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THE INTERACTIVE EFFECTS OF EXPERTISE, EXTRAVERSION, AND AGREEABLENESS ON INFLUENCE AND DECISION QUALITY IN GROUPS

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THE INTERACTIVE EFFECTS OF EXPERTISE, EXTRAVERSION, AND AGREEABLENESS ON INFLUENCE AND DECISION QUALITY IN GROUPS

A DISSERTATION APPROVED FOR THE DEPARTMENT OF PSYCHOLOGY

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Abstract

Empirical studies have examined the effects of expertise and personality in group decision making. However, previous research has not examined these effects on influence and decision quality while using the group as the context for the individual. Consequently, two models were tested in which individual expertise affected influence on group decisions, with the relationship moderated by individual extraversion. In one model, this interaction is expected to be dependent on group extraversion, whereas in the other model the interaction is expected to be dependent upon group agreeableness. Three hundred and seventy six college undergraduates completed the Winter Survival decision-making task. The results were that expertise and extraversion were positively related to influence, but only in groups that achieved synergy. Moreover, the results showed that the effects of expertise and extraversion on influence were dependent upon group agreeableness, rather than group extraversion. Also, the interaction of influence and expertise predicted group decision quality. Results supported the importance of individual differences on group decision quality via influence. The results also support using a more nuanced approach to examine individual differences in groups rather than a group score such as a mean or standard deviation.

The Interactive Effects of Expertise, Extraversion, and Agreeableness on Influence and Decision Quality in Groups

Group members are often expected to work together in an attempt to generate solutions to problems that surpass the quality of the individual members' solutions. Prior research has examined the effects of expertise, extraversion and agreeableness in group decision making on influence and decision quality (Bonner, 2000; Bonner, Sillito & Baumann, 2007; Littlepage & Mueller, 1997; Littlepage, Schmidt, Whisler, & Frost, 1995; Mohammed, Mathieu & Bartlett, 2002; Newman & Wright, 1999). Researchers have commonly examined the effects of individual-difference variables by using group-level indices such as the mean, standard deviation, minimum, and maximum (e.g., Bell, 2007). The individual contributions of all members on the group decision-making process while using the group as the context are not often studied. Consequently, the processes through which expertise, extraversion, and agreeableness affect group decision making are not fully understood.

The research on expertise is fairly consistent in that a positive relationship exists between individual expertise and influence (Bonner et al., 2007; Bottger, 1984). Influence is the extent to which the group agrees upon and utilizes the contributions of an individual member (Littlepage & Mueller, 1997). The research on extraversion is also somewhat consistent in that there is a positive relationship between extraversion and influence (Bonner, 2000). Extraversion may also moderate the relationship between expertise and influence. Moreover, the group is the context for the individual; an individual's extraversion is relative to the other group members. Previous research has

not directly examined the effects of individual expertise and extraversion on influence while taking into account group extraversion.

The effects of individual expertise and extraversion may also be moderated by group agreeableness. Group agreeableness has a moderate positive relationship with team performance (Bell, 2007), and contextual performance (Mohammed et al., 2002). Groups may vary on willingness to compromise and receptiveness to information based upon their group agreeableness. Previous research has also not directly examined the effects of group agreeableness in relation to an individual group member's expertise and extraversion.

Therefore, the purpose of the present study was to more thoroughly examine how individual extraversion and expertise, and group-level extraversion or agreeableness affects the decision-making process using Hierarchical Linear Modeling (HLM). The use of HLM reflects a more fine-grained approach to examine the role of individual-difference variables in group effectiveness as compared to the more coarse approach of using group-level indices. Figure 1 shows the models tested.

Furthermore, in the present study, groups that achieved synergy were identified and separately analyzed to investigate if there are unique effects for these groups. Synergy occurs when the group decision is better than what any individual group member could produce alone (Hill, 1982; Larson, 2010). Social trait-relevant cues pertaining to the expectations about communication, team function, and an individual's effort (Tett & Burnett, 2003) may differ between synergistic and non-synergistic groups. Social trait-relevant cues arise during group interactions and moderate the relationship between personality and behavior (Tett & Burnett, 2003). Synergistic

groups may be more task focused and concentrate more on group performance and less on social and motivational aspects. Consequently, personality may have less of an effect in synergistic groups as compared to nonsynergistic groups.

Group Decision Making

Groups are often formed with the expectation that members bring their expertise to the decision-making process and have the advantage of pooling their collective resources, and therefore the final decision quality of the group should be higher than any individual's decision (Amason, Thompson, Hochwarter, & Harrison, 1995; DeChurch & Marks, 2001; Rogelberg, Barnes-Farrell, & Lowe, 1992). In other words, group potential is thought to be higher than the aggregate sum of the individual group members. Group members should be able to interact effectively and combine their expertise in a synergistic manner (Hill, 1982; Larson, 2010).

However, groups do not always exceed the performance of their average members and rarely surpass the performance of their most capable member (Hill, 1982; Larson, 2010). Groups are often expected to generate high-quality decisions, but this result is not always the case. The results of group decision making are often counterintuitive. Groups can generate poor decisions, reduce individual productivity, and cause member dissatisfaction and frustration (Amason et al., 1995). These negative outcomes stem from motivation and coordination losses which prevent groups from achieving synergy. Motivation and coordination losses include social loafing (Coskun, Paulus, & Brown, 2000), downward matching (Paulus & Dzindolet, 1993), and production blocking (Dennis & Valacich, 1994). Social loafing occurs as members do not exert the same effort in a group as they would in an individual setting (often due to

low accountability and low expectations for the value of their input). Downward matching occurs as group members reduce their input when they see other group members putting forth low effort. Downward matching, or the sucker effect, can often exacerbate social loafing. Production blocking occurs when only one individual can contribute to the group at a time and the other members are forced to wait to express ideas or opinions.

The Effects of Expertise on Influence

The results in much of the literature show that the greater the average expertise of the group the better the group outcome (Bell, 2007). Ideally, group members should be able to share their collective expertise and generate high quality decisions regardless of other effects. The disparity between low performing groups and high performing groups should therefore be able to be reduced by simply introducing a single more expert individual, but this may not always be the case. If the other group members do not recognize the expertise of their best member, then those contributions may be undervalued or underutilized (Littlepage & Mueller, 1997; Littlepage et al., 1995). The expertise of the individual may not benefit final group outcomes if the expert has no influence. The amount of influence that an individual has within a group may relate to the extent with which they are perceived as having expertise.

Bottger (1984) conducted a study in which participants completed the NASA moon-survival task, a task that requires participants to rank order 15 items necessary for survival after a crash landing on the moon. Participants completed the task both as individuals and in groups. Expertise was calculated by taking the absolute differences between individual rankings and correct responses. Influence was calculated by taking

the absolute difference between individual item rankings and group item rankings, similar to the present study. Results were that actual expertise and influence were significantly correlated, $r = .58$ (Bottger, 1894), although this correlation may be spuriously high because there was no adjustment for the nonindependence of observations. Similar results were expected in the present study in that the expertise of the individual is expected to predict influence, but by accounting for the nonindependence of observations, the relationship was not expected to be of the same magnitude.

Bonner and colleagues (2007) examined the effects of perceived expertise and actual expertise on influence. Participants responded to estimation questions. An example item was, "What is the population of the United States?" (Bonner et al., 2007). Perceived expertise was measured using a short questionnaire in which participants rank ordered all group members. Actual expertise was measured using the similarity between individual responses and correct responses. Influence was calculated using the similarity between group estimations and individual estimations. Results were that perceived expertise did not affect influence, but actual expertise did affect influence. The authors concluded that expertise may affect influence and be beneficial to the group decision-making process, even if the expertise is not explicitly recognized. Therefore, based on these studies the following hypothesis was tested.

