Two studies examined the impact of relative differences in access to information and anticipated group interaction on individual reasoning. On 2 different reasoning tasks (P. C. Wason’s [1966] selection task and D. Kahneman & A. Tversky’s [1973] lawyer–engineer problem), participants sensing that they knew more in anticipation of group interaction or knew less when not anticipating interaction were less susceptible to typical cognitive biases demonstrated by these tasks. Study 2 also showed that the effect of these social contexts was contingent on the task presentation format. Thus, knowing more in anticipation of group interaction and knowing less when not anticipating group interaction seemingly compensated for task features that enhance suboptimal reasoning strategies. These results illustrate the importance of the social context in which reasoning is situated and are discussed in terms of cognitive tuning, social comparison, and social motivations.

**Keywords:** anticipated group interaction, differences in access to information, impact of social context on reasoning, selection task, lawyer–engineer problem

In everyday life, people often have access to different sets of information. They are exposed to different sources of information. They do not read and listen to the same media and do not talk to the same people. Moreover, people with different referent groups, social values, and professions are attentive to different kinds of information. As a result, in conversations or meetings, people rarely know the same things, and often some know more than others. Decision environments that contain distributed information are fairly common in organizations and societies. Some decision makers may have access to more information than others, and some may have unique access to particular types of information giving them a sense of expertise. Thus, the knowledge held by individual decision makers may differ both quantitatively and qualitatively.

On the one hand, informational diversity has potential benefits for collective action and can promote team effectiveness (e.g., Jackson, 1991; Reagans & Zuckerman, 2001; Rodan, 2002). On the other hand, the potential benefits of diversity are not necessarily realized. Differential access to information has important consequences for information management in groups and for subsequent group outcomes (for reviews, see Stasser, 1999; Stasser & Titus, 2003; Wittenbaum & Stasser, 1996). For example, this line of research has shown that group discussions are dominated by information that is widely shared among group members before they meet and that the potential advantage of informational diversity within groups often goes unrealized (Larson, Christensen, Abbott, & Franz, 1996; Stasser, Taylor, & Hanna, 1989; Stasser & Titus, 1985, 1987; Stewart & Stasser, 1995). Although the consequences of informational diversity among group members have been examined extensively at the group level, how differential access to information among group members influences individual cognitive processes prior to the group interaction has not been systematically addressed. Nonetheless, it is generally recognized that people may approach impending group work quite differently depending on how they view themselves relative to other group members (Levine, Bogart, & Zdaniuk, 1996; Levine, Resnick, &...
Moreover, information processing at the group level depends on the mental activities of individual group members (Hinsz, Tindale, & Vollrath, 1997; Larson & Christensen, 1993). In this article, we focus on individuals as prospective group members and explore how perceptions of informational access affect individual information processing prior to the group discussion.

When decision makers are aware of possible differences in access to information, they may make inferences about how informed they are relative to other participants in a prospective group. Such inferences can be based on one’s direct experience with others (i.e., gender, physical appearance, occupations, avocations) or on knowledge acquired from the third parties (i.e., task coordinators, institutional authorities, mutual acquaintances). Inferences about relative knowledge likely trigger social comparison processes (Festinger, 1954; Suls & Wills, 1991; Wood, 1989) and impact both individual and collective information processing. For example, Bob thinks that he knows a fair amount about college basketball. He also knows that Ann never watches collegiate sports, whereas Connie reads Basketball News regularly. As a result, Bob feels informed relative to Ann but uninformed relative to Connie. Thus, he will likely react differently to an anticipated discussion about the National Collegiate Athletic Association basketball tournament depending on whether the discussion is with Connie or Ann. In a discussion with Connie, Bob may expect to receive more than transmit information, whereas in a discussion with Ann, he may expect to transmit more than receive. As a result, he would likely adjust his preparation and approach to these conversations as a function of his presumed knowledge relative to that of the conversational partner. In this article, we are primarily interested in how these perceptions of being relatively informed or uninformed affect processing and use of available information in reasoning tasks. Thus, we focus on perceived, not actual, differences in knowledge.

Research on cognitive tuning (Zajonc, 1960) has suggested that people who expect to transmit information develop more complex and organized cognitive structures than those who expect to receive information (for a review, see Guerin & Innes, 1989). In the same manner, Bargh and Schul (1980) showed that participants who expected to teach others verbal material integrated and retained information better than those who learned the same material for their own use. Benware and Deci (1984) noted the motivational processes implicated in such results. Participants who learned material with the expectation of teaching it to another student showed not only higher conceptual learning scores but also higher scores on intrinsic motivation scale. In line with this literature, it is plausible that individuals who think that they have more relevant information than other prospective group members may identify themselves as potential transmitters and thus attend to information more carefully and process it more deeply. Conversely, individuals who think that they have less relevant information than other prospective group members may identify themselves as potential receivers and suspend or postpone elaboration and use of information (Guerin & Innes, 1989; Levine et al., 1993).

In addition to affecting how individuals process information, perceptions of differential access to information may be interpreted as inequities in informational resources, and this sense of inequity could have motivational implications. A sense of having more relevant information than other prospective group members should promote a feeling of responsibility for available information (Tetlock, 1992) and thus increase effort expended in its elaboration and integration (Pett & Cacioppo, 1981). Such increased effort could also stem from an inclination to compensate for less informed group members (Karau & Williams, 1997; Kerr, 2001; Messé, Hertel, Kerr, Lont, & Park, 2002). Thus, both the cognitive tuning and social motivation literatures suggest that a sense of being more informed may promote more complete and systematic information processing.

The social comparison literature suggests a different impact of informational inequities. Comparisons to more informationally advantaged targets may actually enhance information processing (for a review, see Taylor, Waymert, & Carrillo, 1996), perhaps because of an achievement striving or self-improvement motivation (Major, Testa & Bylsma, 1991). Seta (1982) demonstrated, for instance, that participants performed better on a pattern recognition task completed in the presence of another student when the performer thought the other student was more capable rather than less or equally capable. Waymert and Taylor (1995) found that participants who were exposed to a high-performing confederate performed better than participants who were exposed to a low-performing confederate or not exposed to any potential comparison target. Similarly, Huguet, Galvaing, Monteil, and Dumas (1999) showed that forced social comparison with a slightly superior coactor facilitated performance in the Stroop task (Stroop, 1935). Thus, this line of research suggests that the feeling of being less informed may promote more thorough and systematic information processing. However, an important feature of this work is that there is typically no anticipation of working subsequently with the comparison target. In this article, we consider the possibility that perceptions of relative knowledge have countervailing effects on individual performance depending on whether one anticipates working with the comparison others or not.

