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The Social Influence of Confidence in Group Decision Making

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This study investigates the relation between an individual's self-reported confidence and his or her influence within a freely interacting group. Each participant chose responses and provided confidence assessments for choice items of a variety of task types, first as an individual and a second time as a member of a pentad, a member of a dyad, or an individual. The influence of a particular faction within a group was greater if its members were more confident. A participant's response accuracy was related to both greater confidence and greater influence to the extent that the task fell on the intellective end of the intellective–judgmental continuum of task types. As a result, the extent to which group members' confidence predicted their influence was also greatest on intellective rather than judgmental tasks. Results further illustrate that adding group members to work on a problem may increase overconfidence on judgmental tasks but decrease overconfidence on intellective tasks.

Confidence is the strength of a person's belief that a specific statement is the best or most accurate response (Peterson & Pitz, 1988).[1] Empirical efforts dedicated toward investigating the various determinants of confidence (e.g., Arkes, Christensen, Lai, & Blumer, 1987; Griffin & Tversky, 1992; Heath & Gonzalez, 1995; Koehler, 1991; Koriat, Lichtenstein, & Fischhoff, 1980; Mayseless & Kruglanski, 1987; Peterson & Pitz, 1988) greatly outweigh those invested in exploring the effects that one's confidence has on the behavior of the self and others (Olson & Sniezek, 1992; Paese & Kinnaly, 1993; Sniezek & Buckley, 1995). This imbalance is troubling. After all, it is of little use to be able to raise or lower a person's confidence if we cannot predict what effects such changes will have. The purpose of the present experiment is to examine the consequents of

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[1] We will limit our discussion of confidence to this rather strict definition. Self-efficacy (Bandura, 1977), demeanor (Lee & Ofshe, 1981), and optimism (Zullow & Seligman, 1990) all intuitively seem to share certain similarities with confidence. However, the exact nature of the relationships between these variables and confidence remains unclear.

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confidence. Specifically, it attempts to discover if the self-reported confidence of group members predicts who will be most influential in determining the collective decision of a freely interacting group.

The Importance of Task Type

Although there are many factors that could conceivably affect the relation between member confidence and influence within a group, we will focus only on the role of the task, applying the intellective–judgmental continuum of decision tasks (Laughlin, 1980). Tasks at the extreme judgmental end of the continuum are opinion questions such that no answer is more accurate than any other. Moving toward the opposite end of the continuum, a task is intellective to the extent that one could prove the accuracy of the correct response. All decision tasks without correct answers are judgmental. On the other hand, not all problems with correct solutions are intellective. For example, if a problem is extraordinarily difficult, the group may have no available means to demonstrate the superiority of the correct response over any other response.

Laughlin and Ellis (1986) have suggested that it is possible to estimate the intellective versus judgmental nature of a task by analyzing specific characteristics of the decision task environment. A decision task can be considered intellective to the degree that it meets *four criteria of demonstrability.* First, a conceptual system must exist, and there must be a consensus on the rules of the system (e.g., the rules of syntax to solve a verbal problem). Second, sufficient information to solve the problem must be available, either in the decision environment or in memory. For example, solving for X using the equation, $X = 5Y$, would not be an intellective task, assuming the identity of Y is unknown. Third, the incorrect members must have sufficient understanding of the system to recognize a correct answer if it is explained to them. And, finally, at least one correct member must have sufficient time, ability, and motivation to explain the correct answer to the rest of the group. It should be noted that this process of estimating the intellective/judgmental nature of a task a priori can be difficult and imprecise, particularly since the demonstrability of a task is a function of not only the task itself but also of the group members and the decision environment. For example, the same task may be judgmental for low-ability people under time pressure but intellective for experts with unlimited time. Thus, whenever the term "intellective" is used, it should be interpreted as "intellective for the average member of a given population within the given context."

The intellective/judgmental nature of a task may also be estimated empirically by applying a quantitative technique known as social decision scheme (SDS) analysis (see Davis, 1973, for details of the theoretical model). In SDS analysis, a task is classified as intellective if a correct minority can convince the rest of the group to adopt the correct response. The smaller the size of the correct faction sufficient to prevail, the more intellective the task is presumed to be. Conversely, if the correct faction has no more persuasive power than any other faction of equal size (as is suggested by a ‘‘majority-wins’’ social decision scheme), then the task is categorized as judgmental.

Of course, a person need not choose between these two methods for estimating the location of a task type along the intellective/judgmental continuum. It is preferable instead to capitalize upon the strengths of both methods, first estimating the intellective versus judgmental nature of the task a priori by considering the four criteria of demonstrability, and then conducting a social decision scheme analysis to gain further support for one’s previous estimate.

Confidence and Social Influence

A subset of past studies addressing the relation between confidence and influence are readily comparable to one another, and to the present study as well, because they share three important qualities: (*a*) Confidence was defined as a person’s belief that a statement represents the best possible response, (*b*) participants made independent individual decisions prior to reaching a consensus within a freely interacting group, and (*c*) confidence was assessed with a self-report measure.

Frequently, researchers have found that freely interacting groups choose the positions of their most confident members as their group decisions. This phenomenon has been witnessed with groups discussing a mathematical puzzle (Johnson & Torcivia, 1967), a recall task (Stephenson, Abrams, Wagner, & Wade, 1986), and a recognition task (Hinsz, 1990). The effect of confidence on influence in the last of these studies was modest, however, and subordinate to the effects of accuracy and faction size.

On the other hand, more confident members do not always appear to have more influence within a group. Self-reported confidence did not predict influence for novice groups making marketing forecasts (Sniezek, 1989), risk judgments (Sniezek & Henry, 1989), performance evaluations (Zalesny, 1990), or mock jury verdicts (London, 1973).