H1: Individual expertise will be positively related to influence.

The ability of group members to utilize the expertise of an expert member still may be dependent upon their ability to first recognize expertise (Littlepage et al., 1995; Littlepage and Mueller, 1997). The expectation-states theory by Berger and colleagues

(Berger, Cohen & Zelditch, 1972; Berger, Fisek, Norman & Zelditch, 1977; Berger, Rosenholtz, & Zelditch, 1980; Berger, Webster, Ridgeway, & Rosenholtz, 1998) considers two types of cues utilized when determining expectations about competency, ability, and social value which can be specific and diffuse. Specific status characteristics directly pertain to a given situation such as task-related experience, whereas diffuse status characteristics pertain to non-task relevant factors such as demographic characteristics or behaviors consistent with implicit theories of leadership, such as a firm handshake or giving task-related directions. Both specific and diffuse status characteristics have been shown to predict influence in groups (Bunderson, 2003). For example, Thomas-Hunt and Phillips (2004) examined the effects of gender and expertise when predicting influence. They found that women that were expert in all female groups were less influential than their male counterparts in all male groups. The effects of personality variables such as extraversion and agreeableness may be similar to gender in that they may alter the relationship between expertise and influence.

Expertise, Extraversion, and Influence

Extraversion is the extent to which an individual is talkative, outgoing, assertive, or articulate (Goldberg, 1990). One way for an individual to be influential in the decision-making process is to merely speak more often than the other group members (Littlepage & Mueller, 1997). Extraversion may increase the amount of communication within the group, but may not lead to improved overall group performance (Driskell, Goodwin, Salas & O'Shea, 2006). An extraverted individual may contribute more to the discussion, but it may be at the cost of limiting the input from other members, which is a chief component of production blocking. Production blocking may be especially

problematic if the more extraverted yet less expert individuals are blocking the input of more expert group members. If an individual member dominates the discussion, the relative contributions of the other group members may decrease. Indeed, extraversion has been shown to affect the amount of influence that an individual has within a group in the absence of other information about expertise (Bonner et al., 2007). Individual group members that are expert may need a certain level of extraversion so as to communicate effectively and demonstrate their expertise. As previously mentioned, extraversion can be measured in absolute terms or relative to other group members, yet the existing empirical research has not typically utilized the group as a context.

Bonner (2000) conducted a study assessing the effects of extraversion on influence in ambiguous tasks. Participants were instructed to identify an ambiguous piece of artwork based on limited information both individually and as a group. Participants were then rank ordered based on extraversion. Influence was scored as a dichotomy of whether the individual response was adopted as the group response or not. The authors used ANOVA and chi-squares for the analyses and the results were that those that were the most extraverted within their group did exert the most influence in the absence of a pre-existing majority (Bonner, 2000). Brown concluded that in the absence of a majority those with higher levels of extraversion will be more influential than those with lower levels of extraversion within a group.

Perceptions of expertise may be as important in group decision making as actual expertise (Thomas-Hunt & Phillips, 2004). The influence of individuals may be lessened despite their expertise if they do not effectively communicate with the other

group members. Therefore, the final amount of influence of an individual group member may be the result of an interaction between their extraversion and expertise.

Littlepage and colleagues (1995) conducted a study in which a mediated model of group decision making was tested in that perceived expertise mediated the relationship between talking and influence, and talking mediated the relationship between extraversion and perceived expertise. Groups completed the Desert Survival Situation and were scored on their expertise, extraversion, influence, and talking. Expertise was calculated using the sum of the absolute differences between individual rankings and the correct rankings for each of 15 items. Influence was calculated using the sum of the absolute differences between individual rankings and group rankings for each item. A structural equation model of influence in which perceived expertise mediated the relationship between talking and influence, with actual expertise related to perceived expertise, was supported (Littlepage et al., 1995). The authors concluded that if expertise is not made obvious then group members may rely on other cues such as talking to infer expertise.

Extraversion may help make one's expertise more salient to the other group members, but this effect will be attenuated if the other group members are also extraverted. In groups where the extraversion of the individual is equal to the extraversion of the other group members (i.e., high individual extraversion-high others' extraversion and low individual extraversion-low others' extraversion) extraversion may not contaminate the group decision-making process. That is, the amount of information sharing should be equal for the more expert member and not hindered by other group members speaking over the more expert member. Groups that have the

more expert member being less extraverted may not benefit from the expert's recommendations if the individual's ideas are not heard or attended to due to an inability to communicate effectively. The result would negatively affect both the expert's influence and overall group decision quality. Whereas when the more expert members are also more extraverted, the ideas and recommendations may be better attended to as the experts are able to assert themselves in an effective manner and positively affect both their influence and overall group decision quality. Previous research has not been conducted that examines the interaction between expertise and extraversion while taking into account group extraversion. In the present study, the interaction of extraversion and expertise was examined, but the extraversion of the other group members was also included. Littlepage et al. (1995) did not test interactions between group- and individual-level variables. In the present study, the effects of extraversion were expected to be in the form of moderation and not mediation as in Littlepage et al. (1995). A question that may therefore remain is how group-level extraversion affects individual influence? Consequently, the following hypotheses were tested.

H2: Extraversion will moderate the relationship between individual expertise and influence. Specifically, the higher the extraversion of the individual, the larger the relationship will be between expertise and influence.

H3: There will be a three-way interaction between individual expertise, extraversion, and group extraversion in relation to influence. Specifically, the two-way interaction between individual expertise and extraversion will be larger when group extraversion is low.

Expertise, Extraversion, Agreeableness, and Influence

Alternatively, group agreeableness may moderate the relationships individual expertise and extraversion have with influence. Agreeableness, or the extent to which an individual is considerate, friendly, cooperative, and willing to compromise (Goldberg, 1990), may affect the group decision-making process. Agreeable groups are more likely to engage in social and motivational behaviors than disagreeable groups (Mohammed et al., 2002), and there is a positive relationship between group agreeableness and group performance (Bell, 2007; Mohammed et al., 2002; Newman & Wright, 1999). However, agreeableness in groups has not previously been studied in regards to individual expertise and extraversion on influence during the decision-making process. Groups that are generally highly agreeable discuss more opposing views when a disagreeable member is present (Wang, Chen, Tjosvold & Shi, 2010). Agreeable groups should be more cooperative and may compromise more during the decision-making process. Consequently, the expertise of an individual member may not be as well utilized in highly agreeable groups because the ideas and recommendations of all members are considered equally, or even more than those of experts if the experts have opposing ideas and recommendations. Groups that are highly agreeable may have less conflict within the group (Barrick, Stewart, Neubert & Mount, 1998), which may come at the cost of an in-depth consideration and critical evaluation of ideas and recommendations. Agreeable individuals may be more cooperative, but are less likely to engage in change-oriented and constructive communication (LePine & VanDyne, 2001).