In other words, we expect that the effects of knowing that one has more or less relevant information than others will be moderated by anticipation of group interaction. More specifically, for people who have a sense of knowing more, we expect that the anticipation of working with the comparison others will promote more elaboration and use of available information and will result in better performance on reasoning tasks as compared with those who do not anticipate working with the comparison others. We also expected the reverse effect of group anticipation for people who think that they have less relevant information. Knowing less than comparison others without the anticipation of working together will trigger a compensatory motivation and promote better task performance, whereas knowing less than prospective group members will not have such beneficial effects and may actually degrade performance.

**Experiment 1**

In the first experiment, we tested the foregoing predictions using the Wason selection task. Performance on this task typically demonstrates a confirmation strategy in hypothesis testing (see, e.g., Lakatos, 1970; Mynatt, Doherty, & Tweney, 1977; Popper, 1959). In its classic version, participants are given a conditional rule in the abstract form “if $P$ then $Q$” and a card deck. Each of four cards represents a separate instance that may satisfy or violate the rule: One side tells whether the instance has a property $P$, and the other side tells whether it has property $Q$. Participants can only see one
side of each card, and the side facing the participants displays, respectively, \( P \), non-\( P \), \( Q \), and non-\( Q \) properties. The task is to decide what card or cards need to be turned over in order to determine whether the given rule is true. To test the truth of the given conditional rule, participants need to adopt a falsification approach. That is, they need to focus on invalidating instances where a true antecedent is paired with a false consequent. However, instead of selecting cards that may display the \( P \) and non-\( Q \) property, individuals tend to select cards displaying \( P \) and \( Q \) or the \( P \) property alone (for a review, see Evans, 1982). That is, people’s selections are seemingly guided by a verification or confirmation bias in which they look for instances that are consistent with the rule (Klayman & Ha, 1987).

Several researchers explored conditions that may reduce this rather pervasive tendency. Replacing the task’s abstract content with more concrete or familiar themes only slightly diminishes the reliance on a confirmation strategy (see, e.g., Cheng & Holyoak, 1989; Cosmides, 1989; Cosmides & Tooby, 1992; Cox & Griggs, 1982; Evans, 1982; Fiddick, Cosmides, & Tooby, 2000; Johnson-Laird, Legrenzi, & Legrenzi, 1972; Sperber, Cara, & Girotto, 1995). There have also been attempts to test the impact of falsification instructions (i.e., instead of determining whether the given rule is true, participants were invited to decide what cards needed to be turned over in order to establish that the given rule was false). Alone, such instructions fail to enhance performance (Griggs, 1984; Yachanin, 1986; for an exception, see Yachanin & Tweney, 1982). However, falsification prompts may produce performance increments when reinforced by other features, such as specific content of the rule inducing some suspicion about its validity or thematic content of the task (Fiedler & Hertel, 1994).

These studies are evidence of significant attention devoted to the impact of task proprieties on rule-testing strategies. Less attention has been paid to the impact of cues elicited by social context. However, recent work by Dawson, Gilovich, and Regan (2002) showed the importance of individuals’ motivations in the use of a falsification strategy. Participants who tested rules implying their own early death or a self-threatening stereotype outperformed participants who tested pleasant or nonthreatening rules. Yet it is difficult to conclude that such results are due to the use of appropriate reasoning and not due to self-protecting strategies. Moreover, motivated reasoning demonstrated in this study is still elicited by the specific content of the task. Thus, to clearly demonstrate the impact of social context in which individual reasoning is situated, informational set was maintained constant across all conditions in the following experiment, and the task was presented in its abstract form (Wason, 1966) followed by a falsification instruction (Griggs, 1984; Yachanin, 1986). However, in contrast to these earlier studies, our participants were still asked to determine whether the given rule was true, but this classic version of the rule was followed by a general reminder about the importance of showing that no instance violates a rule in order to demonstrate its validity.

In line with our earlier reasoning, this experiment addresses the possibility that perceptions of relative knowledge have countervailing effects on individual performance on the Wason task, depending on whether one anticipates working with the comparison others or not. Thus, we predicted that participants who thought that they had more relevant information than others would be more likely to use the falsification cue and correctly solve the Wason task when they anticipated group interaction but that knowing more would not improve performance when no group interaction was anticipated. This prediction follows from the argument that the anticipation of collaborating with and feeling more informed than comparison others will promote more elaboration and use of available information. We also predicted the opposite effect of group anticipation for participants who thought that they had less relevant information than others. Namely, participants who felt relatively uninformed would perform better when they did not anticipate working with others than when they did. That is, knowing less than comparison others without the anticipation of working with them will trigger a compensatory motivation and enhance performance. Experiment 1 also examined the effects of group anticipation when participants were told nothing about relative knowledge and when they were explicitly told that everyone had the same amount of information. We did not expect that group anticipation by itself or under conditions of perceived information equality would systematically affect performance.

Method

Participants and Design

One hundred forty undergraduates at the Université Paris 5—René Descartes (117 women and 23 men) participated in the research on a voluntary basis. The study was a 2 (anticipated group interaction vs. no anticipated group interaction) \( \times \) 2 (relative amounts of information: more vs. less than others) factorial design.

We also ran three external control groups: one in which group interaction was anticipated but everyone in a prospective group had equal amounts of relevant information, one that simply mentioned that all individuals completing the task had equal amounts of relevant information, and one with no mention of relative amounts of information or group interaction. The dependent variable was performance on the Wason selection task.

