

Research article

Competitive conflict regulation and informational dependence in peer learning

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Abstract

The present set of studies investigates the role of competitive conflict regulation and informational dependence in peer learning. Previous studies have shown that peer work on identical information produces not only confrontation of viewpoints but also competitive conflict regulation, the latter of which is detrimental for learning. Conversely, working on complementary information produces positive interactions but also informational dependence, and good quality information transmission is needed to foster learning. The present research shows that discussion aids (note-taking and access to the study materials during discussion), a variable related to the quality of informational input, moderated the relationship between information interdependence and learning. This moderation was mediated by competitive conflict regulation: Students who worked on identical information with discussion aids reported more competitive conflict regulation than those without discussion aids, which in turn reduced learning, a pattern that did not appear for students working on complementary information. Moreover, when students worked on complementary information, the good quality of information transmission elicited by discussion aids led to high levels of learning for all students. Contributions to research on resource interdependence, socio-cognitive conflict, and peer learning are discussed. Copyright © 2009 John Wiley & Sons, Ltd.

Socio-cognitive conflict was proposed more than 30 years ago as a major factor influencing learning during social interaction (e.g., Doise & Mugny, 1979; Mugny & Doise, 1978; see Buchs, Butera, Mugny, & Darnon, 2004, for a more recent review). This research tradition refers to “socio-cognitive conflict” because the confrontation of diverging solutions induces a conflict that is both social (i.e., the disagreement between two persons) and cognitive (i.e., each individual doubts her/his own answer). Depending on the situation, this conflict can be regulated in two different ways, with differential effects on learning. On the one hand, conflict regulation may consist of focusing on the task and on understanding the problem (called “socio-cognitive” or “epistemic” conflict regulation), leading to cognitive progress and enhanced learning. On the other hand, conflict regulation may consist of focusing on social comparison and on the demonstration of one’s own competence (“relational” or “competitive” conflict regulation), which hinders cognitive activities and learning (Doise & Mugny, 1984; see Darnon, Butera, & Harackiewicz, 2007, and Darnon, Harackiewicz, Butera, Mugny, & Quiamzade, 2007, for recent research extending this work).

Notwithstanding the impressive amount of work carried out in this domain, the hypothesis that socio-cognitive conflict influences learning via conflict regulation has, up till now, remained a hypothesis. Indeed, the vast majority of the research

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that experimentally studied the impact of social interaction on learning used conflict regulation as a theoretical explanation for the observed effects, but never measured it (e.g., Doise, 1989; Girotto, 1987; Mugny, De Paolis, & Carugati, 1984; Psaltis & Duveen, 2006). Only lately have researchers started measuring conflict regulation (Darnon & Butera, 2007; Darnon, Muller, Schragger, Pannuzzo, & Butera, 2006) and, in one recent study, conflict regulation along with learning (Darnon, Doll, & Butera, 2007). So far, however, no study has gone as far as to demonstrate that the impact of social interaction on learning is mediated by conflict regulation. The present research constitutes the first attempt to address the above unanswered question, in the context of a study on peer learning.

RESOURCE INTERDEPENDENCE AND SOCIO-COGNITIVE CONFLICT

Peer learning is encouraged by many instructional models used at school (e.g., Gillies & Ashman, 2003) and university (e.g., Johnson, Johnson, & Smith, 2007; Vazin & Reile, 2006). One factor that plays a key role in prompting positive interactions and learning is positive interdependence (Johnson, 2003; Johnson & Johnson, 1995b, 2005). Particularly important for the present research, resource independence involves the use of *identical* information, whereas positive resource interdependence entails the use of *complementary* information (each member receiving only one part of the necessary information; Johnson, Johnson, & Stanne, 1989; Ortiz, Johnson, & Johnson, 1996). Indeed, positive resource interdependence has been shown to improve students' learning when they work co-operatively on texts (Lambiotte et al., 1987; Lambiotte, Dansereau, O'Donnell, Young, Skaggs, & Hall, 1988). In order to explain their results, educational psychologists have suggested that working on complementary information requires greater processing efforts and reinforces partners' involvement in the task, whereas working on identical information may strengthen "evaluation pressure" which can "be distracting enough to prevent deep processing of content information" (Lambiotte et al., 1987, p. 429).

