiated; if the profile is flat such that many or all interest dimensions are fulfilled to similar extents, then it shows little or no differentiation. For further illustration, examine the three vocational interest profiles depicted in Fig. 1. In the figure, the solid line represents a highly differentiated profile that includes greater interest in the enterprising dimension and lesser interest in others; the dashed line represents a moderately differentiated profile that includes greater interests in investigative, artistic, and social dimensions and lesser interest in others; and the dotted line represents a profile that lacks differentiation and includes about the same amount of interest in each of the six dimensions.

Based on Holland's (1985) assertion that differentiated vocational interest profiles would be more stable and lead to more satisfied and productive employees, extant empirical investigations of vocational interest differentiation have focused on the differentiation of individuals' interest profiles. Studies on individual outcomes such as job satisfaction (Carson & Mowsesian, 1993), job performance (Kieffer et al., 2004), counterproductive behavior (Gottfredson & Holland, 1990), and career indecision (Conneran & Hartman, 1993) have yielded weak or inconsistent findings (see Nauta, 2010). One potential cause behind the inconsistencies is the lack of empirical attention to the interest differentiation of the work environment (i.e., occupation) despite its relevance in Holland's theory. The congruence between a person and an occupation should incorporate not only the interest levels of the person and the occupation, but also the differentiation of profiles for the person and the occupation. Establishing the relevance of occupations' interest differentiation can serve as a critical first step towards the integrated examination of profile congruence.

We assert that differentiation of occupations' interest profiles can reveal important information about the characteristics of work environments, and the role of differentiation is not so much in its main effect as in its moderation of the effects of interest levels. An occupation may require simultaneous interests from more than a single dimension, and the extent to which several interest dimensions compete for the worker's attention and effort can impact the effect of each interest. The influence of a differentiated work environment will be more predictable relative to an undifferentiated environment in which multiple, diffused demands occur simultaneously (see Holland, 1997). Indeed, a differentiated occupation may strengthen the effects of vocational interests by enabling workers to identify with a core set of tasks rather than a wide range of various tasks (Hackman & Oldham, 1976), to avoid potential ambiguity (Jackson & Schuler, 1985) from competing interests, and to practice towards expertise in particular area (Ericsson, Krampe, & Tesch-Römer, 1993). As a result, it would be worthwhile to move beyond simply examining interest levels and to incorporate differentiation.

Hypothesis 4. Interest levels would better predict annual income in differentiated rather than undifferentiated occupations.

Given our hypotheses and research questions regarding expected relationships between interest profiles and the value assigned to employees' performance and productivity within particular occupations, we also seek to explore why such relationships might exist. In other words, what would explain the mechanism through which certain occupational interest profiles become more valuable than others? A critical factor may be the different amounts of education and training required for performing in various occupations. It is likely that occupations with certain interest profiles (e.g., high investigative, low realistic) require greater amount of education and training to perform and excel in. This in turn drives up the value placed on employees in those occupations because greater amounts of education and training are rare and denote substantial, and therefore valuable, expertise. To explore the potential role of education as an explanatory mechanism in relationships between hypothesized predictors and annual income, we propose the following research question:

Research Question 3: Does education and training requirement mediate relationships between interest profile characteristics and annual income?

3. Method

We obtained the data for the current study from two sources: U.S. Bureau of Labor Statistics and O*Net. From the Occupational Employment Statistics published in May 2010 (U.S. Bureau of Labor Statistics, 2010a), we downloaded the most current Occupational Employment and Wage Estimates in the U.S. This dataset was compiled by surveying nonfarm, nonself-employed wage and salary workers across more than 800 occupations, covering a comprehensive list of occupations across a wide range of industries (e.g., furniture finishers, power plant operators, statistical assistants).