Procedure

Participants were recruited to participate in a study on problem solving. Three people were convened at each experimental session. On arrival, they were told that the research addressed how people with different sets of information approach the same problem. They then moved to separate individual testing rooms. Depending on the experimental condition, participants were simply told that they had more or less relevant information than two other people with whom they were going to complete the same problem as a group (anticipated group interaction), or than other participants who had completed the same problem (no anticipated group interaction). In the control conditions, participants were told that (a) they had the same amount of relevant information as the two other people with whom they were going to complete the same problem as a group (anticipated group interaction), (b) they had the same amount of relevant information as other participants who had completed the same problem (no anticipated group interaction), or (c) there was no mention of relative amounts of information or possible group interaction. These preliminary instructions were also printed on the front page of the booklet that participants read. After reading the front page, participants were instructed to complete the task as it was presented on the following page of the booklet. The experimenter also noted that there was not a time limit and asked that they leave the individual testing room when they were finished. For participants assigned to the condition of anticipated group interaction, the experimenter stated that they would move to another experimental room to solve the same problem as a group. Then, the experimenter left the individual testing room. In actuality, there was no group interaction and all
participants were fully debriefed once they completed the problems as individuals.

Materials

As described above, the front page of the booklet given to participants contained the ostensible aims of the study and the manipulations of relative information and group anticipation. In fact, all participants received the same information about the task. The second page of the booklet presented four cards displaying, respectively, “B,” “D,” “3,” and “7.” Printed instructions said that each card had a letter on one side (either B or D) and a number on the other side (either 3 or 7). Their task was to select the cards that were necessary to test the truth of the following rule: “Lorsqu’il y a la lettre ‘B’ sur le recto de la carte, il y a le chiffre ‘3’ sur le verso de la carte” (“If there is a letter ‘B’ on one side of the card, then there is a number ‘3’ on the other”). These instructions were accompanied by an additional falsification cue as follows: “N’oubliez pas que pour pourvoir prouver qu’une règle est vraie, il faut montrer qu’il n’existe aucun cas où elle fausse” (“Do not forget that in order to prove that a rule is true, you need to demonstrate that there is no case in which it is false”) and a blank space for the solution. Performance was scored as correct when participants chose the potentially invalidating instances “B” and “7” and incorrect otherwise.

Results

Performance in Control Conditions

The control conditions were designed to answer two questions. First, does making explicit the fact that everyone has the same amount of information affect performance? Second, under an equal information set, does anticipated group interaction affect performance? When there was no mention of relative amount of information or group interaction, 8% (4 of 50) of participants chose the correct cards. Similarly, when participants were explicitly told that they had the same amount of information as others completing the task, 13% (4 of 30) were correct. Comparing these two control groups suggests that making explicit the fact that people had equal information did not alter the solution rates, \( \chi^2(1, N = 80) = 0.59, p > .5 \). Moreover, anticipated group interaction had no discernable effect on solution rates for participants who thought they had equal information. In the equal-information control, 7% (1 of 15) of those who anticipated group interaction selected the correct cards, and 20% (3 of 15) of those who did not anticipate group interaction solved the problem correctly, \( \chi^2(1, N = 30) = 1.05, p > .3 \). Overall, the solution rate of the control participants was 10% (8 of 80), which is slightly higher than the percentage (3.9%) of correct choices obtained in Wason’s classic experiments (Wason, 1968, 1969; cited in Wason & Shapiro, 1971). However, this difference in solution rates is only marginally significant, \( \chi^2(1, N = 208) = 3.21, p < .1 \). Thus, our participants, even with the addition of the falsification instruction, were not inclined to adopt a falsification strategy, and simply telling them that they had equal information or that they would be working in a group later did not substantially alter solution rates.

Performance in Experimental Conditions

We predicted that the anticipation of group interaction would increase solution rates when participants thought that they had more relevant information. We also predicted that the effect of anticipated group discussion would be reversed for participants thinking that they had less relevant information. The patterns of solution rates, depicted in Figure 1, are consistent with these predictions.

We conducted a \( 2 \times 2 \) logistic regression predicting correct and incorrect solutions as a function of anticipated group interaction and relative amount of information. Because one of the cells had a zero frequency of correct solutions (namely, the no anticipated group interaction–more information condition), a standard frequency adjustment of .5 divided by sample size was used to replace the zero frequency of correct solutions in that condition.\(^1\)

Neither the main effects of group anticipation, \( \chi^2(1, N = 60) = 0.53, p = .47 \), nor of relative amount of information, \( \chi^2(1, N = 60) = 0.81, p = .37 \), were significant. However, the predicted two-way interaction of these factors was significant, \( \chi^2(1, N = 60) = 7.59, p < .01 \).

To decompose the two-way interaction, we examined the simple main effects of anticipated group interaction at each level of relative amount of information. As predicted, when participants thought that they had more relevant information, those anticipating group interaction chose the correct cards (42.9%) more often than those not anticipating group interaction (0%). \( \chi^2(1, N = 29) = 4.11, p < .05 \). For participants who thought they had less relevant information, anticipation of group interaction resulted in lower performance (12.5%) as compared with those not anticipating group interaction (46.7%). \( \chi^2(1, N = 31) = 3.91, p < .05 \). Thus, the best performances were obtained when individuals thought they had more relevant information than two other individuals with whom they were going to work, and when they did not anticipate group interaction and thought they had less relevant information than others. This conclusion is bolstered by comparing individual experimental conditions with the overall performance in the control conditions. Participants thinking that they had more relevant information than the two other prospective group members were more likely to be correct than were the control participants, \( \chi^2(1, N = 94) = 10.15, p < .01 \). Participants who thought they had less relevant information than others but did not expect group interaction were also more likely to be correct than were the control participants, \( \chi^2(1, N = 95) = 12.77, p < .001 \). Solution rates for the remaining experimental conditions did not differ significantly from the rates in the control conditions (all \( ps > .2 \)).

Discussion

The results of Experiment 1 show that the social context in which individual reasoning activity is situated affects the confirmation bias in rule testing (Klayman & Ha, 1987). In preparation for group work on the Wason selection task, participants thinking they had more relevant information than others apparently attended to the available information more completely and performed better. Moreover, group anticipation had the opposite effect for participants thinking they had less relevant information than others. When participants thought they had less relevant information, they performed worse than participants thinking they had more relevant information. These results are consistent with previous findings that the social context in which individuals perform reasoning tasks elicits bias in the reasoning process.