The tasks for which confidence was a significant predictor of influence (recall and math tasks) have each been classified as intellective by past empirical research (Laughlin & Ellis, 1986; Vollrath, Sheppard, Hinsz, & Davis, 1989). The same is not true for tasks in which confidence and influence are unrelated. Each of these tasks appears to be judgmental in nature. The accuracy of forecasts, for example, cannot be effectively demonstrated to other people, since the correct answer cannot be known at the time of the decision. Likewise, past research (Davis, Kerr, Atkin, Holt, & Meek, 1975; Kerr *et al.*, 1976) has also provided strong evidence that jury decisions are judgmental. Performance evaluation tasks are clearly judgmental as well since they involve issues of values and preferences. Consistent with the modest relation between confidence and influence on his recognition task, Hinsz’s (1990) analysis indicates that it may be located at an intermediate location along the intellective–judgmental continuum.

Using this pattern of past results as a guide, we propose:

> HYPOTHESIS 1. (a) Confident group members will be more influential than those less confident. (b) Confidence will better predict a person's influence to the extent that the task is intellective rather than judgmental.

It is of interest to note that some researchers (Lee & Ofshe, 1981; Sev'er, 1989; Tuzlak & Moore, 1984; Wells & Murray, 1984) have, in fact, found significant correlations between confidence and influence on judgmental tasks. However, each of these experiments applied a different definition or measure of confidence or did not use interacting groups.

Theoretical Explanations

There are two potential reasons why confidence might better predict influence for an intellective task rather than a judgmental task. The first explanation to be explored here merely predicts a stronger *correlational* relation between confidence and influence on intellective tasks. The second explanation asserts that an individual's confidence should actually *cause* greater social influence on more intellective tasks. The two explanations should not be seen as mutually exclusive. It is conceivable that they may work together, each being responsible for some portion of the overall effect.

Explanation 1: "Confidence as a cue." The first explanation suggests that confidence should better predict influence on intellective rather than judgmental tasks simply because both confidence and influence are more highly correlated to a third variable, accuracy, if the task is intellective.

First consider the validity of confidence as an estimate of accuracy. Reported confidence may be more valid for intellective tasks than judgmental tasks. Just as it is difficult to demonstrate the accuracy of a judgmental response to others, it is difficult to prove the superiority of a judgmental response to oneself. Thus, confidence should be only weakly related to accuracy for a judgmental task. If this is true, then one cannot expect confidence assessments to accurately predict which group members have chosen the better response. However, if a task is intellective, some individuals will realize that they are simply guessing and, thus, be uncertain. Other members, who systematically justify to themselves that a particular response is correct, will therefore be more confident.

Research appears to support this claim. Experiments employing tasks meeting the minimum requirements of demonstrability (i.e., intellective tasks) have found more accurate participants to be more confident (Hinsz, 1990; Johnson & Torcivia, 1967; Paese & Kinnaly, 1993), while experiments using judgmental tasks (Dunning, Griffin, Milojkovic, & Ross, 1990; Henry, 1993; Sniezek, 1989; Yarmey, 1990; Zalesny, 1990) generally have not found a significant relationship between confidence and accuracy.

Next, consider that accuracy is a better predictor of influence for intellective tasks than judgmental tasks (Laughlin & Ellis, 1986). Because confidence is also a more valid cue to accuracy on intellective tasks, it too will be a better predictor of influence on these tasks. The viability of this explanation depends upon support obtained for the following hypotheses (in addition to support for hypothesis 1).

HYPOTHESIS 2. Accuracy better predicts influence within a group for tasks categorized as intellective than for tasks categorized as judgmental.

HYPOTHESIS 3. Confidence is a more valid estimate of accuracy on intellective tasks than judgmental tasks.

Explanation 2: "Confidence as a cause." Deutsch and Gerard (1955) defined informational social influence as "an influence to accept information obtained from another as *evidence* about reality." Information about group members can be an indicator of their probability of being correct. For example, knowledge that an individual is an expert or has had past success on similar problems may increase the perceived likelihood of his or her current response being accurate.

People may recognize confidence as a valid cue to accuracy, particularly if the task is intellective. As a result, groups may place greater weight upon the input of more confident members (Thomas & McFadyen, 1995). In this respect, confidence (independent of actual accuracy) may be classified as a source of informational influence, which is most critical in intellective tasks (Kaplan, 1989; Kaplan & Miller, 1987).

This second explanation for why confidence better predicts influence on intellective rather than judgmental tasks is tested as:

HYPOTHESIS 4. (a) After controlling for the effects of accuracy, confident group members will remain more influential than less confident members. (b) This relation will remain strongest on intellective tasks.

In summary, the present study will directly test the hypothesis that confident group members are more influential than their less confident collaborators and that this relation is particularly strong for intellective tasks. Furthermore, this study will also assess the validity of both the "confidence as cue" and "confidence as cause" explanations for this effect.

Group Size and Calibration

The experimental design allows the exploration of a second topic: the calibration of decision making groups. Confidence assessments are well calibrated to the extent that they match accuracy rates.

Groups typically report greater confidence in their performance than do individuals for the same task (see Sniezek, 1992, for review). The heightened confidence of groups may be justified, however, because groups are usually more accurate than individuals (Egerbladh, 1981; Holloman & Hendrick, 1971; Laughlin, Kerr, Davis, Halff, & Marciniak, 1975; Littlepage, 1991; Littlepage & Silbiger, 1992), particularly on intellective tasks (Laughlin & Ellis, 1986). We expected that groups would be both more accurate and more confident than individuals, replicating these earlier findings. In addition, we also predicted larger groups to be more accurate and more confident than smaller ones. Consistent with the idea that larger groups have more resources at their disposal than smaller groups, many studies have reported greater accuracy by larger collectives, at least within the investigated range of 2 to 10 members (Cummings, Huber, & Arendt, 1974; Egerbladh, 1981; Laughlin *et al.,* 1975; Littlepage, 1991; Littlepage & Silbiger, 1992; Yetton & Bottger, 1983; see also Holloman & Hendrick, 1971, for one study in which group size and accuracy were not significantly related). Given that accuracy is positively related to group size, it follows that confidence also must increase with group size if people are capable of forming reasonably calibrated confidence assessments. Consistent with this logic, Clark and Stephenson (1989) report that 4-member groups are more confident (and accurate) during a cued recall task than are 2-person groups.

