Original Article

Grading Hampers Cooperative Information Sharing in Group Problem Solving

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Abstract. We hypothesized that individual grading in group work, a widespread practice, hampers information sharing in cooperative problem solving. Experiment 1 showed that a condition in which members' individual contribution was expected to be visible and graded, as in most graded work, led to less pooling of relevant, unshared information and more pooling of less-relevant, shared information than two control conditions where individual contribution was not graded, but either visible or not. Experiment 2 conceptually replicated this effect: Group members primed with grades pooled less of their unshared information, but more of their shared information, compared to group members primed with neutral concepts. Thus, grading can hinder cooperative work and impair information sharing in groups.

Keywords: information sharing, grades, hidden profiles, cooperation, mixed-motives

Can people genuinely cooperate when their performance is assessed individually? This question epitomizes an interesting, albeit problematic societal phenomenon whereby cooperation is promoted as a fruitful working structure in both educational (e.g., Johnson & Johnson, 2009) and organizational settings (e.g., Wong, Tjosvold, & Liu, 2009), while at the same time individual grades are by far the dominant assessment tool used in these settings (Knight & Yorke, 2003). Indeed, students and workers are often required to cooperate on common projects, tasks, assignments, and exercises, while being individually assessed with grades. Such practices, however, place students and workers in a dilemmatic situation (De Cremer, Snyder, & Dewitte, 2001), one in which two demands are to be considered at once: Acting in the interest of the group and cooperating, on the one hand, and considering self-interest and competing for good grades, on the other hand. The aim of the present research is to test the hypothesis that individuals' expectation of being evaluated by grades negatively impacts cooperative information sharing in group problem-solving situations.

Controversial Effects of Grades

All Western citizens, with the exception of a few countries, share the experience of receiving grades (OECD, 2011) – be they numbers, letters, or other labels that easily allow rank-ordering pupils and their products – right from the beginning of their education in primary school and all through their trajectory. It should be noted from the outset that, in some cases, grades can be used to produce criterion-referenced assessments and measure the degree to which one fulfills the goals of a given task (Brookhart, 2004); however the present research is limited to grades used to produce normative, or norm-referenced assessments, that is measuring people's performance in relation to others, an average or any other standard. Indeed, the latter is by far the most widely used form of assessment in the Western world (Ames, 1992; Knight & Yorke, 2003; Pope, 2003).

The practice of using grades was initially seen by educational scientists as extremely positive (Airasian, 1988): Grades were found to be good predictors of achievement tests and ideal tools for summative assessments, to the extent that they allow a standardized measure of academic achievement (both on the short and the long term), and can also predict the results of some personality tests (De Ketele, 1993). The positive effects of grades come from their potential to increase students' visibility and motivation (Cameron & Pierce, 2002). Indeed, expecting to be graded means that one's performance is identifiable by the person assessing one's work, which has been termed by various authors "visibility of performance" (Marshall & Weinstein, 1984), "individual visibility" (Merton, 1968), or "visibility of subjects" (Bond & Titus, 1983). Thus, in the present work we will use the term "visibility" to refer to individual visibility, that is, the visibility of one's own performance.

At the same time, rewards and grades have been found to alter students' intrinsic motivation (Deci, Koestner, & Ryan, 1999; Deci & Ryan, 1985), in particular through

the reduction of perceived autonomy (Pulfrey, Darnon, & Butera, 2013), to have negative effects on performance and learning (Garbarino, 1975; Kohn, 1993), in particular when comparing groups evaluated with grades to groups evaluated with written comments (Butler & Nisan, 1986), to impair cognitive processing (Meloth & Deering, 1992), to reduce creativity (Amabile, 1983), and to amplify confirmatory tendencies (Hayek, Toma, Oberlé, & Butera, 2014). Grades were also found to trigger the adoption of performance-avoidance goals, the need to avoid being outperformed by others (Pulfrey, Buchs, & Butera, 2011), which are related to the propensity to fear social comparison (Elliot & Murayama, 2008); indeed, grades make people's performance apparent within the group, by enhancing the comparability of one's work with that of others, a characteristic that Thorndike called the "relativity" of grades (Thorndike, 1913; see also Pulfrey et al., 2011). In sum, grades appear to elicit both individual visibility and a potentially threatening social comparison.

Effects of Grades on Cooperative Information Sharing in Groups

What happens, then, when educators and managers want to promote cooperation because of its potential for innovation (Wong et al., 2009) and learning (Roseth, Johnson, & Johnson, 2008), in a system that consistently and pervasively assesses group work with individual normative grades? Grades elicit individual visibility, which in itself should not impair cooperation. Indeed, research has shown that individual visibility can yield positive effects on group processes, such as reducing social loafing, the tendency to avoid individual effort during group work (Latané, Williams, & Harkins, 1979; Williams, Harkins, & Latané, 1981). However, grades are also involved in the processes of academic and professional selection (Randall & Engelhard, 2010), and therefore the use of grades in groups could lead to competition and threatening social comparison. The ability of grades to generate both normative and social standards of comparison for individuals might therefore interfere with cooperation, to the extent that grades might motivate individuals to do well personally, instead of cooperating for the sake of group work.