We also obtained occupation-level RIASEC interest levels from the O*Net 16.0 (O*Net Resource Center, 2011). The O*Net 16.0 dataset includes RIASEC ratings for 897 occupations based on procedures "designed to provide data that are valid, reliable, current, and regularly updated" (O*Net Resource Center, 2011). According to Rounds, Smith, Hubert, Lewis, and Rivkin (1999), expert judges rated how descriptive and characteristic each of Holland's environmental descriptors (realistic, investigative, etc.) was of a particular occupation. Ratings were made using a seven-point scale where "1" was labeled as "not at all characteristic," "4" was labeled as "moderately characteristic," and "7" was labeled as "extremely characteristic". Judges' ratings reached high agreement and showed high external validity and structural validity (Rounds et al., 1999).

Data from the two sources were merged using Standard Occupational Classification codes present in both datasets. Only occupations with data on both annual income and RIASEC interests were retained for the analysis, resulting in an effective sample size of 665 occupations.

3.1. Differentiation

We assessed differentiation with the standard deviation of all six interest scores within each occupation (Hirschi & Läge, 2007). We also computed Holland's differentiation index as the difference between the highest and lowest interest scores. These two indices were highly correlated ($r = .77$, $p < .001$). As the standard deviation approach takes into account variations across all six interests and thus more closely reflects an occupation's interest profile, we tested the hypothesis using the standard deviation index for differentiation.

3.2. Annual income

Annual median income for each job from the Occupational Employment Statistics was used as the outcome variable in our analysis. Because the annual median income was positively skewed with outliers in the right end of the distribution, we followed common practice regarding income (see Kahneman & Deaton, 2010) and applied a natural log transformation to reduce skewness and the impact of outliers.

3.3. Education and training requirement

O*Net job zone data were used to represent the amount of education and training typically required for each occupation. Job zone scores range from "1" to "5," with a job zone of "1" indicating an occupation that requires little or no preparation and a job zone of "5" indicating an occupation that requires extensive preparation.

4. Results

We first computed zero-order correlations and presented them in Table 1. These correlations indicate significant relationships among some RIASEC dimensions such that occupations characterized by certain interests also tended to be characterized by higher or lower standing on other interests. For example, occupations characterized by high realistic interests tended to emphasize less artistic ($r = -.44$, $p < .001$), social ($r = -.65$, $p < .001$), and enterprising ($r = -.57$, $p < .001$) interests.

It is worth noting that the correlations among the RIASEC interests at the occupation level differed from the largely positive correlations found at the individual level (see Tay, Su, & Rounds, 2011). At first brush, these correlations did not seem to conform to the order of correlations predicted from the circumplex model (see Rounds, Tracey, & Hubert, 1992). For instance, unlike individual-level correlations, Realistic had very weak associations with its two adjacent dimensions of Investigative ($r = -.10$) and Conventional ($r = -.14$). We conducted a principal component analysis to examine if the two underlying dimensions of people-things and data-ideas (see Prediger, 1982) would emerge from the data. A two-component solution was identified using both Kaiser's criterion and the scree plot, accounting for 65% of variance in observed variables (see Table 2). Spatial representation of the

Table 1
Descriptive statistics and correlations among study variables.

	1	2	3	4	5	6	7	8	9
1. Realistic	–								
2. Investigative	−0.10	–							
3. Artistic	−0.44	0.24	–						
4. Social	−0.65	0.11	0.36	–					
5. Enterprising	−0.57	−0.29	0.06	0.29	–				
6. Conventional	−0.14	−0.12	−0.38	−0.19	0.26	–			
7. Differentiation	0.32	−0.27	−0.41	−0.50	−0.10	0.23	–		
8. Job zone	−0.57	0.66	0.50	0.47	0.15	−0.17	−0.42	–	
9. Annual income	−0.35	0.62	0.26	0.17	0.14	−0.10	−0.16	0.75	–
M	4.90	3.19	2.16	2.90	3.36	4.13	2.12	2.97	10.64
SD	2.11	1.86	1.46	2.07	1.74	1.45	0.21	1.19	0.46

Note. $N = 665$. M = Mean. SD = Standard Deviation. Annual income was subjected to natural-log transformation before analysis. When $|r| \geq .05$, $p < .05$; when $|r| \geq .09$, $p < .01$; when $|r| \geq .13$, $p < .001$.

interest variables on the two dimensions (Fig. 2) resembled the RIASEC structure found in individual level data (Ott-Holland, Huang, Ryan, Elizondo, & Wadlington, in press; Prediger, 1982; Tracey & Rounds, 1996). Interestingly, the correlations between opposing dimensions (i.e., $r = -.65$ between Realistic and Social; $r = -.29$ between Investigative and Enterprising; $r = -.38$ between Artistic and Conventional) provide stronger evidence for bipolar people-things and data-ideas dimensions than individual-level data did (Tay et al., 2011).