\(^1\) For all of the subsequent analyses, we used a two-way chi-square test for independence, which does not require the adjustment for the zero frequency cell. However, because some of the expected frequencies under the null of independence were less than 5, we also performed a Fisher’s exact test for each comparison. Because results of Fisher’s exact test agreed with the chi-square test, we present only latter results.
information, those not anticipating group work performed substantially better than those who did anticipate interaction. The levels of performance under these conditions (43% and 47%, respectively) are rather striking given that the correct selection rates for an abstract version of the task rarely exceed 5% (Wason & Shapiro, 1971), and in our data, the solution rate is 8% for an abstract version accompanied by the falsification cue (control condition with no mention of social information).

The performance increment due to knowing more and anticipating group interaction is consistent with cognitive tuning (Zajonc, 1960)—that is, the idea that knowing more than future group members leads one to adopt an information transmitter role whereas knowing less than future group members leads one to adopt an information receiver role. Transmitters, as opposed to receivers, develop more complex and organized cognitive structures (Bargh & Schul, 1980; Guerin & Innes, 1989) and thus use the available information more thoroughly. Such an interpretation is bolstered by the fact that differences in performance disappeared when participants thought that prospective group members had equal amounts of relevant information (in the control conditions). The results are also consistent with the motivational boost that may occur when participants think they have more relevant information than other group members and feel more responsible (Tetlock, 1992) or more need to compensate for their ill-informed group members (Kerr, 2001).

Additionally, it is noteworthy that the effect of relative knowledge perception was strikingly different when participants did not expect to interact with the comparison others. In this case, perceptions of knowing less led to better performance. Knowing less in this case seemed to trigger compensatory effort.

Experiment 1 has two major limitations. First, we obtained no measures of effort or time expended on the task. Thus, it is not clear whether our results are due primarily to the time or effort expended on the task (as suggested by social motivation accounts) or to qualitative differences in how the available information was processed and integrated (as suggested by cognitive tuning). Second, because solution rates for the Wason task are ordinarily so low, it is possible to obtain performance increments but not feasible to show performance decrements due to the social context. Thus, we showed that knowing more in anticipation of group interaction and knowing less without anticipation of group interaction improved performance relative to control conditions. However, it is not clear whether knowing less in anticipation of group interaction (or knowing more without anticipation) degrades performance, because it is not possible to do much worse than the 5%–10% solution rates that are typical of individual performance.

Experiment 2

The aims of this experiment were several. First, we wanted to replicate our results with another reasoning task less prone to the limitations delineated above. Second, we supplemented task performance with additional measures that would shed some light on the question of whether the social context effects observed in Experiment 1 were due simply to more investment in task completion or also due to qualitative differences in how task-relevant
information was processed. To this end, an argument-listing task was added to assess content of individual cognition, and a time-on-task measure was added to assess the amount of this cognition. Finally, we wanted to investigate the idea that cues provided by social context may compensate for the lack of task features that enhance effective reasoning strategies.

The task that we used in this study is a variant of the lawyer–engineer problem used by Kahneman and Tversky (1973). In its original formulation, participants are presented with a description of a person (“Zev”) who was randomly drawn from a sample composed of 30% lawyers and 70% engineers in one condition and of 70% lawyers and 30% engineers in another condition. The individual case of Zev contains characteristics that are stereotypically diagnostic of lawyers (e.g., politically active, argumentative). The participants are asked to estimate the chances out of 100 that Zev is a lawyer and the chances out of 100 that Zev is an engineer.2

Typical findings have shown that participants tend to ignore or give little weight to the base rates (i.e., the proportion of lawyers and engineers in the sample). That is, when making probabilistic judgments, they tend to disregard the logically relevant base-rate information and to rely instead on the stereotypical similarity between the target and the prototypes of categories under consideration (for reviews, see, e.g., Sherman & Corty, 1985; Tversky & Kahneman, 1982). Some researchers have suggested that base-rate neglect is specific to certain task formats (e.g., Ajzen, 1977; Beckett & Park, 1995; Birbaum & Mellers, 1983; Drozdasenkowski, 1997; Lovett & Schunn, 1999; Macchi, 1995; Richard & Drozda-Senkowska, 2001; for a review, see Koehler, 1996). If, for instance, the task is presented as a list of distinct statements, individuals show stronger base-rate sensitivity than in the original paragraph presentation (Ginossar & Trope, 1987, Experiment 2; see also Trope & Ginossar, 1988). According to these authors, this result is due to equalizing the salience of the base rate and stereotypical trait information in such presentations. This salience equalization is also affected by the order of items in the list format. Indeed, when the base-rate information is introduced in the middle of the list, people use it less than when it is introduced at the beginning of the list (Vasiljevic, 2002). In sum, different presentation formats seemingly affect the salience of base-rate information and the degree to which base-rate information informs judgments.

Thus, we expected that social context effects might be contingent on the task presentation format (Festinger, 1954; Payne, 1982), such that by promoting more systematic and complete consideration of task-relevant information, the social context may compensate for the lack of task features enhancing use of base rates (for a similar argument, see also Baron, Vandello & Brunsman, 1996). To assess this prediction, the same task was presented in three different presentation formats varying in degree of base-rate information salience (high, moderate, and low).

Base-Rate Salience

We predicted that probability estimates and the arguments generated to support them would be the most base-rate consistent when the base-rate information was introduced first in a list format and the least base-rate consistent when the base-rate information was embedded in the introductory paragraph of the traditional format. A list format that included the base-rate information in the middle was expected to yield an intermediate degree of base-rate sensitivity.

Social Context

Consistent with the findings of Experiment 1, we expected that base-rate sensitivity would be affected by an interaction of relative amount of information and the anticipation of group interaction. More specifically, we predicted that individuals who thought that they had more relevant information would make more base-rate-consistent judgments and arguments when they anticipated solving the same problem with others as a group. Conversely, we predicted that individuals thinking they had less relevant information than comparison others would be more base-rate sensitive when they did not anticipate group interaction.

