2002

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Journal of Management

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What is This?

The Interactive Effects of Extraversion and Conscientiousness on Performance

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Received 2 May 2001; received in revised form 24 October 2001; accepted 14 January 2002

The abridged big five dimensional circumplex (AB5C; Hofstee, de Raad & Goldberg, 1992; Johnson & Ostendorf, 1993) integrates the Big Five model of phenotypic personality attributes and circumplex models of personality. The present study of one sample of job applicants and three samples of workers in jobs requiring interpersonal interaction considered two dimensions within the AB5C—extraversion and conscientiousness—and examined the relationships of their interaction with job interview performance and supervisor ratings of job performance. Results of moderated multiple regression analyses supported the hypothesis. Additional units of extraversion led to increments in performance among high-conscientious workers but to decrements in performance among low-conscientious workers.
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Studies examining the relationships between personality variables and job performance have traditionally focused on main effects. Most studies examining personality–performance links in the recent decade examined bivariate relationships between a specific personality dimension and job performance (Arthur, Woehr & Graziano, 2001). In studies in which more than one personality variable were considered, the implicit assumption has been that the joint effects of personality variables are independent and complementary (i.e., additive). However, Hogan, Hogan and Roberts (1996, p. 470) argued that "interpreting a single scale in the absence of other information" is an ill-advised "article of faith in traditional personality assessment." They argued that the impact of a personality trait on behavior depends on other traits. Surprisingly, the issue of interactions among personality dimensions in predicting job performance has not received much, if any, attention. Research on interactions has focused on situational moderators of personality–performance relationships, such as autonomy (Barrick & Mount, 1993).

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The abridged big five dimensional circumplex (AB5C; Hofstee, de Raad & Goldberg, 1992; Johnson & Ostendorf, 1993), which integrates the Big Five and circumplex models of personality, provides a theoretical framework for examining multiplicative (i.e., interactive) relationships among personality variables in predicting job performance. If the joint relationship of two personality variables with job performance is interactive, then each additional unit of a personality variable has a different relationship with job performance at varying levels of the other personality variable. Barrick, Mount and Judge (2001) as well as Hurtz and Donovan (2000) cited the AB5C as a useful guide for grouping facets of the Big Five in order to create optimal composites of the Big Five dimensions. Despite the passing of a decade since Hofstee et al. (1992) introduced the AB5C, it has received very little, if any, empirical attention among selection researchers. In the present study, I examined the relationship between the extraversion × conscientiousness interaction and two work-related outcomes—job interview performance and job performance in jobs requiring interpersonal interaction.

Personality and Performance

Barrick et al. (2001) categorized twentieth century research on personality–job performance linkages into two phases. The first phase ended in the mid-1980s and featured primary studies that examined relationships between job performance and individual scales from a wide variety of personality instruments. They concluded that the outcome of those 80+ years of research was that personality and job performance were not meaningfully related across traits or situations. The second phase began in the mid-1980s and featured two key developments. First was the application of a five-factor structure of personality—the "Big Five" (Goldberg, 1992)—to selection research. Second was the use of meta-analysis to summarize the relationships between the five personality factors and job performance across studies.

Five Factor Structure of Personality

Based on a factor analysis approach to personality in which personality items have principal loadings on one or another of the highest-level factors, a consensus among personality psychologists suggests a structural framework consisting of five basic personality factors (Digman & Takemoto-Chock, 1981; Fiske, 1949; Goldberg, 1992; John & Srivastava, 1999; McCrae & Costa, 1999; Norman, 1963; Wiggins & Trapnell, 1997). While some researchers have argued for a model of less than five factors (e.g., Block, 1995; Eysenck, 1992), it is the Big Five model that has been the focus of personality research in the organizational science literature (Barrick et al., 2001). Indeed, the validity of the Big Five has been well demonstrated in predicting job performance (see Mount & Barrick, 1998) and other work outcomes, such as career success (e.g., Judge, Higgins, Thoreson & Barrick, 1999).

Saucier and Goldberg (2001) noted that the factors are typically labeled extraversion (Factor I), agreeableness (Factor II), conscientiousness (Factor III), emotional stability (Factor IV), and intellect (Factor V). Alternative labels for Factor I have included sociability (Hogan & Hogan, 1992), surgency (Goldberg, 1992), and confident self-expression (Fiske, 1949).