Interests' hypothesized effects were examined based on zero-order correlations. In support of Hypothesis 1, investigative interests had a strong positive zero-order relationship with annual income ($r = .62, p < .001$). Thus, occupations with stronger focus on investigative interests generally provide higher levels of compensation. Enterprising interests' correlation with annual income supported Hypothesis 2, although the effect size was small ($r = .14, p < .001$). Both realistic ($r = -.35, p < .001$) and conventional interests ($r = -.10, p < .01$) had negative associations with income, providing support for Hypothesis 3. Finally, artistic and social interests had positive relationships with income ($rs = .26$ and $.17, ps < .001$).

We used multiple regression analysis to examine the unique effect of each interest dimension on income. Prior to the analysis, all predictors were mean-centered, rendering the intercepts of the regression models interpretable as the average income of the sample. When examined simultaneously, the RIASEC dimensions accounted for 54% of the variance in annual income (see Model 1 of Table 3). Investigative interest had the largest effect ($\beta = .69, p < .001$), while the effects of enterprising ($\beta = .30, p < .001$), realistic ($\beta = -.27, p < .001$), and conventional ($\beta = -.20, p < .001$) interests were consistent with their respective zero-order correlations with income. Artistic interests, however, were not a significant predictor of income ($\beta = -.07, n.s.$), whereas social interests had a slight negative effect ($\beta = -.17, p < .001$). The negative effect of social interests may be due to statistical suppression, as its zero-order association with income was positive.

Because RIASEC dimensions were correlated with others, relative weight analysis (LeBreton, Hargis, Griepentrog, Oswald, & Ployhart, 2007) was used to supplement the information gained from regression coefficients. Relative weight analysis allowed us to identify the importance of each predictor given the presence of multicollinearity. Results indicated that investigative interests were the most important predictor of income, accounting for 71% of the predictable variance in income. Realistic and enterprising interests also played a somewhat important role, accounting for 12% and 9% of the predictable variance. The effects of artistic, conventional, and social interests, on the other hand, were quite minimal.

Next, we examined the degree to which differentiation could contribute to the prediction of annual income beyond RIASEC interests (Hypothesis 4). We created interaction terms using mean-centered predictors (i.e., interests and differentiation) to mitigate multicollinearity in the moderated regression analysis. Differentiation by itself correlated negatively with annual income ($r = -.16, p < .001$). In addition, differentiation in RIASEC interests was positively correlated with Realistic ($r = .32, p < .001$) and Conventional ($r = .23, p < .001$) and negatively correlated with Investigative ($r = -.27, p < .001$), Artistic ($r = -.41, p < .001$), Social ($r = -.50, p < .001$), and Enterprising ($r = -.10, p < .01$). Results of the moderated regression are presented in Models 2 and 3 in Table 3.

The addition of differentiation among RIASEC interests in Model 2 accounted for another 1% of variance in income ($\Delta R^2 = .01$, $\Delta F(1,657) = 9.58, p < .01$), indicating that, controlling for RIASEC levels, occupations with higher differentiation across RIASEC dimensions were relatively well-paid versus those with lower differentiation. In Model 3, all six interaction terms were simultaneously entered as an additional step to test whether differentiation interacted with RIASEC interests to affect annual income. Taken together, the interaction terms accounted for additional 4% of variance in income ($\Delta R^2 = .04, p < .001$). Each of the interaction terms was significant. Fig. 3 presents the patterns of interactions. We employed simple slope analyses to decompose these significant interactions (Table 4).