In line with this suggestion, social psychologists have investigated the effect of resource interdependence not only on learning but also on student interactions (Buchs, Butera, & Mugny, 2004, study 1), and on perceptions of interactions and evaluation pressure (Buchs, Butera, & Mugny, 2004, study 2). This research documented the fact that working on complementary information created positive interdependence in the accessing of information and, in line with the argument put forward by Lambiotte et al. (1987) and the Cohens (Cohen & Cohen, 1991; Cohen, 1994), this interdependence favored co-operation and student involvement in information transmission. But when working on complementary information, listeners were also dependent on the quality of information transmission from their partner, and learning could be impaired in the case of poor informational input (see also Buchs & Butera, 2001). Overall, these studies indicated that the quality of informational input can moderate the positive effect of working on complementary information, due to the informational dependence typical of this condition.

As for identical information, previous work has suggested that working on the same subject at the same time can enhance social comparison processes (e.g., Marshall & Weinstein, 1984; Rosenholtz & Wilson, 1980). In line with this work, research investigating the effect of resource interdependence has indicated that working on identical information favors the confrontation of viewpoints, but at the same time focuses student attention on social comparison of competence and competition (Buchs, Butera, & Mugny, 2004). Students reported more evaluative pressure (called competence threat in this research) when they worked on identical information. It seems that competence threat orients exchanges between participants towards competition, also known to be detrimental to progress in the acquisition of cognitive competence (Doise & Mugny, 1984), information processing (Butera & Mugny, 1995), and learning (Johnson & Johnson, 1995a). Competence threat has also been shown to mediate the negative effect of working with identical information on learning (Buchs, Butera, & Mugny, 2004, study 2).

Other results also reveal that, when students work on identical information, competence threat prevents the confrontation of viewpoints from being positive (Buchs & Butera, 2004; Darnon, Buchs, & Butera, 2002). This result is consistent with the effects of debate introduced by Johnson and colleagues (Johnson and Johnson, 1995a; Johnson, Johnson, & Tjosvold, 2000), indicating that a competitive context reduces the benefits that intellectual confrontation can bring to student relationships, curiosity and learning (Johnson & Johnson, 1985). This detrimental effect comes from the fact that when students are oriented toward competition, they display defensive strategies in order to protect their own competence (Johnson, Johnson, Smith, & Tjosvold, 1990; Falomir-Pichastor, Butera, & Mugny, 2002) that make them reluctant to integrate the other's

perspective and lead them to denigrate their partner (Tjosvold & Deemer, 1980; Tjosvold & Johnson, 1977), all of which is negative for peer learning (Monteil & Chambres, 1990; Tjosvold, 1998). Overall, these studies indicate that when students work on identical information, the resulting perceptions of competition can be negative for learning.

An important point about the above account of the effects of resource interdependence is that it builds upon the integration of different lines of research that have developed independently but that may be fruitfully articulated. On the one hand, the work on interdependence of resources in co-operative learning (Cohen, 1994; Lambiotte et al., 1987, 1988) proposes that positive resource interdependence favors responsibility and student involvement. On the other hand, the work on controversy and debate (Johnson and Johnson, 1995a, Johnson, Johnson, & Tjosvold, 2000; Mitchell, Johnson, & Johnson, 2002) and the work on socio-cognitive conflict (Doise & Mugny, 1979; Mugny & Doise, 1978; Roy & Howe, 1990; Taal & Oppenheimer, 1989; Weinstein & Bearison, 1985) both investigate the effect of intellectual opposition during social interactions.