Factor II has been also labeled friendly compliance (Digman & Takemoto-Chock, 1981), social adaptability (Fiske, 1949), and likability (Hogan & Hogan, 1992). Will to achieve (Digman & Takemoto-Chock, 1981), conformity (Fiske, 1949), and prudence (Hogan & Hogan, 1992) have been alternative labels of Factor III. Factor IV has also been referred to as neuroticism (inflected; McCrae & Costa, 1985), emotional control (Fiske, 1949), adjustment (Hogan & Hogan, 1992), and ego strength (Digman & Takemoto-Chock, 1981). Alternative labels for Factor V have included openness to experience (McCrae & Costa, 1985), culture (Norman, 1963; Tupes & Christal, 1961), intellectance (Hogan & Hogan, 1992), autonomy (Hendriks, Hofstee & de Raad, 1999), and imagination (Goldberg, 1993; Saucier, 1992).

Barrick et al. (2001) cited 15 meta-analytic studies of personality–performance relationships (11 articles and 4 conference presentations), the sum of which suggests that conscientiousness is the most consistent and universal among the Big Five dimensions in terms of its prediction of work outcomes across jobs. Hurtz and Donovan (2000), however, recently suggested that some previous validity estimates for conscientiousness were overestimates; they reported a true criterion-related validity for conscientiousness of .20. Arthur et al. (2001, p. 10) argued that "global, broad-brush dimensions like those assessed by the five-factor approach contain meaningful subgroups that cross-dimensional boundaries, and these may differ in important ways." They suggested that reliance on the simple factor-structure analyses of personality has led to a loss of precision in measurement and a corresponding error in prediction.

Circumplex Model of Personality

Alternative to the factor analysis approach to personality is the interpersonal cirumplex, which presents traits along angular positions in a two-dimensional factor space. Following Leary's (1957) suggestion that interpersonal behaviors could be represented in terms of a circular pattern around two axes, researchers developed a two-dimensional circumplex in which traits appear on the circle around the bipolar, orthogonal coordinates of extraversion and agreeableness (e.g., Lorr & Youniss, 1974; Wiggins, 1982). More recent variations present traits around three factors—extraversion, agreeableness, and conscientiousness (Peabody & Goldberg, 1989) or extraversion, agreeableness, and emotional stability (Saucier, 1992).

The circumplex model designates no optimal orientation of the principal axes of the circumplex, "because any rotation is as good as another" (Wiggins & Trapnell, 1997: 748). As noted by Hofstee et al. (1992, p. 146), circumplex models provide "much more opportunity for identifying clusters of traits that are semantically cohesive," and therefore they permit fine-grained personality descriptions (Becker, 1999). Scoring of the facets has been used for interpretation by professionals or for feedback to clients. As facet scores add no additional variance over and above what is explained by the major dimensions (see Hofstee, Ten-Berge & Hendriks, 1998), selection researchers have paid little attention to circumplex models.

The Big Five and Circumplex Combined

As noted by Hofstee et al. (1992), the circumplex models are missing at least two of the five general personality factors and thus do not capture all of the trait space. Therefore, they

proposed an integration of the Big Five and circumplex models. Recognizing the limitations of operationalizing a full five-dimensional circumplex, Hofstee et al. (1992) proposed the AB5C, which consists of ten two-dimensional circumplexes that consider all possible pairs of the Big Five dimensions as coordinates. The facets are presented in terms of their two highest factor loadings. In other words, each trait is characterized by its loadings on a subset of two of the five factors at a time. Johnson and Ostendorf (1993) revised the AB5C in order to resolve some disputes as to the location of some specific attributes (e.g., ambition) within the Big Five.

The Present Study

Circumplex research suggests that extraversion may be the only "pure" factor in the Big Five. In other words, with the exception of extraversion, the Big Five scales have been defined in the AB5C by blends rather than factor-pure terms (Hofstee et al., 1992; Johnson & Ostendorf, 1993). Watson and Clark (1997) noted that extraversion has been included as a higher-order factor in every major taxonomy of personality offered during the past 50 years. Given the prominence of extraversion in the personality literature and meta-analyses in the selection literature indicating that conscientiousness is the most robust Big Five predictor of performance (Mount & Barrick, 1998), I examined extraversion and conscientiousness as interactive predictors of performance as an initial attempt at applying the AB5C to personnel selection.

Extraversion

Extraversion reflects an "energetic approach to the social and material world" and is characterized by such traits as assertiveness, activity, positive emotionality, and sociability (John & Srivastava, 1999, p. 121). McCrae and Costa (1999) noted that extroverted individuals typically have numerous friendships, enterprising vocational interests, and social skills. Given these characteristics, it is likely that high extraversion enhances interview performance as well as performance in jobs requiring effective interpersonal interaction; that is, extraversion may be irrelevant only to jobs that require very little interaction and coordination between people. Barrick et al. (2001) reported that the average observed validity coefficients for extraversion were .07 for predicting supervisor ratings and .06 for predicting objective measures of job performance. Concluding that the extraversion–job performance relationship could not be distinguished from zero, they suggested that the large $SD\rho^{sw}$ estimate suggested the presence of moderators.