In a study by Newman and Wright (1999) two separate models tested the effects of general cognitive ability, job-specific skills, and personality at both the individual

and group level to predict either individual or group performance. Participants were human resource representatives working in four-person groups completing one of four individual tasks, and completing other shared tasks as a group. Outcome measures were assessed over three years covering the same six dimensions at both the individual and group levels. Individual performance was rated by peers, and group performance was rated by supervisors. Results were that individual-level cognitive ability and extraversion were not related to performance, but agreeableness was significantly related to performance. Group-level results were that cognitive ability and agreeableness were related to task performance, but extraversion was not. Group agreeableness had a positive relationship with interpersonal skill and work completed, but not work accuracy. Newman and Wright (1999) concluded that personality variables should be included at both the individual and group level when evaluating group effectiveness. The authors also reported that agreeable groups were more effective at conflict resolution and had more open communication. Although, agreeable groups were rated by supervisors as better and completed more work, their work was no more accurate than disagreeable groups.

Nevertheless, Newman and Wright (1999) did not examine cross-level interactions, nor did they examine the effects of individual influence on group decisions. In the present study the effects of individual expertise were expected to interact with individual extraversion. Group agreeableness was also expected to have an effect, not as a main effect but as a moderator of the interaction between individual-level expertise and extraversion on influence.

In this model, the interaction of individual expertise and extraversion was examined, but group agreeableness is proposed as the important context variable rather than group extraversion. In the present study, the effect of group agreeableness was expected to be in the form of moderation and not a main effect. Groups that are high in agreeableness may have more communication, but the information discussed may be limited to ideas and recommendations shared by most group members. In highly agreeable groups the ideas and recommendations of all members may be attended to more and with greater compromise than in highly disagreeable groups. Consequently, for an expert to exert influence in a disagreeable group it is more likely they will have to assert themselves more and further demonstrate their expertise than in agreeable groups. A question that may therefore remain is how group agreeableness affects individual influence? The following hypothesis was tested.

H4: There will be a three-way interaction between individual expertise, extraversion, and group agreeableness in relation to influence. Specifically, the two-way interaction between individual expertise and extraversion will be larger when group agreeableness is low.

Extraversion and agreeableness may hinder the decision-making process in that individual influence may become less about expertise and more about how much an individual speaks, or how similar they are to their other group members (Larson, 2010). Groups that achieve synergy are expected to identify and utilize expertise regardless of extraversion or agreeableness. The group decision-making process may be different in synergistic groups in that the expertise of an individual affects influence, and not their extraversion, group extraversion, or group agreeableness.

Synergistic Groups

Prior studies have demonstrated that group decision quality may be improved through the use of structured decision making techniques (Rogelberg, Barnes-Farrell, & Lowe, 1992; Schwenk, 1990). Structured decision-making processes often require additional time as compared to conventional, less structured interactions, but the role of variables such as extraversion or agreeableness may therefore be less important (Forsyth, 2006, Larson, 2010). Structured processes dictate how each group member is to express their ideas and opinions as well as how others listen and not interrupt. With structured processes, groups may then recognize and integrate all members' expertise and not be as greatly affected by a single member.

Two things should occur to achieve synergy in decision-making groups: the sharing of unique information, and the integration of that information to form a decision (Hill, 1982). In synergistic groups the sharing of information may be facilitated by extraversion or agreeableness, but the recognition and utilization of expertise should have a greater effect on influence. The extraversion composition of the group is not as important as the extent to which extraversion effects the process of identifying and utilizing expertise. Similarly, group agreeableness may not be as important in a more structured situation. Groups that generate solutions that surpass their best member are able to recognize the expertise of each individual member to correct flaws in the best member's solution.

Synergistic groups may be imposing their own structure during the decision-making process. Similar to strong situations, the effects of personality may be attenuated in synergistic groups. That is, groups that achieve synergy may engage in

more process planning, which better defines the role of each individual group member, and consequently improves information sharing and integration (Tett & Burnett, 2003). Synergistic groups may have a higher degree of structure, more uniform expectancies of group members, and more social incentives to share and integrate information. Berger and colleagues (Berger et al., 1972; Berger et al., 1977; Berger et al., 1980; Berger et al., 1998) assert that in strong situations the effect of personality will be reduced, and conversely personality will most likely have an effect in weak situations. If synergistic groups impose more structure and create stronger situations, then the effects of extraversion or agreeableness should be reduced.

In the present study synergistic groups were analyzed independently to determine if there were differences in the roles of expertise and personality on influence. By definition groups that are able to achieve synergy identify flaws in the best member's solution and generate a final decision that surpasses the quality any individual group member could produce. Consequently, the expertise of the individual was expected to have a greater effect on influence and in turn improve final decision quality. It was also expected that personality would not affect influence to the same extent in synergistic groups as in groups that are not synergistic. As previously stated, groups should share information and integrate that information into a solution to achieve synergy. Extraversion may facilitate group discussion, but influence should be determined by expertise. Consequently, the expected trend was that expertise would have a greater direct effect on influence in synergistic groups. Accordingly the following hypothesis was tested.

H5: For synergistic groups there will be no direct or indirect effects (i.e., interactions) of personality variables (i.e., extraversion and agreeableness), on influence. Unlike groups that do not achieve synergy, only expertise is expected to be positively related to influence.

The expertise of an individual may not only affect their influence, but their influence and expertise may in turn affect final decision quality. The difference between synergistic and nonsynergistic groups in terms of final decision quality may be due to a greater identification and utilization of expertise in synergistic groups. Groups are expected to have higher quality final decisions when more expert members are more influential.

Influence, Expertise, and Group Decision Quality

The amount of influence that an individual has over a group may affect final decision quality, dependent upon the quality of their contributions. Results of previous research on decision making are that the influence of an individual will be most beneficial if the group member is an expert (Bunderson, 2003; Littlepage et al., 1995). Individual expertise may affect the amount of influence that an individual has within a group, and also affect the decision quality. Bottger and Yetton (1988) conducted a study of group decision making using the NASA Moon Survival task. The task was completed both individually and as a group. The study utilized the previously described measures of expertise using item rankings. Included in the study was a decision scheme variable which measured the extent to which the group agreed with the average ranking of the two most expert members' rankings. Decision scheme is similar to influence in that it is the agreement of the individual scores to group scores, but is different in that decision

scheme is the average of the two best members and not calculated for each individual. Results of the study were that group decision quality was better when there was greater agreement with the two most expert members (Bottger & Yetton, 1988).

Similar results were expected in this study in that group decision making should benefit when the more influential group members were expert. If the individual with the greatest expertise is not influential then the quality of the final group decision will suffer. Accordingly, the following hypothesis was tested.

H6: Influence will predict group decision quality as an interaction with individual expertise. The higher the expertise of the individual, the more positive the relationship will be between individual influence and decision quality.

Method

Participants

Four hundred and twelve male and female students enrolled in Introductory Psychology at the University of Oklahoma participated in the study for partial fulfillment of a course requirement. Participants were assigned to four-person groups. Nine of the groups were given incorrect instructions or did not follow instructions and examination of the data further indicated the groups as outliers. Consequently, these groups were removed from all analyses resulting in a final sample size of 376, yielding 94 groups. There were 80 groups that did not achieve a synergistic effect (i.e., group decisions did not surpass that of the best member) and 14 groups that were synergistic (i.e., group decisions surpassed that of the best member). There were 26 groups that had gender data for the entire group. Given the small sample of synergistic groups, and

resulting weak statistical power, tests of the hypothesis concerning synergistic groups involved a closer look at the magnitude of effect sizes relative to those found for non-synergistic groups.