Although no specific predictions were made, we were also interested in how calibration scores would differ among 5-member groups, 2-member groups, and individuals working on both intellective and judgmental tasks.

METHOD

Participants

Introductory psychology students (77 men and 67 women) served as participants in this experiment. The participants were divided into 18 pentads, 18 dyads, and 18 individuals. They answered 24 multiple-choice questions and were told that there would be $5 cash prizes awarded to the most accurate 20% of the participating individuals. In all, 32 participants (4 pentads, 4 dyads, and 4 individuals) received cash awards.

Procedure

During the first part of the study, each participant was asked to respond independently to 24 multiple-choice questions, each with 5 alternatives. The participants were also asked to assign confidence ratings to each of their responses. For each item, they completed the following sentence with a number between 20 and 100: ‘‘I am _ % certain that I chose the best response.’’ The subjects were instructed to respond that they were 20% certain only if no response seemed better than any of the other 4 responses, and to respond that they were 100% certain only if they knew that they chose the best response.[2]

The participants were randomly assigned to complete the second phase of the experiment as a member of a pentad, as a member of a dyad, or as an individual. The pentads and dyads produced a group response and confidence assessment for each of the items that they answered individually in the first stage. The participants in the individual condition were once again presented with the same items that they completed in the first stage. Participants in all conditions were able to refer to their original responses, and informal observation through a one-way mirror revealed that they usually chose to do so.

Materials

All participants responded to four questions of each of six different task types. The items were similar in that each required a response to be chosen from five discrete nonordered alternatives. With the exception of the opinion questions, each item had one and only one correct response.

[2] Despite the fact that our instructions directed participants to interpret scale endpoints in terms of probability, there remains a reasonable concern that such confidence measures may not map precisely onto subjective probabilities. Since our interests focus on relative differences across conditions rather than absolute values of percentage certainty, however, this concern will not be addressed further.

Tasks were chosen to represent a variety of locations along the intellective–judgmental continuum. Three task types were relatively judgmental; three were more intellective. Some of the task types have been previously studied using social decision scheme analysis to estimate their location along the continuum. The locations of the other tasks were estimated by judging the degree to which the conditions of demonstrability were met. The six task categories, and an example of each, are listed below in order of most intellective to most judgmental.[3]

1. Math problems of moderate difficulty. Example: A house cost Ms. Jones *X* dollars in 1985. Three years later, she sold the house for 25% more than she paid for it. She had to pay a tax of 50% of the gain. How much must Ms. Jones pay? A. 1/24; *B. X/8;* C. *X*/4; D. *X*/2; E. (0.6)*X*.

2. Difficult math problems. Example: A bag contains four blue marbles and six yellow marbles. What is the probability that if two marbles are picked (without looking) from the bag, both marbles will be yellow? A. 2/15; B. 4/15; *C. 1/3;* D. 2/5; E. 3/5.

3. Analogies. Example: Constellation : Stars :: _. A. Earth : Moon; B. Center : Circle; *C. Archipelago : Islands;* D. Rain : Water; E. Maverick : Herd.

4. Postcasts of past events with relevant information and statistics provided. Example: Which of the following states had the highest rate of new AIDS cases in 1991? (The number of new AIDS cases reported in these and other states during each of the previous seven years were provided, although the population of each state was not.) A. California; *B. Florida;* C. Maryland; D. New Jersey; E. Texas.

5. Forecasts of future events with no information provided. Example: Which of the following five cities will have the highest ‘‘high temperature’’ on the day one week from today, as reported by the Weather Service Corporation? A. Cincinatti, OH; B. Denver, CO; C. Kansas City, MO; D. New York, NY; E. Seattle, WA.[4]

6. Opinion questions. Example: The 1993 Academy Awards will be presented on March 29. The following are nominees for ‘‘Best Picture.’’ Of these, which is the most deserving of the award? We are NOT asking you to report which one will win. We want to know which film you personally believe should win. A. *The Crying Game;* B. *A Few Good Men;* C. *Howards End;* D. *Scent of a Woman;* E. *Unforgiven.*

Past research (Laughlin & Ellis, 1986; Stasson, Kameda, Parks, Zimmerman, & Davis, 1991) has found math problems to be highly intellective. Difficult math problems are expected to be less intellective than easier ones since correct members should be less able to explain the correct solution of a more difficult problem to other group members.

Analogies are also intellective tasks, but less so than math problems (Laughlin & Adamopoulos, 1980, 1982). In contrast, opinion questions are the most judgmental tasks since there is no correct answer and thus no means of proving the accuracy of any response (Kerr, Davis, Meek, & Rissman, 1975; Zaleska, 1978).

Forecasts and postcasts are less judgmental than opinion questions because a correct answer does eventually become available. On the other hand, they are likely to be more judgmental than analogies that have a well-defined (verbal) conceptual system. The forecasts were thought to be more judgmental than postcasts for two reasons. First, the correct answer to forecasts cannot be known at the time of the task, so no member can show that he or she has definitely chosen the correct response. Second, related information was provided for postcasts but not for forecasts. This information could be used by group members to demonstrate why they thought one response was superior to the others.

RESULTS

Manipulation Check

Several hypotheses are built upon the assumption that moderately difficult math items, difficult math problems, and analogies are relatively intellective tasks, while postcasts, forecasts, and opinion questions are relatively judgmental tasks.

[3] The correct response for each item is presented in italics. The opinion item has no correct response, and the correct response to the forecast item differed between experimental sessions held on different days.