The moderating effects of differentiation on Realistic, Social, Enterprising, and Conventional supported the hypothesis: As occupations had a stronger emphasis on differentiated interest profiles, the importance of each interest dimension became more pronounced, as indicated by the stronger effects on workers' typical income. Follow-up simple slope analyses revealed that, for occupations with undifferentiated interest profiles (undifferentiated = 1 SD below the mean), Realistic, social, and conventional interests were not associated with income whereas enterprising interest had a weaker yet significant association (see Table 4). For occupations with differentiated interest profiles (differentiated = 1 SD above the mean), all four interests were significantly associated with income.

In contrast, differentiation interacted with investigative and artistic interests in the opposite direction. Specifically, Investigative and Artistic were positively associated with income in occupations with undifferentiated interest profiles (1 SD

Table 2
Loadings of RIASEC from principal component analysis.

Interest	People–things	Data–ideas
Realistic	.90	.22
Investigative	−.14	.60
Artistic	−.64	.50
Social	−.81	.10
Enterprising	−.57	−.66
Conventional	.12	−.74
Variance accounted for	37%	28%

Note. Loadings on the first principal component were reflected to the people-things dimension by multiplying with −1.
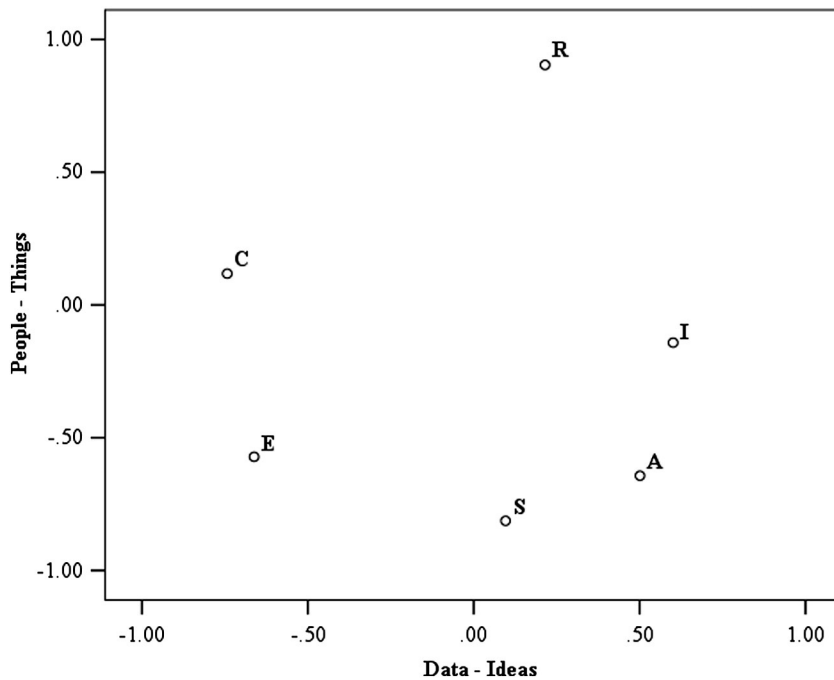
Fig. 2. Spatial representation of principal component loadings.

below the mean), whereas in occupations with highly differentiated interest profiles, interests' effects were either weaker (for Investigative) or nonsignificant (for Artistic).

Finally, we conducted mediation analysis to address the extent to which education and training mediate the effects of occupations' interest profile on annual income. We followed the bootstrapping approach to testing mediation (MacKinnon, Fairchild, & Fritz, 2007) and estimated the distributions of indirect effects by creating 5000 bootstrapped samples (Hayes, 2013). Table 5 presents the effects of interest profile characteristics on job zone, simultaneous effects of interest profile characteristics and job zone on annual income, as well as 95% confidence intervals for the mediated effects. Results revealed that most of the significant effects were at least partially mediated by job zone (i.e., 95% confidence interval did not include zero), with the exceptions of differentiation and its interaction terms with Realistic and Enterprising. In particular, the effects of Realistic and the Artistic-by-differentiation interaction were fully mediated by job zone as their direct effects were no longer significant after entering job zone in the regression model.