Additionally, we expected that social context would interact with base-rate salience. If the social context is affecting how and how much task-relevant information is processed, then the relative knowledge and group anticipation interaction should be most evident when the salience of the base-rate information is low (i.e., the traditional paragraph format) and least evident when the salience of the base-rate information is high (i.e., contained at the beginning of a list format). That is, we predicted a triple interaction of relative amount of information, anticipated group interaction, and task format.

Finally, we explored the relationships among base-rate sensitivity, time on task, and argument content. In particular, we wanted to examine whether base-rate sensitivity was associated with working longer on the task or with focusing attention on the more analytically relevant base-rate information (or both).

Method

Participants and Design

Two hundred twenty-seven undergraduates at the Université Paris 5—René Descartes (190 women and 37 men) participated in the research on a voluntary basis. The main design of the study was a 2 (anticipated group interaction or no anticipated group interaction) × 2 (relative amounts of information: more or less than others) × 3 (salience of base rates within a task format: high, moderate, or low) factorial. Similar to Experiment 1, we also ran three external control groups: one in which group interaction was anticipated but everyone in a prospective group had equal amounts of relevant information, one that simply mentioned that all individuals completing the task had equal amounts of relevant information, and one with no mention of relative amounts of information or group interaction. We ran these three external control groups for all three task-presentation formats. For ease of presentation, we treated the control conditions as a 3 (control condition: equal information–anticipated interaction, equal information–no anticipated interaction, or no mention of information amount nor interaction) × 3 (salience of base rates within a task format: high, moderate, or low) factorial design. The main dependent variable was the estimated probability that the person described was a lawyer. Also, in the experimental conditions, we recorded the number of arguments generated in favor of the estimates proposed and the time spent on generating probability estimates and arguments.

2 Afterward, most of the researchers in the field have followed an asymmetric approach by requesting participants to supply estimates for only one of the target categories (e.g., for lawyers).
**Procedure**

The procedure was similar to the one used in Experiment 1. Participants were recruited to participate in a study on problem solving. Three people attended each experimental session. On arrival, they were told that the research aimed to study how people with different sets of information approach the same problem. Then they moved individually to adjoining testing rooms and received the instructions regarding relative information (more or less than others) and group anticipation (anticipation or no anticipation). In the control conditions, participants were told that they had the same amount of relevant information as the two other people with whom they were going to complete the same problem as a group (anticipated group interaction) or they had the same amount of relevant information as other participants who had completed the same problem (no anticipated group interaction) or there was no mention of relative amounts of information or possible group interaction. These preliminary instructions were also printed on the front page of the booklet that participants read. After reading the front page, participants were instructed to complete the tasks as they were presented on the subsequent pages of the booklet. The experimenter also noted that there was no time limit and asked that participants leave the individual testing rooms when they were finished. For participants assigned to conditions of anticipated group interaction, the experimenter stated that they would move to another experimental room to solve the same problem as a group. Then, the experimenter left the experimental room and recorded the elapsed time (in seconds) until each participant returned the completed questionnaire. There was no actual group interaction, and participants were fully debriefed once they had finished.

**Materials**

Each participant received a booklet containing the ostensible aim of the study and information relative to the experimental inductions on the front page. As in Experiment 1, the informational set was actually constant across all conditions even though some participants were told that they had more or less information. The second page of the booklet contained the lawyer–engineer problem (Kahneman & Tversky, 1973) and a blank space for the solution. The third and final page of the booklet contained instructions at the top asking participants to list arguments supporting the judgment that they had made on the previous page.

According to experimental condition, the lawyer–engineer problem was presented in different formats varying the salience of base rates (a) in a list format (Ginossar & Trope, 1987), (b) in a list format but with base-rate information introduced in the middle of the list (Vasiljevic, 2002), or (c) in the original paragraph format (Kahneman & Tversky, 1973), respectively. In all formats, the portrait of the person (“Jean”) contained characteristics that are stereotypically characteristic of lawyers, and the presented base rates were inconsistent with the description (30% lawyers and 70% engineers).

**Arguments**

Two judges independently coded 104 of the argument protocols. Written protocols of 9 participants were excluded from the analyses because of unclear handwriting. Coders counted the number of arguments generated by participants in support of their probability estimates. Coders also categorized generated statements into base-rate and case-consistent arguments. A generated statement was coded as a base-rate consistent argument when it referred to the base-rate information (e.g., “There was only 30% of lawyers in the sample”; “Jean was randomly selected from the sample”) and also when it discounted the relevance of a piece of descriptive information in the case (e.g., “Both lawyers and engineers can possess excellent oral abilities”; “A doctor, a lawyer . . . anybody can be politically active” “Having two kids does not say much about the probability of being a lawyer”). A statement was coded as base-rate inconsistent when it used descriptive information from the case as a supporting argument (e.g., “He is a lawyer because lawyers are often highly argumentative and politically active”; “A family—that is typical of a lawyer”).

**Results and Discussion**

**Base-Rate Sensitivity in Control Conditions**

As in Experiment 1, the control conditions were designed to assess whether making explicit the fact that everyone had the same amount of information and whether anticipated group interaction by itself affected performance. Additionally, the control conditions provided a test of the presumed effect of presentation format. We analyzed participants’ estimates that “Jean is a lawyer” in a 3 (control condition) × 3 (base-rate salience) analysis of variance (ANOVA). The main effect of control condition, $F(2, 96) = 0.27$, ns, and the interaction of control condition with task format, $F(4, 96) = 1.40, p > .2$, were both nonsignificant. However, as predicted, the main effect of task format was significant, $F(2, 96) = 9.93, p < .001, \eta^2 = .17$.

Recall that all participants were told that only 30% of the cases in the sample were lawyers, whereas the description of Jean was stereotypically representative of lawyers. Thus, estimates near 30% signify more base-rate sensitivity than estimates much greater than 30%. As expected, participants assigned to the presentation format with high base-rate salience showed a relatively strong base-rate sensitivity ($M = 39.2; SD = 13.5$). Slightly less base-rate sensitivity was observed for participants who received the task in moderate base-rate salience format ($M = 44.4; SD = 19.6$).