QUALITY OF INFORMATIONAL INPUT DURING CO-OPERATIVE LEARNING

From the research outlined above, it is clear that neither working on complementary information nor working on identical information can guarantee *a priori* optimal learning and indications from the existing literature would seem to point to the role of the quality of informational input as a possible moderator, acting as informational support when working on complementary information and as a threat to competence when working on identical information. Thus, we chose to document the effects of discussion aids that are based on note-taking, a proxy for the manipulation of quality of informational input, in that it can affect the quality of the summarizer's informational input and act as a threat to competence, both of which are aspects of socio-cognitive conflict supposed to be relevant in the two peer learning settings. Discussion aids involve the possibility to take notes during reading and to use study materials during discussion. Can relying on discussion aids improve the quality of the summarizer's informational input and thus favor the listener's learning when students work on complementary information? Moreover, can lacking discussion aids reduce competence threat when students work on identical information and thereby be beneficial? In other words, the present research studies the role of discussion aids as a moderator of the differential effects of resource interdependence on learning, and investigates whether this moderation is mediated by competitive conflict regulation.

A first aspect of discussion aids is its effect on the quality of informational input. Research has shown that taking notes improves information recall (Armbruster, 2000; Caverly, Orlando, & Mullen, 2000; Weener, 1974). Moreover, Weiland and Kingsbury (1979), and Shrager and Mayer (1989) found that students who took notes during lectures obtained better results when tested on the content of the lectures than those who did not take notes. The benefits of taking notes have been also demonstrated as an aid in memorizing specific and general ideas during text reading (Dyer, Riley, & Yekovich, 1979). Thus, being instructed not to take notes and discussing without any backup could reduce the quality of informational input. In this case, we could predict that listeners working on complementary information—those who are the most dependent on their partner—will achieve poorer learning outcomes if their partner does not rely on discussion aids, compared to listeners working with a summarizer who relies on discussion aids. In other words, varying the quality of information input through the manipulation of discussion aids will allow us to test whether, as a result of informational dependence, the quality of the summarizer's input is a moderator of the positive effect that working on complementary information can have on listeners' learning.

Another aspect of discussion aids is related to student interaction processes: Discussion aids could increase the already existing tendency in students to focus on social comparison of competences and on competition. In line with Kiesler's theory of commitment (Kiesler, 1971), it can be argued that note-taking may accentuate students' commitment to their own positions. Being committed to one's own position could make attitudes more resistant to change (Petty & Cacioppo, 1990). Moreover, permanent access to notes and study materials can strengthen reciprocal evaluation of the quality of partner's informational input. As students working on identical information are in a situation of confrontation of opinion, discussion aids could reinforce social comparison of competence and orient conflict regulation toward a competitive conflict regulation, detrimental for learning (Butera & Mugny, 1995; Darnon et al., 2002; Doise & Mugny, 1984; Quiamzade & Mugny, 2001). The more students are committed to their positions, the more any contradiction can be perceived as a threat to their own competence, which thereby reinforces competition between students. In order to preserve their feeling of competence, students may be inclined to defend their positions and to close their minds to divergent

viewpoints (Butera & Buchs, 2005; Johnson et al., 1990; Mugny, Quiamzade, Pigière, Dragulescu, & Buchs, 2002; see also Muller & Butera, 2007, for research showing that threatening self-evaluation can lead to a narrowing of attention). This is also consistent with recent work showing that the actual quality of the summarizer's informational input, manipulated through a confederate, is detrimental for the listener's learning when working with identical information (Buchs & Butera, in press). Thus it can be predicted that relying on discussion aids could strengthen competition when students work on identical information, as compared to when they work on complementary information. Indeed, in the complementary information condition, discussion aids should not lead to competition, as partners do not access the same information, and comparison is less direct.

PILOT EXPERIMENT

Before undertaking the main study to test the above general hypotheses, the assumptions underlying these hypotheses had to be verified. The properties and effects of discussion aids during co-operative learning had to be explored, in particular with regards to the quality of the summarizer's input and the perceptions students had of competition. This pilot experiment will be presented in detail, as it is to the best of our knowledge the first study that has directly investigated the effects of discussion aids relying on note-taking in a co-operative setting.