Materials

Winter Survival Exercise. The decision making task in the study was the winter survival exercise (Johnson & Johnson, 2000). The winter survival exercise was administered twice: once individually and once in groups. For this exercise, participants read a short scenario that explains they were traveling in a plane that crash landed in the wilderness during winter. Their task is to rank 12 salvaged items (e.g., ball of steel wool, compass, and hand ax) in order of importance to their survival. Accuracy of the item rankings was scored as the absolute difference between a participant's rankings and previously established expert rankings (i.e., the absolute value of the participant ranking minus the expert ranking). Overall decision-making effectiveness is the sum of the item differences. Thus, a low score indicated greater agreement with expert rankings and higher decision-making effectiveness. The expertise of each group member was the individual accuracy. Similar tasks such as the desert survival situation (Littlepage & Mueller, 1997; Littlepage et al., 1995), the bushfire simulation (Thomas-Hunt & Phillips, 2004), and the moon survival task (Bottger, 1984; Bottger & Yetton, 1988) were scored in the same manner for expertise. The scores were reversed for the HLM and regression analysis.

Extraversion and Agreeableness

The extraversion of the participants was assessed individually before group discussions. The items were from the Unipolar Markers (Goldberg, 1990), and consisted

of 20 items for each scale. The items were on a nine-point scale (1 = Extremely inaccurate, and 9 = Extremely accurate). The obtained coefficient alpha was .91 for extraversion and .90 for agreeableness.

Influence

Influence in the winter survival task was assessed using methods adapted from past literature (Bonner, 2000; Bonner et al., 2007; Littlepage & Mueller, 1997; Littlepage et al., 1995). Influence was calculated as the sum of the absolute differences between the group rankings and the individual rankings for each item for each participant. Thus, a low score indicated greater agreement with group rankings and greater influence. These scores were reversed for the HLM and regression analysis.

Procedure

Upon arriving for the experiment the participants were given an informed consent form that briefly summarized the activities involved in the study. Participants then completed the extraversion and agreeableness scales. The experimenter then read the instructions for the winter survival exercise aloud as participants followed along on written copies provided. Participants were then given 10 minutes to complete the exercise as individuals. Following this, the experimenter randomly assigned participants to their respective groups.

The groups were then given 10 minutes to complete The Case of the New Truck, an unscored exercise used to give participants an opportunity to familiarize themselves with their fellow group members. The task requires participants to allocate work trucks to employees based upon their preference and tenure. Following this warm-up task, the groups were then told that they would work on the winter survival exercise again as a

group. At this time, participants were read consensus instructions. These instructions were based on the instructions used by Schweiger et al. (1986) and Diaz et al. (2004). Participants were instructed to openly discuss and thoroughly explore how the 12 items should be ranked similar to Schweiger et al. (1986) and Diaz et al. (2004). They were also instructed to reach agreement about the rankings and not to use conflict-reducing strategies like majority voting and tossing a coin. Groups were given ten minutes to reach consensus.

Results

Expertise, Extraversion, Agreeableness, Influence, and Decision Quality

Before conducting the HLM analyses, the relationships between the study variables were first examined following the commonly used coarse approach using means and standard deviations to operationalize individual differences at the group level. Similarly, the simple correlations between individual difference variables and the degree of influence were examined. Table 1 presents the means, standard deviations, and correlations for the study variables at the group level. A standard deviation score was calculated for each group to examine the effects of the heterogeneity of the groups. Table 2 presents the means, standard deviations, and correlations for the study variables at the individual level. Table 3 presents the results of *t*-tests comparing the means and standard deviations of synergistic and nonsynergistic groups. In Tables 1, 2, and 3 lower scores indicate better performance for expertise, group decision quality, and influence.

As shown in Table 1, group performance was not related to any of the study variables at the group level. That is, neither mean levels nor heterogeneity for expertise, extraversion, and agreeableness were related to group performance. These results are

mirrored in Table 3, at the group level none of the study variables was significantly different between synergistic and nonsynergistic groups except for group decision quality (t (92) = 6.28, $p < .001$, $d = 1.82$). Synergistic groups generated overall higher quality decisions. Average expertise yielded a moderate effect (t (92) = −1.80, $p < .10$, d = −.52) that was not at a conventional level of statistical significance. Synergistic groups, on average, were comprised of individuals with less expertise. Also, the heterogeneity of groups was not a significant predictor of performance, neither in terms of achieving synergy nor group decision quality. At the individual level only extraversion was significantly related to influence ($r = -.12$, $p < .05$). Individuals that were more extraverted were more influential. Simply stated, these results do not show much of a relationship between individual-difference variables and group performance.

Expertise, Extraversion, and Influence

Analyses for the first model tested included individual expertise, individual extraversion, and group extraversion. The analyses were conducted using HLM for Hypotheses 1, 2, 3, and 5 for the overall sample, groups that did not achieve synergy, and synergistic groups. As previously stated, the reason for using HLM was to account for nonindependence and mutual influence inherent in groups. The analyses were conducted consistent with compositional or contextual analyses as recommended by Raudenbush and Bryk (2002). In the model the individual expertise, individual extraversion, and the individual expertise × individual extraversion interaction were entered as first-level variables, and group extraversion as a second-level variable. All cross-level interactions were also included in the model. Influence was grand-mean centered. Individual-level variables (i.e., expertise and extraversion) were group-mean

centered and the group-level variable (i.e., group extraversion) was grand-mean centered. Slopes- and intercepts-as-outcomes were utilized because group membership was expected to have a predictive effect on individual-level variables and cross-level interactions were expected. Contextual analyses were conducted as the effects of the aggregate of individual-level effects (i.e., group extraversion) on the outcome (i.e., influence) were expected to occur even after controlling for the individual-level effect (i.e., individual extraversion) (Raudenbush & Bryk, 2002).

As shown in Table 4, there were no significant effects in support of Hypotheses 1, 2, or 3 in the overall sample for individual expertise, or for any of the interactions between individual expertise, individual extraversion, and group extraversion on influence. That is, individual expertise was not positively related to influence. Also, higher individual extraversion did not generate a stronger relationship between individual expertise and influence. Finally, the two-way interaction between individual expertise and individual extraversion was not larger when group extraversion was low.

Similarly, there were no significant effects in support of Hypotheses 1, 2, or 3 in groups that did not achieve synergy. However, in nonsynergistic groups there was a significant interaction between individual extraversion and group extraversion ($\gamma_{21} = .10$, $p < .05$). As shown in Figure 2, in groups that did not achieve synergy more individual extraversion resulted in greater influence in extraverted groups than in less extraverted groups.

Results supported Hypothesis 1 in synergistic groups. Individual expertise was related to influence ($\gamma_{10} = .48$, $p < .001$) in that more individual-level expertise resulted in more influence. Hypothesis 2 was not supported in synergistic groups. Although,

individual expertise ($\gamma_{10} = .48$, $p < .001$) and individual extraversion ($\gamma_{20} = .35$, $p < .05$) were related to influence, the interaction of individual expertise and individual extraversion was not significant ($\gamma_{30} = .18$, $p > .05$). Hypothesis 3 was also not supported, in that there was no statistically significant three-way interaction between individual expertise, individual extraversion, and group extraversion ($\gamma_{31} = -.13$, $p > .05$). The finding that individual extraversion was positively related to influence contradicts Hypothesis 5, which was that unlike groups that do not achieve synergy, only individual expertise was expected to be positively related to influence.

Expertise, Extraversion, Agreeableness, and Influence

Analyses for the second model included individual expertise, individual extraversion, and group agreeableness, and were conducted using the previously described HLM procedures. This model was used to test Hypothesis 4 which stated that a two-way interaction between individual expertise and individual extraversion would be larger when group agreeableness was low. As shown in Table 5, there were no significant effects in support of Hypotheses 1, 2, or 4 in the overall sample for expertise, or for any of the interactions between expertise, extraversion, and group agreeableness on influence. Similarly, there were no significant effects in support of Hypotheses 1, 2, or 4 in groups that did not achieve synergy.