Thus, we expect a negative effect of grades on cooperative behavior; in the present research, we study a specific cooperative behavior, namely information sharing in groups that is the sharing with others of information that has the potential to benefit the whole group. This seems an appropriate behavior for the present study, as many group work situations require cooperation at the level of group information sharing (e.g., the jigsaw task, Aronson, Blaney, Stephan, Sikes, & Snapp, 1978; Johnson & Johnson, 2009), and an effective way of ensuring that a group is cooperating is precisely to check whether its members appropriately exchange the information that is the most relevant for the task (Greitemeyer & Schulz-Hardt, 2003; Schulz-Hardt, Brodbeck, Mojzisch, Kerschreiter, & Frey, 2006).

However, the literature on *group* information sharing suggests that individuals are often reluctant to share their critical, most relevant information (e.g., Larson, Christensen, Abbott, & Franz, 1996; Stasser & Stewart, 1992; Stasser & Titus, 2003). This effect is particularly problematic in situations in which there is an asymmetric distribution of information, as it often happens in working groups, and group members need to pool their unshared information (information possessed by only one member at a time), as opposed to shared information (possessed by all members), in order to find the optimal solution (a situation that has been termed "hidden profile" in the literature on group decision making; cf. Stasser & Titus, 1985, 1987). Indeed, although hidden profiles imply positive interdependence of resources and necessarily require cooperation to pool unshared information, the majority of research suggests that members do not effectively pool their unshared information (Lu, Yuan, & McLeod, 2012), an effect also found with children (Gummerum, Leman, & Hollins, 2013).

The use of grades in such interdependent situations could lead members to face a mixture of cooperative incentives to act in the interest of the group and share all available information, and competitive incentives to do well personally and keep relevant information for themselves (Davis, Laughlin, & Komorita, 1976; Wittenbaum, Hollingshead, & Botero, 2004). In this respect, De Dreu, Nijstad, and Van Knippenberg (2008) have suggested that in mixed-motive situations there is a conflict between collective and self-interests that negatively impact group processes and information sharing. In mixed-motive situations, individuals either perceive their goals as positively linked (cooperation) or as negatively linked to the goals of their fellow members (competition). The Theory of Cooperation and Competition (Deutsch, 1949) suggests that cooperation leads to effective communication, while competition impairs communication through the use of deceptive tactics and disinformation. In line with this idea, studies with hidden profiles have shown that crucial, unshared information was pooled to a lower extent under competitive than under cooperative instructions, a difference that was not found on shared information (Toma & Butera, 2009; Toma, Vasiljevic, Oberlé, & Butera, 2013). Interestingly, the greater withholding of unshared information in the competitive conditions appeared even if this was at the cost of reducing the likelihood to find the correct answer. Mistrust (or fear or being exploited) was found to mediate the relation between competitive (vs. cooperative) motives and unshared information pooling (Steinel & De Dreu, 2004; Toma & Butera, 2009).

Other studies showed that individuals pursuing competitive goals are less open to exchange task-relevant information with others, but are more prone to exchange irrelevant information while using others' relevant information (Poortvliet, Janssen, Van Yperen, & Van de Vliert, 2007, Study 2). This is because competition activates a weak reciprocity orientation and induces strong exploitative behaviors (Poortvliet et al., 2007). Broadly speaking, by

controlling the access to the most valuable information, such as unshared information, members who expect to be individually evaluated by grades might try to keep their competitive advantage relative to others (French & Raven, 1959; Stroebe, Diehl, & Abakoumkin, 1992).

Overview of Experiments

We therefore hypothesized that in a hidden-profile problem-solving situation the expectation of individual grades, as compared with no grades, should result in members pooling less unshared information, but not necessarily less shared information. We conducted two experiments to test this hypothesis. In both experiments we used a cooperative hidden profile task.

The aim of the first experiment was to test the negative effects of grades on information sharing in groups. We used a realistic manipulation of grades. As shown previously, grades imply both increased individual visibility (i.e., making one's performance visible) and focus on social comparison (i.e., making one's performance comparable to that of others). Therefore, the grades condition was contrasted with two control conditions to account for two possible sources of variation: One control condition in which grades were not expected but individual performance was visible and a second control condition in which grades were not expected and individual performance was not visible. Our hypothesis was that the exchange of unshared, but not shared information, would be lower in the grades condition compared to the two control conditions.

The aim of second experiment was mainly to replicate the results obtained in Experiment 1 using the same task, but controlling for the potential confounds in the manipulation of grades. Precisely, in Experiment 2 we manipulated the presence/absence of grades using a priming procedure.

