

Personality in teams: Its relationship to social cohesion, task cohesion, and team performance

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This study continued past research on the relationship between personality composition in teams and social cohesion and team performance (Barrick, Stewart, Neubert, & Mount, 1998). Results from the Barrick et al. sample ($N = 50$) were compared with data from two new samples, one comprising drilling teams in the US ($N = 24$), and the other comprising student teams in The Netherlands ($N = 25$). Furthermore, this study examined the relationship between personality composition and task cohesion, usually considered to be a stronger predictor of team performance than social cohesion. Results partly confirmed the relationships between personality composition, cohesion, and team performance that were found previously. Minimum levels of conscientiousness and agreeableness contributed positively to both task cohesion and team performance. High mean levels of extraversion and emotional stability contributed positively to social cohesion. Some results differed across the three samples, stressing the importance of task characteristics as a factor influencing relationships between team personality, team processes, and team performance. Although significant relationships were found between social cohesion, task cohesion, and performance, cohesion measures did not mediate relationships between personality composition and team performance.

The study of teams and team performance is becoming increasingly important as more and more organizations require participative management, reduce hierarchy, and organize work in teams. To understand team work, many researchers adopt an input–process–output model (Barrick, Stewart, Neubert, & Mount, 1998; Cohen & Bailey, 1997; Hackman & Morris, 1975) and assume that team

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performance is a function of team processes including group cohesion. Team processes in turn are expected to depend on a variety of input variables, such as team size and tenure, members' skills and abilities, and their work values and attitudes (e.g., Guzzo & Shea, 1992; Mullen & Copper, 1994; West & Anderson, 1996).

Using the input–process–output model as a starting point, this study examines an input issue that only recently has received some attention in the I/O literature: the team's personality composition (Barrick et al., 1998; Barry & Stewart, 1997). Our goal was to replicate and extend findings regarding the effects of personality composition on team processes and team performance. Since most studies that examined personality in teams struggle with finding samples with an adequate number of teams, replication studies are necessary for obtaining robust results. We report original data and analyses regarding the effects of team's personality composition on cohesion and team performance and compare these data with those reported by Barrick et al. (1998). Moreover, we examined team processes by assessing different types of group cohesion: social cohesiveness and task cohesiveness. With this approach we extended previous studies that focused on social cohesiveness only.

PERSONALITY IN TEAMS

Previous studies examined specific personality traits for understanding group processes and task performance. Some studies focused on individual differences in positive and negative affectivity (e.g., George, 1992). Other studies worked with taxonomies that distinguish collectivist from individualistic orientations, in order to predict group behaviour and performance (De Dreu & Boles, 1998; Eby & Dobbins, 1997; Van Knippenberg & Sleebos, 1999). Personality psychology tends to collapse and summarize these traits into the so-called Big Five personality taxonomy (Costa, McCrea, & Dye, 1991; Goldberg, 1993). The taxonomy identifies five personality dimensions. The first is *extraversion*, which is associated with being sociable, assertive, and talkative. The second is *agreeableness*, which concerns being good-natured, cooperative, and tolerant. The third is *conscientiousness*, which concerns being careful, responsible, and organized. The fourth one is *emotional stability*, which is associated with not being anxious, depressed, worried, and insecure; and the fifth one is *openness to experience*, defined as curious, original, and broad-minded.

The question addressed in this study is how team members' personalities are related to teams' outcomes, i.e., how the personality composition of teams affect team processes and team performance. Several studies on interpersonal relationships and group processes appear to support similarity of team members to be important for individual outcomes, such as turnover and commitment (e.g., Jackson et al., 1991; Kristof, 1996). It was also found that individuals are more

attracted to other people who are closer regarding their own characteristics than to others who are very different to them (Byrne, Griffitt, & Stefaniak, 1967; Moskowitz & Coté, 1995). Moreover, interpersonal attraction among members of a team was found to be related to group cohesion (Colarelli & Boos, 1992). Thus, from the similarity-attraction perspective it follows that the more homogeneous a team is in terms of personality, the more positive team processes will be.

In a recent study, Barrick et al. (1998) found very few relationships between personality homogeneity of work teams and social cohesion. Only homogeneity of agreeableness was related to social cohesion. Other aspects of personality composition appeared to be more important for group processes, such as the mean personality of the team or the minimum and maximum scores of individual team members. Which personality composition is most appropriate for creating group cohesion may depend on other factors, such as the group's specific goal. Homogeneity of personality may be less relevant for cohesiveness in work groups than it is for groups operating in a non-working context.

Also with respect to team performance, Barrick et al. (1998) argued that the optimal team composition depends on the nature of the task being completed by the team, the specific traits being analysed, and the research questions being asked. Most teams perform tasks that are highly interdependent, including additive, conjunctive, and disjunctive components (Saavedra, Earley, & Van Dyne, 1993; Steiner, 1972; West, Borrill, & Unsworth, 1998). Team performance is an additive function of the members' inputs when, for instance, team members work on similar tasks and the team's performance is the summing of the team members' individual input. However, team performance may also depend on the input of the least productive member. This is the case with conjunctive tasks, for example when the team climbs a mountain (the team reaches the top when the slowest member reaches the top). Finally, team performance may also depend on the input of the most productive member. For instance, when the task requires the team to come up with a good solution; the best solution proposed by an individual member will then determine the team's performance. Such tasks are defined as disjunctive.

Based on this analysis of team work, Barrick et al. (1998) proposed that in addition to *homogeneity* (operationalized as the team's level of variance on a particular personality trait) the *mean level* of a particular personality trait may be important as well. Their argument was that personality composition operationalized as the mean level of a trait was more appropriate in cases where the team's tasks are additive. They further proposed to incorporate measures of the *minimum and the maximum individual-trait score* for the team. They argued that the minimum and maximum methods of operationalization are appropriate if team tasks are conjunctive and disjunctive, respectively.