Results in the second model again supported Hypothesis 1 in synergistic groups. Individual expertise was related to influence ($\gamma_{10} = .58$, $p < .001$) in that more individual expertise resulted in more influence. Hypothesis 2 was not supported in synergistic groups, individual expertise ($\gamma_{10} = .58$, $p < .001$) and extraversion ($\gamma_{20} = .37$, $p < .01$) were related to influence, but not the interaction of expertise and extraversion ($\gamma_{30} = .18$,

$p > .05$). However, the results partially supported Hypothesis 4. Although there was no statistically significant two-way interaction between individual expertise and individual extraversion, there was a statistically significant three-way interaction between individual expertise, individual extraversion, and group agreeableness ($\gamma_{31} = -.41$, $p < .05$). There were also significant interactions between individual expertise and group agreeableness ($\gamma_{11} = -.41$, $p < .05$) and between individual extraversion and group agreeableness ($\gamma_{21} = -.41$, $p < .05$). As shown in Figure 3, in synergistic groups more influential members were both expert and extraverted and in groups that were low in agreeableness. However, the results contradict Hypothesis 5, which stated that unlike groups that do not achieve synergy, only individual expertise was expected to be positively related to influence.

Gender

Based upon the results of Thomas-Hunt and Phillips (2004) individual gender and group gender were included in the analyses for the 26 groups for which gender was available. The results did not show any statistically significant interactions involving gender that would qualify any conclusions made based on the preceding analyses.

Effects of Influence and Expertise on Decision Quality

The quality of the group's final decision was an outcome that was common to every member in a group. Consequently, including all participants when examining how influence and expertise are related to group performance was not appropriate, even for analyses such as HLM. Consequently, when examining how individual influence is related to group performance one participant from each group was randomly selected for the analyses and moderated regression analyses were conducted consistent with the

recommendations of Aiken and West (1991). First, study variables were converted to *z*-scores. The dependent variable was final winter survival score. In the first and second steps of the regression analyses the main effects of influence and expertise were entered. In the third step the influence × expertise interaction was entered.

As shown in Table 6, expertise yielded a significant main effect on group decision quality ($\beta = .23$, $p < .01$), as well as the interaction between expertise and influence ($\beta = .44$, $p < .001$). Together they accounted for 27% ($p < .001$) of the variance. The results were consistent with Hypothesis 6; expertise moderated the relationship between influence and final decision quality. As shown in Figure 4, group decision quality was better when the more influential individuals were more expert and worse when less expert members were influential.

Discussion

Previous Research

Previous research has examined the effects of expertise, extraversion, and agreeableness in group decision making on influence and decision quality (Bonner, 2000; Bonner, Sillito & Baumann, 2007; Littlepage & Mueller, 1997; Littlepage et al., 1995; Mohammed, Mathieu & Bartlett, 2002; Newman & Wright, 1999) often using indices such as the mean or standard deviation (e.g., Bell, 2007). Results are often that average group expertise is related to decision quality. The effects of personality are less consistent and often have little to no effect. The individual contributions of group members during the decision-making process are not often studied. Also, using the group as the context for each individual group member is not often studied. Consequently, the effects of expertise and personality in the group decision-making

process remain relatively unexamined. Similarly, studies have not examined possible differences in these effects between synergistic and nonsynergistic groups.

Contributions of the Present Study

The present study demonstrates the importance of utilizing a more nuanced approach when examining individual differences in groups. Results supported including individual-level variables while using the group as the context with both task-related and personality variables in studying group decision making. The results supported the important roles of expertise and personality on group decision quality via influence. In the present study, the group members' individual differences had an effect on both their influence and the influence of the other group members, which in turn affected group decision quality. These individual differences were important to influence, not necessarily as a direct effect, but as a complex interaction including the individual and group levels. Moreover, the individual differences in both expertise and personality only predicted influence in synergistic groups.

In synergistic groups more influential individuals were extraverted, expert, and in groups that were low in agreeableness. Results suggest that groups that are low in agreeableness may be less willing to compromise to appease all group members. Consequently, expertise may be more salient in less agreeable groups as individuals are forced to effectively introduce and defend their ideas and recommendations. Synergism may occur as groups initiate a form of debate that does not simply adopt expert recommendations, but corrects flaws in experts' plans. This process is similar to task conflict, but task conflict does not necessarily positively relate to group decision quality (De Dreu & Weingart, 2003). The discussion of ideas and recommendations may have

to first focus on identifying the most important elements of the problem to improve decision quality. The identification of the most important elements may occur at the same time as the identification of individual expertise. An important distinction may be made between a debate, and a debate that supports the utilization of expertise and discussion of the best ideas and recommendations. The discussion of ideas and recommendations may be equal in quantity between groups, but the identification of expertise and the most important elements of the problem may vary.

Implications

The results of the present study provide evidence that expertise, extraversion, and agreeableness are all important variables when studying group decision making. The results also provide evidence to support using the group as the context for individual contributions during the decision-making process. There were significant interactions between individual- and group-level variables, including interactions between task-relevant expertise and personality. Using indices such as the mean or standard deviation may not capture important elements in the decision-making process. Consistent with previous research, it is important to consider interactions among personality variables and between personality variables and other individual differences (e.g., Perry, Dubin, & Witt, 2002; Witt, Burke, Barrick, & Mount, 2002), as well as between personality and contextual variables (e.g., Colbert et al., 2004; Witt, Kacmar, Carlson, & Zivnuska, 2002). Examining which individuals are influential within groups, and how their expertise is utilized promotes a better understanding of group decision making.

A key finding in these results is that the effects of expertise, extraversion and agreeableness are different between synergistic and nonsynergistic groups. In synergistic groups both expertise and personality had a larger effect as compared to nonsynergistic groups. Synergistic groups were able to utilize the expertise of their best members and improve upon their ideas and recommendations. In this study, personality did not contaminate the decision-making process as expected. Instead, results for synergistic groups suggest that individual differences in personality appeared to facilitate the identification of expertise and consequently improve group decision quality. Debate in synergistic groups may have promoted the identification of expertise and the discussion of the best ideas as opposed to a discussion of all possible ideas. In the present study, the more influential members in synergistic groups were both expert and extraverted, and were in a group that was low in agreeableness. Groups that are low in agreeableness may not simply adopt the ideas and recommendations of the more expert members. Rather, they must engage in more debate to correct flaws in the more expert plans. Therefore, it could be argued that individual differences in personality will facilitate group decision making, but not necessarily in absolute terms of more or less of a certain trait. The benefit may occur when the levels of expertise and personality are in a specific balance that may be better examined in future research.

Limitations

The present study was conducted in a laboratory and used undergraduate student samples that were likely not feeling vested in the decision-making task. Moreover, the decision-making groups interacted for a short period of time. Future studies should attempt to use recurring decision-making groups in business and industry that may be

more vested in the outcomes of their decisions. Similarly, the winter survival scenario is an unstructured task to which most individuals would not commonly be exposed. In fact, the correct decisions for the winter survival task may be considered counterintuitive. Although many real-world problems are unstructured, a different result may occur in more common or structured situations.