Experiment 1

Method

Participants

A total of 162 students (104 women and 57 men, one participant did not mention her/his gender, $M = 23.60$ years, $SD = 4.01$) from a large Swiss university were recruited by email and paid 20 Swiss francs for their participation. Participants were randomly assigned to 54 three-person groups, whose discussions were videotaped. Twelve groups were removed because of the bad quality of the recording; the remaining 42 groups were distributed across different experimental conditions as follow: 13 groups in the Non Graded–Non Visible condition, 15 groups in the Non Graded–Visible condition, and 14 groups in the Graded–Visible condition.

Task

The task used was a problem-solving task concerning a road accident structured as a hidden profile and adapted from Toma and Butera (2009; see Appendix). Four persons were potential suspects in this accident, but three of them were exonerated (Mr. X, Mrs. Y, and Mr. Z) and the fourth (Mr. X's son) incriminated based on a critical set of 18 clues. The entire set of information contained 39 items: 21 shared and 18 critical unshared items. A hidden profile was created by distributing six critical unshared items to each of the group members. The 21 shared items described the accident's circumstances and suspects' characteristics (descriptive information). The 18 unshared items, if pooled together, allow for the identification of Mr. X's son as the guilty person (identification information). This task is particularly suited to measure cooperative information sharing among group members, because any neglect of unshared information can be interpreted as intentional and motivated behaviour. Indeed, task characteristics have been pretested in several pilot experiments by Toma and Butera (2009), which revealed that participants were able to discriminate between shared and unshared information, and between important and unimportant information; participants also understand that pooling unshared information is needed to solve the case.

Procedure

Upon their arrival in the laboratory, participants were told that they were taking part in a study on "how people who work in teams get to solve criminal cases." The experimenter explained that the study included two phases. During the first phase, the participants were individually provided with the case, and asked to identify the person responsible for the car accident. They were each provided with 21 shared information items and six unshared items, orienting each participant toward one specific suspect. They had a maximum of 3 min to individually derive who was the person responsible for the accident. During the second phase, participants were asked to work as a team and to discuss the case in order to identify the guilty person for no more than 15 min.

They were also informed that they did not have the same information and that shared information items were presented in the first paragraph of the case description page, while unshared information items in the second paragraph. The groups were instructed to cooperate to reach a common solution, write down their final solution once they decided, and call the experimenter to end the session. After the introductory instructions, supplementary instructions depending on the experimental conditions were given.

The most ecological manipulation of grades requires a context of both individual visibility (because, as shown, grades usually make one's performance visible) and comparison (because, as also shown, grades usually make one's performance comparable to that of others). Thus, the grade condition was contrasted with two control conditions, to account for the two possible sources of variation.

Groups in the Graded – Visible condition, the experimental condition, were told that the teamwork was videotaped, and that the experimenter was not only interested in the group solution but also in each member's individual contribution. They were told that *each contribution* would be graded on a scale ranging from 1 to 6, which corresponds to the usual grading range in Switzerland: "Although I'm interested in your team product, I will observe your work and at the end also give each one of you a grade (from 1 to 6) as a function of each one's contribution to the investigation."

Groups in the Non Graded – Visible condition were told that the teamwork was videotaped in order to ensure that each group member contributed in finding the group solution. They were also told that the experimenter was only interested in the group solution, and that the individual contributions were not assessed.

Groups in the Non Graded – Non Visible condition were told that the teamwork was not videotaped and that the experimenter was only interested in the group solution. We moreover pointed to the fact that cameras were not turned ON which did not raise any questions as the cameras did not display any external sign of recording process (i.e., no external red/green light showing).

All groups were instructed to call the experimenter when the discussion ended. The experimenter then explained the purpose and design of the study, and requested consent to use the videos for research purposes; all participants agreed. The entire experiment lasted about 45 min.

Dependent Measures: Information Pooling During Group Discussions

Every group discussion was videotaped and fully transcribed. Two independent coders, blind to the hypotheses and to the type of information (unshared vs. shared), analyzed the transcriptions. Coders had been especially trained in video coding: They were instructed to code the number of times all information items were mentioned, which included the unshared and shared information, but also other information mentioned during the discussion. This coding thus allowed having the full group discussions coded. The inter-raters reliability was calculated by computing for each item of information an intra-class coefficient (ICC) of absolute agreement in a mixed model (McGraw & Wong, 1996). When an item had an ICC of minimum value of .4 and a p-value < .05, the two scores of the raters were combined into a mean. The disagreements between raters were solved by discussion. The intra-class correlation of the coded information items had an estimated reliability varying between 0.44 and 1.[1]

The dependent measures were derived from the coded group discussions. Participants had 39 items of information available to solve the case: 21 shared and 18 unshared information items, and we therefore computed two scores, namely the proportion of *unshared information* and the proportion of *shared information*. Why a proportional score, instead of a simple count of the number of unshared and shared information mentioned? In the seminal article that started the line of research on hidden profiles, Stasser and Titus (1985) outlined an "Information Sampling Model." This model explains that in order to understand when and why different pieces of information are discussed in a group, it is crucial to consider the probability that each piece of information is mentioned by members. This has a very important consequence: Unshared and shared information do not have the same likelihood of being discussed (see also Stasser, Taylor, & Hanna, 1989). In the present work, we wanted to study whether unshared and shared information were differently pooled as a function of our experimental manipulations, accounting for the different likelihood of being discussed of unshared and shared information. Thus, we have used a proportional index, just as in previous work on hidden profiles (Scholten et al., 2007; Toma & Butera, 2009).