TEAM PERSONALITY AND COHESION

Team cohesion is a proxy to team functioning and defined as “the resultant of all the forces acting on the members to remain in the team” (Festinger, 1950). Team cohesion breaks down into interpersonal or social cohesion and task cohesion. Social cohesion concerns an individual’s attraction to the group because of positive relationships with other members of the group. Task cohesion refers to an individual’s attraction to the group because of shared commitment to the group task (Brawley, Carron, & Widmeyer, 1987; Zaccaro, 1991).

A meta-analysis by Mullen and Copper (1994) showed that task cohesion has a stronger relationship with group performance than social cohesion. Unfortunately, however, Barrick et al. (1998) focused on social cohesion only and ignored its (potential) relationship with one of the Big Five dimensions: openness to experience. Their results regarding social cohesion showed no relationships with composition measures of conscientiousness, positive relationships with all composition measures of agreeableness and extraversion, and positive relationships with the mean and minimum level of emotional stability. In the current study we expected to replicate these findings with social cohesion. For each of the personality dimensions, we added hypotheses regarding the relationships between one or more composition measures on the one hand and task cohesion on the other. Further, we developed hypotheses concerning the relationship between (task and social) cohesion and a measure for openness to experience.

Conscientiousness

Individuals high in conscientiousness share the need for being organized and to achieve individual and team goals. Individuals low in conscientiousness share the tendency to be disorganized and approach the task in a less structured way. When a team consists of both high and low conscientious members, there may be substantial disagreement and irritation about how to approach the task, and what to achieve. Put otherwise, we expected homogeneity in conscientiousness to affect task cohesion: The more similar team members are in terms of conscientiousness, the higher the team’s task cohesion will be (hypothesis 1).

Agreeableness

Individuals high in agreeableness are likely to comply with team goals even if these goals conflict with their own self-interest. Thus, in work teams with higher mean levels of agreeableness there will be strong compliance with team goals and high levels of cooperation. Accordingly, we expected higher task cohesion in work teams with higher mean levels of agreeableness (hypothesis 2a) and with relatively high minimum individual agreeableness scores (hypothesis 2b).

Extraversion

Communication about how the tasks have to be done is important for making the team's strategies and goals more explicit, i.e., for getting people facing the same direction. Extraverts are more likely to initiate discussions, to be active and energetic and to be perceived as leaders (Littlepage, Schmidt, Whisler, & Frost, 1995; Young & French, 1996). They therefore could enhance task cohesion. Barry and Stewart (1997), however, revealed that a higher proportion of extraverts was not associated with openness of within-group communication and reduced the task focus of the group. They suggested that "extraversion increases the quantity of verbal communication but without necessarily affecting its quality" (p. 75). Thus, whether or not extraversion positively affects task cohesion very much depends on the content of the communication and the nature of the tasks to be done. We therefore expected no relationships between composition measures of extraversion and task cohesion.

Emotional stability

Emotionally stable individuals are self-confident and secure about the goals that have to be chosen and the decisions that have to be made. Moreover, individuals low in emotional stability will repeatedly call decisions into question, because they are anxious about taking decisions and they feel uncertain about their own and others' ideas. Hence, work teams with higher mean levels of emotional stability will report greater task cohesion (hypothesis 3a). Also, teams with higher scores for the least emotionally stable member of the team will report greater task cohesion (hypothesis 3b).

Openness to experience

This personality factor was not included in previous studies on the relationship between group composition, group processes, and outcomes, perhaps because of the confusion about the labelling and specific content of this personality factor in the literature (see Hendriks, 1997). In the present study, we used the Five-Factor Personality Inventory (FFPI; Hendriks, 1997) in which openness to experience was labelled and operationalized as *autonomy* (see also our Method section). This personality factor is represented by traits such as "decides things on his/her own", "takes charge", "takes risks", "engages in discussions" on the positive pole, versus "follows the crowd", "waits for others to lead the way", and "does what others want him/her to do". If a work team consists of individuals that are all high on autonomy this may lead to many discussions and fights for getting control and power, which will be detrimental for both social and task cohesion. On the other hand, when only one team member rates high on autonomy and others are the followers (low on autonomy) this may create task cohesion in the group. From the specific operationalization of autonomy in this study we

therefore hypothesize that work teams with higher mean levels of autonomy (hypothesis 4a) and with a relatively high minimum level of autonomy (hypothesis 4b) will report both lower social cohesion and task cohesion. Moreover, we expect that variance in autonomy will be positively related to task cohesion (hypothesis 4c).

TEAM PERSONALITY AND PERFORMANCE

In addition to measures of social cohesion, Barrick et al. (1998) collected supervisor ratings of team performance. With regard to *conscientiousness*, Barrick et al. demonstrated that conscientious teams perform better than teams that are less conscientious. Moreover, their results also indicated a negative relationship between heterogeneity (i.e., variance) in conscientiousness and team performance. Concerning *agreeableness*, it appeared that teams that are more agreeable receive higher performance ratings. Also, teams with relatively high levels of agreeableness were more cohesive. This is consistent with research indicating that agreeable individuals are motivated to maintain positive relations with others and tend to be cooperative (see De Dreu & Van Lange, 1995). Relationships between *extraversion* and team performance were only found with the minimum method of operationalizing team composition: Teams without introverted members performed better. They explained this by suggesting that a minimum level of extraversion is important for performing additive tasks. Barry and Stewart (1997), however, found that teams with a moderate proportion of extraverted members received higher performance evaluations. Thus, as long as there are some team members with a reasonable level of extraversion, sufficient communication about task performance in order to be effective as a team is guaranteed. Finally, Barrick et al. found significant and positive relationships between the mean level of *emotional stability* and team performance. Teams that were more emotionally stable received higher performance ratings. In the current study we expected to replicate the Barrick et al. findings concerning the relationships between personality composition and team performance. As we have already noted, the relationship between *openness to experience* and team performance was not examined in previous studies. We saw no reason to assume that our measure of *autonomy* would have a direct effect on team performance. One could argue that behaviours such as “takes charge” and “takes risks” are beneficial for performance at the individual level. Hendriks (1997), however, suggested that these behaviours are particularly relevant for high-level (managerial) jobs and less relevant for low-level jobs. Whether or not autonomy will affect team performance will therefore also depend on the specific task of the team. In this study, we will further explore relationships between our measure of autonomy and team performance.

