

The Effects of Extraversion and Expertise on Virtual Team Interaction and Performance

Pierre A. Balthazard
School of Management
Arizona State
University West
Email: pb@asu.edu

Richard E. Potter
Department of Information
and Decision Sciences
College of Business
Administration
University of Illinois at
Chicago
Email: rpotter@uic.edu

John Warren
Department of Information
and Decision Sciences
College of Business
Administration
University of Illinois at
Chicago
Email: jwarre3@uic.edu

Abstract

This paper investigates the effects of extraversion and team member expertise on virtual team interaction and performance. Sixty-three virtual teams of professional managers participated in an intellectual decision making task using a web-based conferencing tool. The results revealed level of extraversion to be positively and significantly correlated with the aggressive and constructive interaction styles. Differences in extraversion levels within virtual teams was positively and significantly correlated with a passive interaction style and negatively and significantly correlated with solution acceptance and perceived effectiveness. Average expertise was negatively and significantly correlated to the constructive interaction style and team errors. Average expertise also correlated highly and positively with the best member's expertise.

In virtual team settings, extraversion was found to promote effective team interactions; teams with lower variances in extraversion did best, especially in teams with good knowledge to start off with. However, for the most part, group styles, and not individual personality or expertise, have predictive power on performance outcomes.

1. Introduction

One approach to improving virtual team performance is to identify characteristics that differentiate low performing FTF teams from high performing FTF teams and then determine if virtual

teams also have these characteristics. If they do, and if those characteristics can be properly managed, virtual teams may enjoy increases in performance similar to those realized with FTF teams.

Interaction style has been shown to have a great effect on conventional work teams' ability to achieve solution quality and solution acceptance [8,33]. Group interaction styles affect communication and thus team performance by facilitating or hindering the exchange of information among group members. These styles reflect an aggregation of communication traits of individual team members, rooted in their individual personalities. Recent research by Potter, Balthazard and Cooke [26] revealed that the interaction styles produced similar results in virtual teams. Among the issues requiring further study is how different constellations of personality types manifest into team interaction styles. The practical implication of this research is that it may be possible to predict virtual team interaction style from an assessment of the personalities of its individual members. Once the interaction style can be predicted, the effectiveness of the team's performance on certain types of tasks can also be predicted, and managed proactively. Below we elaborate on interaction styles, personality, and their manifestations and effects in the FTF and virtual team environments. After this background we present a study that examines the relationship between measures of one of the personality factors (extraversion) that a group's members possess, and the interaction style that the group exhibits.

2. Background

2.1 Interaction styles, expertise, and team performance

Communication is a fundamental behavior of conventional (FTF) teams [25]. However, members of problem-solving teams face two types of pressures in achieving quality solutions and high solution acceptance [19]. On the one hand, there is pressure on each member to contribute unique, and possibly controversial, information to maximize the team's resources. On the other hand, members of teams tend to believe that closure to team problem solving and strong solution acceptance are best achieved through conformity of opinions [10,24]. The way in which a team deals with the conflicting "task" and "maintenance" pressures is reflected in the team's *interaction style*. Watson and Michaelsen [33] showed that a team's interaction style affects performance.

Building on the Watson and Michaelsen typology and others [19], Cooke and Szumal [9] showed that group interaction, aggregated from stable personality factors of the individual group members, can be categorized as constructive, passive, and aggressive styles. The *constructive style* is characterized by a balanced concern for personal and group outcomes, cooperation, creativity, free exchange of information, and respect for others' perspectives. The *constructive style* enables group members to fulfill both needs for personal achievement as well as needs for affiliation. The *passive style* places greater emphasis on fulfillment of affiliation goals only, maintaining harmony in the group, and limiting information sharing, questioning and impartiality. The *aggressive style* places greater emphasis on personal achievement needs, with personal ambitions placed above concern for group outcome. Aggressive groups are characterized by competition, criticism, interruptions, and overt impatience.

Group interaction style is theorized to affect performance because it can impede or enhance team members' ability to bring their unique knowledge and skills to bear on the task, and the extent to which they develop and consider alternative strategies for approaching the task [1]. This is particularly critical for groups with heterogeneous levels of expertise, as communication by most expert group members is positively correlated with group performance. Zalesny [36] found that the most accurate member in interacting groups did not influence performance unless he or she was assertive and confident. Bottger [5] also found that amount of communication time and expertise were positively correlated with performance, though only with high-performing groups. In their

study of estimation methods for individual/team performance differences, Cooke and Kernaghan [6] found that average individual scores explain an average of 57% of the variance in team scores. They also noted that the expertise of the best member contributes significantly to the team score, above and beyond the average individual score, with both factors together explaining an average 69% of the variance in team score performance. Group performance has usually been found to inferior to that of the best individual, and typically, groups perform better than the average of their individual members and worse than their best individual member [13,18,35].