Finally, the presentation in the traditional paragraph format yielded the highest base-rate neglect ($M = 57.2; SD = 19.8$). Testing for trends across the a priori ordering of task format yielded a significant linear trend, $F(1, 96) = 18.15, p < .0001, \eta^2 = .16$, and a nonsignificant quadratic trend, $F(1, 96) = 1.72, p > .15$. However, pairwise contrasts revealed that the estimates for the two list formats, although in the predicted direction, were not significantly different, $F(1, 96) = 0.99, p > .30$. The estimates for the classic paragraph format were significantly higher than estimates for the list formats, $F(1, 96) = 18.88, p < .0001, \eta^2 = .16$. Thus, the control data suggest that presentation format affected base-rate sensitivity, but this effect was not reliably different for the two list formats.

**Base-Rate Sensitivity in Experimental Conditions**

We predicted that probability estimates and the arguments generated to support these estimates would be associated with an interaction among relative amount of information, group anticipation, and task format. More specifically, we expected a two-way interaction between relative amount of information and group anticipation in the formats that obscure base-rate information (paragraph and list with base-rate information in the middle) but not when the base-rate information was first in a list format.

**Probability estimates.** To test the above prediction, a $2 \times 2 \times 3$ ANOVA with anticipated group interaction, relative amount of information, and task format as the three between-participants factors was conducted using probability estimates as the dependent variable. This analysis yielded a significant main effect of task format, $F(2, 110) = 8.76, p < .001, \eta^2 = .14$. As with the control data, the linear contrast using the a priori ordering of the task
format was significant, $F(1, 110) = 17.25, p <.0001$, $\eta^2 = .14$, and the quadratic trend was not significant, $F(1, 110) = .25, ns$. Moreover, the probability estimates of the experimental participants supported our initial assumption that the two list formats of the task differed in their capacity to elicit use of base rates. Indeed, the pairwise comparison between the task presented as a list format with base-rate information first ($M = 40.5, SD = 17.8$) and the task presented as list format with base-rate in the middle ($M = 50.1, SD = 17.7$) was significant, $F(1, 110) = 6.35, p < .02, \eta^2 = .05$. Consistent with the results from the control condition, probability estimates for the task in a classic paragraph presentation ($M = 56.4, SD = 18.6$) were significantly higher than for the two list presentations, $F(1, 110) = 11.17, p < .002, \eta^2 = .09$. Thus, as we originally expected, the experimental data showed that the task presented in the list format, base-rate information first, elicited more base-rate sensitivity than the task presented in the list format with the base-rate information in the middle of the list. Moreover, both the control and experimental data supported the conclusion that the classic paragraph format yielded the least base-rate sensitivity.

The interaction of anticipated group interaction by relative amount of information was also significant, $F(1, 110) = 5.23, p < .03, \eta^2 = .05$. However, this two-way interaction was qualified by the predicted three-way interaction of anticipated group interaction, relative amount of information, and task presentation format, $F(2, 110) = 3.68, p < .03, \eta^2 = .06$. We decomposed this triple interaction (depicted in Figure 2) by testing the two-way interaction of Anticipated Group Interaction $\times$ Relative Amount of Information at each level of task format. As predicted, the two-way interaction was not significant for the high base-rate salience format, $F(1, 110) = 0.79, ns$. For all combinations of relative amount of information and anticipated group interaction, participants who received this presentation format supplied estimates relatively close to the given base rate ($M = 40.2, SD = 17.8$). However, as predicted, the interaction of the anticipated group interaction and relative amount of information was significant for presentation formats with moderate, $F(1, 110) = 6.44, p < .02, \eta^2 = .06$, and low, $F(1, 110) = 5.29, p < .02, \eta^2 = .05$, salience of base rates.

As shown in Figure 2, the patterns for presentation formats moderate and low in base-rate salience were similar to those observed in Experiment 1. For the format moderate in base-rate salience, participants’ estimates tended to be closer to the given base rate (30%) when they thought that they had more relevant information than others and anticipated group interaction ($M = 44.5, SD = 20.2$) than when they thought they had more information and did not anticipate group interaction ($M = 57.0, SD = 16.9$), $F(1, 110) = 2.54, p < .10, \eta^2 = .02$. The same pattern was more pronounced for participants assigned to the format low in base-rate salience, $F(1, 110) = 6.84, p < .02, \eta^2 = .06$. They evidenced more base-rate sensitivity when thinking they had more relevant information than others and anticipating group interaction ($M = 48.5, SD = 18.9$) than their counterparts who did not anticipate group interaction ($M = 69.0, SD = 16.1$).

As compared with those who thought they had more information, participants who thought that they had less relevant information produced a reverse pattern of group anticipation effects. For these relatively uninformed participants, estimates were closer to the given base rate when they did not anticipate group interaction than when they did. However, this effect was significant only for the task presentation with moderate salience of base rates (no group anticipation: $M = 41.5, SD = 9.4$; group anticipation: $M =$

Figure 2. Estimated likelihood (chances out of 100) that the individual described is a lawyer as a function of anticipated group interaction, relative amount of information, and task format.
Arguments. Arguments generated to support probability estimates formed another indicator of base-rate sensitivity. On the basis of the independently coded protocols, intercoder reliability was estimated by correlating the counts generated by the two coders. For the total number of arguments, the estimated intercoder reliability was \( r(104) = .91, p < .0001 \). For the number of base-rate-consistent arguments (i.e., either explicitly mentioning base-rate information or discounting the relevance of case information), the estimated intercoder reliability was \( r(104) = .90, p < .0001 \).

As expected, the number of base-rate-consistent arguments was negatively correlated with estimates, \( r(113) = -.59, p < .0001 \). More base-rate-consistent arguments were associated with lower, and more base-rate-consistent, estimates. However, as might be expected, the number of base-rate arguments was correlated with the total number of arguments, \( r(113) = .27, p < .01 \). Therefore, we computed the partial correlation between the number of base-rate arguments and probability estimates, controlling for the total number of arguments. This partial correlation was high, \( r(113) = -.73, p < .0001 \).

