Personality and the Prediction of Team Performance

THOMAS A. O'NEILL* and NATALIE J. ALLEN

Department of Psychology, The University of Western Ontario, London, Ontario, Canada

Abstract: Although much is known about personality and individuals' job performance, only a few studies have considered the effects of team-level personality on team performance. Existing research examining the effects of personality on team performance has found that, of the Big Five factors of personality, Conscientiousness is often the most important predictor. Accordingly, we investigated the criterion validity of lower-level Conscientiousness traits to determine whether any one trait is particularly predictive of team performance. In addition to Conscientiousness, we examined the criterion validity of the other Big Five personality factors. We found that Conscientiousness and its facets predicted team performance. Agreeableness, Extraversion and Neuroticism were not predictive of team performance, whereas Openness had a modest negative relation with team performance. Copyright © 2010 John Wiley & Sons, Ltd.

Key words: team performance; team composition; personality; Big Five; narrow traits; personality facets

INTRODUCTION

The composition of a work team is defined by the individual characteristics of its members. One implicit rationale underlying the research on team composition is that individual characteristics of team members (i.e. their personalities, demographic characteristics, attitudes and so on) serve as inputs that indirectly influence team performance through group processes (e.g. collaboration) and emergent states (e.g. team cohesion). In other words, the characteristics of team members affect the way in which a team operates and its subsequent performance.

Personality, as a class of team composition variables, is the focus of the present study. Over the past several years, research on personality has received considerable attention in the teams literature (e.g. Bell, 2007; Humphrey, Hollenbeck, Meyer, & Ilgen, 2007; Peeters, van Tuijl, Rutte, & Reymen, 2006). Interest in this topic continues for at least two reasons. First, there is an intuitive appeal to the argument that personality will influence team-related variables. Conceptually, personality should be related to (a) team knowledge, skills and abilities, (b) processes and emergent states and (c) general dimensions of teamwork (e.g. collaboration, supportive behaviour, team trust). Most of these variables appear to be natural outgrowths of personality and, therefore, one would expect personality to be a valid predictor in many cases (see Halfhill, Sundstrom, Lahner, Calderone, & Nielsen, 2005; Kichuk & Wiesner, 1998).

A second reason that personality continues to be investigated in team settings is that it is a consistent and important predictor of individuals' job performance (e.g. Barrick & Mount, 1991; Tett, Jackson, Rothstein, & Reddon,

1999). Extending these findings to the team level is needed as organizations are increasingly turning to *teamwork* in an effort to stay competitive in the global marketplace (Allen & West, 2005; Kozlowski & Ilgen, 2006). Thus, research on personality and team performance is an ongoing priority.

In this study, we collected personality data from members of project design teams, operationalized those data at the group level (e.g. using the group mean on each trait), and correlated the resulting team-level personality scores with team performance. Our purpose in this research was threefold. First, we examined the extent to which any content-relevant personality facets of Conscientiousness could demonstrate superior prediction of team performance relative to a broad Conscientiousness composite. An investigation of this type is needed given that Conscientiousness has been shown to be one of the most consistent Big Five predictors of job performance and team performance, but the criterion validity of its facets have rarely been examined at the team level (but see LePine, 2003). Second, we investigated whether any personality factors besides Conscientiousness could be valid predictors of team performance in the present context. Specifically, we assessed the criterion validity of the other Big Five factors: Agreeableness, Extraversion, Neuroticism and Openness. Third, when considered as a *team-level* construct, personality has historically been operationalized in several ways. In this study we provide new evidence regarding the criterion validity of the four most common team-level personality operationalizations.

TEAM-LEVEL PERSONALITY

Typically, the operationalization of personality variables at the team level is accomplished by aggregating individual-level personality scores using one of four group-level

*Correspondence to: Thomas A. O'Neill, Department of Psychology, Social Science Centre, The University of Western Ontario, London, Ontario N6A 5C2, Canada. E-mail: toneill7@uwo.ca

indices: Mean, variance, minimum and maximum scores (see Barrick, Stewart, Neubert, & Mount, 1998; Halfhill et al., 2005; Williams & Allen, 2008). The particular operationalization is usually chosen through a consideration of the personality variable, the nature of the task, and how the two are expected to interact (e.g. Allen & West, 2005; Hecht & Allen, 1999; LePine, Hollenbeck, Ilgen, & Hedlund, 1997).

The mean approach involves computing the arithmetic average of each team member's score on the personality variable. This approach is appropriate when the trait is theorized to work additively—that is, when it is suspected that the more (or less) team members possess the trait, the better the team will perform. The variance approach indexes the dispersion, or heterogeneity, of the trait across team members. This operationalization is used when the researcher believes a greater (or lesser) amount of variation in the trait will be related to the criterion. Finally, sometimes it is appropriate to consider only the team member with the highest, or lowest, score on a trait (referred to as the maximum or minimum approach, respectively), and refer to that value as the team-level score. As an analogy, on an assembly line, the number of units produced will often depend on the slowest working team member, and, accordingly, the minimum score on a trait such as Achievement could be most predictive of team performance. Conversely, on a creativity task, the team member with the highest score on a trait such as Innovation could be most responsible for the level of team performance achieved (because a novel idea has only to come from one team member). Theorizing about the most appropriate operationalization for team personality is critical as these may substantially affect the magnitude of personality's criterion validity (Moynihan & Peterson, 2004; Williams & Allen, 2008).

In the most recent and comprehensive meta-analysis examining relations between team-level personality and performance, Bell (2007) found that, overall, team-level personality does predict team performance. The findings for lab studies were generally weak, likely because team performance measurement in those studies tended to be too coarse to detect small variations in behaviour related to expressions of personality. Field studies in Bell's meta-analysis, however, demonstrated the strongest and most consistent findings for Conscientiousness. Teams with high means, high team member maximum and minimum scores and low variance had the greatest performance levels (Emotional Stability was coded in the socially desirable direction). Other Big Five factors were predictive of team performance, but not with the same magnitude and consistency across operationalizations.

Given that Conscientiousness was the most consistently predictive trait of team performance in Bell's (2007) meta-analysis, it is reasonable to consider that facets of Conscientiousness might even be more predictive (see Dudley, Orvis, Lebiecki, & Cortina, 2006). For example, the factor of Conscientiousness encompasses several more specific facets of personality, such as Industriousness, Order, Self-Control, Responsibility, Traditionalism and Virtue (see Roberts, Chernyshenko, Stark, & Gold-

berg, 2005). Arguably, some of these lower-level personality variables belonging to the same higher-level personality factor may correlate differently, in magnitude or direction, from the others in the prediction of a criterion (see Ashton, 1998; Ashton, Jackson, Paunonen, Helmes, & Rothstein, 1995; Hough, 1992; LePine, 2003; Paunonen, 1998, 2003). Reflecting on Bell's meta-analytic findings, as well as the literature demonstrating the validity of narrow traits, we suggest that, in order to maximize the predictive power of Conscientiousness as it relates to team performance, criterion-relevant facets ought to be considered.