Groups whose interactions are characterized by a dominant style achieve different levels and patterns of effectiveness. Specifically, predominantly constructive groups produce solutions that are superior in quality to those produced by passive groups and superior in acceptance to those produced by either passive or aggressive groups. Predominantly passive teams produce solutions that are inferior in quality to those of constructive (and sometimes aggressive) groups and inferior in acceptance to those of constructive groups. Similarly, groups with predominantly aggressive styles produce solutions that are not as consistently of high quality as those generated by constructive groups but not as consistently of low quality as those produced by passive groups. The solutions produced by aggressive groups generate less overall acceptance than those developed by constructive groups and about the same level of acceptance as those generated by passive groups [9].

Communication quality is also emerging as a key determinant of virtual team performance. Recent studies show that communication characteristics including high frequency, initiation of contact, positive tone, and appropriate feedback style are key to establishing "swift" trust, and that swift trust has a significant positive effect on team performance [17]. Maznevski and Chudoba [20] found that successful distributed teams developed a rhythm in media choice, using both FTF and CMC meetings when each was deemed appropriate. The successful teams' communication was characterized by higher message frequency, positive tone, and appropriate feedback. Building on research that examined information exchange in FTF teams [27], Hightower and Sayeed [12] found information exchange to be positively linked to distributed team performance on an intellectual decision task. Tan et al. [29] found information exchange positively related to distributed team performance on a preference task. Warkentin, Sayeed, and Hightower [31] found that perceptions of shared norms and expectations of task process were types of relational links positively related to a higher

level of team cohesion and information exchange in computer-supported distributed teams.

Cooke and Szumal [8] developed an instrument that can reliably assess interaction styles of FTF groups. It is a self-report survey that solicits post task feedback from team members on their perceptions of team interaction (we give a more complete description later). Potter, Balthazard, and Cooke [26] validated a web-based version of the Cooke and Szumals' (1994) interaction style assessment tool. A series of experiments with distributed teams showed that team interaction via CMC did not significantly interfere with the expression and perception of individual interaction characteristics. The computer-supported communication medium (described below) did not interfere with team members' ability to accurately assess their team's interaction style. The virtual teams used in those studies all exhibited interaction styles, and the effects of those styles on team decision performance and process outcomes were directionally consistent with those commonly found with FTF teams.

2.2 Personality Factors and Team Performance

Individuals working in teams each bring something to the team that affects the way that the team interacts. This "something" consists of the personalities exhibited by each team member. Hoyle and Crawford [16] asserts that the analysis of a group or work team should include what the group member brings to the group. Research indicates that there is a complex and profound relationship between personality and job performance [3]. Also, many companies use personality assessment tools (e.g., Myers – Briggs) to assist in hiring decisions and work assignments of its employees.

Five personality factors have been identified that constitute the fundamental dimensions of personality [14,22]. These dimensions/factors are extraversion, agreeableness, conscientiousness, openness and neuroticism. The five factors represent bipolar dimensions of personality and provide a broad, yet inclusive and empirically tested way of looking at personality in the work environment [4,14]. McCrae and John [22] investigated the history and evolution of the model and concluded that all five factors were shown to have convergent and discriminant validity across instruments and observers.

2.3 Extraversion and Team Performance

Extraversion refers to the degree to which individuals are gregarious, friendly, complaint,

cooperative, nurturing, caring and sympathetic versus introversion, which is characterized by those who are shy, unassertive, and withdrawn. Extraverts are usually active participants in group interactions and often have high intragroup popularity [4]. Barrick and Mount [3] found that extraversion and conscientiousness were the two personality factors that consistently related to success in the work place. They concluded that extraversion correlates positively with individual performance in jobs involving social interaction. Barry and Stewart [4] found that at the individual level, extraversion was the "key" personality correlate with individual impact on group performance. At the group level the proportion of high extraversion members in a group was found to be curvilinearly related to group processes and performance [4].