Because personality traits affect team members' approach of the team tasks and task cohesion is important for team outcomes, we also expected task

cohesion to mediate relationships between personality traits and team performance. Conscientiousness and emotional stability (i.e., neuroticism) were found to be valid predictors for performance at the individual level, for all occupational groups (Barrick & Mount, 1991; Hough, Eaton, Dunnette, Kamp, & McCloy, 1990; Piedmont, 1994; Salgado, 1997). Thus, a high mean of conscientiousness and emotional stability will have a direct effect on performances at the team level. It can be argued, however, that the relationships that were found with performance at the team level are also partly due to its effect on team processes. We already hypothesized that homogeneity in conscientiousness would influence task cohesion and that task cohesion would be positively related to team performances. It is likely then that homogeneity in conscientiousness will have an effect on team performances due to its relationship with task cohesion. The Barrick et al. (1998) study also found relationships between agreeableness measures and team performance. There are, however, no studies that show direct relationships between agreeableness and performance at the individual level (Salgado, 1997). We therefore assume that the relationships that were found at the team level are due to the effect of agreeableness on team processes. Hence, task cohesion will mediate relationships between team performance and personality traits of (homogeneity of) conscientiousness and (mean and minimum levels of) agreeableness (hypothesis 5).

OVERVIEW OF THE PRESENT STUDY

The current study builds on a recent study by Barrick et al. (1998). In two samples of work teams we examined the relationships between various measures of personality composition (mean, variance, minimum, and maximum), social and task cohesion in teams, and supervisor ratings of team performance.

The data we collected allowed us to do two things. First, we were able to put the results provided by Barrick et al. (1998) to a new test. This is important because in the Barrick et al. study many hypotheses were tested and some were accepted while others were rejected on the basis of conventional significance tests. Relying on significance levels is potentially misleading, because they can detect the possibility of a type I error (the unwarranted acceptance of an hypothesis), but neglect the possibility of a type II error (the unwarranted acceptance of a no-effect hypothesis). Schmidt (1996) showed that the possibility of a type II error easily exceeds .40 (see also, Hunter, 1997; for discussions, see Abelson, 1997; Cortina & Dunlap, 1997; Estes, 1997). In the current research, we tested whether the results of the Barrick et al. study could be replicated with other samples in different settings. Our results might provide a firmer indication of the existence and direction of particular relationships than one single study using one single sample could yield.

In addition to establishing the robustness and generalizability of the findings reported by Barrick et al. (1998), the current study tested a set of hypotheses

regarding the relationship between the team's personality composition on the one hand and task cohesion on the other. Moreover, we examined the role of task cohesion as a mediator between the team's personality composition and its performance. Barrick et al. focused on social cohesion only, and additional knowledge about task cohesion is relevant as task cohesion is a better predictor of team performance than social cohesion (Mullen & Copper, 1984).

METHOD

Team task and participants

The first original sample consisted of 86 male employees from 24 teams placing underground cables and pipes located in the south east of the USA. Drilling crews located in Maryland and Virginia were included for reasons of standardization, i.e., similar environmental work conditions. The drilling process can be shortly described as follows. The drilling crews use a design plan and drawing to plot and drill a pilot bore hole. This hole is drilled along the predetermined path using a jet bit or down-hole mud motor. Progress of the drill bit is reported to the surface where information is analysed and necessary corrections made to ensure an accurate installation. A questionnaire was handed out by a researcher to the crew members in an all-crew meeting. Twenty-four crews were involved. Ten crews consisted of three members, thirteen teams consisted of four members, and one team consisted of five members. Questionnaires were filled out immediately, and individually (i.e., without discussing with others). Voluntary participation and anonymity was ensured. Mean age was 29.3 (SD = 5.69). 66% were Caucasian, 32% were African American, and 2% were Hispanic. Tenure with the organization ranged from 0 to 13 years with an average of 3.1 years (SD = 3.04). Tenure with the crew ranged from 0 to 72 months with an average of 13.4 months (SD = 15.22). Schooling ranged from the 8th grade to the 16th grade with an average of 12th grade (SD = 1.11).

The second original sample consisted of 107 students from 28 teams at the University of Amsterdam that work in a research project. The students involved were in their second year of the Psychology programme. As part of this programme, the students have to work on a research project in groups of four or five, under the supervision of a PhD student or faculty member. Students participated in every aspect of the research project, starting with formulating hypotheses and ending up with a written report of the results of the project. The whole project took a period of 3 months in which the students worked closely together. Questionnaires were handed out to the students at the end of the second month. The teams consisted of two ($n = 3$), three ($n = 7$), four ($n = 10$), or five students ($n = 8$). Only teams with more than two members were involved in the final data analyses, which resulted in 25 teams with 101 students, of which 20 were males and 81 were females. Mean age of the students was 23.6 (SD = 4.98).

Although the tasks were different for the student teams and the drilling teams, the tasks invariantly comprised additive, conjunctive, and disjunctive elements. The individual resources of team members were combined into a collective output (the number of pipes, and the final research report, respectively). Team members were responsible for their own sub-tasks, which rotated over the team members. Meanwhile, task interdependence was high: Team members exchanged information and resources, coordinated the sub-tasks, and outcomes were influenced by the actions of individual team members (Saavedra et al., 1993).

Measures

Input and process measures (personality, interpersonal, and task cohesion) were collected at the individual level and aggregated to the mean level. The team's supervisor provided the performance ratings.