However, we did not compute the proportions of unshared and shared information by, respectively, dividing the number of mentioned unshared items by the total number of unshared items available (18) and by dividing the number of mentioned shared items by the total number of shared items available (21). Indeed, because several studies suggested that participants do not follow base rates (Stasser & Stewart, 1992; Toma & Butera, 2009; Tversky & Kahneman, 1974), we computed a measure that is closer to the participants' actual behavior. More specifically, we computed (1) the proportion of *unshared information* by dividing the number of mentioned unshared information by the total amount of all items of information actually mentioned, and (2) the proportion of *shared information* by dividing the number of mentioned shared information by the total amount of all items of information actually mentioned during each group discussion, as Toma and Butera (2009) did. It should be noted that, in order to remain close to the participants' actual behavior, which may include irrelevant information, the denominator contained every piece of information actually mentioned. Indeed, we observed that participants used quite often pieces of information that were not part of the materials, such as for instance personal experience to confer legitimacy to one's argument in favor of an unshared information or in favor of one of the preferred profiles.

It is important to note that the two measures are independent, given the above description of the denominator of the proportional scores. The overall discussion time of

[1] Although a correlation of one seems very unlikely to happen, it is nevertheless not surprising to have some measures with a perfect correlation, for some of the items coded were not prone to subjective coding (e.g., concerning measures where coders had to count the number of times where an unshared information was stated).

each group was measured, and entered in the analysis as a covariate.[2]

Results

Overview of Analyses

To test our hypothesis we set two orthogonal contrasts: C1, the model contrast that describes our hypothesis (+1, +1, −2, corresponding respectively to the Non Graded – Non Visible, Non Graded – Visible, and Graded – Visible conditions), and C2, its orthogonal contrast (+1, −1, 0) corresponding to the residual variance (Abelson & Prentice, 1997).

Preliminary linear regression analyses on the proportion and the amount of pooled information included Groups' sexual composition (coded −1 for groups with a minority of women and +1 for groups with a majority of women), Discussion Time, as well as a marginal interaction between Discussion Time and the C1 contrast. These analyses revealed no effect of Groups' sexual composition, but a main effect of Discussion Time and two interactions with our relevant contrasts.[3] Therefore, Discussion Time as well as its interactions with the C1 and C2 contrasts were entered as covariates (Yzerbyt, Muller, & Judd, 2004), while Groups' sexual composition was dropped from the final model.

Proportion of Unshared Information

The model in which the proportion of unshared information was regressed on the five predictors revealed a main effect of the C1 contrast (+1, +1, −2), $b = .02$, $SE = .006$, $F(1, 36) = 9.94$, $p < .003$, $\eta_p^2 = .22$, showing that, as predicted, groups in the Graded – Visible condition pooled significantly less unshared information ($M = 0.46$; $SD = 0.05$) than did groups in the Non Graded – Visible condition ($M = 0.51$; $SD = 0.08$) and the Non Graded – Non Visible condition ($M = 0.53$; $SD = 0.07$). The effect of the residual contrast C2 was not significant, $b = .01$, $SE = .011$, $F(1, 36) = 1.49$, $p = .23$.

Proportion of Shared Information

The model in which the proportion of shared information was regressed on the five predictors revealed a main effect of the C1 contrast (+1, +1, −2), $b = -.02$, $SE = .008$, $F(1, 36) = 5.24$, $p < .03$, $\eta_p^2 = 0.13$, showing that the amount of shared information pooled during discussion also significantly differed between conditions. This time, groups in the Graded – Visible condition pooled significantly more shared information ($M = 0.29$; $SD = 0.07$) than groups in the Non Graded – Visible ($M = 0.24$; $SD = 0.09$) and Non Graded – Non Visible conditions ($M = 0.22$; $SD = 0.08$). The effect of the residual contrast C2 was not significant, $b = -.01$, $SE = .014$, $F(1, 36) = 0.97$ $p = .33$. No other effect reached significance.[4] The results are presented in Figure 1.[5]

Discussion

The results revealed that information pooling was impacted differently by the experimental manipulation depending on whether this information was uniquely or jointly held by the group members. More precisely, groups in the Graded – Visible condition pooled a lower proportion of critical, unshared information compared to groups in the two control conditions. Interestingly, in the two control conditions, where individual visibility was either not enhanced, or enhanced but without the expectation of grades, groups

[2] Discussion Time and its interaction with the two contrasts were added to the information pooling regression analysis. Indeed, one can argue that the time spent by the groups to discuss and achieve the task is directly linked to the opportunity groups had to share a given amount of information (the more time groups have spent to achieve the task, the longer the opportunity to share information).