Individuals exhibiting extraversion personality characteristics were found to be dominant in both FTF and CMC groups [27]. Similarly, in a study involving extraverts and introverts in traditional FTF meetings and a virtual environment, all participants contributed more original solutions in the virtual environment, compared to the FTF. Although there were more comments in the FTF setting, overall, the extraverts had more comments in both environments [34].

Two ways in which extraversion could be linked to group interaction are based on the nature of extraverted individuals and their behavior characteristics. Extraverted persons have strong tendencies to be articulate, expressive, and may be able to persuade and influence others [32]. An important behavioral characteristic of extraversion is dominance [30]. House and Howell [15] describes dominance as a tendency to "take initiative in social settings, to introduce people to each other, and to be socially engaging by being humorous, introducing topics of discussion, and stimulating social interaction" (p. 85).

The proportion of group members that are high in extraversion may be related to the groups' interaction style, which in turn, relates with group performance. Barry and Stewart [4] found that the proportion of high-extraversion group members was related curvilinearly to task focus and group performance. Too few extraverts can result in low performance whereas too many extraverts can lead to a decrease in group performance due to the group's lessened ability to remain focused on task completion [22]. Two possible reasons are: 1) extraverts may be more concerned with pleasurable social interactions than task completion [4] and, 2) too many extraverts may result in intra-team conflict. Recalling that one of the characteristics of extraverts is dominance, conflict can occur when there are too many dominant individuals [21].

To summarize, previous research shows that while expertise is positively related to team performance, it will be only so long as the team exhibits an interaction style that permits the expertise to be heard, considered, and when possible, improved upon. The presence of extraverted team members is conducive to this process only if those members place high value on social rather than task-related processes. As extroverts commonly display dominance both in the FTF and virtual settings, expertise held by nonextroverts is likely to be suppressed, yielding lower information sharing, lower performance, and lower satisfaction with process. Even if the expertise is held by extroverts, dominated introverts will likely feel less free to contribute and improve upon the knowledge, yielding lower performance as well as lower satisfaction with the team process.

2. Hypotheses

H1 Levels of group extraversion and differences in extraversion between virtual team members will influence the development of group interaction styles and process outcomes.

H1(a) Extraversion will be positively related to aggressive and constructive interaction styles.

H1(b) Extraversion will be positively related to measures of solution acceptance and effectiveness.

H1(c) Differences in extraversion between virtual team members will be positively related to the passive interaction style and negatively related to constructive interaction style.

H1(d) Differences in extraversion between virtual team members will be negatively related to measures of solution acceptance and effectiveness.

Rationale: Group deliberations with gregarious, friendly, cooperative, and nurturing individuals suggest that there will be active participation in the virtual setting. However, extraversion does not necessarily balance both needs for personal achievement and group outcomes. Extraverts with needs for affiliation will create an atmosphere suited for a constructive interaction style. Extraverts without concern for the group outcome will be perceived as more aggressive than constructive by their peers. These two behavioral extremes also suggest that there is no linear relationship between extraversion and passive interaction styles.

A large difference in extraversion within one experimental virtual team indicates that only one member of the team is a true extravert or that the team is truly bi-polar -- suggesting friction between the personalities. Since the (minority) aggressive behavior begets a (strong) passive response and that small

number of extraverts cannot produce constructive interactions by themselves, we postulate that a passive interaction style will prevail with a significantly lower incidence of constructive interactions.

Introverts will not produce the type of interactions that team members would find effective. Consequently, "buy in" the solution would be equally difficult. Groups with many extraverts will produce a fulfilling discussion that, although might not produce an optimum solution, would produce "buy in" and be evaluated as effective by the membership. The behavioral friction of a bi-polar team suggests that, even though the solution might be of high quality, there will not be much solution acceptance or perceived effectiveness in those teams.

H2 Levels of expertise in a virtual team will influence the development of group interaction styles and (objective) performance.

H2(a) Expertise will be negatively related to the constructive interaction style.

H2(b) Expertise will be negatively related to team errors.

Rationale: Intuitively, low amounts of expertise lead to large amounts of team errors and high levels of expertise will minimize the team errors. Knowledgeable teams have better quality information shared among several participants. Thus, through straightforward information exchanges (even those with limited or poor group dynamics), those virtual teams have a greater potential to create a better solution. However, the greater the knowledge in the group, the more difficult it will be to produce a "synergistic" outcome -- one with significantly less errors than the solution proposed by the best individual in the group. Teams with limited expertise will also find it difficult to outperform the best since the knowledge does not exist to do so. However, the potential exists for large improvements in performance.