Conscientiousness

Conscientious individuals maintain socially prescribed impulse control (e.g., thinking before acting, delaying gratification, planning, prioritizing, and following rules and norms) that enhances task performance (John & Srivastava, 1999). McCrae and Costa (1999) suggested that conscientious individuals often have long-term plans, technical expertise, and an organized support network. Meta-analytic studies indicate that conscientiousness is the

most generalizable Big Five predictor of job performance (e.g., Barrick et al., 2001). The meta-analytic studies also indicate the presence of moderators, and at least three primary studies have demonstrated that situational moderators affect the conscientiousness-job performance relationship (Barrick & Mount, 1993; Barrick, Mount & Strauss, 1993; Gellatly, 1996).

Extraversion × Conscientiousness

Adjectives have been used to illustrate the AB5C facets (Hofstee et al., 1992; Johnson & Ostendorf, 1993). Low-conscientious, low-extraversion (i.e., introverts) individuals can be described as aimless, apathetic, frivolous, helpless, inactive, indecisive, inefficient, lazy, noncommittal, nonpersistent, passive, sluggish, unassured, uncooperative, unenergetic, vague, and wishy-washy. In contrast, high-conscientious, high-extraversion (i.e., extroverts) individuals are active, alert, competitive, enterprising, firm, persistent, purposeful, self-confident, and vigorous. High-conscientious introverts have a task orientation; they are described as cautious, conservative, deliberate, formal, prudish, reserved, restrained, serious, and thrifty. Low-conscientious extroverts have a person-centered orientation; they are described as boisterous, demonstrative, devil-may-care, exhibitionistic, gregarious, immodest, impulse-ridden, mischievous, rash, reckless, thoughtless, and unruly. Examining an extraversion × conscientiousness interaction would permit an assessment of how these facets of the AB5C are related to work-related outcomes when using conventionally scored Big Five measures. Accordingly, I examined the relationship of the extraversion × conscientiousness interaction with supervisor ratings of job performance in three samples.

Recent work by Spector and his colleagues (Cook, Vance & Spector, 2000; Fox & Spector, 2000; Spector, Schneider, Vance & Hezlett, 2000) has pointed to the utility of research on job interview performance. Cook et al. (2000) noted that although a considerable literature had examined the validity of the job interview, most of the research focused on interviewer judgment processes. Similarly, Spector et al. (2000) suggested that assessment centers, which typically include a structured interview, have predictive power because they tap attributes important for job performance (Russell & Dorman, 1995). They went on to observe, "we just do not know what those attributes are." Based on Dipboye and Gaugler's (1993) argument that the accuracy of the interviewer's assessment of the applicant's personality contributes to the validity of the interview, Cook et al. (2000) advocated research focused on understanding relationships between interviewee personality and interview performance. They suggested that such research, which has been neglected in the literature, may lead to improvements in interview processes by helping interviewers focus on characteristics that are likely to influence job performance. Early work in this area suggests that both extraversion (Caldwell & Burger, 1998; Cook et al., 2000; Spector et al., 2000) and conscientiousness (Cook et al., 2000; Spector et al., 2000) are related to interview performance. To extend research in this area, I also examined the relationship of the extraversion × conscientiousness interaction with job interview performance (hire vs. not hire) in a fourth sample.

Self-confident, competitive, and persistent high-conscientious extroverts are likely to be effective in jobs requiring interpersonal interaction and successful in job interviews. They are likely to get the details right (high conscientiousness) as well as spend the time

necessary to satisfy and solve the problems of internal and external customers (high ex-
traversion) on the job and respond thoroughly to questions in job interviews. In contrast,
the aimless, uncooperative, and inactive low-conscientious introverts are unlikely to be
effective in such jobs and in interviews. They lack the predisposition to attend to details
and follow-up (low conscientiousness) as well as the orientation to approach others for
purposes of identifying opportunities and ensuring satisfaction (low extraversion). Despite
their attention to detail and thoroughness, the high-conscientious introverts may only be
a little more effective than their low-conscientious introvert cohorts. For example, with-
out the tendency to interact with others (low extraversion), they may fail to discover what
others need from them, and therefore they may work on unwanted priorities and discuss
irrelevant issues in job interviews. They may also fail to create the impression with others
that they are working to satisfy them. However, the immodest, exhibitionistic, and reck-
less low-conscientious extroverts may be ineffective rather than just low in effectiveness.
They are likely to engage in unproductive interactions with co-workers, interviewers, and
customers.

Hypothesis. The relationships of extraversion with both interview and job performance
are dependent upon the level of conscientiousness. Additional units of extraversion lead to
increments in performance among high-conscientious workers but to decrements in perfor-
mance among low-conscientious workers.