Table 3
Hierarchal multiple regression analyses predicting log annual income.

	Model 1				Model 2		Model 3	
	b	β	RW	RW–RS	b	β	b	β
Intercept	10.64				10.64		10.61	
Realistic	−.06	−.27***	.06	12%	−.06	−.26***	−.04	−.21***
Investigative	.17	.69***	.38	71%	.18	.71***	.18	.75***
Artistic	−.02	−.07	.02	4%	−.01	−.04	.00	.00
Social	−.04	−.17***	.01	2%	−.03	−.12**	−.03	−.14**
Enterprising	.08	.30***	.05	9%	.08	.31***	.09	.35***
Conventional	−.06	−.20***	.01	3%	−.06	−.20***	−.05	−.15***
Differentiation					.23	.10**	.33	.15***
R × differentiation							−.12	−.11*
I × differentiation							−.15	−.13***
A × differentiation							−.15	−.10**
S × differentiation							−.17	−.16***
E × differentiation							.11	.08*
C × differentiation							−.30	−.20***
ΔR^2		.54***				.01**		.04***

Note. $N = 665$.
RW = relative weight; RW–RS = relative weight rescaled to proportion of total R^2.
  * $p < .05$.
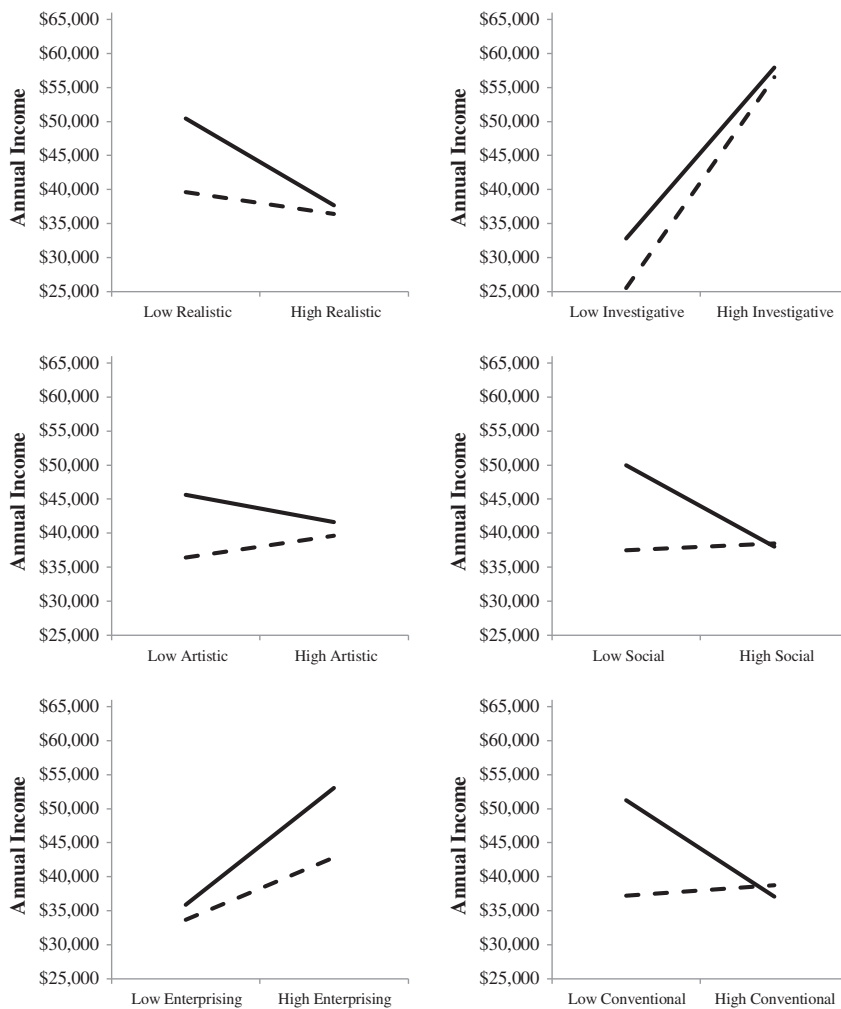 ** $p < .01$.
*** $p < .001$.