Counter-intuitively, we postulate that large amounts of expertise will result in a less-than-constructive interaction style because, without appropriate training, members will not naturally attempt to improve his/her own knowledge. Alternatively, lower amounts of expertise will lead to better interactions since participants will seek knowledge but the lack of knowledge will ultimately limit the potential of the group.

H3 Expertise from the best member on a virtual team will influence group expertise and (objective) performance.

H3(a) The expertise of the best member will be positively related to group expertise.

H3(b) The expertise of the best member will be negatively related to team errors and team synergy.

Rationale: These hypotheses are intuitive also. The knowledge of the best member in a virtual group is, by extension, a component of the group knowledge. Higher levels of knowledge will improve the potential for producing a good solution. However, the greater the score of the best individual in the group, the more difficult it will be for the group to outperform him/her. We do not expect a relationship between knowledgeable individuals and an extraverted personality. Since group interaction style is more a function of personality traits than knowledge and that the virtual setting attenuates the personality of the individuals, we do not expect the best member to influence the development of a predominant group interaction style. We use the same argument with respect to the influence of the best member on process measures -- it is not a function of knowledge.

H4 The expertise and personalities of individuals are aggregated within the team into a group interaction style to produce performance and process outcomes, that is, the importance of interaction style as a predictor of objective and process performance will be significantly more important than specific estimates of knowledge and/or personality.

Rationale: Like individuals, virtual teams have distinct "personalities" (styles of interaction) and potential (available expertise). These group interaction styles are a reflection of a complex interaction between participant characteristics at the individual level and process and personality synergies and losses at the group level. Like people's personalities, group styles can be positive and effective, leading to high-quality solutions to which members are committed. Or they can be negative and defeating, leading to solutions of marginal quality and acceptance.

We postulate that the resulting predominant interaction style within the virtual team will be a much greater predictor of group outcomes than measures derived from its members.

3. Method

3.1 Participants

Extraversion, group interaction style, performance and process outcomes data were collected from 248 members of 63 groups who had completed the Internet version of the "Ethical Decision Challenge" [2]. Subjects were executive MBA students and mid-level managers. The median

number of participants per team was four with 14 three-member teams, 39 four-member teams, and 10 five-member teams. All participants reported to be highly computer literate with respect to the technologies in use within the computer-mediated exercise (Windows, a browser, e-mail, chat room).

3.2 Task and technology

The Internet version of the "Ethical Decision Challenge" requires participants to rank ten biomedical and behavioral research practices—all of which involve human subjects—in terms of their relative permissibility and acceptability [2]. Solutions to the "Ethical Decision Challenge" were developed and posted via an ASP input form, first on an individual basis and then as a group. Individual and team solutions were then compared to experts' solution based on the decisions of over 800 Institutional Review Board (IRB) members who are responsible for reviewing proposals for research involving human subjects. Comparisons between individual solutions and the experts' solution indicate how well participants are exercising their knowledge, experience, and skills with respect to ethical analysis and complex problem solving in a distributed environment. Comparisons between participants' individual scores and their team's score indicate whether they were able to achieve team synergy by fully using and building on their collective knowledge and skills [6]. In other words, the team's score should be better than any individual score if team synergy were achieved.

Participants were introduced to the "Challenge" during a regular 90-minute class meeting. Each randomly selected team was asked to provide a team name and select a team secretary. The participants were provided with the URL of the home page for the exercise and directed to the problem statement. Each participant was given a first 10-minute block to read the situation and a second 10-minute block to rank 10 items (e.g., permissibility and acceptability of 10 behaviors). Groups were then given up to 45 minutes to discuss the problem (exclusively on the Internet) and provide the best possible consensus ranking of the items—a ranking with which all group members could "live with". Team members were segregated among several dispersed computer laboratories within the large urban campus and were closely observed to eliminate verbal communication and non-verbal cues (with anyone regardless of team membership). All of their discussion was to take place in writing within the "conference" and "chat" features of FirstClass®, a web-based communication tool and course management software used extensively by the participants in other work. Each

team was provided with its own password-protected work area. We allotted 45 minutes to the test, all FTF teams completed the task within 25 minutes and all distributed teams completed the task within 34 minutes.