[4] All forecast items asked about events in the near future to make it possible for the experimenters to determine the correct response.

TABLE 1

RESULT OF THE KOLMOGOROV–SMIRNOV TEST (D_{max}) FOR SIX SOCIAL COMBINATION MODELS

	Social combination model					
Task	TWINS	TSW-E	TSW-P	Equi	Prop	Maj-P
Moderate math	.057*	.014*	.012*	.402	.344	.272
Difficult math	.183	.001*	.111*	.227	.347	.487
Analogies	.323	.192	.113*	.132	.200	.285
Postcasts	.493	.329	.230	.061*	.042*	.165
Forecasts	.476	.275	.154	.106*	.028*	.174
Opinion tasks	NA	NA	NA	.307	.157	.014*

Note. TWINS, truth wins; TSW-E, truth-supported wins, equiprobability otherwise; TSW-P, truth-supported wins, proportionality otherwise; Equi, equiprobability; Prop, proportionality; Maj-P, majority wins, proportionality otherwise. Smaller values of D_{max} indicate a better fit of the model. An asterisk (*) represents a model that cannot be rejected at the critical value of $\alpha = .20$ ($D_{max} = .126$).

This belief was supported by past research and strong theory. Its accuracy was further examined through a social decision scheme analysis (Davis, 1973) of the pentad condition.

Six social combination models were tested. Of these, three are associated with judgmental decision tasks: ‘‘equiprobability,’’ for which each response selected by at least one member is equiprobable to be chosen by the group; ‘‘proportionality,’’ for which the probability of a response to be chosen by the group is equal to the proportion of the group supporting it; and ‘‘majority wins, proportionality otherwise’’ (a proportionality subscheme for distributions without a majority faction). The other three social combination models are associated with intellective tasks. Of these three models, the one that fits the most intellective tasks is called ‘‘truth wins.’’ The remaining intellective models include ‘‘truth-supported wins, equiprobability otherwise,’’ and ‘‘truth-supported wins, proportionality otherwise.’’

For each task type, the data have been aggregated over the four items. Although this strategy has often been used in the past (e.g., Laughlin & Ellis, 1986; Stasson *et al.,* 1991), it is uncertain how this lack of independence among items affects the test statistic. Unfortunately, it is necessary to collapse the data to provide statistical power to test the models. The aggregation of items was accomplished for all tasks other than the opinion task by dividing all responses into one of two classifications: correct and incorrect. Responses to opinion items were divided into five classifications: most popular individual response, second most popular individual response, etc.

The fit of each social combination model was tested with the Kolmogorov–Smirnov one-sample test. Because nonsignificant discrepancies between observations and a model's predictions provide support for the model, alpha is set at the conservative level of .20. The results of these tests are presented in Table 1.

Again, it should be emphasized that the results are based upon small sample

TABLE 2
PROPORTION OF CASES IN WHICH THE DYAD CHOSE THE RESPONSE OF THE MORE CONFIDENT MEMBER

Task	More confident member is correct	More confident member is incorrect	All cases
Moderate math	24/24 (1.000)	7/12 (.583)	31/36 (.861)
Difficult math	20/22 (.909)	17/20 (.850)	37/42 (.881)
Analogies	10/10 (1.000)	11/19 (.579)	21/29 (.724)
Postcasts	6/7 (.857)	13/27 (.481)	19/34 (.559)
Forecasts	3/8 (.375)	17/27 (.630)	20/35 (.571)
Opinion tasks	NA	NA	20/30 (.667)
Total	63/71 (.887)	65/105 (.619)	148/206 (.718)

sizes, but they are promising nonetheless. None of the three tasks presented as intellective was fit adequately by a judgmental social combination model, and none of the three tasks presented as judgmental was fit adequately by an intellective model. The rank order of tasks along the intellective–judgmental continuum was as predicted.

Hypothesis 1

Member confidence was expected to predict the influence of individuals within groups to the extent that the task had a demonstrably correct solution. This hypothesis was tested for both pentads and dyads. In the dyad condition, interpersonal influence could only be determined for dyad–item combinations in which (*a*) the two members' initial responses were in disagreement, (*b*) their reported confidence levels were not identical, and (*c*) the group's response (R_G) was the same as either the more confident individual's response (R_{IC+}) or the less confident individual's response (R_{IC-}). A total of 206 cases (of 432) existed in which influence could be determined. The proportion of cases in which the more confident member's response was chosen by the group, $P(R_G = R_{IC+})$ is presented in the right-hand column of Table 2 by task type. Overall, $R_G = R_{IC+}$ in 148 of 206 cases, while $R_G = R_{IC-}$ in the remaining 58 cases. A binomial distribution demonstrates that a proportion this high occurring by chance alone is unlikely ($p < .001$). As predicted by the first hypothesis, $P(R_G = R_{IC+})$ differs as a function of task type, as revealed by a significant Pearson chi-square test of

TABLE 3
PROPORTION OF CASES IN WHICH THE PENTAD CHOSE THE RESPONSE OF THE MOST CONFIDENT FACTION

	Number in most confident faction				
Task	One	Two	Three	Four	Total
Moderate math	1/16 (.063)	10/13 (.950)	16/17 (.941)	12/12 (1.000)	39/58 (.672)
Difficult math	16/30 (.533)	16/21 (.800)	11/11 (1.000)	1/1 (1.000)	44/63 (.698)
Analogies	3/20 (.150)	16/25 (.640)	13/15 (.867)	6/6 (1.000)	38/66 (.576)
Postcasts	3/18 (.167)	4/10 (.400)	12/17 (.706)	11/11 (1.000)	30/56 (.536)
Forecasts	4/31 (.129)	13/19 (.684)	8/10 (.800)	5/6 (.833)	30/66 (.455)
Opinion tasks	1/18 (.056)	6/13 (.462)	13/13 (1.000)	4/4 (1.000)	24/48 (.500)
Total	28/133 (.211)	65/101 (.644)	73/83 (.880)	39/40 (.975)	205/357 (.574)

association, χ^2 (5) $= 17.53$, $p < .005$. $P(R_G = R_{IC+})$ was greater for the three intellective tasks (.832) than for the three judgmental tasks (.596), χ^2 (1) $= 14.14$, $p < .001$.