Personality. This was measured with the Five-Factor Personality Inventory (FFPI), assessing the Big Five factors of personality (Hendriks, Hofstee, De Raad, & Angleitner, 1995). The 100 items were constructed interactively in Dutch, English, and German versions. The FFPI results from the Abridged Big-Five Dimensional Circumplex taxonomic model of traits (Hofstee, De Raad, & Goldberg, 1992). The five scales (extraversion, agreeableness, conscientiousness, emotional stability, and autonomy), consisting of 20 items each, showed good reliabilities, ranging from .89 to .93 in previous studies with $N = 1311$ (Hendriks et al., 1995). The FFPI also showed good convergent validities with the 225-item trait-adjective rating list and the Revised NEO Personality Inventory (Hendriks, 1997, p. 70). The FFPI was chosen because it involves short behavioural statements rather than (abstract) trait adjectives (as in the NEO). The FFPI was therefore more suitable for our lower-educated participants. Additionally, the FFPI was available in Dutch and English.

Social cohesion. This was measured with five items derived from the Group Environment Questionnaire developed by Carron, Brawley, and Widmeyer (1985) and used in previous studies (e.g., Brawley et al., 1987). We asked participants to indicate their level of agreement with each of the statements on a 5-point scale (1 = strongly disagree, 5 = strongly agree). One such statement was: "Our team likes to spend time together after work". Cronbach's alpha was .82 for the student teams and .71 for the drilling teams. Individual ratings were averaged into one index of social cohesion. This procedure is appropriate if there is within-team agreement on the variable in question (George & James, 1993). Interrater agreement was estimated with two steps. In the first step, interrater agreement coefficients were calculated for each team using r_{wg} of James, Demaree, and Wolf (1984). A multiple-item estimation instead of a single-item estimation (the

scale scores, based on the mean of the items) was used in order to reduce the influence of response bias on the estimated reliabilities. A r_{wg} of .70 is conceived of as an acceptable level of interrater agreement. Three teams (drilling crews) with a low r_{wg} were excluded from further analyses with this scale. In the second step, we estimated the intraclass correlation coefficient (ICC) as suggested by James (1982). ICC (1) was .44, which implies agreement among the team members.

Task cohesion. This was measured with another four items derived from the Group Environment Questionnaire (Brawley et al., 1987; Carron et al., 1985), with Cronbach's alpha ranging from .80 (students) to .77 (drilling teams). One statement was: "Our crew is united in trying to reach its goals for performance". Four teams (drilling crews) with a low r_{wg} were excluded from further analyses with this scale. ICC (1) was .24, allowing individual ratings to be averaged into one index of task cohesion.

Team performance. This was measured by obtaining supervisor ratings on six items (comparable to the approach of Barrick et al., 1998). These items were developed based on a description of the tasks, and thus slightly different for the student teams and the drilling teams. The items concern task behaviour of the team members, such as keeping appointments, presence at meetings (at work), keeping deadlines (taking undeserved work breaks), conscientiousness, following instructions, and spending time on personal conversation (reverse coded). Supervisors were asked to rate each item on a 5-point scale, ranging from strongly disagree to strongly agree with the statement: "The members of this team ...". Alpha reliability of this scale was .77 for the students' teams and .75 for the drilling teams, respectively. Supervisors in both sub-samples (students and drilling teams) worked closely together with their teams and they were all familiar with assessing team performances.

RESULTS

Treatment of the data

Data were analysed in two phases. First, for each of the two original samples in the current study, zero-order correlations were calculated between the four personality composition measures (mean, variance, minimum, and maximum). These correlations are shown in Table 1. The highest correlations were between different methods of operationalizing the same trait. The average of these correlations across the five personality variables was $r = .48$ and $r = .42$ for the student teams and the drilling teams, respectively. The average correlation for the same method across different traits was $r = .37$ and $r = .30$, respectively. The average correlation for different methods across different traits was $r = .22$ and $r = .19$, respectively. These results correspond with the results found in the