Upon achieving a consensus solution, the team's secretary registered the ranking by submitting a Web form. Last, each member independently completed two questionnaires: (1) The *Group Style Inventory*TM (GSI) [1], was answered immediately by all participants. (2) A group process questionnaire (that required some comprehensive essay answers) that assesses satisfaction with the process and "buy-in" into the consensus solution was answered after the session but within 48 hours of the completion of the session. Both questionnaires were answered after ranking the items as a group but before receiving feedback on the "experts' rank" or the quality of their own or team solution.

3.3 Measures

The "Average (Individual) Expertise" measure represents the average of the absolute difference between individual solutions and the expert's solution. Since this is an *error* score, we reverse the sign to create an *expertise* measure. At the individual level, the higher the score (ideally 0), the greater the consistency between each participant's solution and the expert's solution. Participants with low initial scores were most likely to have considered the implications of their decisions on all the stakeholders within the simulation problem. More generally, individuals with well-honed task skills -- such as extensive knowledge, experience, or skills in ethical analysis (here) and/or complex problem solving -- will have the best (higher) scores. At the group level of analysis, higher scores indicate teams with better *potential* for performance.

From individual expertise we derive "Best Member Expertise" as follows. The best member's score is the lowest individual error score achieved by a member of the virtual team. Since it is an error score, we again reverse the sign to create an expertise measure -- where a score of 0 is perfection. This measure provides another standard or benchmark for analyzing the team's performance.

Two measures of solution quality were derived for each team. The first, "Team Error," represents the absolute difference between the team's consensus solution and the expert's solution. Being an error score, a low team score represents good solution quality and general agreement with the expert's solution. Groups with relatively few errors in their solutions are more likely to have considered the implications of their decisions on all the stakeholders

within the simulation problem. A low team score can be the result of high-quality group interaction, but it can also be achieved when members have significant task skills and knowledge (as reflected by the individual expertise measure discussed above).

Second, "Team Synergy," is computed by subtracting the team consensus score from the best member's score. If the team's *error score* is *lower* than the best member's error score, the difference represents a gain in quality over the best member's initial solution; if the team's error score is *higher* than the best member's score, the difference represents a loss in quality.

Process loss is indicated when better solutions are developed by members working alone rather than as a group. It occurs when the group interacts and approaches problems in ways that either prevent members from sharing relevant knowledge and information or from recognizing and using relevant knowledge and information when it is offered.

In contrast, when groups outperform even their best-scoring members, they have achieved synergy. Synergy is evident when the results produced by a group of people working interactively exceed those that are achieved when members work independently. A team score that is better than the initial score of any of its members cannot be explained by initial task ability or knowledge; rather, such performance are due solely to the quality of interaction, communication, and learning within the group.

At the start of the course or professional seminar in which they were enrolled, several weeks prior to the exercise, individuals participating in the study completed a 50-statement "five factor" instrument. Respondents judged the accuracy of each sentence as a description of self on a 5-point response scale. Within the instrument, 10 items are intended to represent each of the five personality dimensions that comprise the five factor model --extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience [4,22]. The answers to the 10 extraversion items were summed to form a single individual measure (Cronbach alpha = .86).

We then determined the overall levels of extraversion within each team by averaging the scale scores of individual members. Another group level extraversion measure captures the difference in extraversion scores for each member (operationalized as the standard deviation of extraversion in each team).

To assess a group's interaction style, participants answered the GSI which contains 72 questions that focus on the ways in which members of a group might interact with one another and approach their task during a meeting or specific problem-solving

session [9]. After the "Ethical Decision Challenge," participants completed the questionnaire by indicating the extent to which each item described the style of their group using a five-point response scale. The answers to 24 items that assessed the aggressive interaction style were summed to form a single measure ($\alpha = .87$).

Another 24 items that assessed the constructive interaction style were also summed to form a single measure ($\alpha = .93$). The last set of 24 items that assessed the passive interaction style were also summed to form a single measure ($\alpha = .84$).

The overall levels of aggressive, constructive, and passive interaction styles within each team were then computed by averaging the scale scores of individual members. Justification for the aggregation of our measures to the group level is discussed below.

Two measures of process performance were derived for each team: "Solution Acceptance" and "Effectiveness." Perceived effectiveness of the process was measured by asking participants on the post-task questionnaire to rate three sentences that dealt with group effectiveness and satisfaction with the group process.