Fig. 3. Interaction between differentiation and each interest on annual income. *Note.* Solid lines represent relationships between interests and annual income for high differentiation occupations; dashed lines represent relationships between interests and annual income for low differentiation occupations.

5. Discussion

This research highlighted the value of vocational interests for predicting annual income at the occupation level of analysis. Correlational analyses provided initial support for Hypotheses 1, 2, and 3, as well as addressed Research Questions 1 and 2 — namely that greater annual incomes are found in occupations characterized by greater levels of investigative, enterprising, artistic, or social interests, or weaker levels of realistic and conventional interests. When the six interests were included as simultaneous predictors in a regression analysis, over half the variance in annual income across occupations was explained. Results from relative weights analysis – which was conducted in order to supplement multiple regression analysis results given the presence of predictor multicollinearity –

Table 4
Summary of results for simple slope analyses predicting log annual income.

	Low differentiation			High differentiation		
	b	β	p	b	β	p
R	− .02	− .09	.16	− .07	− .32	<.001
I	.22	.87	<.001	.15	.62	<.001
A	.03	.09	.04	− .03	− .10	.07
S	.01	.03	.58	− .07	− .30	<.001
E	.07	.26	<.001	.11	.43	<.001
C	.01	.05	.42	− .11	− .35	<.001

Note. Simple slope analysis conducted for each interest dimension separately. Low differentiation = 1 *SD* below the mean; High differentiation = 1 *SD* above the mean.

Table 5
Results of mediation analysis.

	DV = job zone		DV = log annual income		Bootstrapped indirect effect 95% confidence interval	
	b	β	b	β	Lower bound	Upper bound
Intercept	2.92		10.63			
Realistic	−.18	−.32***	.00	.01	−.06	−.03
Investigative	.41	.63***	.08	.34***	.08	.12
Artistic	.10	.12***	−.03	−.08*	.01	.04
Social	.04	.07*	−.04	−.18***	.00	.02
Enterprising	.11	.15***	.07	.25***	.01	.04
Conventional	−.08	−.10***	−.03	−.09**	−.03	−.01
Differentiation	.06	.01	.31	.14***	−.07	.12
R × differentiation	−.21	−.08*	−.07	−.07	−.12	.01
I × differentiation	−.23	−.07**	−.10	−.09**	−.10	−.01
A × differentiation	−.29	−.07**	−.07	−.04	−.15	−.02
S × differentiation	−.24	−.09**	−.12	−.11**	−.10	−.01
E × differentiation	.07	.02	.09	.07*	−.04	.08
C × differentiation	−.43	−.11***	−.19	−.12***	−.18	−.05
Job zone	–	–	.25	.65***	–	–
R^2	.75		.69			

Note. 95% confidence intervals for indirect effects (unstandardized) were estimated with 5000 bootstrapped samples.
  * $p < .05$.
 ** $p < .01$.
*** $p < .001$.

showed that investigative interests were most predictive of income (71%), with realistic and enterprising interests holding secondary importance (12% and 9%, respectively). Taken together, these results indicate that higher annual incomes in occupations were associated with greater investigative and enterprising interests and weaker realistic interests. Although artistic, social, and conventional interests were related to annual income, their relationships held substantially less import. Furthermore, the current study uncovered education and training required to perform a particular job as the key mechanism by which occupations' interest profile characteristics influence annual income. Put in the context of the most important predictors of income, occupations with higher investigative and enterprising interests and lower realistic interests tend to yield higher income because they tend to require extensive education and training.

The results of this study also show that differentiation of an occupation's interest profile adds to the understanding of the value attached to the occupation: after controlling for the levels of interests associated with an occupation, differentiation positively predicted its median annual income and also moderated the effect of each interest (level) on the median annual income. Together, including differentiation and its moderating effects accounted for 5% additional variance in annual income.