TABLE 1
Zero-order correlations between the four personality composition measures for US drilling teams
(above the diagonal) and Dutch student teams (below the diagonal)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Conscientiousness																				
1. Mean	—	-.46*	.71	.71*	.46*	-.45*	.50*	.28	.17	-.01	.11	.11	.40	-.25	.10	.30	.36	.42*	.24	.14
2. Variance	-.08	—	-.50*	-.35	-.32*	.71*	-.30	-.28	.01	.51*	-.09	-.05	-.17	.44*	-.13	-.26	-.21	.63*	-.17	-.12
3. Minimum	.56*	-.71*	—	.16	.68*	-.26	.75*	.50*	.05	-.06	.05	.07	.32	-.19	.37	.09	.18	-.50*	.39	-.13
4. Maximum	.73*	.42*	-.03	—	.09	-.40	.05	.04	.23	-.01	.13	.19	.44*	.20	.00	.56*	.38	-.19	.06	.40
Agreeableness																				
5. Mean	.33	-.27	.23	.14	—	-.15	.91	.84*	-.16	.18	-.23	-.07	.26	.04	.17	.14	.22	-.22	.24	-.02
6. Variance	-.23	.42*	-.33*	.03	-.29	—	-.14	.02	-.03	.54*	-.02	-.08	-.03	.47	.14	-.19	-.04	.63*	.03	-.15
7. Minimum	.22	-.42*	.29	-.01	.61*	-.83*	—	.71*	-.27	.19	-.32	-.02	.20	.06	.13	.06	-.01	-.21	.16	-.16
8. Maximum	.03	.07	-.12	.07	.70*	.22	.11	—	-.13	.20	-.24	-.07	.16	.29	.11	.07	.36	-.12	.21	.06
Extraversion																				
9. Mean	.15	-.06	.06	.18	-.22	.46*	-.42*	.01	—	-.29	.78*	.64*	.66*	-.07	.28	.53*	.24	-.07	.18	-.09
10. Variance	.23	.19	.06	.20	.19	-.13	.26	.00	-.42*	—	.57*	.09	.10	.60*	-.31	-.02	.14	.63*	.03	-.15
11. Minimum	.07	-.19	.08	.04	-.21	.32	-.38	.00	.86*	-.70	—	.14	.58*	-.44*	.48*	.35	.04	-.24	.34	-.30
12. Maximum	.22	.11	.02	.31	-.26	.49*	-.36	-.13	.68*	.18	.32	—	.38	.28	.10	.52*	.12	.03	.08	.03
Emotional stability																				
13. Mean	-.08	-.38	.22	-.33	-.14	.03	.00	.00	.57*	-.27	.55*	.33	—	.22	.55*	.74*	.25	-.10	.24	-.03
14. Variance	.17	.39	-.08	.22	.17	-.02	-.02	.19	-.35	.57*	-.59*	-.09	-.53*	—	-.57*	-.03	-.09	.66*	-.41*	-.04
15. Minimum	-.12	-.48*	.22	-.38	-.07	-.11	.22	-.13	.37	-.27	.47*	.21	.77*	-.81*	—	.14	.20	-.40	.66*	-.17
16. Maximum	-.01	-.27	.28	-.28	-.22	.20	-.21	-.07	.39	-.01	.25	.33	.67*	.00	.20	—	.09	.00	.02	.05
Autonomy																				
17. Mean	-.13	.14	-.26	-.11	-.37	.23	-.30	-.02	.60*	-.37	.61	.26	.64*	-.30	.45*	.41*	—	-.27	.46*	.63*
18. Variance	.20	.20	.08	.29	.00	.09	-.08	-.10	-.01	.68*	-.35	.35	-.09	.53*	-.35	.26	-.22	—	-.62*	.03
19. Minimum	-.29	-.03	-.21	-.32	.22	.17	-.21	.16	.36	-.57*	.61	-.12	.46*	-.49*	.50*	.10	.73*	-.67*	—	-.14
20. Maximum	.05	.14	-.11	.06	-.42*	.26	-.37	-.28	.48*	.08	.33	.47*	.48*	-.08	.24	.53*	.66*	.45*	.12	—

* $p < .05$.

Barrick et al. (1998) study. The different methods of operationalizing the same team-level trait correlate moderately, but this also suggests that team-level traits were indeed operationalized differently.

Second, both our samples were combined and correlations were calculated between the five personality composition measures, supervisor ratings, social cohesion, and task cohesion, with controlling for team size and sample. In the Method section we argued that the tasks in the students teams and in the drilling teams can be conceived of as more or less equivalent due to the fact that they both contain additive, conjunctive, or disjunctive elements. These elements are only formal characteristics of the tasks. The content of the tasks of the two samples, however, was very different, which may affect the hypothesized relationships. To deal with this issue we show the correlations for each of the samples separately, while controlling for team size. In addition, we estimated whether the correlations found in both our samples significantly differed from each other, using Fisher-Z transformations. Significant differences in correlations may indicate qualitative differences between samples. Such qualitative differences then should reveal itself in interactions between personality composition measures on the one hand, and sample type on the other. We found only two out of sixty possible differences between drilling and student teams that were significant. Because this low number of significant differences can be attributed to chance, we felt it justified to consider main effects only and to ignore possible interaction effects. Finally, we estimated differences in correlations found in the Barrick et al. (1998) teams and those found in our two samples.

We first analysed relationships between personality composition measures and supervisor ratings of team performance and those between personality composition measures and social cohesion. Our results were compared to those from the Barrick et al. (1998) sample. We then analysed relationships between personality composition measures and (task) cohesion, testing our hypotheses 1–4c. Finally, we analysed relationships between measures of team cohesion (social and task) and supervisor's ratings of team performance and we tested for the mediation role of task cohesion (hypothesis 5).

Personality composition and team performance

Table 2 contains correlations between the four measures of personality composition and the measure of team performance per sample (i.e., the Barrick et al., 1998 sample and the two samples in this study). Consistent with the Barrick et al. conclusions, the minimum level of conscientiousness contributed positively to team performance and the maximum level of conscientiousness did not relate to team performance. However, contrary to the Barrick et al. study, no significant relationships were found for the mean level and variance in conscientiousness, although the correlation with the variance measure was in the predicted (negative) direction.

The results with regard to agreeableness were highly comparable in both studies. The variance and maximum on agreeableness did not contribute to team performance and mean and minimum level of agreeableness were positively related to team performance. The correlations with the mean and minimum level of agreeableness in our study were, however, nonsignificant for the drilling teams. Three of the four correlations with extraversion were as expected: the mean, variance, and maximum scores of extraversion did not significantly relate to team performance. This was particularly true for the student teams, but the drilling teams showed substantial (but not significant) correlations for the mean and maximum scores of extraversion. Contrary to the Barrick et al. study, the minimum level of extraversion did not relate to team performance in our study, but the correlation was in the predicted direction for the drilling teams. The correlation for the students' teams significantly differed from the Barrick et al. teams (see Table 2).

No significant correlations were found with emotional stability in our study. Comparable to the Barrick et al. study, the variance as well as the minimum and maximum scores of emotional stability did not relate to team performance. Barrick et al. found a positive correlation between the mean level of emotional stability and performance. This finding could not be replicated in our study, but the correlation for the drilling teams was in the predicted direction.

Relationships between autonomy and team performance were examined in our study only. The correlations significantly differed between the two samples. No relationships were found for the drilling teams, while the mean and minimum scores of autonomy were negatively related to team performance in the student teams.