Responses to each of these items, which ranged from (1) *not at all* to (5) *to a very great extent*, were summed for each team member ($\alpha = .79$). High scores along this scale therefore reflect a high degree of satisfaction with the process in the group. The overall level of satisfaction within each team then was computed by averaging the scale scores of individual members.

Member acceptance of the group's decision (Solution Acceptance) was measured by three supplementary questions included in the group interaction questionnaire. The questions were adapted from the work of Cooke and Lafferty [7]. Responses to each of these items, which ranged from (1) *not at all* to (5) *to a very great extent*, were summed for each team member ($\alpha = .72$). High scores on this scale therefore reflect a high degree of solution acceptance in the group. The overall level of member acceptance of the group's decision (Solution Acceptance) within each team then was computed by averaging the scale scores of individual members.

4. Analysis

The hypotheses were tested two ways. First, correlations were computed among the different measures. The correlations provide an indication of the direction and magnitude of the relationship between the expertise, extraversion, group styles, and solution quality measures.

Second, 2 sets of multiple regression analyses were performed to define the relative importance of each measure as a predictor of outcomes. In the first set, aggregated expertise and extraversion measures were the independent variables and group interaction styles, objective performance measures, and process outcome measures were the dependent variables.

The second set of multiple regressions -- with average expertise, extraversion, variance in extraversion, and group interaction styles as the independent variables and the performance and outcome variables as the dependent variables -- was used to examine hypothesis 4.

Also, since the group interaction style measures defined earlier are expected to be distinct but interrelated, correlational and regression analyses were performed on the aggregated (group mean) factor scores obtained from a principal components analysis with varimax rotation on the 248 individual members' responses aggregated to the three orthogonal factors representing aggressive, constructive, and passive group interaction styles. The Kaiser-Meyer-Olkin measure of sampling adequacy was .87 and appropriate item loading behavior was observed, suggesting that factor analysis approach would be appropriate to insure independence of the measures.

5. Results

The correlational analysis shows (Table 1) that extraversion is positively and significantly correlated with the aggressive and constructive interaction styles (H1a) in virtual teams. At the $p < .10$ level, there is a positive correlation between extraversion and perceived effectiveness of the group (partial support for H1(b)). The predicted relationship between extraversion and solution acceptance in a virtual team did not materialize at a significant level.

Differences in extraversion within a virtual team is positively and significantly correlated with a passive interaction style (H1c) and negatively and

TABLE 1
Group-Level Means, Standard Deviations, and Correlations^a

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11
1. Average Expertise ^b	-23.5	3.65	n/a										
2. Best Member Expertise	-16.2	4.45	.61**	n/a									
3. Extraversion	3.50	0.33	.04	-.04	.86 ^c								
4. Variance in Extraversion	0.62	0.23	.03	.01	-.09	n/a							
5. Aggressive Styles (factor) ^d	0.01	0.65	-.07	.03	.21*	.02	.93						
6. Constructive Style (factor)	-0.18	0.63	-.27*	-.05	.30**	-.19+	.02	.94					
7. Passive Style (factor)	0.14	0.63	-.07	.03	-.06	.36**	-.14	-.03	.89				
8. Team Error ^e	20.46	5.29	-.49**	-.52**	.11	.07	.03	.05	.17+	n/a			
9. Team Synergy	-4.30	4.81	-.03	-.35**	-.08	-.09	-.07	-.01	-.21*	-.62**	n/a		
10. Solution Acceptance	3.46	0.49	-.10	.01	.11	-.23*	-.25*	.62**	-.22*	-.14	.16+	.72	
11. Effectiveness	3.71	.54	-.04	.03	.18+	-.22*	-.16+	.64**	-.36**	-.13	.11	.81**	.79

a. N = 63 teams.
 b. Personal expertise represents the numerical difference between the initial participant ranking and expert's rank. A score of 0 is best.
 c. Cronbach alphas appear on diagonal for scale measures.
 d. Factor scores used for interaction styles (for independence of measures).
 e. Team error represents the numerical difference between group consensus rank and expert's rank. A score of 0 is best.
 * p < .05; ** p < .01; + p < .10

TABLE 2
Group-Level Multiple Regression Analysis

Outcome	Average Extraversion	Best Member Expertise	Extraversion	Difference in Extraversion	R ²	F
Aggressive Style	-.16	.14	.22+	.04	.06	.093
Constructive Style	-.42**	.22	.31**	-.16	.23	4.20**
Passive Style	-.14	.11	-.02	.36**	.15	2.46*
Team Error	-.28*	-.35**	.12	.09	.34	7.38**
Team Synergy	.31**	-.54**	-.13	-.10	.20	3.63**
Solution Acceptance	-.17	.12	.10	-.22+	.08	1.26
Effectiveness	-.11	.11	.17	-.21+	.09	1.36

* p < .05; ** p < .01; + p < .10

significantly correlated with solution acceptance and perceived effectiveness (H1d). At the p < .10 level, we also see a negative relationship with the constructive interaction style (partial support for H1c).