The fact that personality variables other than Conscientiousness (e.g. Agreeableness) were predictive of team performance in Bell's meta-analysis suggests that they, too, may be relevant in the present study. As we will argue later, our criterion, project team performance, could be associated with certain team-level operationalizations of Agreeableness, Extraversion, Neuroticism and Openness. Finally, the method of operationalizing team personality (e.g. mean, minimum) that will be most predictive of team performance must also be considered in maximizing criterion validity. In the section that follows we develop our predictions regarding the operationalization that is, in the context of our study, most theoretically appropriate for each personality factor and facet included in this study.

THE PRESENT STUDY

Our sample consisted of concept design teams, composed of engineering students, who worked interdependently for 6.5 months. The teams were engaged in an intensive, complex engineering design task. The team members had shared outcomes of significant value, and coordinated most work dynamically and reciprocally (rather than through pooled or sequential processes). These were classic 'project teams' as they were created for a specific purpose and time frame, after which they would disband (see Chiocchio & Essiembre, 2009). Knowledge of these contextual details was important in generating predictions, outlined below.

The Big Five

In the present research we assessed the Big Five factors of personality. In order to optimize their prediction of team performance, we judged it most appropriate to operationalize the Big Five factors, at the team-level, as follows: Conscientiousness (mean), Agreeableness (mean), Neuroticism (mean), Extraversion (variance) and Openness (maximum). Important theoretical rationales underlie the choice of team personality operationalizations. Beginning with Conscientiousness, we contend that this factor captures a class of attributes that manifest themselves as valuable resources, such as achievement-striving, organization, planning and task focus. The team may draw upon resources of this type to accomplish its work (see LePine et al., 1997; Stewart, 2003). An additive team-level conceptualization, using the mean approach, is most appropriate in the present research because

the more team members are conscientious, the better the team should perform (see also Barrick et al., 1998). Similarly, Agreeableness represents a factor of personality that can be expected to foster effective team interactions because members are trusting, altruistic and cooperative. Such teams could perform well because of their smooth conflict resolution, and inclination towards open communication and information seeking (Peeters et al., 2006). We also see Agreeableness as accumulating additively, as the more members are characterized as agreeable, the more they should have positive interactions, and in turn, create a higher performing team. Regarding the personality factor Neuroticism, most previous studies have found important relations with team performance for the mean only (see Bell, 2007). As Neuman, Wagner and Christiansen (1999) pointed out, teams that are higher on Neuroticism will have difficulty coordinating one another's tasks and may experience disruption from temperamental and/or impulsive team members (see also Driskell, Hogan, & Salas, 1987). Thus, we predicted that the mean operationalization of Neuroticism would be most predictive of team performance relative to other operationalizations.

Turning to Extraversion, we expected that the variance operationalization would be the strongest predictor of team performance for that trait. A team comprising all extraverts could be expected to have high conflict as its members will all be assertive and leadership oriented, and therefore, power struggles are likely to emerge (see Barry & Stewart, 1997). Conversely, a team composed of all introverts would likely not perform well because members may not converse enough to generate a compelling design idea and stay coordinated during project work. A mix of introverts and extraverts (i.e. heterogeneity) may characterize effective teams because there will likely be fewer leadership battles, but enough communication to keep the team coordinated and on track towards effective task completion (see Mohammad & Angell, 2003). Thus, we operationalized Extraversion using the variance approach.

Finally, Openness was operationalized as the maximum score. Given that the engineering projects in the present study required that teams generate novel solutions to design problems of their choosing, generating a creative solution or approach to the project was critical. However, only one team member is likely needed to generate an idea that other group members can subsequently develop (see Valente, 1995). Original and innovative ideas might be expected to come

from the member highest on Openness, which calls for the maximum operationalization.

Conscientiousness facets

Recall that one purpose of this research was to investigate whether any lower level personality facets, within the Conscientiousness domain, would be especially predictive of team performance. Regarding the selection of these narrow, facet-level traits, we chose a subset that we expected, on an *a priori* basis, to predict team performance on the project teams' tasks. To select the traits, we considered three sources of content-relevant information that have been shown to lead to effective *a priori* selection of criterion-relevant personality traits (for a review, see O'Neill, Goffin, & Tett, 2009). We began with a large pool comprising 35 narrow personality traits found in two highly regarded and established personality instruments: the *Personality Research Form* (PRF; Jackson, 1989) and the *Jackson Personality Inventory-Revised* (JPI-R; Jackson, 1994). A sample of subject matter experts, comprising eight industrial-organizational psychology faculty and graduate students, rated the extent to which each trait would be most likely to predict team performance (i.e. trait relevance for predicting team performance; see also Goffin et al., 2009; Paunonen & Ashton, 2001). These traits were a mix of Conscientiousness-related and unrelated traits, but only those with content overlapping with Conscientiousness were considered in this research for reasons explained earlier. Second, we examined the literature, including literature reviews, theoretical articles, and empirical studies (e.g. English, Griffith, & Steelman, 2004). Third, the characteristics of the project teams' tasks, and surrounding context, were taken into account, and traits were aligned to this context by theorizing about *how* they might relate to team performance. Overall, this approach was consistent with commonly used methods of identifying potentially job-related personality traits (see Goffin et al., 2009; Raymark, Schmit, & Guion, 1997; Tett & Guterman, 2000).

The result of the process outlined above was the selection of four facets of Conscientiousness, to each of which we assigned a specific trait operationalization for comparison with the Big Five at the team level: Organization (maximum), Cognitive Structure (maximum), Achievement (mean) and Endurance (mean; see Table 1 for trait definitions). These traits were identified by Ashton, Jackson,

Table 1. Narrow trait definitions

Personality variable	Description
Organization	Concerned with keeping personal effects and surroundings neat and organized; dislikes clutter, confusion, lack of organization; interested in developing methods for keeping materials methodically organized.
Cognitive structure	Does not like ambiguity or uncertainty in information; wants all questions answered completely; desires to make decisions based upon definite knowledge, rather than upon guesses or probabilities.
Achievement	Aspires to accomplish difficult tasks; maintains high standards and is willing to work towards distant goals; responds positively to competition; willing to put forth effort to attain excellence.
Endurance	Willing to work long hours; doesn't give up quickly on a problem; persevering, even in face of great difficulty; patient and unrelenting in work habits.

Note: Definitions modified from Jackson (1989, 1994).

Helmes, and Paunonen (1998) as scales that chiefly define the Conscientiousness factor. Important theoretical rationales for each trait and team-level operationalization accompanied these decisions, which are described next.