The first hypothesis was tested in a similar manner for pentads (see Table 3), using faction confidence rather than individual confidence. A faction is composed of all persons who initially support the same response. For the pentad condition, cases were eliminated if (*a*) there was only one faction, (*b*) no faction had an average member confidence higher than that of all other factions, or (*c*) the group's response (R_G) differed from that of the most confident faction (R_{FC+}) and that of all less confident factions (R_{FC-}). Thus, only 357 of the 432 total pentad–item combinations were included in the analyses. Across tasks, $R_G = R_{FC+}$ in 205 of 357 cases ($P = .574$). When one considers that the average pentad had the responses of 2.78 factions to choose from, the predictive power of confidence is all the more apparent. The likelihood of a single less-confident faction's response to be chosen by the group ($R_G = R_{FC-}$) was only .239. A significant Pearson chi-square test, $\chi^2(1) = 111.23$, $p < .001$, confirms that a pentad was more likely to choose the response of the most confident faction than that of any other faction.

As in the dyad condition, $P(R_G = R_{FC+})$ differs as a function of task type for pentads, χ^2 (5) $= 11.55$, $p < .05$. Again, $P(R_G = R_{FC+})$ was greater for intellective tasks (.647) than it was for judgmental tasks (.494), χ^2 (1) $= 8.52$, $p < .005$. These results are potentially misleading, however, because the tests did not differentiate between cases in which the size of the most confident faction differed. Faction

TABLE 4
PROPORTION OF CASES IN WHICH THE DYAD CHOSE THE CORRECT RESPONSE (WHEN ONE OF THE TWO MEMBERS WAS CORRECT)

Task	Proportion
Moderate math	30/33 (.909)
Difficult math	23/31 (.742)
Analogies	14/18 (.778)
Postcasts	15/22 (.682)
Forecasts	10/20 (.500)
Total	92/124 (.742)

size is a powerful predictor of group decisions (Asch, 1951; Davis 1973); therefore, the analysis was redone with a stratum-adjusted chi-square test. This test indicates that after controlling for the size of the most confident faction, $P(R_G = R_{FC+})$ remained greatest for intellective tasks, χ^2 (1) = 11.92, $p < .001$.

Hypothesis 2

The data also support the hypothesis that accuracy better predicts interpersonal influence on intellective rather than judgmental tasks. Opinion items were not included in this analysis because their responses cannot be categorized as correct or incorrect. In the dyad condition, this hypothesis was tested by analyzing cases in which (*a*) one individual chose the accurate response (R_{IA+}) and one individual did not (R_{IA+}), and (*b*) one of the two pregroup responses was chosen as the group response (R_G). Due to high levels of initial agreement, only 124 of a potential 360 cases could be analyzed for interpersonal influence. For each task type, $P(R_G = R_{IA+})$ is displayed in Table 4. A significant Pearson's chi-square test of association shows that $P(R_G = R_{IA+})$ differs as a function of task type, χ^2 (4) = 11.47, $p < .05$. Dyads chose the correct response more frequently when the task was one of the three intellective tasks ($P = .817$) rather than a postcast or forecast ($P = .595$), χ^2 (1) = 7.14, $p < .01$.

The results were similar in the pentad condition. All cases were considered in which one faction's response was chosen as the group response and there existed both a correct faction and at least one incorrect faction (resulting in 279 meaningful cases of the total 360). The probability of the group choosing the response of the correct faction is shown in the right-hand column of Table 5 by task type. Clearly, these proportions vary as a function of task type, χ^2 (4) = 55.54, $p < .001$. Controlling for the size of the correct faction, a stratum-adjusted

TABLE 5
PROPORTION OF CASES IN WHICH THE PENTAD CHOSE THE CORRECT RESPONSE (WHEN BOTH A CORRECT AND AN INCORRECT FACTION EXISTED)

	Number in correct faction				
Task	One	Two	Three	Four	Total
Moderate math	0/0	19/20 (.950)	24/24 (1.000)	16/16 (1.000)	59/60 (.983)
Difficult math	18/29 (.621)	15/16 (.938)	11/11 (1.000)	1/1 (1.000)	45/57 (.789)
Analogies	1/18 (.056)	21/26 (.808)	16/17 (.941)	3/3 (1.000)	41/64 (.641)
Postcasts	5/23 (.217)	6/16 (.375)	5/5 (1.000)	6/6 (1.000)	22/50 (.440)
Forecasts	5/25 (.200)	6/12 (.500)	6/8 (.750)	2/3 (.667)	19/48 (.396)
Total	29/95 (.305)	67/90 (.744)	62/65 (.954)	28/29 (.966)	186/279 (.667)

chi-square test, $\chi^2\,(1) = 25.63$, $p < .001$, indicates that the correct answer was more likely to be chosen by the group for an intellective task rather than a nonopinion judgmental task.