Control Variables

Cognitive ability has been shown to be a nontrivial predictor of performance (e.g., Hunter,
1983; Schmidt & Hunter, 1998). Demographic variables have predicted performance (e.g.,
Crant, 1995). To eliminate spurious relations with performance, I included sex, age, orga-
nizational tenure, and cognitive ability, when available, as covariates in the analyses.

Method

Participants and Procedure

Sample 1. As part of a predictive validity study, data were collected on 130 candidates
(49% women) for a sales and customer service position in a private sector financial services
company. Individuals had applied for a job that had not previously existed in the organiza-
tion. Applicants were screened on the basis of minimum requirements criteria (e.g., years
of experience in sales and customer service). Then, only qualified candidates took tests as
part of the application process for purposes of the predictive validity study but were hired
on the basis of their performance in an interview. Because of a subsequent reorganization,
the business line was drastically changed, and job performance data could not be collected.

Sample 2. As part of a predictive validity study, data were collected on 195 customer
service representatives (76% women) working in a call center of a health maintenance
organization. The representatives received calls from customers who called with questions

and problems associated with their health care and insurance coverage. They were expected to handle customer calls not only quickly but also to the satisfaction of the customers. Participants were incumbents who had been on the job at least 6 months at the time the criterion data were collected. Job performance ratings were collected on each of the workers from their respective immediate supervisors.

Sample 3. As part of a larger study conducted for both applied and research purposes (Hochwarter, Witt & Kacmar, 2000), data were collected on 144 clerical employees (80% women) of a distribution services firm. Workers interacted primarily with internal associates. Job performance ratings were collected on each of the workers from their respective immediate supervisors. Both the employees and supervisors were assured that these responses would be treated confidentially.

Sample 4. Data were collected on 122 volunteer nonsales office workers (80% women) across 15 organizations. Job performance ratings were collected on each of the workers from their respective immediate supervisors. Both the employees and supervisors were assured that these responses would be treated confidentially.

Measures

Interview performance in Sample 1. Each candidate was interviewed by a human resources recruiter, the human resources director responsible for the new job function, and two line managers slated to be regionally responsible for the job function. They met to discuss their impressions and together made a "don't hire" (coded as 0; $N = 41$) or "hire" (coded as 1; $N = 89$) decision on each candidate.

Job performance in Samples 2, 3, and 4. In Sample 2, nine items ($\alpha = .93$) assessed job performance (e.g., "[employee name] gives accurate, objective information to customers" and "[employee name] thinks things through carefully before taking action"). These items were based on the results of a job analysis. In Sample 3, five items ($\alpha = .88$) assessed job performance (e.g., "[employee name] works efficiently—does not waste time" and "[employee name] keeps working even when others are standing around talking"). Item development was based on the results of a job analysis. In Sample 4, six generic job performance items ($\alpha = .88$) assessed job performance (e.g., "[employee name] consistently produces a high quality of work" and "[employee name] strives to meet deadlines"). In each sample, supervisors rated their employees on each item using the following scale: (a) "weak or bottom 10%," (b) "fair or next 20%," (c) "good or next 40%," (d) "very good or next 20%," or (e) "best or top 10%." Responses were scored as 1, 2, 3, 4, and 5, respectively.

Personality. In Sample 1, extraversion and conscientiousness were assessed by the sociability and prudence scales of the Hogan Personality Inventory (Hogan & Hogan, 1992), respectively. In Sample 2, the Occupational Personality Questionnaire (OPQ; Saville, Holdsworth, Nyfield, Cramp & Mabey, 1984) assessed personality. Following outcomes of factor analyses of the OPQ (Stanton & Mathews, 1991) and a procedure outlined by