Summary. Taken together, the results of our combined samples were comparable with those of the Barrick et al. study for 13 out of 16 correlations between the personality composition measures and team performance (not including autonomy). Neither the maximum level of any of the four personality dimensions, nor the variance in agreeableness, extraversion, and emotional stability, contributed to team performance. Variance in conscientiousness was the only homogeneity measure that negatively related to team performance (in the predicted direction, but not significant in our study), i.e., the more homogeneous teams were with respect to conscientiousness the higher their performance ratings. Also, minimum levels of conscientiousness (significant in both studies) and agreeableness (in the predicted direction, but not significant in our study) were positively related to team performance ratings. Results with the mean level of conscientiousness and emotional stability were different across the samples. The same was true for the minimum level of extraversion, with significant differences between the Barrick et al. sample and our students' teams. Moreover, correlations between team performance and the composition

measures of extraversion, emotional stability, and autonomy tended to be different for the drilling teams and the student teams. A significant difference between both samples was found for the correlations between team performance and the minimum level of autonomy.

Personality composition and social cohesion

Table 2 contains the correlations for the relationships between the four measures of personality composition and the measure of social cohesion per sample. Both studies showed that all composition measures of *conscientiousness* were not associated with social cohesion. The drilling teams, however, were somewhat different from the other samples, because a significant correlation was found with the mean level of conscientiousness. Our results with *agreeableness* deviated from those of the Barrick et al. (1998) sample. None of the composition measures in our study were correlated with social cohesion, while Barrick et al. found positive correlations between the mean and minimum level of agreeableness and social cohesion and negative correlations with the variance and maximum personality composition measures. Results for the variance and minimum measures were significantly different for the Barrick et al. teams and the students' teams.

Table 2 shows comparable relationships with two of the four composition variables of extraversion. Mean and minimum levels of extraversion were positively related to social cohesion. In our study, these relationships were stronger (and significant) for the students teams than for the drilling teams. The results with variance in extraversion were different across the two studies. Contrary to the Barrick et al. (1998) study, we found no positive correlations between the variance in extraversion and social cohesion. Moreover, the positive correlation between the maximum level of extraversion and social cohesion in the Barrick et al. study was only replicated in the student teams. Inspection of the correlations with emotional stability indicated that the mean level of emotional stability was positively related to social cohesion in both studies, but this correlation was not significant for the drilling teams. As expected, no correlations were found for the variance in emotional stability. Our results for the minimum and maximum levels of emotional stability differed somewhat from those found in the Barrick et al. study, but they were in the same direction. In hypotheses 4a and 4b we predicted that high mean and minimum levels of autonomy would be negatively related to social cohesion. The correlations between the autonomy measures and social cohesion could not confirm these hypotheses.

Summary. Our data corroborate the pattern observed by Barrick et al. (1998) for the relationships between most of the composition measures of conscientiousness, extraversion, and emotional stability on the one hand, and

social cohesion on the other. Social cohesion in teams is stronger when teams have higher mean, minimum, and maximum levels of extraversion and emotional stability. As opposed to the Barrick et al. study, no relationships were found with social cohesion for the personality composition measures of agreeableness and for team variance in extraversion. Contrary to what was expected, no relationships were found between mean and minimum levels of autonomy and social cohesion.

Personality composition and task cohesion

Correlations for the relationships between the four measures of personality composition and the measure of task cohesion are also shown in Table 2. With these data we tested our hypotheses 1–4c.

We expected homogeneity in conscientiousness to affect task cohesion (hypothesis 1). This hypothesis was confirmed, particularly for the student teams. We found negative relationships between variance in conscientiousness and task cohesion. In contrast, the mean and the minimum level of conscientiousness were positively related to task cohesion. Homogeneous teams with high mean and minimum levels of conscientiousness showed higher ratings on task cohesion. The maximum level of conscientiousness was not related to task cohesion. Our hypotheses concerning the relationships between agreeableness and task cohesion were also supported. We found (significant) positive correlations between the mean (hypothesis 2a) and minimum (hypothesis 2b) level of agreeableness and task cohesion. No hypotheses were developed for the relationship between extraversion and task cohesion. Indeed, none of the personality composition measures of extraversion were significantly related to task cohesion. Moreover, the results for extraversion differed across the two subsamples (but not significantly). Positive relationships with task cohesion were expected for the mean (hypothesis 3a) and the minimum (hypothesis 3b) level of emotional stability. As can be seen in Table 2, these hypotheses were only confirmed for the students' teams, because the correlations were significant or in the predicted direction. A significant relationship was found with the variance measure for the combined samples, indicating that teams with members that were more homogeneous concerning their emotional stability rated their task cohesion higher. Negative relationships were hypothesized between task cohesion and mean (hypothesis 4a) and minimum (hypothesis 4b) levels of autonomy and positive relationships were expected for variance in autonomy (hypothesis 4c). Our results did not support these hypotheses.

Summary. Taken together, results show that the mean and minimum level of conscientiousness and agreeableness contributed positively to task cohesion in teams. Furthermore, variance in conscientiousness and emotional stability were negatively related to task cohesion. Hypotheses 1, 2a, and 2b were supported,

whereas hypotheses 3a and 3b received only partial support for the student teams and hypotheses 4a–4c were not supported.

The mediating role of task cohesion

First, we analysed relationships between measures of team cohesion and supervisors' ratings of team performance, because previous studies indicated stronger relationships for task cohesion than for social cohesion (Mullen & Copper, 1994). In the present study, social cohesion and task cohesion were correlated ($r = .58, p < .01$ and $r = .62, p < .01$, for the student and drilling teams respectively). However, correlations between the cohesion measures and performance were different for the students and drilling teams. For social cohesion correlations with performance were $r = .08$ (n.s.) and $r = .54$ ($p < .05$), and for task cohesion correlations with performance were $r = .29$ (n.s.) and $r = .37$ (n.s.), respectively. Thus, as with Mullen and Copper, we found that task cohesion correlated positively (but not significant) with team performance in both samples. In the drilling teams, however, task cohesion was less important than social cohesion.

Before the mediation hypothesis can be tested, there must be a relationship between the independent variables and the criterion (Baron & Kenny, 1986). However, our study revealed no significant relationships between variance in conscientiousness, mean, and minimum levels of agreeableness and team performance. As shown in Table 2, the possibility of mediation (but not hypothesized) existed only for the minimum level of conscientiousness. We tested mediation of task cohesion for this personality composition measure for the combined samples of students and drilling teams.¹ The regression results are shown in Table 3.