Organization was expected to be important for team performance as individuals high on this trait should use their time wisely and avoid procrastination. However, we predicted that only one team member needed to be high on Organization in order to manage the team and keep the work structured and on schedule; thus, we operationalized Organization using the maximum score within the team. We also predicted that Cognitive Structure would be important because individuals high on this trait want to carefully plan out and research all aspects of a task before getting started. Again, we expected that only one team member needed to engage in this systematic planning and forethought to ensure that the team effectively structured its work and adapted it as needed over time. Accordingly, we selected the maximum operationalization for Cognitive Structure.

Those who are high on Achievement tend to set difficult goals by choosing challenging tasks that they find engaging (Gellatly, 1996). We surmised that these attributes are valuable qualities for any team members to possess, and that the more team members are Achievement-oriented, the more likely the team is to perform at a superior level. This additive rationale supports the mean operationalization. We also predicted that Endurance would be a valuable trait for all team members to have. The more Endurance team members have, the higher their team's performance because members will be more likely to devote long hours at various milestones of the project lifecycle (e.g. prototype design, prototype construction). Thus, the mean approach was used for operationalizing Endurance.

METHOD

Participants, procedure, and description of teamwork context

Team personality and performance data were collected from 129 student engineering design teams comprised of three, four or five team members each. The mean age of the 564 respondents was 18.6 ($SD = 2.2$), and 81% were male. Data were collected at two points: First, on the day that the project teams were assembled, personality and demographic data were collected; second, approximately 6.5 months later, when the teams completed their work, team performance data were collected.

Teams participating in this study carried out a complex design project. Specifically, the project required teams to develop a functional prototype that either (a) demonstrated and explained a physical law in an innovative way that would have pedagogical value in a secondary school setting, *or* (b) represented an innovative concept that could help protect the environment. In addition to building a physical prototype demonstrating their design concepts, the project required teams to produce a detailed report of their work and to deliver a public 'science fair' presentation of the prototype.

Outcome interdependence was high given that instructor ratings of team performance constituted 20% of students' final course grades.

It should be noted that team members spent a great deal of time interacting with one another over the course of the 6.5 months. In addition to completing the large design project, teams worked on small course-related projects and tasks almost every week for the duration of the 6.5 months. They met for at least 2 hours per week in mandatory laboratory sessions where they completed required tasks and assignments together. Most of these teams also met extensively outside of class time, especially during the 3 months prior to completing the large design project that was our focal interest in the present research.

Measures

Personality: Narrow traits

The following narrow trait scales from the PRF (Jackson, 1989) and JPI-R (Jackson, 1994) were administered: Achievement (PRF), Endurance (PRF), Organization (JPI-R) and Cognitive structure (PRF). Original scales included 20 items (JPI-R) or 16 items (PRF), but, because of time constraints, we could administer scales that were only eight items long. To select items, we retained an equal number of positively- and negatively-keyed items. We also retained items that were context-relevant, such as those that refer to work styles and behaviour at work. Ratings were provided on a typical five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Personality: Broad traits

Participants completed a version of Goldberg's (1999) International Personality Item Pool (IPIP) measure of the Big Five personality factors, as described in Johnson (2001; see also Hastings and O'Neill, 2009). The measure includes 24 items for each of the Big Five and uses the usual five-point Likert scale ranging from 1 (very inaccurate) to 5 (very accurate). The content measured is intended to reflect the same content as is found in the NEO-PI-R (Costa & McCrae, 1992), and, supportively, high convergent correlations have been reported (see Goldberg, 1999; Johnson, 2001).

Team performance

Team performance consisted of a composite of ratings on several key dimensions associated with the design project. These included Problem Definition, Design Methodology, Engineering Validation (i.e. appropriate application of engineering design principles), Design Documentation, and Technical Writing. Team performance ratings were provided by experienced course administrators. Because administrators did not rate the same teams, interrater reliability could not be assessed. Thus, we adopted procedures typically used in similar situations (e.g. Wageman & Gordon, 2005). Specifically, to control for the possibility that raters used different performance distributions (i.e. mean and variance of distributions), we standardized the composite performance scores within rater.

RESULTS

Cronbach's αs were calculated on the full sample of individual participants. Reliabilities for the narrow traits ranged from .65 to .74, whereas for the Big Five they fell between .81 and .88. Intercorrelations of team-level personality operationalizations are displayed in Table 2. That table shows that, whereas within-trait operationalizations tend to be correlated and are somewhat interdependent, these correlations are not sufficiently large to suggest completely overlapping constructs (see also Barrick et al., 1998). Table 3 presents the mean and variance for each team-level personality operationalization, as well as the zero-order correlations among team-level personality and team performance. Table 3 also identifies the trait operationalizations that were expected to show the strongest team personality-performance relations for each trait (see underlined values) and the strongest observed correlations (see boldfaced values).

Criterion validity of conscientiousness and selected conscientiousness facets

The criterion validity of the Conscientiousness scale was generally supported across operationalizations (see Table 3). The mean was the strongest predictor of team performance, $r = .27$, followed by the maximum, $r = .21$, and the minimum, $r = .19$. In contrast to findings in Bell's (2007) meta-analysis, the variance was not predictive of team performance in this study.