Nyfield, Gibbons, Baron and Robertson (1995), conscientiousness and extraversion scores were computed as a combination of six OPQ scales—detail conscious, conscientiousness, and forward planning for conscientiousness and outgoing, affiliative, and emotional control (reversed scored) for extraversion. The OPQ scores were converted to z-scores and then combined to form conscientiousness and extraversion (Nyfield et al., 1995). In Sample 3, the extraversion ($\alpha = .85$) and conscientiousness ($\alpha = .74$) scales of the Personal Characteristics Inventory (PCI; Mount & Barrick, 1995) assessed extraversion and conscientiousness. In Sample 4, extraversion and conscientiousness were measured by the 10-item versions of the extraversion ($\alpha = .86$) and conscientiousness ($\alpha = .82$) scales, respectively, of Goldberg's (1999, Appendix A) Big Five factor markers in the International Personality Item Pool (IPIP). The construct validity of the HPI, PCI, and the Big Five factor markers of the IPIP has been demonstrated in terms of their relationships with other Big Five measures, such the NEO (Costa & McCrae, 1992). To assess the convergent validity of the OPQ extraversion and conscientiousness scales with a well-known Big Five measure, data collected from 138 private sector customer service and sales agents as part of larger a study were examined. Specifically, correlations between OPQ five factor scale and PCI scale scores were computed. Results indicated that the OPQ conscientiousness scale was most strongly related to the PCI conscientiousness scale ($r = .60$, $<.01$, vs. agreeableness: $r = .32$; emotional stability: $r = .52$, extraversion: $r = .22$, and openness to experience: $r = .33$). Similarly, the OPQ extraversion scale was most strongly related to the PCI extraversion scale ($r = .59$, $<.01$, vs. agreeableness: $r = .22$; emotional stability: $r = .13$, conscientiousness: $r = .14$, and openness to experience: $r = .22$). The lack of orthogonality among the factors (e.g., the relationships of OPQ conscientiousness scale scores with PCI conscientiousness and emotional stability scores) as demonstrated in these correlations is consistent with arguments advocated by circumplex researchers.

Demographics. The organizations provided the sex, age, and organizational tenure of the participants in Samples 2 and 3. The participants in Samples 1 and 4 self-reported age and sex.

Cognitive ability. A job analysis was performed to ascertain the requirements for effective job performance and establish minimum requirements for purposes of advertising the position in Sample 1. Based on results of the job analysis, human resources personnel determined that analytical thinking was critical for job performance. Hence, a cognitive ability test assessing analytical ability—the Watson–Glaser Critical Thinking Appraisal (WGCTA; Watson & Glaser, 1994)—was selected to be part of the predictive validity study. Based on the job analysis results, two ability measures were used in Sample 2. A 36-item, timed 12-min semantic reasoning test assessed the ability to understand written information and reach appropriate, reasoned conclusions (Saville and Holdsworth Ltd. USA Inc, 1996). A 35-item, timed 20-min data reasoning test assessed the ability to use numerical data in order to answer questions (Saville and Holdsworth Ltd. USA Inc, 1996). In Sample 3, the Wonderlic Personnel Test (WPT), Form 5, measured cognitive ability (Wonderlic Personnel Test, 1992). The 50-item, 12-min WPT assesses vocabulary, arithmetic reasoning, and spatial relations. Cognitive ability was not measured in Sample 4.

Analyses

Because the criterion variable in Sample 1 was dichotomous (0 = not hire, 1 = hire), logistic regression analysis (Aldrich & Nelson, 1984) tested the hypothesis. Ordinary least squares (OLS) regression was used to test the hypothesis in Samples 2, 3, and 4. As the main effects of GMA and personality on job performance have been well-documented and therefore not the theoretical focus in the present study, I entered the main effects of extraversion, conscientiousness, and the available control variables at step one of the regression analysis. I entered the extraversion × conscientiousness cross-product term at step two. I converted the extraversion, conscientiousness, and performance criterion scores into z-scores prior to conducting the OLS regression analyses.

Results

The descriptive statistics are presented in Table 1, and the intercorrelation matrices are presented in Table 2. As shown in Table 1, extraversion scores were positively related to interview performance in Sample 1 ($r = .41$, $p < .01$) but unrelated to job performance in Samples 2, 3, and 4. The correlations between conscientiousness and performance ranged from .10 to .34.

Results of the regression analyses of extraversion, conscientiousness, and their cross-product on performance are presented in Table 3. Outcomes of the logistic regression analysis revealed that the addition of the cross-product term into the model improved the fit, as it decreased the -2 Log Likelihood from 131.10 (Goodness of Fit = 127.74, $\chi^2 = 30.97$, $p < .01$) to 126.86 (Goodness of Fit = 131.82, $\chi^2 = 4.25$, $p < .05$) and increased the Nagelkerke R^2 estimate from .28 to .33 ($\Delta R^2 = .05$, $p < .05$). Overall, the final model correctly predicted 78% (vs. the 77% prediction of the original model) of the cases, more successfully predicting the candidates not hired (91% correct) than those who were hired (51% correct). As also shown in Table 3, the addition of the extraversion × conscientiousness cross-product term at step two was significant in the prediction of job performance in Samples 2 ($\Delta R^2 = .02$, $p < .05$), 3 ($\Delta R^2 = .02$, $p < .05$), and 4 ($\Delta R^2 = .04$, $p < .01$).