[3] Controlling for Discussion Time regarding the proportion of Unshared Information, a significant main effect of Discussion Time was found, $b = .001$, $SE = .001$, $F(1, 35) = 14.65$, $p < .001$, $\eta_p^2 = 0.3$. A marginal interaction between Discussion Time and C1 was also found, $b = -4.812^{E-5}$, $SE = .001$, $F(1, 35) = 3.05$, $p < .09$, $\eta_p^2 = 0.08$. Therefore Discussion Time and its interactions with the contrasts were kept in the model (Yzerbyt et al., 2004).
Controlling for Discussion Time regarding the proportion of Shared Information, a significant main effect of Discussion Time was found, $b = -.001$, $SE = .001$, $F(1, 35) = 9.33$, $p < .004$, $\eta_p^2 = 0.21$. A marginal interaction between Discussion Time and the residual contrast was found, $b = -.001$, $SE = .001$, $F(1, 35) = 3.87$, $p < .06$, $\eta_p^2 = 0.1$. Again, Discussion Time and its interactions with the contrasts were kept in the model.

[4] One might be interested in the sheer amount of unshared and shared information. We tested the same model on the number of *unshared* pieces of information, and found that groups in the Graded – Visible condition mentioned significantly less unshared information ($M = 15.96$; $SD = 3.79$) than did groups in the Non Graded – Visible condition ($M = 17.70$; $SD = 1.93$) and the Non Graded – Non Visible condition ($M = 17.50$; $SD = 2.19$), $b = -.64$, $SE = .37$, $F(1, 36) = 5.47$, $p = .025$, $\eta_p^2 = .08$ (for the contrast C1). The effect of the residual contrast C2 was not significant, $b = -.08$, $SE = .47$, $F < 1$.
We also tested the same model on the number of *shared* pieces of information, and found that groups in the Graded – Visible condition mentioned more shared information ($M = 10.60$; $SD = 4.78$) than groups in the Non Graded – Visible ($M = 9.10$; $SD = 4.82$) and Non Graded – Non Visible conditions ($M = 7.54$; $SD = 3.08$), although this contrast did not reach the usual significance level, $b = .58$, $SE = .36$, $F(1, 36) = 2.65$, $p = .11$ (for the contrast C1). The effect of the residual contrast C2 was not significant either, $b = -.91$, $SE = .62$, $F(1, 36) = 2.16$, $p = .15$. These analyses show that the pattern of results does not follow a different logic as compared with that obtained on the proportional score, although the effects are significant for unshared information only.

[5] Although our main interest was to study precisely the group information sharing process, it is common practice in the literature on hidden profiles to report group performance. Therefore, the solutions provided by the groups (Mr. X, Mrs. Y, Mr. Z, or Mr. X's son) were studied; it appeared that 90.7% of the groups had found the correct answer (Mr. X's son), regardless of condition, χ^2 (6, $N = 54$) = 8.65, $p = .19$.

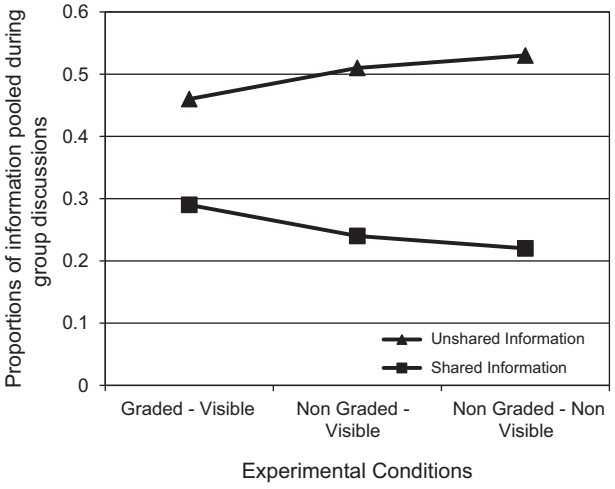

Figure 1. Proportions of unshared and shared information pooled as a function of experimental conditions (Experiment 1).

appeared to be willing to exchange the same proportion of unshared information. This suggests that individual visibility alone is not detrimental to group information sharing, unless it is accompanied by the expectation of being graded.

Although the results of this experiment were in line with our hypothesis, one could argue that the Graded – Visible condition, although closely patterning most natural situations of grading, implied negative reward interdependence between group members (Deutsch, 1979; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Kelley & Thibaut, 1969). Moreover, this condition also introduced two sources of individual visibility: One explicitly stated by the experimenter and one more implicit, inherent to the attribution of grades in a group (Monteil & Huguet, 1993). Thus, the Graded – Visible condition differed from the others with regard to attribution of grades, enhanced individual visibility and negative reward interdependence.