Hypothesis 3

The third hypothesis states that the self-reported confidence in a response should better predict its accuracy for intellective tasks than judgmental tasks. A repeated-measures ANOVA, which compared correct versus incorrect responses using the task item as the unit of analysis, demonstrates that individuals who chose the correct response for a particular item during the first administration of the tasks were typically more confident than those who chose an incorrect response for the same item, $F(1, 19) = 7.81$, $p < .02$ (see Table 6). This difference

TABLE 6
PROPORTION CORRECT AND REPORTED CONFIDENCE BY TASK TYPE

		Average reported confidence for	
Task	Proportion correct	Correct pregroup individuals	Incorrect pregroup individuals
Moderate math	.586	84.3	54.9
Difficult math	.292	64.1	42.4
Analogies	.397	66.5	54.9
Postcasts	.333	55.6	61.1
Forecasts	.236	51.7	52.4

TABLE 7
PROPORTION OF CASES IN WHICH THE PENTAD CHOSE THE RESPONSE OF THE MOST CONFIDENT FACTION (WHEN IT WAS ALSO CORRECT)

Task	Number in most confident faction: One	Two	Three	Four	Total
Moderate math	0/0	10/10 (1.000)	14/14 (1.000)	12/12 (1.000)	36/36 (1.000)
Difficult math	14/14 (1.000)	10/10 (1.000)	8/8 (1.000)	1/1 (1.000)	33/33 (1.000)
Analogies	1/6 (.167)	11/13 (.846)	10/10 (1.000)	2/2 (1.000)	24/31 (.774)
Postcasts	2/6 (.333)	1/3 (.333)	2/2 (1.000)	3/3 (1.000)	8/14 (.571)
Forecasts	2/6 (.333)	3/4 (.750)	2/2 (1.000)	1/2 (.500)	8/14 (.571)
Total	19/32 (.594)	35/40 (.875)	36/36 (1.000)	55/56 (.975)	109/128 (.852)

was not found for all items, however. Correct respondents were more confident in their choices than incorrect respondents for intellective items, $F(1, 11) = 31.79$, $p < .001$, but not nonopinion judgmental items, $F(1, 7) = 2.35$, $p > .10$.

Hypothesis 4

Support for the first hypothesis suggests that a group member's confidence predicts his or her influence within the group to the extent that the task is intellective. Support for the second and third hypotheses, however, demonstrates that accuracy better predicts both self-reported confidence and influence on the intellective tasks. These results highlight the possibility of Explanation 1 (“Confidence as a Cue”): Confident individuals *may* have more influence on intellective tasks simply because they are also typically more accurate. Therefore, the analyses testing hypothesis 1 were redone separately for cases in which the more confident member or faction was correct, and for cases in which the more confident member or faction was incorrect. The latter category is crucial since, in these cases, it is clear that the more confident members' responses are not chosen due to the confounding effect of accuracy.

In the dyad condition (see Table 2), $R_G = R_{IC+}$ in 63 of 71 cases when R_{IC+} was correct, and in 65 of 105 cases for which R_{IC+} was not correct. Binomial distributions indicate that chance alone is unlikely to produce proportions this high ($p < .001$ and $p < .01$, respectively). For cases in which the more confident member was correct, $P(R_G = R_{IC+})$ was greater on the three intellective tasks ($P = .964$) than it was on the two judgmental tasks ($P = .600$), χ^2 (1) $= 15.70$, $p < .001$. However, in cases in which the more confident member was incorrect,

TABLE 8
PROPORTION OF CASES IN WHICH THE PENTAD CHOSE THE RESPONSE OF THE MOST CONFIDENT FACTION (WHEN IT WAS INCORRECT)

	Number in most confident faction				
Task	One	Two	Three	Four	Total
Moderate math	1/16 (.063)	0/3 (.000)	2/3 (.667)	0/0	3/22 (.136)
Difficult math	2/16 (.125)	6/11 (.545)	3/3 (1.000)	0/0	11/30 (.367)
Analogies	2/14 (.143)	5/12 (.417)	3/5 (.938)	4/4 (1.000)	14/35 (.400)
Postcasts	1/12 (.083)	3/7 (.429)	10/15 (.667)	8/8 (1.000)	22/42 (.524)
Forecasts	2/25 (.080)	10/15 (.667)	6/8 (.750)	4/4 (1.000)	22/52 (.423)
Total	8/83 (.096)	24/48 (.500)	24/34 (.750)	16/16 (1.000)	72/181 (.398)

this difference was not statistically significant ($P = .686$ versus $P = .556$; χ^2 (1) $= 1.90$, $p > .10$).

Next, we will consider the pentad condition (see Tables 7 and 8). The response of a correct faction was more likely to be chosen by the pentad if it was also the most confident faction ($P = .852$) rather than one of the less confident factions ($P = .504$), χ^2 (1) $= 35.93$, $p < .001$. Likewise, an incorrect faction also proved influential more often if it was the most confident faction ($P = .398$) rather than a less confident faction ($P = .144$), χ^2 (1) $= 47.91$, $p < .001$.

For cases in which the most confident faction was correct, $P(R_{\mathrm{G}} = R_{\mathrm{FC+}})$ was greater on the intellective tasks than on the judgmental tasks after controlling for the size of the most confident faction, χ^2 (1) $= 13.32$, $p < .001$. But, if the most confident faction's response was incorrect, then $P(R_{\mathrm{G}} = R_{\mathrm{FC+}})$ did not differ between intellective and judgmental tasks after controlling for group size, χ^2 (1) $= 0.22$, $p > .10$.

In summary, similar results were found for both dyads and pentads. Greater confidence made a person (or faction) more influential regardless of accuracy. Contrary to the fourth hypothesis, however, when influence could not be directly attributable to accuracy, the social influence of confident individuals (factions) did not differ between intellective and judgmental tasks.