Table 2. Team-level personality correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13
Organization													
1. Mean													
2. Variance	−.06												
3. Minimum	.76	−.57											
4. Maximum	.71	.56	.30										
Cognitive Structure													
5. Mean	.44	−.03	.27	.27									
6. Variance	−.11	.19	−.20	.04	−.08								
7. Minimum	.34	−.14	.32	.14	.67	−.73							
8. Maximum	.25	.11	.07	.26	.68	.56	.11						
Achievement													
9. Mean	.44	−.12	.35	.24	.30	.05	.14	.24					
10. Variance	−.14	.26	−.28	.06	.03	.12	−.05	.18	−.13				
11. Minimum	.43	−.21	.44	.18	.24	−.02	.16	.12	.80	−.61			
12. Maximum	.27	.10	.08	.28	.26	.12	.07	.33	.72	.51	.34		
Endurance													
13. Mean	.33	.10	.06	.27	.32	.11	.12	.31	.42	.11	.27	.40	
14. Variance	−.15	.24	−.27	.04	−.01	.08	−.07	.08	.01	.47	−.25	.29	.08
15. Minimum	.36	−.07	.32	.20	.27	.03	.17	.19	.37	−.27	.46	.14	.69
16. Maximum	.13	.25	−.08	.24	.21	.11	.05	.27	.31	.39	.04	.51	.75
IPIP Conscientiousness													
17. Mean	.66	.00	.47	.49	.50	−.03	.31	.34	.49	−.10	.47	.37	.43
18. Variance	.00	.25	−.13	.17	−.06	.20	−.13	.13	−.04	.21	−.15	.08	.01
19. Minimum	.48	−.14	.44	.28	.35	−.16	.31	.12	.40	−.26	.50	.22	.29
20. Maximum	.50	.18	.26	.53	.32	.06	.16	.33	.36	.04	.30	.39	.36
IPIP Extraversion													
21. Mean	−.05	.08	−.07	.03	−.22	.06	−.21	−.12	−.14	.07	−.18	−.07	.23
22. Variance	.00	.13	−.12	.06	.06	−.05	.07	.01	.01	.08	.02	.12	−.04
23. Minimum	−.04	−.04	.04	−.04	−.18	.08	−.19	−.10	−.12	−.03	−.11	−.16	.15
24. Maximum	−.11	.15	−.20	.02	−.14	.03	−.15	−.08	−.15	.14	−.18	.02	.11
IPIP Agreeableness													
25. Mean	.16	−.05	.15	.09	.11	−.09	.12	.05	.25	−.17	.27	.09	.18
26. Variance	.06	.00	.05	.05	.01	−.01	.03	.04	−.01	.19	−.09	.12	.03
27. Minimum	.08	−.05	.09	.02	.06	−.09	.09	−.03	.17	−.24	.23	−.04	.08
28. Maximum	.14	−.07	.13	.07	.08	−.11	.12	.06	.19	.03	.12	.17	.14
IPIP Neuroticism													
29. Mean	−.05	−.07	−.02	−.14	.07	−.09	.15	−.03	.05	−.07	.06	−.06	−.22
30. Variance	−.10	.05	−.16	−.08	−.07	.07	−.14	−.08	−.02	.15	−.11	.05	−.07
31. Minimum	.06	−.12	.15	−.07	.11	−.07	.19	.03	.04	−.20	.15	−.14	−.14
32. Maximum	−.08	.01	−.13	−.11	.01	.02	−.02	−.05	.01	.07	−.07	.00	−.16
IPIP Openness													
33. Mean	−.11	−.07	−.04	−.14	−.09	−.03	−.04	−.08	.02	.02	.03	.06	.14
34. Variance	−.09	.21	−.20	.06	−.01	.10	−.06	.13	−.03	.17	−.08	.13	.07
35. Minimum	−.01	−.21	.14	−.16	−.05	−.07	.00	−.16	.03	−.11	.09	−.05	.05
36. Maximum	−.14	.08	−.17	−.06	−.08	.02	−.08	.00	−.02	.13	−.06	.13	.10

Table 2.   (Continued)

	14	15	16	17	18	19	20	21	22
Organization									
1. Mean									
2. Variance									
3. Minimum									
4. Maximum									
Cognitive Structure									
5. Mean									
6. Variance									
7. Minimum									
8. Maximum									
Achievement									
9. Mean									
10. Variance									
11. Minimum									
12. Maximum									
Endurance									
13. Mean									
14. Variance									
15. Minimum	−.59								
16. Maximum	.67	.16							
IPIP Conscientiousness									
17. Mean	−.05	.38	.28						
18. Variance	.24	−.15	.15	−.05					
19. Minimum	−.24	.43	.09	.73	−.61				
20. Maximum	.07	.25	.33	.74	.52	.31			
IPIP Extraversion									
21. Mean	.01	.10	.13	−.06	.14	−.16	.03		
22. Variance	.08	−.04	.07	.05	.00	.07	.05	−.02	
23. Minimum	−.04	.09	.02	−.05	.10	−.13	−.01	.67	−.68
24. Maximum	.11	−.03	.15	−.03	.10	−.11	.04	.71	.57
IPIP Agreeableness									
25. Mean	−.09	.20	.05	.35	−.03	.27	.28	.19	.04
26. Variance	.20	−.13	.13	.05	.19	−.10	.14	.00	−.05
27. Minimum	−.17	.19	−.06	.20	−.10	.21	.10	.13	.05
28. Maximum	.14	−.01	.16	.30	.13	.10	.32	.17	.01
IPIP Neuroticism									
29. Mean	−.06	−.10	−.18	−.25	−.02	−.17	−.24	−.50	.08
30. Variance	.19	−.16	.07	−.20	.13	−.26	−.11	−.12	.15
31. Minimum	−.21	.06	−.24	−.09	−.07	.00	−.16	−.31	−.09
32. Maximum	.09	−.17	−.04	−.28	.12	−.32	−.19	−.36	.10
IPIP Openness									
33. Mean	−.02	.09	.05	.04	−.10	.04	−.07	.29	.17
34. Variance	.12	−.01	.11	−.14	.10	−.14	.00	.12	−.03
35. Minimum	−.12	.11	−.05	.14	−.18	.14	−.09	.10	.18
36. Maximum	.07	.02	.10	−.07	−.07	−.07	−.10	.25	.11

Turning to the narrow traits of Conscientiousness that were identified *a priori*, all four were significantly related to team performance using the predicted operationalization: maximum Organization, $r = .30$, maximum Cognitive Structure, $r = .20$, mean Achievement, $r = .27$ and mean Endurance, $r = .19$. Further inspection of Table 3 reveals that the mean on facets of Conscientiousness were significantly and positively related to team performance for each facet, thereby supporting an additive trend for all Conscientiousness-related traits. In addition, the maximum was significantly related to team performance for all facets of Conscientiousness other than for Achievement, although minimum scores on Achievement were significantly related to team performance.

In order to investigate the criterion validity of Conscientiousness versus its facets, we created a unit-weighted composite of Conscientiousness by summing our Conscientiousness facet scores within each operationalization (e.g. mean). This allowed us to make a direct comparison of predictive validities between broad and narrow Conscientiousness variables. Comparing criterion validities across scales (i.e. the JPI/PRF facets versus the IPIP Conscientiousness scale) could be confounded due to varying content domains of the measures.

Some observations regarding the validities of the Conscientiousness composite versus its facets are warranted (see Table 3). First, there is some evidence that the broad Conscientiousness composite is a stronger predictor of team performance than are any of its narrow trait constituents. The mean operationalization of the Conscientiousness composite was its most predictive operationalization, $r = .31$, which exceeded the prediction of all facet-level mean operation-

Table 2.   (Continued)

	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Organization														
1. Mean														
2. Variance														
3. Minimum														
4. Maximum														
Cognitive Structure														
5. Mean														
6. Variance														
7. Minimum														
8. Maximum														
Achievement														
9. Mean														
10. Variance														
11. Minimum														
12. Maximum														
Endurance														
13. Mean														
14. Variance														
15. Minimum														
16. Maximum														
IPIP Conscientiousness														
17. Mean														
18. Variance														
19. Minimum														
20. Maximum														
IPIP Extraversion														
21. Mean														
22. Variance														
23. Minimum														
24. Maximum	.16													
IPIP Agreeableness														
25. Mean	.03	.08												
26. Variance	.07	.06	−.22											
27. Minimum	−.01	.01	.77	−.74										
28. Maximum	.06	.13	.69	.46	.23									
IPIP Neuroticism														
29. Mean	−.36	−.32	−.31	.03	−.20	−.26								
30. Variance	−.23	−.01	−.15	.26	−.26	.04	.21							
31. Minimum	−.08	−.30	−.19	−.12	−.03	−.28	.70	−.45						
32. Maximum	−.33	−.20	−.30	.22	−.33	−.12	.73	.77	.18					
IPIP Openness														
33. Mean	.03	.29	.25	.00	.14	.21	−.19	.09	−.26	−.09				
34. Variance	.09	.10	−.01	.13	−.06	.11	−.09	.09	−.21	−.02	.13			
35. Minimum	−.06	.14	.18	−.10	.17	.06	−.03	.01	.01	−.03	.68	−.57		
36. Maximum	.05	.27	.14	.08	.04	.21	−.13	.15	−.31	−.02	.71	.74	.10	

Note: $n = 129$. Correlations above .17 and .22 are significant at $p < .05$ and $p < .01$, respectively.

alizations (correlations ranged from .19 to .30). Thus, for the mean operationalization, these results suggest that suboptimal prediction may be obtained when considering only the best-predicting facet of Conscientiousness.