Another limitation of this study is that the proposed model did not include all possible variables in group decision making. Future research should also examine the effects of group processes including variables such as information sharing, idea generation, and critical evaluation. Including measures of which specific ideas were discussed and to what extent, may provide insight into the group decision-making process. Per example, in the present study greater extraversion is speculated to be associated with more talking and more assertiveness, which would in turn facilitate the recognition of expertise. In Littlepage and Mueller (1997) talking had a positive relationship with expert recognition and influence, but extraversion did not. Talking may mediate the relationship between extraversion and influence. Similarly, extraverted individuals may introduce their ideas first and repeat the ideas more often which may increase the probability of their ideas being chosen (Larson, 2010). The inclusion of measures such as of information sharing and idea generation would further shed light on these relationships. Possible results could be that the first ideas introduced by individuals are simply chosen for the group decision, regardless of expertise and with a limited generation of other possible alternatives. The three-way interaction that occurred in synergistic groups may have occurred because the first ideas introduced by their more extraverted members happened to also be by their more expert members, and

in disagreeable groups continued idea generation and evaluation did not occur. Individuals in disagreeable groups may not have wanted to work together and consequently accepted the first ideas introduced. In synergistic groups the first ideas may have been introduced by their more extraverted members that were also more expert.

An alternative explanation is that the synergistic groups were able to improve more as they started with less average expertise. Groups that have lower average expertise have more opportunity for synergy, especially when there are a finite number of possible solutions (Larson, 2010). The inclusion of a variable such as critical evaluation, or the extent to which groups question their assumptions, may provide insight into this process. Groups with lower average expertise would require less critical evaluation to achieve synergy. Groups with higher average expertise may not achieve synergy as often as large changes to their individual plans stemming from critical evaluation may be detrimental to final decision quality.

Conclusions

The present study highlights the importance of studying individual-level variables while using the group as the context with both task-related and personality variables in group decision making. Individual differences in both expertise and personality are important to final group decision quality via influence, primarily in synergistic groups. One's expertise and personality play roles in one's influence on others, and they also play roles in how others have influence. In general, the present study showed how the expertise and personality of individuals can affect influence on group decisions via interactions between individual- and group-level variables.

Consequently, when examining individual differences in groups, nuanced approaches are necessary.

The effects of personality during the decision-making process may be beneficial, not on an absolute scale but in balance with the other characteristics of the group. Per example, a moderate level of disagreeableness may be beneficial in groups with lower average expertise so that the groups will reevaluate their initial ideas which may be faulty. Conversely, in groups with higher average expertise the same level of disagreeableness may be detrimental as the group may alter a correct decision. Thus, in terms of achieving synergy and the associated decision quality more research is necessary. Future research should utilize nuanced approaches involving cross-level interactions to examine the roles of individual differences in group decision making via influence and other mediating processes.

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Table 1
Means, Standard Deviations, and Correlations for Variables at the Group Level

Variable	*M*	*SD*	1	2	3	4	5	6
1. Mean expertise[b]	50.06	3.29	---					
2. SD expertise[a]	7.86	3.35	−.37***	---				
3. Mean extraversion	116.53	10.42	.20†	−.11	---			
4. SD extraversion[a]	20.69	8.07	.03	.01	.00	---		
5. Mean agreeableness	141.67	8.42	−.02	.06	.23*	.04	---	
6. SD agreeableness[a]	14.28	6.77	.03	.02	.10	.05	−.42***	---
7. Decision quality[b]	49.10	7.86	.15	−.12	.09	−.12	.12	−.04

Note. [a] A standard deviation score was calculated for each group, this is the mean of the group-level standard deviations. [b] Lower scores indicates better performance. $N = 94$. †$p < .10$. *$p < .05$. ***$p < .001$. All tests are two-tailed.

Table 2
Means, Standard Deviations, and Correlations for Variables at the Individual Level

Variable	*M*	*SD*	1	2	3
1. Expertise [a]	50.06	8.09	---		
2. Extraversion	116.53	21.86	.05	---	
3. Agreeableness	141.67	16.05	.04	.18***	---
4. Influence [a]	32.38	11.84	−.03	−.12*	.05

Note. $N = 376$. [a] Lower scores indicates better performance. *$p < .05$. ***$p < .001$. All tests are two-tailed.

Table 3
Means and Standard Deviations of Group Level Variables for Synergistic and Nonsynergistic Groups

	Nonsynergistic		Synergistic		
Variable	*M*	*SD*	*M*	*SD*	*d*
Mean expertise[a]	49.81	3.27	51.50	3.13	−0.52†
SD expertise[b]	7.97	3.28	7.22	3.74	0.22
Mean extraversion	116.68	10.67	115.69	9.18	0.09
SD extraversion[b]	20.53	8.12	21.59	8.00	−0.13
Mean agreeableness	141.93	8.70	140.19	6.73	0.21
SD agreeableness[b]	14.37	6.64	13.73	6.57	0.10
Decision quality[a]	50.89	6.43	38.86	7.67	1.82***

Note. [a] Lower scores indicates better performance. [b] A standard deviation score was calculated for each group, this is the mean and standard deviation of the group level standard deviations. †$p < .10$. ***$p < .001$. All tests are two-tailed.

Table 4
Summary of the HLM Analyses Testing the Effects of Expertise, Extraversion, and Group Extraversion on Influence

Sample	Variable	*df*	γ	*SE*
Overall				
	Expertise	368	.08	.07
	Extraversion	368	.09	.06
	Expertise × Extraversion	368	.00	.06
	Group Extraversion	92	.09†	.05
	Expertise × Group Extraversion	368	.02	.07
	Extraversion × Group Extraversion	368	.09†	.05
	Expertise × Extraversion × Group Extraversion	368	.01	.06
Nonsynergistic				
	Expertise	312	.01	.07
	Extraversion	312	.05	.06
	Expertise × Extraversion	312	−.05	.07
	Group Extraversion	78	.08	.05
	Expertise × Group Extraversion	312	.03	.07
	Extraversion × Group Extraversion	312	.10*	.05
	Expertise × Extraversion × Group Extraversion	312	.05	.07
Synergistic				
	Expertise	48	.48**	.15
	Extraversion	48	.35*	.15
	Expertise × Extraversion	48	.18	.19
	Group Extraversion	12	.15	.13
	Expertise × Group Extraversion	48	−.08	.15
	Extraversion × Group Extraversion	48	−.02	.15
	Expertise × Extraversion × Group Extraversion	48	−.13	.16

Note. Nonsynergistic and synergistic groups are subsets of the overall sample. Influence is the dependent variable. Number of groups: overall $n = 94$, nonsynergistic $n = 80$, synergistic $n = 14$. Results are parameter estimates from slopes and intercepts-as-outcomes models. Group extraversion is grand mean centered. Expertise and extraversion are group mean centered. †$p < .10$. *$p < .05$. **$p < .01$.