Group Size and Calibration

Increases in confidence and accuracy between the first and the second administrations of the task items were predicted to be positively related to group size. The data were analyzed with a series of repeated-measure 2 (administration) $\times$ 3

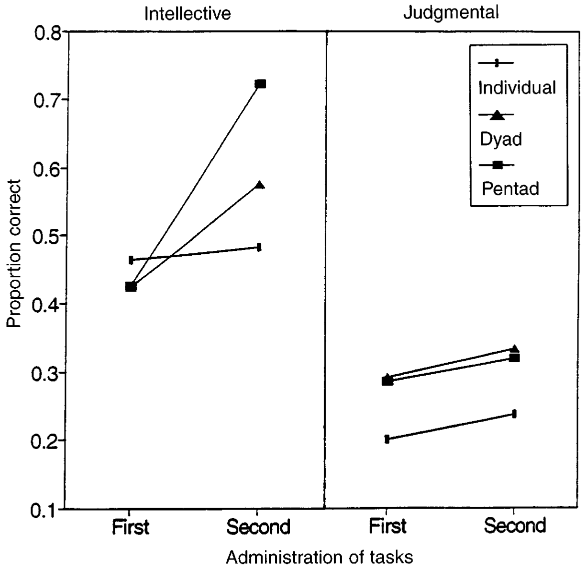

FIG. 1. Mean proportion correct as a function of task type, administration of task items, and group size during the second administration. (Data from the opinion task items were not used to compute accuracy.)

(group size) ANOVAs, averaging the initial confidence levels, and the initial accuracy levels, of group members in the pentad and dyad conditions. Separate analyses were conducted for the intellective and judgmental items. As before, data from the opinion items were not used to compute either accuracy or overconfidence.

For intellective tasks, the improvement in accuracy (from the first to second administration of the task) was much greater for teams with more members than teams with fewer members, $F(2, 51) = 29.7$, $p < .001$. See Fig. 1. In contrast, gains in accuracy did not vary as a function of group size for the judgmental items, $F(2, 51) = 0.0$, $p > .10$.

As shown in Fig. 2, reported confidence varied in the same manner as accuracy, though the differences between the intellective and the judgmental tasks were not as extreme. For intellective tasks, reported confidence increased more for larger than smaller groups, $F(2, 51) = 24.8$, $p < .001$. The same was true, to a lesser extent, for judgmental tasks, $F(2, 51) = 4.5$, $p < .02$.

The net effect of the changes in accuracy and confidence can be interpreted as changes in overconfidence (Soll, 1996; Yates, Lee, & Shinotsuka, 1996). The overconfidence levels are displayed in Fig. 3. For intellective tasks, there was a greater increase in overconfidence for groups that had fewer members, $F(2, 51) = 3.5$, $p < .05$. The opposite was true for judgmental tasks. Overconfidence of larger groups increased marginally more than that of smaller groups, $F(2, 51) = 2.8$, $p < .10$.

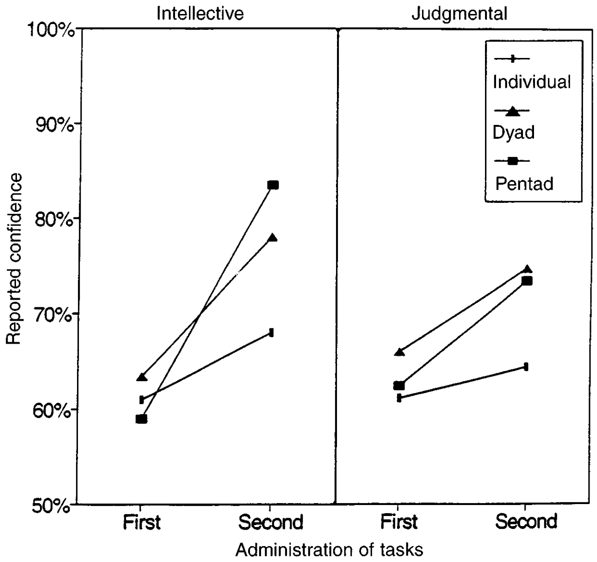

FIG. 2. Mean reported confidence as a function of task type, administration of task items, and group size during the second administration.

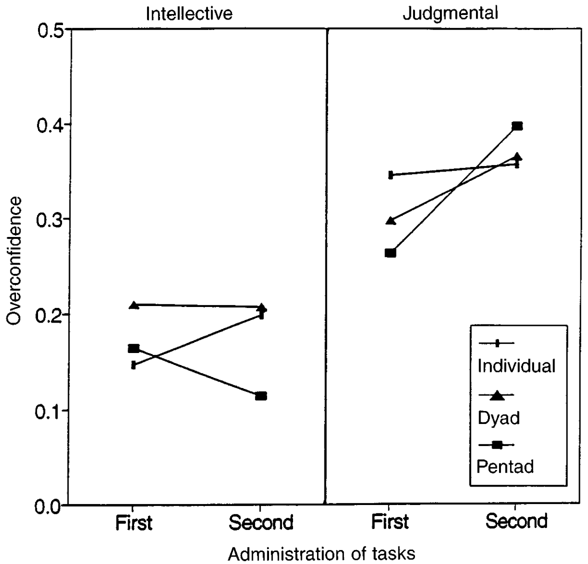

FIG. 3. Mean overconfidence (confidence–accuracy) as a function of task type, administration of task items, and group size during the second administration. (Data from opinion items were not used to compute overconfidence.)

DISCUSSION

As predicted, an individual's self-reported confidence best predicted his or her influence within a freely interacting group if the group was working on a task located on the intellective end of the judgmental–intellective continuum. This general conclusion not only accounts for the data generated in the present study; it can also reconcile a body of research (detailed in the introduction) with results previously thought to be mutually contradictory.

Two alternative explanations for this result have been proposed. As was suggested by the first of these explanations, ''Confidence as a Cue,'' confidence best predicted influence for intellective tasks largely as the result of two underlying effects: First, group members who chose the correct response were more likely to have their response chosen by their group to the extent that the task was classified as intellective. Second, individuals who chose the correct response on a particular item reported higher confidence than those who chose an incorrect response. Again, this effect was only apparent to the degree that the task was intellective rather than judgmental in nature.