To explore whether social context affected the focus of arguments on base-rate information, we ran a \( 2 \times 2 \times 3 \) ANOVA with anticipated group interaction, relative amount of information, and task format as three between-groups factors on the number of base-rate-consistent arguments. The main effect of task format was significant, \( F(2, 101) = 4.93, p < .01, \eta^2 = .09 \). There were higher numbers of base-rate arguments for the format with high salience of base rate (\( M = 1.64, SD = 1.08 \)) than for the formats with moderate (\( M = 1.41, SD = 1.28 \)) and low salience of base rate (\( M = 0.83, SD = 1.03 \)). The linear trend was significant across task formats ordered by base-rate salience, \( F(1, 101) = 9.59, p > .01, \eta^2 = .09 \), and the quadratic trend was not significant, \( F(1, 101) = 0.39, ns \).

The pattern of means for number of base-rate arguments in Figure 3 looks like the mirror image of the pattern for probability estimates (see Figure 2), consistent with the high negative correlation reported above. Nonetheless, unlike the results for the probability estimates, the three-way interaction for the number of base-rate arguments was not significant, \( F(2, 101) = 0.75, ns \). However, the two-way interaction of relative amount of information and anticipated group interaction was significant, \( F(1, 101) = 6.65, p < .02, \eta^2 = .06 \).

To further examine the relationship between content of arguments and probability estimates, we ran a \( 2 \times 2 \times 3 \) analysis of covariance with anticipated group interaction, relative amount of information, and task format as three between-groups factors, using probability estimates as the dependent variable and the
number of base-rate-consistent arguments and the total number of arguments as covariates. Consistent with the correlational analysis, the effect of both covariates was significant for total number of arguments, \( F(1, 99) = 56.11, p < .0001, \eta^2 = .36 \), and for number of base-rate arguments, \( F(1, 99) = 86.45, p < .0001, \eta^2 = .47 \). Recall that these covariates have countervailing relationships with estimates: More arguments overall were associated with higher estimates, but more base-rate arguments were associated with lower estimates. Controlling for arguments, the three-way interaction of task format, group anticipation, and amount of information on estimates was not significant, \( F(2, 99) = 1.94, p > .10 \). Similarly, the two-way interaction of group anticipation and amount of information was nonsignificant in the presence of the covariates, \( F(1, 99) = 1.24, p > .20 \). This pattern of findings is consistent with the interpretation that cues provided by the social context led to more attention to and use of the base-rate information, which in turn affected estimates.

### Time Spent on Task

As for base-rate sensitivity, we predicted that time spent on task would be a function of the three-way interaction between group anticipation, relative amount of information, and task format. A \( 2 \times 2 \times 3 \) ANOVA yielded a significant two-way interaction of amount of information and group anticipation, \( F(2, 110) = 8.89, p < .01, \eta^2 = .14 \). The three-way interaction was not significant \( F(2, 110) = 2.86, p = .06, \eta^2 = .05 \). Decomposing the two-way interaction revealed that participants who thought they had less information spent more time on task when they did not anticipate group interaction \((M = 486 s, SD = 197)\) than when they did \((M = 383 s, SD = 123)\), \( F(1, 110) = 5.35, p < .05, \eta^2 = .05 \). The reverse pattern obtained for those who thought they knew more. For these participants, those who anticipated group interaction spent more time on task \((M = 519 s, SD = 205)\) than those who did not \((M = 435 s, SD = 172)\), although this difference was not significant, \( F(1, 110) = 3.54, p < .07, \eta^2 = .03 \).

Even though this overall pattern of findings is consistent with our original hypotheses, time spent on task was not correlated with probability estimates, \( r(122) = .04 \), or with the number of base-rate-focused arguments, \( r(113) = .14 \). Time on task was correlated slightly with total number of generated arguments, \( r(120) = .27, p < .01 \). Remember, however, that recorded time encompassed time to generate both probability estimates and arguments and that the total number of arguments generated was inversely related to base-rate sensitivity. Therefore, it is possible that total number of arguments suppressed the zero-order correlation between time and probability estimates. However, the partial correlation between time and probability estimates, controlling for total number of arguments, was also not significant, \( r(113) = -.05 \).

Thus, even if the similarity in patterns between base-rate sensitivity and the time spent on task suggests that the effects of social context on base-rate sensitivity were partly due to the time spent generating estimates, the low correlation between time and estimates (even when variation due to number of arguments was partialed out) makes this an untenable conclusion. Rather, it appears that social context affected similarly the investment of time to complete the task and base-rate sensitivity but that these effects were independent of one another.

## General Discussion

The findings from the two experiments provide substantial evidence in favor of social regulation of individual reasoning. Our original thinking was that elaboration and use of available information would be enhanced by cues provided by social context as defined by relative amount of information and anticipated group interaction. We hypothesized that more systematic and thorough use of information would occur when participants thought they knew more than other people with whom they were going to complete the same problem and that this enhanced information processing would reduce cognitive deficiencies such as confirmation bias and base-rate neglect. The results are consistent with this idea. In Experiment 1, using a rule-testing task (Wason, 1966), participants who thought that they had more relevant information and anticipated group interaction were more likely to benefit from the added falsification cue and less likely to fall prey to the confirmation bias (Klayman & Ha, 1987). In Experiment 2, using the lawyer–engineer problem (Kahneman & Tversky, 1973), the same combination of being relatively informed and anticipating group interaction resulted in more base-rate sensitivity. Moreover, the benefits of being relatively informed in anticipation of group interaction were most evident when the task presentation obscured the salience of the base-rate information. Thus, social context seemed to compensate for the lack of task features that enhance more optimal reasoning strategies.

We considered two general types of explanations for the effects of social context on reasoning: social motivation and cognitive tuning. Consistent with the presumed role of social motivation, the time spent on task in Experiment 2 suggests that knowing more in anticipation of subsequent group work resulted in more investment of time. However, neither time nor time adjusted for total number of arguments correlated with performance. Thus, participants did seem to work longer on the task when they thought they had more relevant information than their future group members, but the degree of base-rate sensitivity was not affected by this additional effort. Additionally, producing more arguments was associated with lower base-rate sensitivity. This also suggests that working longer and doing more were not the reasons for improved base-rate sensitivity. Such results are consistent with the idea that general motivation to perform well, as evidenced by investment in the task (Kiesler, 1971), is not sufficient to improve performance, at least on reasoning tasks such as those we used (Dawson et al., 2002; Wason & Johnson-Laird, 1972).