Table 1
Descriptive statistics

Variable	Sample 1		Sample 2		Sample 3		Sample 4	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
1. Performance	1.68	.47	3.36	.76	3.29	.98	3.33	.62
2. Extraversion	17.70	3.84	.00	1.00	2.20	.36	3.39	.79
3. Conscientiousness	22.08	3.88	.00	1.00	2.68	.20	3.96	.65
4. Sex	1.48	.50	1.76	.43	1.79	.40	1.57	.49
5. Age	34.26	10.66	29.37	9.44	31.97	10.25	33.86	11.06
6. Tenure	–	–	1.70	.58	4.35	4.89	–	–
7. Cognitive ability	26.84	5.39	–	–	17.75	6.77	–	–
8. Data reasoning	–	–	12.05	4.82	–	–	–	–
9. Semantic reasoning	–	–	20.50	4.63	–	–	–	–

Table 2
Intercorrelation matrices

Variable	Samples 1 and 2								Samples 3 and 4					
	1	2	3	4	5	6	7	8	1	2	3	4	5	6
1. Performance	–	.04	.11*	.02	.02	.29**	.25**	.22**	–	−.12†	.20**	−.03	.04	–
2. Extraversion	.41**	–	.41**	−.08	−.21**	−.05	.15*	.06	−.10	–	−.08	−.19**	.08	–
3. Conscientiousness	.10	−.25*	–	−.04	−.04	−.03	.13*	.05	.34**	−.10	–	.08	.31**	–
4. Sex	−.04	−.00	−.00	–	.14*	.07	−.31**	−.15*	.04**	−.10	.15*	–	−.08	–
5. Age	−.01	−.21*	−.03	−.09	–	.26**	−.10†	−.01	.34**	−.28**	.34**	.17*	–	–
6. Tenure	–	–	–	–	–	–	.03	.04	.30**	−.17*	.21**	.08	.58**	–
7. Data reasoning	–	–	–	–	–	–	–	.50**	–	–	–	–	–	–
8. Semantic reasoning	–	–	–	–	–	–	–	–	–	–	–	–	–	–
9. Cognitive ability	.00	.05	−.06	−.16	.03	–	–	–	.09	.01	.16*	−.18*	.00	.01

Correlations on the left below the diagonal are from Sample 1, and correlations above the diagonal are from Sample 2. Correlations on the right below the diagonal are from Sample 3, and correlations above the diagonal are from Sample 4. Tenure was not collected from Samples 1 and 4. Cognitive ability was not measured in Sample 4.

† $p < .10$.

* $p < .05$.

** $p < .01$.

Table 3
Regression results

Predictors	β			
	Sample 1	Sample 2	Sample 3	Sample 4
Step 1				
Sex	.13	.24	−.03	−.09
Tenure	NA	.53**	.03[†]	NA
Age	−.32	−.01	.02[†]	.00
Cognitive ability	−.02	NA	.01	NA
Data reasoning	NA	.04*	NA	NA
Semantic reasoning	NA	.03	NA	NA
Extraversion	−.30	−.01	−.02	−.10
Conscientiousness	−.32	.14[†]	.19**	−.17[†]
R^2	.28**,[a]	.17**	.19**	.05
Adjusted R^2		.14**	.15**	.02
Step 2				
Extraversion × conscientiousness	.03*	.12*	.17*	.20**
R^2	.33**,[a]	.19**	.21**	.09*
Adjusted R^2		.16**	.17**	.06*
ΔR^2	.05*	.02*	.02*	.04**
Sample size	130	195	144	139

The β's presented are those derived at the second step. NA: not available.

[a] The Sample 1 R^2 reflects the Nagelkerke estimate.

[†] $p < .10$.

[*] $p < .05$.

[**] $p < .01$.

To identify the forms of the interactions, I plotted the equations at the mean as well as at low and high levels of the conscientiousness. Alternatively, the form of the interaction might be illustrated by plotting the equations at the mean as well as at low and high levels of the extraversion. Both approaches equally well illustrate the nature of the interaction. As hypothesized, extraversion was positively related to performance among high-conscientious individuals. Figure 1 presents the extraversion × conscientiousness interaction on interview performance in Sample 1. As shown there, high-conscientious extroverts had a higher probability of being selected than low-conscientious extroverts. The extroverts' probability of being hired became 100% at about .75 of a S.D. units of conscientiousness. Similarly, the plots of the OLS regressions revealed that high-conscientious extroverts received higher performance ratings than low-conscientious extroverts. They also indicated that extraversion was negatively related to job performance among low-conscientious individuals. As an example, Figure 2 presents the extraversion × conscientiousness interaction on job performance in Sample 4.