Experiment 2

We therefore conducted a second study to eliminate the above confounds, using a more subtle manipulation of grades with a priming procedure, and we hypothesized that groups working in an explicitly cooperative setting will pool less unshared information, but not necessarily less shared information, when primed with grades than when primed with a neutral concept (control condition).

Method

Participants

A total of 96 students enrolled in a large Swiss university (54 women and 42 men, $M = 21.78$ years, $SD = 3.34$) with different academic backgrounds volunteered in this study. They were recruited mainly via email but also directly in cafeterias and working areas. Participants were randomly assigned to 32 three-person groups. Six groups were removed from the analyses because of the poor quality of the recording. Therefore the remaining 26 groups were distributed to different experimental conditions as follow: 14 groups primed with grades, and 12 primed with a neutral concept.

Procedure

The task used in this second experiment was identical to the one used in Experiment 1 except that grades were not manipulated with instructions mentioning individual visibility and individual grades. Rather, upon their arrival at the laboratory, participants' attention was drawn to a poster hanging in one of the corners of the room. They were told that the poster had been previously used for an introductory training session devoted to new foreign teaching assistants, and that they were not to pay attention to it. Two different posters were presented depending on which experimental condition groups were assigned to. The two posters had exactly the same format (a vertical axis in the shape of an arrow pointing to the top) with a description on its right, but their content differed. In the Grades Prime condition the poster was entitled "Grading and ranking students," and the description displayed grades used in the Swiss educational system, ranging from (1) Poor, to (6) Excellent, and moving from bottom to top (see Appendix). For each grade, the percentage of success it implied was mentioned. In the Neutral Prime condition the poster was entitled "Getting to know one's work environment," and the description displayed the different organizational structures belonging to the university campus, ranging from bottom, the common services provided (student associations, university restaurant), to top, the highest authorities (president of university), again in six levels.

Groups in both conditions received the same experimental instructions as in Experiment 1 with regard to group work and the task. They followed the same two-step procedure: Individual work, then group work. This time the experimenter announced at the beginning of the study that the group work would be recorded, implying that in both conditions individual performance would be visible; all participants gave consent to use the videos for research purposes. At the end of the session experimenter explained the purpose and design of the study.

Dependent Measures

The same dependent measures as in Experiment 1 were used, namely the proportion of unshared and shared information. The intra-class correlation of the coded information items had an estimated reliability varying between 0.71 and 1.

Results

Overview of Analyses

As in Experiment 1, Discussion Time[6] was entered as a covariate. The Experimental conditions variable was coded (−1) for the Neutral Prime condition and (+1) for the Grades Prime condition. Preliminary analyses also included Groups' sexual composition, coded (−1) for groups with a minority of women and (+1) for groups with a majority of women, but these analyses revealed no effect of Groups' sexual composition on the proportion and the amount of pooled information. Therefore the variable was not retained in the model.

Proportion of Unshared Information

The linear regression model in which the proportion of unshared information was regressed on the three predictors revealed a main effect of the experimental conditions variable, $b = -.03$, $SE = .014$, $F(1, 22) = 4.28$, $p < .05$, $\eta_p^2 = .16$, showing that groups in the Grades Prime condition pooled significantly less unshared information ($M = 0.50$; $SD = 0.05$) than did groups in the Neutral Prime condition ($M = 0.56$; $SD = 0.07$).

Proportion of Shared Information

The model in which the proportion of shared information was regressed on the three predictors revealed a main effect of the experimental conditions variable, $b = .04$, $SE = .015$, $F(1, 22) = 5.76$, $p < .03$, $\eta_p^2 = .21$, showing that groups in the Grades Prime condition pooled significantly more shared information ($M = 0.27$; $SD = 0.07$) than groups in the Neutral Prime condition ($M = 0.18$; $SD = 0.06$).[7] The results are presented in Figure 2.[8]

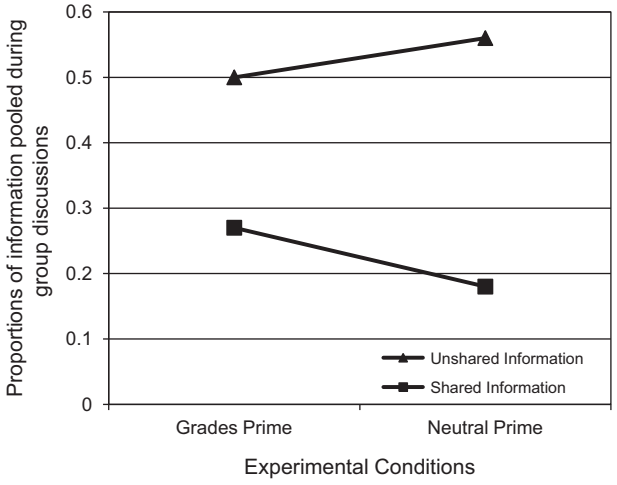

Figure 2. Proportions of unshared and shared information pooled as a function of experimental conditions (Experiment 2).