The cognitive tuning idea provides a better account of the relative knowledge effects when group interaction is anticipated. That is, knowing more in anticipation of group work may have invoked an information transmitter role that led to more complex and elaborated thinking. In support of this notion, argument content was correlated with performance. When participants’ arguments focused more on base-rate information or discounted the relevance of descriptive information, judgments were more base-rate sensitive. Moreover, mediational analyses supported the conclusion that the content of arguments mediated the judgments. Thus, Experiment 2 provided substantial evidence that cognitive focus on base-rate information was crucial for the performance increment.

In sum, the performance effects of knowing more in anticipation of group interaction can be understood in terms of cognitive tuning.
(Zajonc, 1960; see also Bargh & Schul, 1980; Benware & Deci, 1984; Guerin & Innes, 1989). That is, knowing more than future group members leads one to adopt an information transmitter rather than a receiver role, resulting in more thorough elaboration and use of available information.

Our results also show that when participants did not anticipate working with others, the sense of having less, not more, information resulted in performance increments. On the face of it, these findings are consistent with the idea of compensatory motivation due to comparisons with a more advantaged target (Huguet et al., 1999; Major et al., 1991; Seta, 1982; Waymert & Taylor, 1995). It is important to note that if compensatory motivation is beneficial to performance for informationally disadvantaged participants, the expectation of group interaction eliminates it. Moreover, the lack of correlation between time on task and base-rate sensitivity in Experiment 2 suggests that the effects of knowing less than comparison others seems to be due to something other than simply working harder or longer on the task. Like knowing more in anticipation of group interaction, knowing less than comparison others without anticipated group interaction fostered more systematic and critical use of available information that was independent of the investment of time and effort in the task performance. Although we are inclined to interpret the group anticipation results in terms of cognitive tuning, this idea does not provide a plausible explanation for the sizable performance increments that are due to knowing less when future interaction is not anticipated. In the absence of anticipated interaction, transmitter and receiver roles are not relevant. In sum, the performance similarities for being more informed than future groups members and for being less informed than generalized comparison others are striking, despite obvious differences in social contexts.

One implication of our findings is that the motivational effects of social comparison are quite different depending on one’s anticipated relationship to the comparison target. Stated differently, our findings suggest that the anticipation of future interaction moderates the performance effects of upward and downward comparisons. These findings raise several questions regarding social comparisons and performance. For example, in our studies, participants who anticipated group interaction expected to work on the same problem as a group. Moreover, the cognitive tuning explanation is most relevant when the anticipated group work is identical, or at least very similar, to the individual performance. Thus, our explanation suggests that it was not the anticipation of group interaction, per se, but the anticipation of working together on the same problem that produced the performance increments for the “more informed” and decrements for the “less informed.” This raises a question of both theoretical and applied significance. If future group members expect to work on a different task in the group than the one they complete individually, what would be the performance effects of knowing more and knowing less those in the group? Our conjecture is that it would depend on the inferred similarity between that individual and group task. If future group members assumed that performance on the individual task would positively transfer to performance on the group’s task, then we expect that our group anticipation findings would be obtained. However, if the individual and group tasks were seen as unrelated, then one might expect the performance effects of knowing more or less to resemble those of our “no-anticipation” participants. Another possibility is that knowing more relative to future group members confers a sense of status or responsibility that has motivational effects independent of the relationship between individual and group tasks. The current findings suggest, on the whole, that people approach impending group work differently depending on how they view themselves relative to other group members. However, one limitation of the studies is precisely the fact that participants never actually worked in a group. Although it seems plausible that individual cognitive work in preparation for group work would impact the quality of group performance, we certainly have not demonstrated that this is the case. Thus, from a group performance perspective, the degree to which our findings impact group performance is an open question. It still remains highly plausible that the individuating information (in the lawyer–engineer problem) may dominate in group discussion of the problem even if some members were induced to focus on the base-rate information prior to discussion. Indeed, representations of the problem that are easily defendable in discourse or widely shared may dominate the group’s production (see Tindale, 1993; Tindale, Smith, Thomas, Filkins, & Sheffey, 1996).

Finally, the current results are relevant to the literature on collective information pooling, which shows that information that is widely shared before discussion dominates group discussions and decisions (for reviews, see Stasser, 1999; Stasser & Titus, 2003; Wittenbaum & Stasser, 1996). The typical cover story in the information-pooling literature states, “In real life, group members often have different information. Thus, you may not all have the same information.” This forewarning could be interpreted by participants in one of several ways. One way could be, “I do not know everything that others know,” which is similar in meaning to the instruction that we used in the less information conditions. It could also be interpreted as, “I know things that others do not”—an interpretation that according to our results has a quite different information-processing effect. If participants in the classic information-pooling experiments (Gigone & Hastie, 1993, 1996; Stasser & Stewart, 1992; Stasser & Titus, 1985, 1987; Stewart & Stasser, 1995) tended toward the “I know less” interpretation, the inefficiency in collective information sharing may originate in how individuals process information prior to the group discussion. Moreover, Stasser, Vaughan, and Stewart (2000; see also Stasser, Stewart, & Wittenbaum, 1995; Stewart & Stasser, 1995) found that expertise assignment increased the amount of information pooling during group discussions. It is plausible that the expertise assignment may have induced the same underlying mechanisms as the “know more” frame in the current experiments. That is, the expert role manipulation focused on identifying the type of information that one knows that others do not. Our findings suggest that such a “know more” impression may lead future group members to process the available information more extensively and more deeply. Moreover, an unambiguous “know more” frame may also lead to feelings of responsibility and thus stronger adherence to the expert role. Both seem necessary conditions for effects of expert role assignment to occur (Stasser, 1999; Stasser et al., 1995).

Thus, intrainsividual and group-level approaches to consequences of differential access to information are seemingly complementary. However, this claim of such complementarities is not new. Asch (1952) pointed out that

we need a way of understanding group process that retains the prime reality of individual and group, the two permanent poles of all social
processes. We need to see group forces arising out of the actions of individuals and individuals whose actions are a function of the group forces that they themselves (or others) have brought into existence. (p. 251)

References