The minimum level of conscientiousness was significantly related to task cohesion (see model 1) and team performance (see model 2). However, task cohesion was not related to team performance when the minimum level of conscientiousness was included in the equation (see model 3). When both task cohesion and the minimum level of conscientiousness were included, the regression equation became nonsignificant. These results do not support a mediation effect of task cohesion.

CONCLUSIONS AND DISCUSSION

The relationship between personality characteristics and individual performance has been subject of many studies. Far less research has considered the relationship between personality and team functioning. The current research expanded on a recent study by Barrick et al. (1998), and examined the relationships between various personality composition measures on the one hand and social

¹The correlation between task cohesion and performance for the total sample was $.26$ ($p < .05$).

cohesion, task cohesion, and team performance on the other. We compared the results from a sample obtained by Barrick et al. with a new sample containing drilling teams in the south east of the US and Dutch student teams working on a joint research project. This comparison allows us to examine the generalizability of the results and conclusions advanced by Barrick et al. This was deemed important as their study tested many hypotheses and only part of it was supported. We also added personality composition measures referring to the fifth factor of the Big Five: autonomy. This factor was not included in previous studies on personality in teams.

Results largely confirm the conclusions reached previously by Barrick et al. (1998). Both studies show that social cohesion is stronger when teams have high mean and minimum levels of extraversion and a high mean level of emotional stability. This implies that team members experience more positive relationships with others in the group if the emotional stability of most of the team members is reasonably high and if there is no single member who is highly introvert. The results further indicate that social cohesion in teams is independent of the personality composition measures of conscientiousness. Also, our study showed no relationships between social cohesion in teams and levels of autonomy. Contrary to Barrick et al., this study has not found any relationships between social cohesion and the composition measures of agreeableness. This discrepancy between the two studies is difficult to explain. Inspection of the results for both our samples (student teams and drilling teams) separately, however, shows that the results of the student teams particularly differ from those of the Barrick et al. teams. The student teams, as opposed to the other teams, worked together on a temporary base and not full time. The level of agreeableness apparently is less important for social cohesion in these more "loose" work groups.

Both studies showed that the minimum level of conscientiousness positively contributes to team performance. This indicates that inclusion of a single member who is relatively low on conscientiousness will reduce team performances. Moreover, the results of both studies suggest that the team members have to be quite similar in conscientiousness, because higher variance in conscientiousness is related to lower performances. We expected that conscientious teams (mean) would perform better than teams that are less conscientious. Our correlation between performance and mean conscientiousness was, however, rather low and nonsignificant compared to that found in the Barrick et al. study, particularly for the student teams. For these teams, a high mean level of agreeableness and a low mean and minimum level of autonomy were significantly related to team performance. Apparently, university supervisors evaluate their students team's performances more positively if their students are cooperative and do what their supervisor wants them to do. Overall, the results suggest that a relatively high minimum level of conscientiousness and agreeableness is necessary for better performances in most types of teams. This is in line with studies that indicate that

TABLE 2
 Personality composition, team performance, social cohesion, and task cohesion

	Team performance			Social cohesion			Task cohesion				
	$r_{Barrick}$	$r_{This\ study}$	r_{Drill}	r_{Studs}	$r_{Barrick}$	$r_{This\ study}$	r_{Drill}	r_{Studs}	$r_{This\ study}$	r_{Drill}	r_{Studs}
<i>Personality composition</i>											
<i>Conscientiousness</i>											
Mean	.26*	.09	.11	.05	.00	.23	.39*	.02	.30*	.36	.27
Variance	-.33*	-.20	-.14	-.32	.03	.04	.25	-.17	-.35*	-.16	-.51*
Minimum	.34*	.35**	.29	.34*	.14	.24	.19	.09	.41	.37	.41
Maximum	.01	-.01	.09	-.12	-.08	.10	.18	.00	.01	-.06	.00
<i>Agreeableness</i>											
Mean	.34*	.17	.13	.35*	.32*	-.05	.13	.13	.38*	.44*	.31
Variance	-.08	-.11	-.11	-.02	-.23*	.07	-.20	.30 ^b	-.25	-.37	-.22
Minimum	.32*	.19	.12	.22	.38*	-.07	.07	-.17 ^b	.32*	.36	.36*
Maximum	-.06	.01	.05	-.04	-.39*	-.02	.02	.01	.15	.35	-.02
<i>Extraversion</i>											
Mean	.12	.05	.35	-.02	.36*	.38*	.30	.51*	.23	-.11	.33
Variance	.02	.07	-.09	.11	.35*	-.07	.05	-.20 ^b	-.20 ^b	-.09	-.22
Minimum	.26*	-.08	.24	-.22 ^b	.24*	.32*	.25	.43*	.22	-.05	.31
Maximum	-.02	.15	.30	.09	.33*	.25	.06	.43*	.13	.20	.27
<i>Emotional stability</i>											
Mean	.24*	.06	.23	-.07	.53*	.43*	.17	.51*	.14	-.23 ^a	.34*
Variance	.12	.03	-.19	.08	-.04	-.12	-.03	-.20	-.26*	-.10	-.29
Minimum	.03	.07	.31	-.06	.34*	.22	.04	.23	.24	.00	.33
Maximum	-.11	.24	.31	.11	.18	.35*	.13	.51*	.03	-.16	.20
<i>Autonomy</i>											
Mean	—	-.23	-.03	-.43*	—	.17	-.02	.28	.03	-.07	.03
Variance	—	.12	-.05	.29	—	.06	.06	-.01	-.21	-.19	-.16
Minimum	—	-.28	.08 ^a	-.64*	—	.09	.03	.13	.08	.15	-.05
Maximum	—	-.01	.02	-.04	—	.01	-.26	-.20	-.11	-.17	-.11

$r_{Barrick}$ = correlations found in the Barrick et al. (1998) study ($N = 51$); $r_{This\ study}$ = correlations found in this study ($N = 49$) with correcting for team size and sample (US drilling teams and Dutch student teams); r_{Drill} = correlations found in the US drilling teams ($N = 24$); r_{Studs} = correlations found in the Dutch student teams ($N = 25$).