These results largely support Holland's (1997) reasoning that differentiation is an important indicator of occupational interest profiles. It also provides a contrasting view versus extant studies based on outcomes associated with individuals' interest profiles. Our findings are particularly relevant in the current economy as changes in job availability and security compel organizations to place greater value in some occupations versus others and entail individuals to modify their career paths and to look for new occupations (Sverke & Hellgren, 2002; U.S. Bureau of Labor Statistics, 2010b). Understanding how interest levels and differentiation influence occupational income has clear implications for psychological research and practice — particularly in the realms of job search, career counseling, and workforce planning. For people seeking to learn about different career options, career counselors may discuss with them a variety of factors influencing annual income. Given the current research, one of those factors is occupational interest profile. Workforce planners in organizations that seek to hire new employees or to adjust compensation packages for current employees often make decisions after evaluating the norms of their competitors and the market in general. Our results suggest that by attending to occupational interest profiles, workforce planners will be better equipped to make these compensation decisions. These findings also have implications for areas outside of psychology and business. For example, as there is considerable gender difference in individual interest profiles (Su et al., 2009), levels and differentiation of occupations' interest profiles may be a potential lens to understand male–female pay difference that is of interest to sociologists, economists, and labor relation researchers (e.g., Barón & Cobb-Clark, 2010; Kilbourne, England, Farkas, Beron, & Weir, 1994; Solberg & Laughlin, 1995).

Our investigation of occupations' interest profiles reveals a pattern of correlations distinct from the more typically studied area of *individuals'* interests (see Tay et al., 2011). Although Holland's theory pertains both to the person and the work environment, most research attention has remained on individuals with work environments taking an ancillary role in the literature. The current findings help advance the understanding of the work situation that serves as a backdrop to understand the person's preferences, choices, and behaviors (see Funder, 2001). Our findings also lay the groundwork for future research on person-environment fit (Edwards, Cable, Williamson, Lambert, & Shipp, 2006): the congruence between an individual's interest profile and the interest profile required for a given occupation may need to take in to account the differentiation of both profiles.

Several limitations of the current study should be noted. First, our inability to include multiple occupational outcomes such as satisfaction and strain is a limitation, but this is compensated by the study's comprehensive coverage of major occupations in the U.S. Although this research only examines one occupational outcome (i.e., annual income), it supports a unique perspective in

assessing vocational interests. Nevertheless, future studies are needed to provide a comprehensive examination of the effects of occupation-level vocational interests, together with other occupational characteristics such as prestige (e.g., Walker & Tracey, 2012), on various occupational outcomes. Indeed, it is even possible for future studies to examine interests and income as potential predictors of perceived occupational prestige.

Second, by attending to occupations' interest profiles, the current study did not take into account the variation of workers' interest levels within a particular occupation. As different occupations tend to attract and retain individuals with different personality profiles (e.g., Schaubroeck, Ganster, & Jones, 1998), one can assume that the interest profiles of workers will converge to a certain extent within a given occupation. However, the degree to which such convergence occurs may be a variable of interest for future research.

Third, our study focused on the associations between vocational interests and income at the occupation level based on cross-sectional data. We could not examine the potential change and development of vocational interest as a result of occupational experience (see Savickas, 2002). Given recent research on personality trait change due to occupational experience (e.g., Jackson, Theommes, Jonkmann, Lüdtke, & Trautwein, 2012), future studies may begin to explore whether occupational interest profiles can influence workers' vocational interests over time, and whether individuals with greater propensity to adapt are more ready to change (Savickas & Porfeli, 2012). We posit that, when occupational experience leads to changes in workers' interest levels, an occupation with a differentiated rather than undifferentiated interest profile may yield more potent changes.

6. Conclusion

Using data from U.S. Bureau of Labor Statistics and O*Net, we examined the association between interest profiles and income at the occupation level of analysis. Investigative, enterprising, and realistic interests emerged as the most important predictors of income. Extending Holland's (1997) theory on differentiation, the study demonstrated the role of differentiation in moderating main effects of interest levels. The education and training requirement of an occupation was found to mediate the influence of occupational interest profile on income.

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