Second, there were some indications that the narrow Conscientiousness facets provided theoretically interesting information. For example, the maximum Conscientiousness composite significantly predicted team performance, but maximum Organization was a slightly better predictor, whereas the validity for maximum Achievement was small and non-significant. We tested the difference in the magnitudes of the criterion correlations involving maximum Achievement and maximum Organization using Meng, Rosenthal, and Rubin's (1992) Z-test, but the difference was not significant, $Z = 1.45$, $p > .05$. Thus, the observed variability in the magnitude of these correlations could be due to chance. Another case where lower-level facets appeared to be potentially informative was for minimum operationalizations of Conscientiousness-related traits. Specifically, whereas the minimum operationalization of the Conscientiousness composite was non-significant, the minimum score on the facet of Achievement was significantly related to team performance, $r = .23$. Once again, however, the difference in the magnitudes of these criterion correlations was not significant, $Z = 1.29$, $p > .05$.

Criterion validity of other Big Five factors and *a priori* predictions

Criterion validities for Big Five personality variables other than Conscientiousness were all non-significant except for Openness (see Table 3). Note, however, that the findings for

Table 3.   Means, standard deviations, and correlations between team-level personality variables and team performance

PRF/JPI scales				IPIP Big Five scales			
Variable	Mean	SD	Team performance	Variable	Mean	SD	Team performance
Team Performance	8.33	.86					
Organization				Conscientiousness			
Mean	**3.19**	**.33**	**.26****	**Mean**	**3.62**	**.26**	**.27****
SD	**.54**	**.21**	**.13**	SD	**.44**	**.18**	−.03
Minimum	2.58	.43	.06	Minimum	3.13	.36	.19*
Maximum	3.81	.41	**.30****	Maximum	4.11	.34	.21*
Cognitive Structure				extraversion			
Mean	3.40	.25	.19*	Mean	3.51	.26	.02
SD	.47	.21	.11	_SD_	.49	.20	.04
Minimum	2.83	.42	.01	Minimum	2.95	.38	−.04
Maximum	**3.90**	**.34**	**.20***	**Maximum**	**4.04**	**.33**	**.05**
Achievement				**Agreeableness**			
Mean	3.40	.30	**.27****	Mean	3.56	.26	.01
SD	.48	.20	−.15	_SD_	.44	.18	.01
Minimum	2.89	.43	.23**	Minimum	3.05	.39	−.05
Maximum	3.96	.40	.15	Maximum	4.03	.32	−.00
Endurance				Neuroticism			
Mean	3.53	.27	**.19***	Mean	2.63	.32	−.05
SD	.49	.22	.05	_SD_	.50	.25	.09
Minimum	2.98	.39	.09	Minimum	2.07	.33	−.08
Maximum	**4.07**	**.42**	**.17***	**Maximum**	**3.19**	**.53**	**.10**
Conscientiousness Composite				**Openness**			
Mean	3.42	.25	.31**	Mean	3.21	.23	−.16*
SD	.46	.19	.06	_SD_	.43	.21	−.03
Minimum	**2.90**	**.34**	**.14**	**Minimum**	**2.74**	**.32**	−.18**
Maximum	**3.93**	**.36**	**.29***	**Maximum**	**3.71**	**.37**	−.11

Note: n = 129. Underlined values are the trait operationalizations that were expected, _a priori_, to be the most appropriate approach for aggregating each factor/trait in the prediction of team performance. Bold values are the empirically strongest operationalizations in the prediction of team performance (i.e. they demonstrated the strongest within-factor/trait correlation with team performance).
*p < .05; **p < .01.

Openness were in the direction opposite to prediction. Taken together, these results are surprising given the recent meta-analysis (Bell, 2007) in which it was reported that all Big Five personality factors were positively correlated with the performance of field teams (i.e. with Emotional Stability coded in the socially desirable direction). This may be due partly to the nature of our criterion, which we examine in greater depth later.

In addition to examining the criterion validities of the Big Five and the facets of Conscientiousness, for each team-level personality variable we hypothesized which operationalization would be most strongly predictive of team performance (see underlined coefficients in Table 3). A consideration of context guided these predictions. Our predictions were supported for nearly all factors and facets that were significantly related to team performance: Conscientiousness (mean), Organization (maximum), Cognitive Structure (maximum) and Endurance (mean). That is, for these important traits, our _a priori_ predictions regarding which trait operationalization would be most strongly related to team performance were all supported. This supports previous findings and theory emphasizing the advantages of linking traits to criteria by considering the context and the nature of the variables involved (e.g. Tett & Christiansen, 2007; Tett, Jackson, & Rothstein, 1991). One of our predictions that was not supported was the significant and negative relations

between Openness and team performance. We predicted the maximum operationalization would be positively related to team performance, but this finding was not supported, r = −.11, _ns_. However, other Openness correlations were significant, although in the direction contrary to prediction. Mean and minimum Openness correlated significantly and negatively with team performance, r = −.16 and −.18, respectively.

DISCUSSION

Maximizing the validity of personality in the prediction of workplace criteria is a top research priority (Rothstein & Goffin, 2006). In this study, we investigated the extent to which facets of team-level Conscientiousness could surpass the predictive validity of a composite Conscientiousness variable composed of those facets. We also reported the criterion validity of Big Five traits other than Conscientiousness, and the validity of _a priori_ selected personality trait operationalization at the team level. Perhaps the most important finding of the present study was that the substrate measured by Conscientiousness-related variables was, by and large, the only predictive personality content regardless of whether one considered facets, their composite, or the separate IPIP Conscientiousness scale. Openness was the

exception, although validities were in the unexpected direction. We interpret our findings, in turn, beginning with those related to Conscientiousness, followed by results for the other Big Five traits and, finally, the accuracy of our *a priori* trait operationalizations.