The second explanation, ''Confidence as a Cause,'' asserted that, to the extent that the task is intellective, confidence creates an additional form of informational social influence, which acts independently of any effect of accuracy. The present investigation failed to provide evidence to support this idea. It should be stressed that the confidence of a group member does, in fact, have a significant impact upon the amount of influence that the individual enjoys within a group, above and beyond the influence related to the individual's accuracy. However, the location of the decision task along the intellective–judgmental continuum does not appear to affect strongly the degree to which confidence causes influence.

In short, confidence and accuracy both appear to act as forms of social influence in group decision making. The social influence of accuracy is strongest if the task is intellective rather than judgmental. In contrast, the social influence directly attributable to confidence is relatively constant regardless of accuracy or task type. While it is true that confidence is a more valid predictor of an individual's influence if the task is relatively intellective, this is not the result of additional social influence attributable to confidence on such tasks. Instead, confidence is correlated with accuracy on intellective tasks, and accuracy, in turn, is directly responsible for the increase in social power.

Although the current study suggests that confidence does, in fact, act as a form of social influence, one fundamental question remains unanswered: What is the specific reason why a group will more frequently choose the response of its most confident faction rather than the choice of a less certain faction? To address this question properly, one would need to investigate process variables more carefully than was done in the present study. Still, it may be useful to present some potential explanations.

First, it is possible that confident individuals tend to adopt *behavioral styles* (Moscovici, 1976) that are more persuasive. For example, confident group members may be more talkative or more confrontational. They are perhaps more zealous in defending their own viewpoints or more vehement in questioning the positions of others. A second interpretation is provided by Stasser and Davis's (1981) social interaction sequence (SIS) model. This model postulates that confident group members have more influence on the final group decision, not because they are more persuasive, but rather because they are more resistant to the normative pressures of the group situation. If a confident faction within a group steadfastly refuses to abandon its position, the others in the group may eventually choose to give up and let the confident faction have its way. Finally, one could also hypothesize that some groups turn to confidence levels to simplify the decision-making process. Such a group may use the choice of its most confident member as a default option. Group members may use this strategy either because they believe confidence to be an indication of accuracy or because they believe such behavior is dictated by social norms of fairness and courtesy. As stated earlier, the current study neither supported nor refuted any of these potential explanations. We do believe, however, that this may prove to be a fruitful area for future work.

A second general conclusion of this experiment is that task type mediates several effects of group size. Three group sizes were examined: one-, two-, and five-member teams. Task type mediated the impact of group size on reported confidence, accuracy, and overconfidence.

This set of results can be summarized as an effect analogous to the hard–easy effect (Lichtenstein, Fischhoff, & Phillips, 1982). Decision-makers appear to be aware of the task characteristics that should influence their confidence assessments, but the weight given to these factors is less than what is necessary to ensure perfect calibration. In the case of the hard–easy effect, individuals report higher confidence on easier tasks than more difficult tasks, but they do not adjust their confidence assessments far enough. As a result, people are overconfident for hard tasks and underconfident for easy tasks.

In the present study, reported confidence increased with group size to a greater degree for intellective than judgmental tasks. This is a good strategy if one believes calibration to be a desirable quality. After all, group size was shown to result in greater increases in accuracy to the extent that the task was intellective. However, people do not adjust their confidence estimates far enough in response to the nature of the task. Although the difference in confidence estimates made by large and small groups is greater for intellective than judgmental tasks, the difference is still too large for judgmental tasks and still not large enough for intellective tasks. As a result, (*a*) smaller groups may be more overconfident than larger groups on intellective tasks, and (*b*) larger groups may be more overconfident than smaller groups on judgmental tasks.

In short, the effect of group size on overconfidence is mediated by the nature of the task. This principle can account for the results of past research regarding the forecasting of future events—a judgmental task. Group discussion (Heath & Gonzalez, 1995) and other means of increasing effort on these tasks (Dunning *et al.*, 1990; Paese & Sniezek, 1991) have each resulted in increased overconfidence.

The current study illustrates that these findings may be limited to the choice of a judgmental task. The same methods may well cause a reduction in overconfidence if applied to a more intellective task.

In general, the judgmental tasks used in this study were the most difficult. This is not surprising. Recall that *demonstrability* is determined, in part, by the ability of correct group members to explain the accuracy of their solution and by the ability of incorrect members to understand well enough to accept the explanation (Laughlin & Ellis, 1986). On the other hand, the low accuracy rate on one relatively intellective task (difficult math problems) provides evidence that the term "intellective" should not be treated as a simple synonym of "easy." Further evidence of the difference between the two has been gathered by Vollrath *et al.* (1989). Their experiment included two tasks. One task (recall memory) was both more difficult and more intellective than the other (recognition memory).

Participants in this experiment were confronted with both intellective and judgmental tasks. It is possible that the presence of a variety of task types caused participants to look for salient differences between the tasks, thereby intensifying the effects of task type. On the other hand, if participants tried to develop a single decision-making strategy for the entire set of items, our method may have dampened the mediating role of task type.

Although the results were very similar between the two- and the five-person groups, there has been no attempt to deny the fact that the results of this study may not generalize to all situations. Indeed, the principal motivation of this experiment has been to demonstrate that the relation between confidence and influence is not constant or fixed. Evidence provided by this study has successfully shown that the relations between these and other variables are contingent upon the type of task with which the group is confronted.

The results suggest that by estimating the location of the task type along the intellective–judgmental continuum, one will be in a much better position to predict the relations among the group members' confidence, accuracy, and influence. The information provided by this study, however, is not sufficient to allow one to make specific predictions about the extent to which confidence will serve as a source or predictor of social influence outside a narrow range of situations. Beyond the choice of a task, we have identified three other aspects of group decision-making experiments that are likely to alter the relation between confidence and influence: the definition of confidence chosen by the researcher, the technique used to measure confidence, and the procedures that the participants are allowed or encouraged to use to reach a decision. This list is certainly incomplete, but it may serve as a useful guide for future research.

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