Looking at the interaction from the perspective of the impact of conscientiousness, conscientiousness was more highly related to performance among extroverts than introverts. In other words, high conscientiousness in the absence of extraversion had little impact on performance.
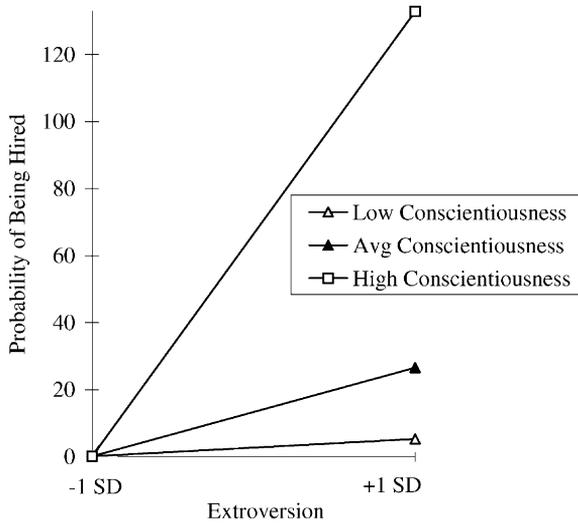
Figure 1. Interview performance (hire decision) regressed on extraversion scores: low, average, and high conscientiousness groups. $Y = (-.30 + .03f)X + (-.32f + 1.82)$. Not hired = 0 ($N = 89$) and hired = 1 ($N = 41$). Low score = 1 S.D. below the mean; high score = 1 S.D. above the mean.
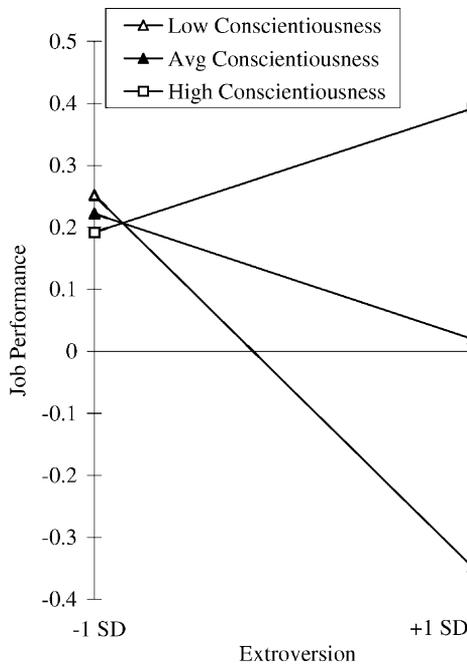

Figure 2. Job performance in Sample 4 regressed on extraversion scores: low, average, and high conscientiousness groups. $Y = (-.10 + .20f)X + (-.17 + .12)$. Low score = 1 S.D. below the mean; high score = 1 S.D. above the mean. Only z-scores $\pm$ one standard from the mean of extraversion scores are plotted.

Discussion

Across four samples, conscientiousness was unrelated to performance among the most introverted workers. Extraversion was positively related to job performance among the highly conscientious workers but negatively related among low-conscientiousness workers. The results are consistent with the hypothesis, as they reflect the relationships between the AB5C facets and performance. The self-confident, competitive, and persistent high-conscientious extroverts in Sample 1 had the highest odds of being selected and in Samples 2, 3, and 4 received the highest supervisor ratings of job performance. Both groups of introverts—the aimless, uncooperative, and inactive low-conscientious introverts as well as the restrained, conservative, and cautious high-conscientious introverts—received lower performance ratings than the high-conscientious extroverts. High extraversion may be necessary for conscientious workers to reach the highest levels of effectiveness. In other words, without extraversion, conscientiousness may add little to performance in jobs requiring interpersonal interaction. However, the immodest, exhibitionistic, and reckless low-conscientious extroverts received the lowest performance ratings. Extraversion without conscientiousness may yield dysfunctional behavior in jobs requiring interpersonal interaction.

Limitations and Strengths

Before discussing potential implications, I emphasize three limitations of the present study. First, a limitation of applying the AB5C is that only two dimensions can be considered simultaneously. With the development of an expanded Big Five-based circumplex, future researchers may be able to consider three, four, or even five dimensions simultaneously. Taking into account even three dimensions simultaneously would be helpful. For example, high-conscientious extroverts who are high in intellect (Factor V) are likely to be more effective in many jobs than those low in intellect. Another limitation is the potential role of personality-based self-selection into specified jobs and the resultant range restriction on the personality dimension of interest (Arthur et al., 2001). Finally, there may have been selection or rating biases that affected the hiring and rating decisions. For example, managers high in both extroversion and conscientiousness may have preferred employees with similar personalities.