Broad and narrow conceptualizations of conscientiousness

As this and other research demonstrates, there are cases where broad factors can exceed the prediction of the narrow traits they encompass (see also Hastings & O'Neill, 2009). For instance, the means on the IPIP Conscientiousness scale, and on the Conscientiousness composite, were more strongly related to team performance than was any one facet's mean operationalization. That the mean Conscientiousness composite was the strongest operationalization, compared to the narrow traits it comprises, indicates that common variance among the facets was more important than was their unique variance for criterion prediction (see Ashton et al., 1995; Paunonen, 1998).

Notwithstanding the findings described above, we maintain, as do others (e.g. Ashton et al., 1995; Paunonen & Ashton, 2001; Rothstein et al., 2009; Schneider, Hough, & Dunnette, 1996; Tett & Christiansen, 2007), that without explicit empirical examinations of narrow facets of personality, such as the one presented here, one can never truly know whether the predictive variance associated with a personality factor is primarily due to one or two highly criterion-relevant facets, in which case misinterpretation of factor-criterion linkages are likely, or, whether the predictive variance associated with a personality factor is primarily due to equally important criterion-relevant contributions from each facet, in which case appropriate factor-level interpretations are likely. Our view is that until research firmly establishes that only common variance is relevant for the prediction of a certain criterion, one should always theorize in advance regarding the possibility of differential facet-level predictions. Moreover, we see the continued employment of measures that allow for empirical examination, and exploitation, of within-factor variation in criterion validities as an ongoing priority (see Hough & Oswald, 2008; Paunonen, Rothstein, & Jackson, 1999; Tett, Steele, & Beauregard, 2003).

Findings for non-conscientiousness traits

As noted earlier, it was surprising that the other Big Five traits were mostly unrelated to team performance as this runs contrary to findings reported by Bell's (2007) meta-analysis, where all team-level Big Five factors were valid predictors of team performance in field settings. One explanation for these findings is that our criterion emphasized the task performance of the team, as performance was based entirely on project report quality. It is likely that different team-related criteria, such as interpersonal liking and satisfaction with team members, would be predicted by Big Five factors other than Conscientiousness (see Barrick et al., 1998). Moreover, perhaps previous studies using criteria that might have

incorporated the effectiveness of the teams' interactions, such as ratings of team performance given by the team supervisor (e.g. Neuman & Wright, 1999), explain why Bell's meta-analysis found criterion validity support for all Big Five factors of personality, whereas ours did not.

Unexpectedly, minimum and mean operationalizations of team-level Openness were negatively related to team performance. We expected that maximum Openness would relate positively to team performance because of theory on innovation diffusion (see Valente, 1995). More specifically, we surmised that open individuals, who tend to be creative, would present new ideas that other group members could subsequently develop. Accordingly, only one team member high on Openness should be needed, because other group members can further refine that individual's innovative proposals. Observed negative relations involving mean and minimum Openness, however, suggest that the more team members tend to be characterized by Openness (mean), and if even one team member is high on Openness (minimum), team performance may suffer. Perhaps this is because the Openness scale used in this study measures not only traits related to creativity, but also traits related to adventurousness and emotionality. It is possible that the latter traits detracted from the sustained effort and the task-focus needed to see the teams' project through to completion.

On making *a priori* predictions of personality criterion relations

Previous research has found strong support for the *a priori* predictions of those personality traits that are criterion relevant. In their meta-analysis, Tett et al. (1991) found that validities were nearly twice as large when traits were linked to job performance through explicit consideration of the context and variable content (i.e. job analysis). In the present study, the four Conscientiousness facets that were identified as criterion-relevant were in fact empirically related to team performance. An especially novel finding is that, for both the Conscientiousness factor and facets, we were able to identify, *a priori*, the most predictive team-level operationalization of those personality variables. This further supports the superiority of carefully aligning traits with criteria through a consideration of their content and the context in which the study exists (see Bartram, 2005; O'Neill et al., 2009).

The supportive findings for our *a priori* predictions regarding Conscientiousness might be tempered against the unsupported predictions regarding other Big Five factors. We surmised that certain operationalizations of Agreeableness, Extraversion, Neuroticism and Openness would predict team performance, but these associations were not borne out as predicted. As argued above, the non-significant findings may have been a reflection of the task-related nature of our team performance criterion. The findings for Openness were contrary to prediction, but again, it is possible that individuals high on Openness were susceptible to distraction and avoidance of persistent task-related efforts. Future research could examine the accuracy in which *a priori* predictions of team-level personality operationalizations are supported for a wider range of criteria.

Strengths, limitations, and future research

In this study, we examined a large sample of teams doing comparable and consequential work over a substantial period of time. We agree with numerous other researchers (e.g. Behfar, Peterson, Mannix, & Trochim, 2008; Ilies, Wagner, & Morgeson, 2007; Tasa, Taggar, & Seijts, 2007) who view student-based project teams of this sort as a valuable way to conduct, and advance, research on teamwork. Our teams were embedded in a larger educational and professional context (engineering) that has a unique culture and set of expectations around teamwork. Moreover, the competitive nature of the context was one that strongly encouraged team members to treat the projects seriously and to interact frequently, and intensely, in order to complete their work. Finally, team performance was consequential as the administrator rating on each project represented a considerable proportion of overall course grades. Taken together, the teams comprised by our sample met the criteria of many teamwork definitions; team members had shared, consequential outcomes and goals, and had to work interdependently over a lengthy period of time to reach those goals (see Sundstrom, De Meuse, & Futrell, 1990).

One potential limitation of the present research was the use of only four narrow traits. Researchers comparing broad factors with narrow traits sometimes use a large number of narrow traits from which the best predictors of the criterion are selected *post-hoc* through statistical procedures (e.g. stepwise regression, canonical or set correlation; Paunonen, 1998; Tett et al., 2003). These predictors are then pitted against the Big Five. If a similar approach was used here, we would have measured many narrow traits and selected only the predictive ones for comparison to the Big Five. Our reason for avoiding this approach was that narrow traits selected *post-hoc* could capitalize on chance (see Paunonen & Ashton, 2001); therefore, we see *a priori* tests of narrow trait validities as most compelling. Nevertheless, it could be beneficial to examine a larger number of narrow traits to assess their predictive validity as well.

Another potential limitation is that the Conscientiousness facets had much lower scale reliabilities, ranging from .65 to .74, than did the IPIP Conscientiousness scale ($\alpha = .88$). Note, however, that the facet scales were one third the length of the IPIP Conscientiousness scale (8 versus 24 items). Using longer scales might have resulted in greater validities for the narrow traits through more reliable measurement (see Paunonen et al., 1999), although in practice this would require the administration of more items per facet and would reduce the number of personality variables one could feasibly measure. That being the case, the fact that the Big Five were measured with substantially greater reliability implies that they may have had an ' 'unfair advantage' in terms of predictive validity. One way to equate the broad and narrow traits, in terms of reliability, would have been to correct each personality-performance correlation for measurement error (e.g. Hastings & O'Neill, 2009). Such corrections require team-level reliabilities of personality scores; unfortunately, however, these could not be estimated in the present study because there exists only one measurement value per team-level trait operationalization (e.g. mean, minimum). How exactly the reliability of measurement at the individual level (e.g. α) might play out in the aggregate team-level operationalizations (e.g. the mean approach) is not entirely clear, and future research is needed in that area especially for meta-analytic purposes (but see Bliese, 1998). Nevertheless, the α reliability of lower-level traits observed in this study likely reduced their predictive validity relative to the Big Five.