The standardized betas generated in the multiple-regression equations for group interaction styles and process outcomes are consistent with these findings (Table 2). Extraversion is the most important of the factors, and extraversion, in concert with average expertise, have significant regression betas explaining the constructive style. The F statistic for the constructive style equation indicates that the variance explained by average expertise and extraversion is also significant. At the p < .10 level of significance, the standardized betas indicate a negative relationship between the difference in extraversion within a virtual team and the solution acceptance and effectiveness measures.

In support of hypotheses H2 and H3, the correlational analysis shows that average expertise is negatively and significantly correlated to the constructive interaction style (H2a) and team errors (H2b). Average expertise also correlates highly and positively with the best member's expertise (H3a). The best member's expertise is negatively associated with team errors and synergy in the virtual setting (H3b). The F statistic for the team errors equation indicates that the variance explained by average

expertise and best member expertise (34%) is significant. The F statistic for the team synergy equation indicates that the variance explained by average expertise and best member expertise (20%) is also significant.

The second multiple-regression analysis results (Table 3) pertain to hypothesis H4. Expertise in the group and a constructive interaction style are negatively and significantly related to team errors in virtual teams. There is a positive relationship between extraversion and team errors and between a passive interaction style and team errors.

Aggressive and passive interaction styles are negatively related to team synergy, and there is also a positive relationship between constructive interaction style and team synergy. There are no such relationships between synergy and the expertise and extraversion measures. Aggressive and passive interaction styles are negatively and significantly related to solution acceptance and effectiveness whereas the constructive interaction style is positively and significantly related to solution acceptance and effectiveness. In support of H4 the effects of expertise and extraversion on those process outcomes is quite small and more likely than not are zero in the population.

TABLE 3
Contributions to Group Outcomes: Multiple Regression Analysis

Outcome	Average Expertise	Extraversion	Difference in Extraversion	Aggressive	Constructive	Passive	R ²	F
Team Error	-.63**	.13+	.00	.06	-.17*	.10	.44	13.47**
Team Synergy	.01	-.12	-.08	-.19*	.15	-.16+	.13	2.47*
Solution Acceptance	.09	-.05	.02	-.36**	.59**	-.26**	.59	24.49**
Effectiveness	.06	.01	.00	-.20**	.66**	-.28**	.61	27.37**

* p < .05; ** p < .01; + p < .10

6. Discussion

6.1 Role of Group Styles, Expertise, and Extraversion

Group styles emerge and can be perceived/assessed by virtual team members [27]. Personality factors such as extraversion contribute to these styles. This research revealed that extraversion leads to constructive and/or aggressive styles and that differences in extraversion within a team lead to passive styles. Perhaps most important, we have shown that it is mostly group styles (and not individual personality or the expertise of one individual) that have predictive power on outcomes.

As predicted, expertise decreases team errors and promotes synergy. However, it is more difficult (but not impossible) for the team to outperform its most expert member. In addition, a high level of expertise leads to non-constructive behaviors.

Extraversion increases team errors. Variances in extraversion within virtual teams appear to trigger largely negative interaction characteristics. We predicted but could not find a significant relationship between extraversion and solution acceptance. But the right mix of extraversion and expertise is beneficial. To do well in either a virtual or FTF setting, there has to be adequate knowledge within the team and a willingness to share and build upon that knowledge base toward synergistic solutions that are superior to those of the best individual within a virtual team. We found that in virtual settings extraversion is an important personality trait to promote that interaction and that teams with lower variances in extraversion do best, especially in teams with good knowledge to start off with.

7. Conclusion

In virtual teams, the mix of expertise and personality traits does its work via the group interaction style it promotes. Organizations often collect personality data on its members and this information should be scrutinized when assembling a virtual team. We have presented a methodology that

can be used to assess individual personalities, expertise, and the interaction styles of virtual teams.

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