Table 5
Summary of the HLM Analyses Testing the Effects of Expertise, Extraversion, and Group Agreeableness on Influence

Sample	Variable	*df*	γ	*SE*
Overall				
	Expertise	368	.08	.07
	Extraversion	368	.08	.06
	Expertise × Extraversion	368	.00	.06
	Group Agreeableness	92	.01	.05
	Expertise × Group Agreeableness	368	−.07	.07
	Extraversion × Group Agreeableness	368	.00	.06
	Expertise × Extraversion × Group Agreeableness	368	−.05	.06
Nonsynergistic				
	Expertise	312	.01	.07
	Extraversion	312	.04	.06
	Expertise × Extraversion	312	−.05	.07
	Group Agreeableness	78	.01	.05
	Expertise × Group Agreeableness	312	−.05	.07
	Extraversion × Group Agreeableness	312	.02	.07
	Expertise × Extraversion × Group Agreeableness	312	−.00	.07
Synergistic				
	Expertise	48	.58***	.13
	Extraversion	48	.37**	.12
	Expertise × Extraversion	48	.18	.16
	Group Agreeableness	12	−.19	.15
	Expertise × Group Agreeableness	48	−.40**	.14
	Extraversion × Group Agreeableness	48	−.34*	.14
	Expertise × Extraversion × Group Agreeableness	48	−.41*	.16

Note. Nonsynergistic and synergistic groups are subsets of the overall sample. Influence is the dependent variable. Number of groups: Overall $n = 94$, Nonsynergistic $n = 80$, Synergistic $n = 14$. Results are parameter estimates from slopes- and intercepts-as-outcomes models. Group agreeableness is grand mean centered. Expertise and extraversion are group mean centered. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 6
Summary of the Regression Analyses Testing the Interaction between Influence and Expertise on Group Decision Quality

Model	β_1	β_2	β_3	R^2	ΔR^2
1. Influence	−.22*	−.23*	−.17†	.05*	
2. Expertise		.18†	.23*	.08*	.03†
3. Influence × expertise			.44***	.27***	.19***

Note. Group decision quality is the dependent variable. β_1 = standardized regression coefficients in the first model. β_2 = standardized regression coefficients in the second model. β_3 = standardized regression coefficients in the full model. R^2 = proportion of variance accounted for in the dependent variable by the set of predictors in the regression equation. ΔR^2 = incremental variance accounted for by the additional step in the regression equation. *N* size = 94. †$p < .10$ *$p < .05$. **$p < .01$. ***$p < .001$.

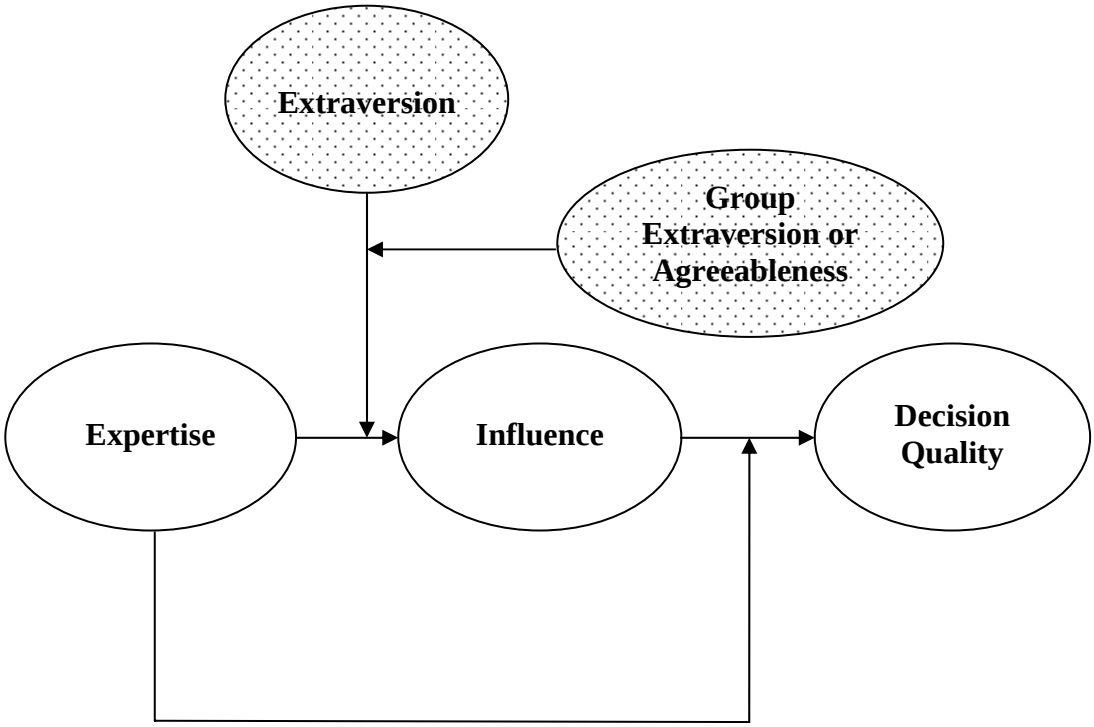


Figure 1. Proposed model of the interactions between expertise and personality in group decision-making. *Note:* Shaded variables are only expected in non-synergistic groups.

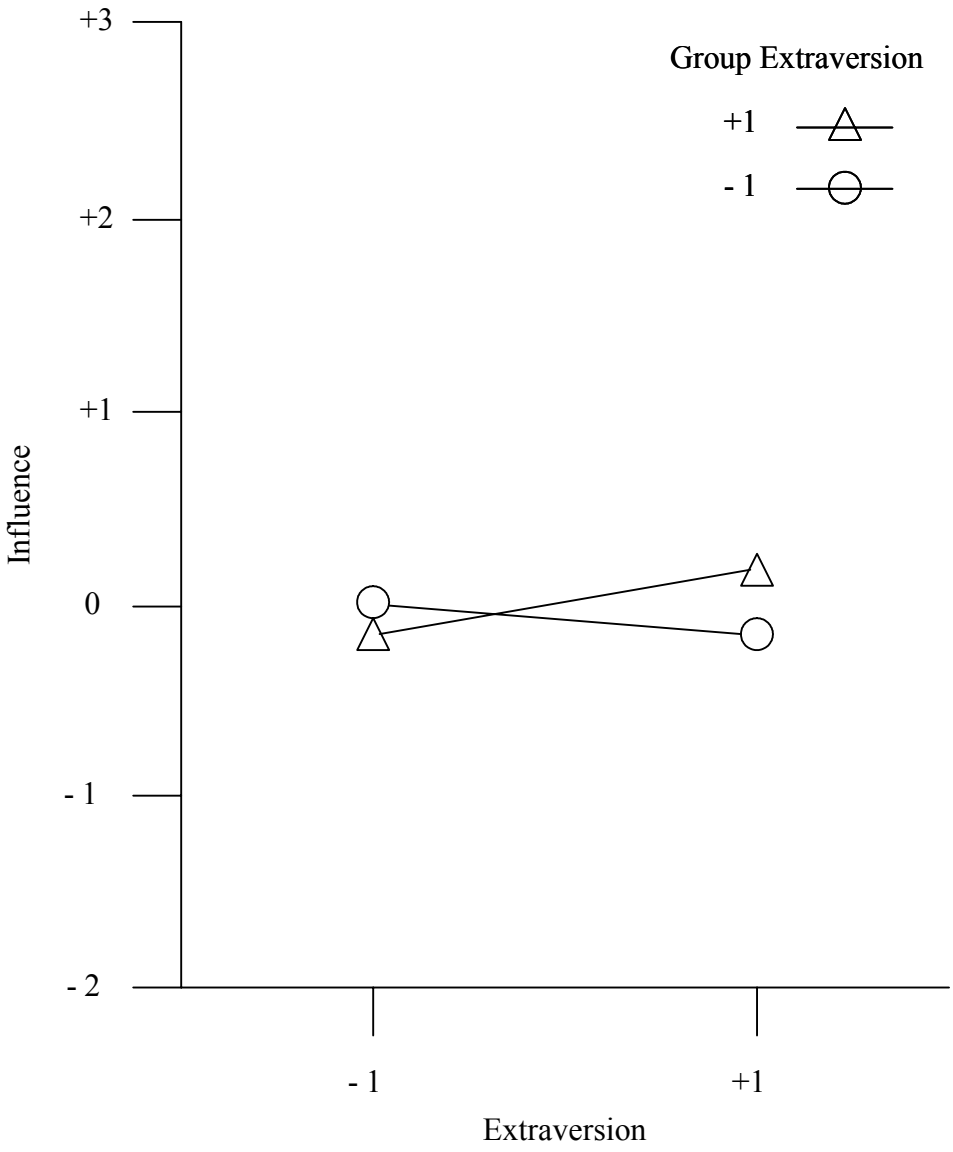


Figure 2. The effects of extraversion and group extraversion on influence for nonsynergistic groups. Scores are expressed in terms of standard deviations.