Final remarks

Steiner's (1972) observation that 'research on group composition always requires a simplification of unmanageable complexities' (p. 107) is clearly still applicable today. As McGrath (1998) noted, the complexities 'have made it highly unlikely that we could build up a substantial body of research information on any one composition factor, much less a substantial body of information on all of them' (p. 258). Almost 10 years later, Bell's (2007) meta-analysis is a step in the right direction; however, more studies, across a wider range of situations (e.g. team types and tasks, lab versus field, different methodologies and statistical approaches) are still needed. Also needed are procedures for the implementation of such knowledge in real life situations (but see Humphrey et al., 2007). Indeed, there is a great deal of room for advancements in knowledge related to team composition, and more research of this type is needed.

ACKNOWLEDGMENTS

REFERENCES

Allen, N. J., & West, M. A. (2005). Selecting for teamwork. In A. Evers, N. Anderson, & O. Voskuijl (Eds.), *The Blackwell handbook of personnel selection* (pp. 476–494). Oxford: Blackwell Press.

Ashton, M. C. (1998). Personality and job performance: The importance of narrow traits. *Journal of Organizational Behavior*, *19*, 289–303.

Ashton, M. C., Jackson, D. N., Helmes, E., & Paunonen, S. V. (1998). Joint factor analysis of the Personality Research Form and the Jackson Personality Inventory: Comparisons with the Big Five. *Journal of Research in Personality*, *32*, 243–250.

Ashton, M. C., Jackson, D. N., Paunonen, S. V., Helmes, E., & Rothstein, M. G. (1995). The criterion validity of broad factor

scales versus specific facet scales. *Journal of Research in Personality*, *29*, 432–442.

Barrick, M. R., & Mount, M. K. (1991). The Big Five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*, *44*, 1–26.

Barrick, M. R., Stewart, G. L., Neubert, M. J., & Mount, M. K. (1998). Relating member ability and personality to work-team processes and team effectiveness. *Journal of Applied Psychology*, *83*, 377–391.

Barry, B., & Stewart, G. L. (1997). Composition, process, and performance in self-managed groups: The role of personality. *Journal of Applied Psychology*, *82*, 62–78.

Bartram, D. (2005). The Great Eight competencies: A criterion-centric approach to validation. *Journal of Applied Psychology*, *90*, 1185–1203.

Behfar, K. J., Peterson, R. S., Mannix, E. A., & Trochim, M. K. (2008). The critical role of conflict resolution in teams: A close look at the links between conflict type, conflict management strategies, and team outcomes. *Journal of Applied Psychology*, *93*, 170–188.

Bell, S. T. (2007). Deep-level composition variables as predictors of team performance: A meta-analysis. *Journal of Applied Psychology*, *92*, 595–615.

Bliese, P. D. (1998). Group size, ICC values, and group-level correlations: A simulation. *Organizational Research Methods*, *1*, 355–373.

Chiocchio, F., & Essiembre, H. (2009). Cohesion and performance: A meta-analytic review of disparities between project teams, production teams, and service teams. *Small Group Research*, *40*, 382–420.

Costa, P. T., Jr., & McCrae, R. R. (1992). *Revised NEO personality inventory (NEO-PI-R) and NEO five-factor inventory (NEO-FFI): Professional manual*. Odessa, FL: Psychological Assessment Resources.

Driskell, J. E., Hogan, R., & Salas, E. (1987). Personality and group performance. In C. Hendrick (Ed.), *Group processes and intergroup relations* (pp. 91–112). Beverly Hills, CA: Sage.

Dudley, N. M., Orvis, K. A., Lebiecki, J. E., & Cortina, J. M. (2006). A meta-analytic investigation of Conscientiousness in the prediction of job performance: Examining the intercorrelations and the incremental validity of narrow traits. *Journal of Applied Psychology*, *91*, 40–57.

English, A., Griffith, R. L., & Steelman, L. A. (2004). Team performance: The effect of team Conscientiousness and task type. *Small Group Research*, *35*, 643–665.

Gellatly, I. R. (1996). Conscientiousness and task performance: Test of a cognitive process model. *Journal of Applied Psychology*, *81*, 474–482.

Goffin, R. D., Rothstein, M. G., Rieder, M. J., Poole, A., Krajewski, H., Powell, D. M., et al. (2009). *Choosing job-related personality traits: Criterion-related evidence of validity*. Poster presented at the annual meeting of the American Psychological Association: Toronto, Ontario.

Goldberg, L. R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. De Fruyt, & F. Ostendorf (Eds.), *Personality psychology in Europe* (Vol. 7, pp. 7–28). Tilburg, The Netherlands: Tilburg University Press.

Halfhill, T., Sundstrom, E., Lahner, J., Calderone, W., & Nielsen, T. M. (2005). Group personality composition and group effectiveness: An integrative review of empirical research. *Small Group Research*, *36*, 83–105.

Hastings, S. E., & O'Neill, T. A. (2009). Predicting workplace deviance using broad and narrow personality traits. *Personality and Individual Differences*, *47*, 289–293.

Hecht, T. D., & Allen, N. J. (1999). The complexity of considering personality at the team level. In D. Miller (Ed.), *Proceedings of the Administrative Sciences Association of Canada Conference*, Organizational Behaviour Division, 20, 50–59.

Hough, L. M. (1992). The "Big Five" personality variables – construct confusion: Description versus prediction. *Human Performance*, *5*, 139–155.

Hough, L. M., & Oswald, F. L. (2008). Personality testing and industrial-organizational psychology: Reflections, progress, and prospects. *Industrial and Organizational Psychology*, *1*, 272–290.

Humphrey, S. E., Hollenbeck, J. R., Meyer, C. J., & Ilgen, D. R. (2007). Trait configurations in self-managed teams: A conceptual examination of the use of seeding for maximizing and minimizing trait variance in teams. *Journal of Applied Psychology*, *92*, 885–892.

Ilies, R., Wagner, D. T., & Morgeson, F. P. (2007). Explaining affective linkages in teams: Individual differences in susceptibility to contagion and individualism-collectivism. *Journal of Applied Psychology*, *92*, 1140–1148.

Jackson, D. N. (1989). *Personality research form manual* (3rd ed.). Port Huron, MI: Sigma Assessment Systems.