^aCorrelations significantly differ between our sub-samples.

^bCorrelations significantly differ between the Barrick et al. sample and this sample.

** $p < .01$ (one-tailed); * $p < .05$ (one-tailed).

TABLE 3
Regression results for testing whether task cohesion mediates the relationship between personality and team performance ($N = 49$)

	<i>b</i>	ΔR^2	Total R^2
Conscientiousness model 1 (task cohesion)			
Controls		.017	.017
Conscientiousness (minimum)	0.523**	.148**	.165*
Conscientiousness model 2 (team performance)			
Controls		.013	.013
Conscientiousness (minimum)	0.737**	.124**	.137*
Conscientiousness model 3 (team performance)			
Controls		.013	.013
Task cohesion	0.193	.067*	.080
Conscientiousness (minimum)	0.619*	.072*	.152

b = unstandardized regression coefficients.

** $p < .01$ (one-tailed); * $p < .05$ (one-tailed), for *t* values (for unstandardized regression coefficients) or *F* values (for overall model).

for optimal (team) performance individuals need to comply with rules and regulations and need to help one another (see, e.g., Borman & Motowidlow, 1993; Organ, 1988, 1997; Van Dyne & LePine, 1998; Van Scotter & Motowidlow, 1996).

Our results for task cohesion show that the mean and minimum level of agreeableness and conscientiousness contribute positively to task cohesion in teams. Furthermore, the negative (but not always significant) relationships between the variance measures for all personality dimensions suggest that homogeneity in personality contribute to task cohesion.

As in previous studies, we have found that team processes affect team performance. Surprisingly, in the drilling teams social cohesion was more strongly related to team performance than task cohesion. This result could be explained by the specific circumstances of the job. For some projects, these teams had to work and live together at a site that was located quite far from their own homes. Under such work conditions, social cohesion might be highly important for team performances, because team members have to rely on each other not only during their working hours but also after that.

We assumed that personality composition of teams would indirectly influence team performance through its contribution to team processes. We did not find, however, any evidence for the mediating role of group cohesion. This implies that the specific part of the variance in team cohesion that can be explained by the team's personality composition is not the part that is responsible for the variance in team performance. Of course, team processes and team performances are not only affected by the personality composition of the team, but also by other factors such as work conditions and the behaviour of leaders.

This study revealed that some results varied across samples (see Table 2). Samples co-varied in terms of tasks (production teams and research teams) and cultural background (the US and The Netherlands). Moreover, some teams operated on a temporary basis whereas others were established for a longer period of time. These differences could be perceived as a limitation of this study, because sample variability restrains the possibility to replicate the findings of previous studies. We would like to emphasize, however, that our approach offered us the possibility to examine which results are more robust across (rather) different types of teams and which results are more vulnerable to team and context characteristics. Relatively robust results were found for the relationships between team performance and the personality composition measures of conscientiousness and agreeableness. The effect of personality composition measures of extraversion and emotional stability on team performance, however, appeared more contingent upon content of the team task and/or other team characteristics. Also, relatively robust results were found for the relationships between social cohesion and mean levels of extraversion and emotional stability, whereas the results with the personality composition measures of conscientiousness and agreeableness were affected by characteristics of the team task or context.

A limitation of this study is that the average team size in the drilling teams and the student teams was rather small compared to the team sizes in the Barrick et al. (1998) study. This may have caused smaller team variances on personality measures, which reduced the possibility of finding significant results for the homogeneity measures. Furthermore, a ceiling effect may have occurred (i.e., only teams with low minimum scores can have a large variance) which probably has caused relatively high interrelations between some of the personality composition measures. Future studies should focus on larger teams and on important moderators such as team tasks.

Our findings have implications for research on similarity and heterogeneity in teams and organizations. The person–organization fit literature and literature on similarity and interpersonal attraction stress homogeneity to be important, especially for affective outcomes (Kristof, 1996; Van Vianen, 2000). Other theoretical accounts, however, have been advanced indicating that heterogeneity in teams is functional to team performance (for a review, see O'Reilly & Williams, 1998). The current results provide some evidence for the homogeneity hypothesis but not for the heterogeneity hypothesis. Variance in personality seems negatively related to task cohesion, but variance in personality is hardly related to team performance. Thus, homogeneity appears to contribute partly to task cohesion while homogeneity or heterogeneity does not contribute to team performance.

It is important to note that the current results pertain to homogeneity in terms of personality, while other research considered homogeneity in terms of demographic variables (e.g., age, gender, level of education). Together, these

findings indicate that homogeneity in personality within teams may be quite functional to group processes. Homogeneity or heterogeneity in personality may be relatively unimportant for team performance. In light of this, it is interesting to note that organizations display a tendency to select members that are similar to one another, and to expel members dissimilar to the organization (Schneider, Smith, Taylor, & Fleenor, 1998). At least in terms of personality composition, current results indicate that if this tendency also accounts for teams this may be quite fruitful as it comes to establishing high levels of task cohesion.

Taken together, the current study corroborated many of the conclusions advanced by Barrick et al. (1998). The results indicate that organizations should compose their teams with individuals who show satisfactory levels of conscientiousness and agreeableness, as this will contribute positively to task cohesion and team performance. Too many autonomous members in a team could be detrimental for team performances, but this depends on the team's tasks. Also, team members' levels of extraversion and emotional stability are relevant for only some types of teams and most of all for their social cohesion. This study highlights the importance of task characteristics of teams for examining personality in teams and its relationship to team processes and performance.

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