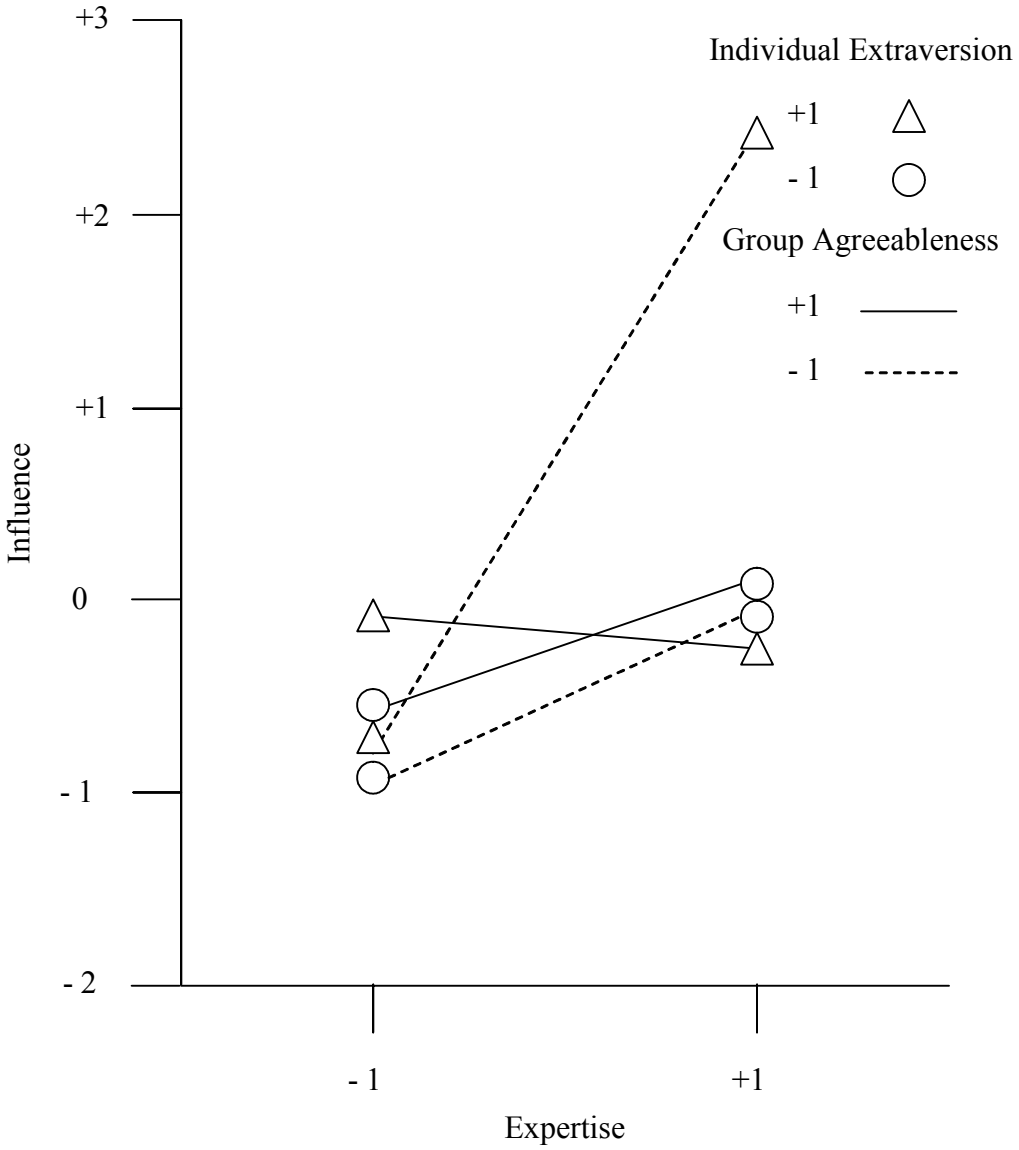


Figure 3. The effects of expertise, extraversion, and group agreeableness on influence for synergistic groups. Scores are expressed in terms of standard deviations.

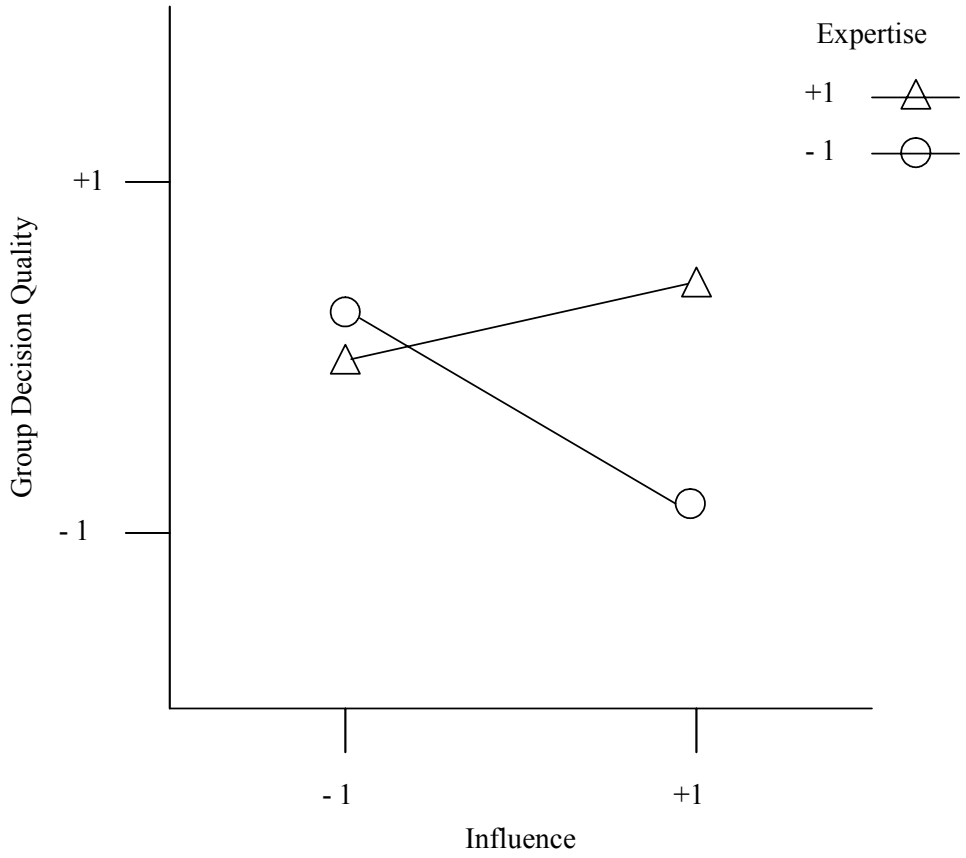


Figure 4. The effects of influence and expertise on group decision quality for the overall sample. Scores are expressed in terms of standard deviations.