Jackson, D. N. (1994). *Jackson personality inventory-revised manual*. Port Huron, MI: Sigma Assessment Systems.

Johnson, J. A. (2001). Screening massively large data sets for non-responsiveness in web-based personality inventories. Invited Talk to the joint Bielefeld-Groningen Personality Research Group, University of Groningen, The Netherlands.

Kichuk, S. L., & Wiesner, W. H. (1998). Work teams: Selecting members for optimal performance. *Canadian Psychology*, *39*, 23–32.

Kozlowski, S. W. J., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological Science in the Public Interest*, *7*, 77–124.

Lepine, J. A. (2003). Team adaptation and postchange performance: Effects of team composition in terms of members' cognitive ability and personality. *Journal of Applied Psychology*, *88*, 27–39.

LePine, J. A., Hollenbeck, J. R., Ilgen, D. R., & Hedlund, J. (1997). Effects of individual differences on the performance of hierarchical decision-making teams: Much more than g. *Journal of Applied Psychology*, *82*, 803–811.

McGrath, J. E. (1998). A view of group composition through a group-theoretic lens. In M. A. Neale, E. A. Mannix, & D. H. Gruenfeld (Eds.), *Research on managing groups and teams: Composition* (Vol. 1, pp. 255–272). Stamford, Connecticut: JAI Press Inc.

Meng, X.-L., Rosenthal, R., & Rubin, D. B. (1992). Comparing correlated correlation coefficients. *Psychological Bulletin*, *111*, 172–175.

Mohammad, S., & Angell, L. C. (2003). Personality heterogeneity in teams: Which difference makes a difference for team performance? *Small Group Research*, *34*, 651–677.

Moynihan, L. M., & Peterson, R. S. (2004). The role of personality in group processes. In B. Schneider, & D. B. Smith (Eds.), *Personality and organizations* (pp. 317–345). Mahwah, NJ: Laurence Erlbaum.

Neuman, G. A., Wagner, S. H., & Christiansen, N. D. (1999). The relationship between work-team personality composition and the job performance of teams. *Group and Organization Management*, *24*, 28–45.

Neuman, G. A., & Wright, J. (1999). Team effectiveness: Beyond skills and cognitive ability. *Journal of Applied Psychology*, *84*, 376–389.

O'Neill, T. A., Goffin, R. D., & Tett, R. P. (2009). Content validation is fundamental to optimizing the criterion validity of personality tests. *Industrial and Organizational Psychology*, *2*, 509–513.

Paunonen, S. V. (1998). Hierarchical organization of personality and prediction of behavior. *Journal of Personality and Social Psychology*, *74*, 538–556.

Paunonen, S. V. (2003). Big Five factors of personality and replicated predictions of behavior. *Journal of Personality and Social Psychology*, *84*, 411–424.

Paunonen, S. V., & Ashton, M. C. (2001). Big five factors and facets and the prediction of behaviour. *Journal of Personality and Social Psychology*, *81*, 411–424.

Paunonen, S. V., Rothstein, M. G., & Jackson, D. N. (1999). Narrow reasoning about the use of broad personality measures for personnel selection. *Journal of Organizational Behavior*, *20*, 389–405.

Peeters, M. A. G., van Tuijl, H. F. J. M., Rutte, C. G., & Reymen, I. M. M. (2006). Personality and team performance: A meta-analysis. *European Journal of Personality*, *20*, 377–396.

Raymark, P. H., Schmit, M. J., & Guion, R. M. (1997). Identifying potentially useful personality constructs for employee selection. *Personnel Psychology*, *50*, 723–736.

Roberts, B. W., Chernyshenko, O. S., Stark, S., & Goldberg, L. R. (2005). The structure of Conscientiousness: An empirical investigation based on seven major personality questionnaires. *Personnel Psychology*, *58*, 103–139.

Rothstein, M. G., & Goffin, R. D. (2006). The use of personality measures in personnel selection: What does current research support? *Human Resouce Management Review*, *16*, 155–180.

Rothstein, M. G., Goffin, R. D., Rieder, M. J., Poole, A., Krajewski, H. T., Powell, D. M., et al. (2009). The incremental validity of narrow versus broad personality measures. In N.D. Christiansen & A. Billington (Chairs), Trait, criterion, and situational specificity in personality-job performance relations. Symposium presented at the annual meeting of the Society for Industrial and Organizational Psychology, New Orleans, LA.

Schneider, R. J., Hough, L., & Dunnette, M. D. (1996). Broadsided by broad traits: How to sink science in five dimensions or less. *Journal of Organizational Behavior*, *17*, 639–655.

Steiner, I. D. (1972). *Group process and productivity*. New York: Academic Press.

Stewart, G. L. (2003). Toward an understanding of the multilevel role of personality in teams. In M. R. Barrick, & A. M. Ryan (Eds.), *Personality and work: Reconsidering the role of personality in organizations* (pp. 183–204). San Francisco, CA: Jossey-Bass.

Sundstrom, E., De Meuse, K. P., & Futrell, D. (1990). Work teams: Applications and effectiveness. *American Psychologist*, *45*, 120–133.

Tasa, K., Taggar, S., & Seijts, G. H. (2007). The development of collective efficacy in teams: A multilevel and longitudinal perspective. *Journal of Applied Psychology*, *92*, 17–27.

Tett, R. P., & Christiansen, N. D. (2007). Personality tests at the crossroads: A response to Morgeson, Campion, Dipboye, Hollenbeck, Murphy, and Schmitt. *Personnel Psychology*, *60*, 967–993.

Tett, R. P., & Guterman, H. A. (2000). Situation trait relevance, trait expression, and cross-situational consistency: Testing a principle of trait activation. *Journal of Research in Personality*, *34*, 397–423.

Tett, R. P., Jackson, D. N., & Rothstein, M. (1991). Personality measures as predictors of job performance: A meta-analytic review. *Personnel Psychology*, *44*, 703–742.

Tett, R. P., Jackson, D. N., Rothstein, M., & Reddon, J. R. (1999). Meta-analysis of bidirectional relations in personality-job performance research. *Human Performance*, *12*, 1–29.

Tett, R. P., Steele, J. R., & Beauregard, R. S. (2003). Broad and narrow measures on both sides of the personality job-performance relationship. *Journal of Organizational Behavior*, *24*, 335–356.

Valente, T. W. (1995). *Network models of the diffusion of innovations*. Cresskill, NJ: Hampton Press.

Wageman, R., & Gordon, F. M. (2005). As the twig is bent: How group values shape emergent task interdependence in groups. *Organizational Science*, *16*, 687–700.

Williams, H. M., & Allen, N. J. (2008). Teams at work. In J. Barling, & C. L. Cooper (Eds.), *The Sage handbook of organizational behavior: Micro approaches* (Vol. 1, pp. 124–140). Los Angeles, CA: Sage.