Discussion

This second study provides supplementary evidence that in a cooperative group situation grades interfere with group's cooperative behavior and negatively impact the pooling of the most relevant information, namely unshared information. In Experiment 1 it was difficult to disentangle whether the effect observed on information sharing was due to the presence of grades, or to the negative interdependence of reward that the manipulation of grades implied. Therefore, in Experiment 2 we rendered the two experimental conditions comparable by proposing two cooperative twin-conditions, set with the same positive resource and goal interdependences and no negative interdependence of rewards. Results found in this second study confirmed our hypothesis showing that groups primed with grades were less focused on the most relevant, unshared information during the group discussion. At the same time, groups primed with grades pooled more irrelevant, shared information, than groups in the control condition.

General Discussion

The practice of using grades, whatever their form, has been considered for many years as a positive feature of performance assessment, because it was supposed to increase

[6] Preliminary analyses revealed that Discussion Time was not normally distributed; therefore it was entered in the model after a square root transformation.

[7] Again, we tested the same model on the number of *unshared* pieces of information, and found that groups in the Grades Prime condition did not pool significantly less unshared information ($M = 17.50$; $SD = 2.34$) than did groups in the Neutral Prime condition ($M = 17.16$; $SD = 2.33$), $F < 1$. However, groups in the Grades Prime condition pooled significantly more shared information ($M = 9.78$; $SD = 3.74$) than did groups in the Neutral Prime condition ($M = 5.62$; $SD = 2.32$), $F(1, 22) = 2.96$, $p = .05$, $\eta_p^2 = .06$. These analyses show that the pattern of results does not follow a different logic as compared with that obtained on the proportional score, although the effects are significant for shared information only.

[8] Again, we studied group performance as a supplementary analysis, but the effect of our manipulation on group performance could not be tested, since all groups, irrespective of the condition, found the correct solution. Although the focus of this research is on group information sharing process, one might ask why in both experiments the vast majority of groups found the correct solution. In this respect, it should be noted that in all conditions of both experiments participants worked with a cooperative group structure (positive interdependence), a condition that in Toma and Butera (2009) resulted in increased pooling of unshared information and a higher level of group performance. Accordingly, the present results showed that overall all participants pooled more unshared than shared information, regardless of the conditions and therefore finding the correct solution was quite easy. In other words, in this task the overall neglect of unshared information was not substantial enough to affect the final solution.

workers' and learners' visibility and motivation (Cameron & Pierce, 2002), and thereby facilitate achievement and cooperation (De Ketele, 1993; Johnson & Johnson, 2002). It is therefore common practice to use individual grading even for tasks that need to be carried out cooperatively. In the present research, we took the perspective of a different line of research pointing out that individual grading for cooperative tasks is particularly problematic, because it creates mixed-motives situations in which people are in fact required to act in the interest of the group and cooperate, and at the same time to consider self-interest and compete for good grades. We therefore hypothesized that the expectation of being graded hampers the cooperative information sharing behavior in group problem solving.

In two studies we tested the effects of grading on a group cooperative behavior, namely on groups' willingness to share relevant, unshared information in hidden profiles. In Experiment 1 results revealed that groups in the Graded – Visible condition pooled a lower proportion of unshared information, the really valuable information in this task, and a higher proportion of shared information than groups in the other two conditions. In Experiment 2 we conceptually replicated this effect using a priming manipulation of grades: Group members primed with grades pooled a lower proportion of their unshared information, and a higher proportion of their shared information compared to group members primed with neutral concepts.

The results of the two studies are complementary and point to the negative effects of grades in cooperative settings: When grades were present, group members exchanged a lower proportion of useful, unshared information and discussed a higher proportion of information that the other group members already had. The first experiment highlights that individual visibility in itself has not deleterious effects, and that it is the use of grades that hampers cooperative group work. The second experiment confirms our contention that grades are indeed responsible for group members being less focused on the pooling of relevant information, by showing that the mere priming of grades produces similar effects to those obtained in Experiment 1 with actual expectation of grades.

This research has important theoretical and practical implications. First, this research contributes to questioning the theoretical perspective that grades are ideal tools for summative assessments and more broadly, good normative standards for evaluation (Butler & Nisan, 1986; Covington & Omelich, 1984; Graham & Golan, 1991). At least as far as cooperative work is concerned, the present research shows that grading affects information sharing. This research also contributes to showing the consequences of the view that grades, by increasing students' individual visibility, increase their motivation to perform well on tasks (Cameron & Pierce, 2002). Indeed, in cooperative tasks, the motivation to perform well may very well interfere with the motivation to interact cooperatively. Our results, in particular those of Experiment 1, revealed that while individual visibility in itself was not found to impair information sharing, individual visibility associated with grades did. Taken together, the two studies point to the difficulty to create cooperative group environments when normative evaluative standards are used with the aim to assess individuals' contribution. It seems that a cooperative structure can be easily damaged when group members expect to be individually graded.