Considering the results from the four samples together suggests at least five strengths. First, the measures of job performance were based on job analyses and thus organizationally relevant in Samples 2 and 3. Second, the interaction was found in four different samples. The consistency of the form of the interaction identified by OLS regression found in Samples 2, 3, and 4 provides replication, as advocated by Golding (1975). The form of the interaction identified by the logistic regression was similar to those found in Samples 2, 3, and 4, in that extraversion was positively related to performance only among high-conscientious individuals. The consistency of the form of the interaction is particularly impressive, considering not only the different criterion measures but also the four different personality measures. Third, the cross-product terms contributed unique variance over-and-above the variance contributed not only by the main effects of extraversion and conscientiousness but also by three demographic characteristics—sex, age, and tenure—in three of the samples, by sex and age in the sample in which tenure was not measured, and

by cognitive ability in the three samples in which it was measured. The inclusion of the demographic variables and cognitive ability permitted a stringent test of the hypothesis. Fourth, this may be the first empirical study to apply the AB5C to personnel selection. A PsychInfo search of the 1992–2001 abstracts of the literature for either "abridged big five dimensional circumplex" or "AB5C" yielded only eight studies other than Hofstee et al. (1992) and Johnson and Ostendorf (1993). Each of the eight studies (e.g., de Raad & Hendriks, 1997) focused on issues of trait measurement (e.g., mapping of traits). Examining other personality interactions may provide empirical support for links between the AB5C descriptions of personality and work-related outcomes. Finally, the relationship between the extraversion × conscientiousness interaction and job interview performance further builds upon findings from recent studies conducted using college students (Caldwell & Burger, 1998; Cook et al., 2000; Fox & Spector, 2000) of relationships between personality and interview outcomes. Further work examining personality antecedents of interview performance may lead to improved interview techniques.

Implications for Theory

The results suggest that conscientiousness may partially account for the typically weak relationship between extraversion and performance (e.g., Barrick et al., 2001). Upon looking at Figure 2, it is easy to imagine why the extraversion–job performance relationship could not be distinguished from zero in meta-analytic studies: Extraversion was positively related to job performance among high-conscientiousness workers but negatively related among low-conscientiousness workers. In effect, these groups canceled out each other, yielding the impression that extraversion was unrelated to job performance in Samples 2, 3, and 4. Perhaps one reason that extraversion has not been consistently related to job performance is that extraversion interacts with conscientiousness. This interaction can also be conceptualized in terms of extraversion affecting the conscientiousness–performance relationship. It appears that conscientiousness is more strongly related to performance among extroverts than introverts, which may be one reason that the main effect of conscientiousness has been low (e.g., .20; Hurtz & Donovan, 2000). Future research looking at interactions between other elements of the five factors may have utility, particularly factors whose relationships with performance have strong intuitive appeal but have had disappointing or mixed results to date.

Theory may also be advanced by research aimed at replicating these results and examining the relationship of the extraversion × conscientiousness interaction to performance in others types of jobs and on other types of performance measures, such as sales commission and upward feedback ratings of managerial performance.

Barrick et al.'s (2001) second-order meta-analytic study indicated that the main effects of the Big Five dimensions were relatively low and likely affected by moderator variables. Perhaps a next step in research is to focus on primary studies that define Big Five interactions based on the AB5C descriptions of personality. The validity of any particular dimension of personality may depend on where individuals are within the continua of other personality dimensions. A theory-based interactional approach toward assessing the validity of personality constructs may yield a more accurate framework for predicting performance and other work outcomes.

Implications for Practice

The results reported in the present study suggest that selecting candidates for jobs requiring interpersonal interaction on the basis of their extraversion scores is appropriate when the candidates are also high in conscientiousness. Hiring candidates who are high in extraversion but low in conscientiousness may actually be destroying, rather than adding value. Some researchers have advocated the use of conscientiousness in selection, because of its apparent universal validity (Barrick & Mount, in press; Behling, 1998). Human resources managers may find it useful to assess both conscientiousness and extraversion. If extraversion is not assessed, people high on conscientiousness but low on extraversion may be selected. In addition, subsequent research may suggest opportunities to develop structured interviews based on personality. For example, when the labor market does not offer sufficient numbers of candidates scoring high in both extraversion and conscientiousness on personality tests, applicants with moderate scores on these factors might be sent to follow-up interviews to assess behavioral characteristics associated with these traits.

Additional research may also demonstrate utility in applying the AB5C for selection based on person-culture fit rather than only person-job fit. For example, when business strategies call for high levels of service quality, successful implementation requires strong "customer service climates" (Schneider, White & Paul, 1998) that yield strong customer service cultures. Organizations with such strategies may find it useful to hire individuals high in both extraversion and conscientiousness, as such individuals may be predisposed to proactively and effectively serve others. Similarly, work on the AB5C might point to improved selection protocol for managerial positions. Indeed, extending the AB5C methodology to develop theoretically-based, empirically-supported profiles of both customer service and managerial effectiveness may be research objectives with high potential utility.

Acknowledgments

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