One might ask why grades negatively impact groups' cooperative information sharing behaviors. Indeed, the lack of any measure of perceived competition and cooperation as potential mediators in the present research is a limitation that calls for future studies, particularly in order to better interpret the direction of the results presently obtained. Although not tested in this research, one possibility is that grades induce a threatening social comparison with the other group members; the priming effect in Experiment 2 suggests indeed that grades may remind group members of previous situations in which individual evaluation had resulted in differential appreciation of people, as it often happens for instance in school. By keeping useful, unshared information for themselves and pooling useless, shared information students might think that this behavior maximize their chances to be the one who discovers the correct solution and, even though the task is cooperative, to receive greater praise for this achievement. This suggests that the normative component of grades can lead to strategic behavior. In line with this idea, a study by Fischer, Kastenmüller, Frey, and Peus (2009) showed that individuals facing a threatening social comparison are more reluctant to transmit high-quality information to their colleagues.

At the same time, the threatening social comparison elicited by grades can also induce attentional deficits (Muller & Butera, 2007) such as distracting individuals from key elements of the task (e.g., unshared information) while devoting more attentional resources to less useful aspects (e.g., shared information). The difference in the proportion of unshared and shared information obtained in both experiments supports this explanation. Future research should pit these motivational and attentional explanations against each other when studying the effects of grades on information sharing.

Second, this research also contributes to the recent trend that has started considering groups as motivated information processors (De Dreu et al., 2008; Toma, Vasiljevic, Augustinova, Oberlé, & Butera, 2012). This literature suggests that the conflict between collective and self-interests generates mixed-motive that negatively impact group information sharing (e.g., Wittenbaum et al., 2004). Some studies involving information pooling have shown, for example, that in competitive situations less unshared information is pooled than in cooperative situations, a difference that is not found on shared information (Toma & Butera, 2009; Toma et al., 2012). Other studies obtained similar results when testing the impact of cooperative and competitive individual traits on group decision processes (De Dreu, Beersma, Stroebe, & Euwema, 2006). However, in previous research mixed-motives were represented by the confrontation of the positive resource interdependence elicited by the hidden-profiles task and the negative goal interdependence elicited by competition instructions; no study to date directly used a mixed-motive situation combining positive and negative goal interdependence. In the present research, we created for the first time a group working context in

which members are explicitly asked to cooperate – a context of positive goal interdependence – while being individually evaluated by grades – a context that is most often one of negative goal interdependence, as students have learned in the course of their history of academic selection (Darnon, Dompnier, Delmas, Pulfrey, & Butera, 2009). Therefore our research adds to the previous literature on group information sharing by showing that in a mixed-motives situation, negative goal interdependence takes over positive goal interdependence, with the result of reducing the sharing of relevant information.

Finally, this research suggests that grades may represent two dangers for actual working groups. The first is to interfere with cooperation. Recent research in the area of cooperative work, and cooperative learning in particular, has shown that cooperation is a delicate structure, and that any cue that might imply some form of threatening social comparison disrupts the beneficial effects of cooperative learning (e.g., Buchs, Butera, & Mugny, 2004; Buchs, Gilles, Dutrévis, & Butera, 2011; Buchs, Pulfrey, Gabarrot, & Butera, 2010). Grades might very well be one instance of such cues. The second danger is to induce antisocial behaviors, even in settings with a clear cooperative structure. Recent research has shown that self-enhancement values, defined as the pursuit of individual interests, personal success and power acquisition (Schwartz, 2006), predict cheating (Pulfrey & Butera, 2013). As the expectation of grades may prioritize individual interests and personal success, it is also possible that it induces cheating behaviors, even when group members are encouraged to cooperate. With this in mind, we can only recommend to avoid grading individuals in cooperative groups.

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Appendix

Priming Material Used in Experiment 2

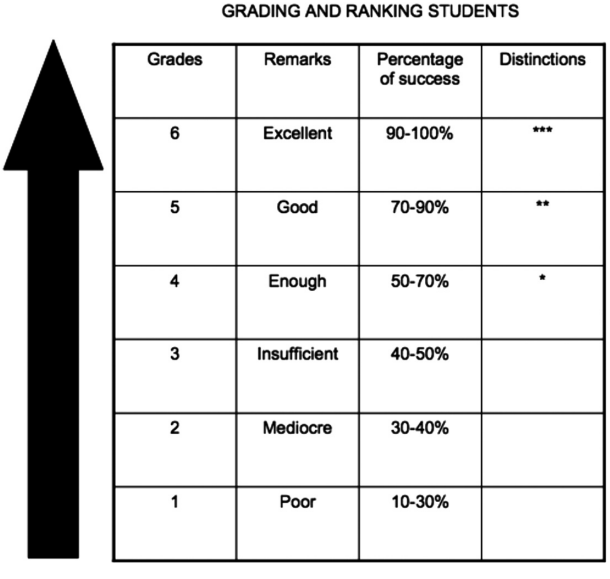

Figure A1. Poster for the grades prime condition.