Procedure

Eighty eight second-year French psychology students (including 12 men) volunteered to participate in a 1-hour experiment on co-operative learning (11 dyads per condition). This proportion of men is typical of the student population in Psychology; effects do not change significantly when controlling for sex. This study took place in a single laboratory session. Students were requested to work with a same-sex partner with whom they were not acquainted before the experiment. They were asked to read two texts and share their ideas. Positive goal interdependence and role interdependence were included in both experimental conditions: They were required to work co-operatively and particular emphasis was put on the fact that they should try their best to promote both their own learning and that of their partner. Indeed, they were told that at the end of the session they would have to fill in an individual multiple choice test (MCT) on both texts (but in fact this test never took place).

The pilot experiment had a 2 (resource distribution) \times 2 (note-taking) \times 2 (roles) design. Participants were randomly assigned to one of the experimental conditions. Students expected to work on two texts during the session and to reverse roles for the second text. But, in fact, the experiment stopped after they had studied the first and only text (a social psychology text on causal attribution and social categorization used by Buchs & Butera, 2001). We made this decision because the 1-hour format of the experimental session did not include enough time for students to work on two texts, and also fill out the questionnaires and be debriefed. Thus, while the students worked on the "first" text and filled out the questionnaires about the "first" interaction, they still anticipated working on a second text with reversed roles in order to maintain a clear perception of positive interdependence. The text used in the study was unfamiliar to the students and its content had never been used in any course the students had taken in the past.

Students had 20 minutes to read the text silently and 10 minutes to discuss it according to the assigned roles. We recorded students' discussions (due to technical problems, two records were not available) and two judges independently coded the number of ideas and the quality of the summary. Students also answered a questionnaire about their perceptions of the interactions they had had with their partner.

Independent Variables

Resource Distribution

In both conditions, students worked only on one psychology text, but they expected right up until the end of the experiment to read a second psychology text in a second stage and to answer the announced (but fictitious) individual multiple choice

text on the information contained in both texts. In *positive resource interdependence conditions*, one of the students, the one who was to play the summarizer role, had 20 minutes to read the “first” text silently during which time the listener read a newspaper article (an unrelated filler text) in order to maintain his/her level of attention. In this condition, students were informed that each student would read only one of the two psychology texts so that they would work on different information (one psychology text at each stage) and that only the psychology texts, not the newspaper article, would be discussed.

In *resource independence conditions*, both partners silently read the “first” social psychology text during the 20 minutes reading period, following which the summarizer presented the text to the listener during the discussion. Students thus worked on identical information.

Roles

In line with scripted co-operation procedures (O'Donnell, 1999; O'Donnell & Dansereau, 1995), two roles were introduced in order to facilitate the discussion. The *summarizer* role consisted in explaining as clearly as possible and in a detailed way the information contained in the text. *Listeners* had to ask questions, request clarifications, add comments, and identify errors or inconsistent information while listening to the summarizer. Since in this pilot experiment students only worked on one text, roles were not alternated (see the main experiment for the alternation procedure). In each dyad, one student played summarizer and the other one listener (role was therefore a between-participants variable). Roles were presented to students as flexible roles introduced in order to facilitate discussion. The terms “Summarizers” and “Listeners” thus designated the students' primary role but did not preclude interactive exchanges.

Discussion Aids

In the *discussion aids* conditions, students were directed to take notes during the reading phase (on a separate sheet, not on the text), and informed that they could use the text and their notes during the discussion. All students in this condition did take notes. In the *no discussion aids* conditions, they were asked to try their best to keep in mind the information (without taking notes) and to discuss the text without any backup, either notes or text. None of the students in this condition took notes.

Dependent Variables

Quality of Informational Input Provided by Summarizers

Two judges coded the 42 recorded discussions that were available. They were asked to code the summarizers' input on four seven-point bipolar scales: The summary is *difficult–easy to understand*; the ideas are *not–are clearly explained*; the experiments proposed in the text are *not–are clearly explained*; the sequence of ideas is *not logical–is logical*. The quality of the summarizers' informational input was assessed by calculating the mean of the two judges' evaluations (inter-item reliability, $\alpha = .92$, inter-judge reliability = .75).

Numbers of Ideas Expressed by Summarizers

The number of ideas expressed by the summarizers was also coded. This measure consisted of the mean number of ideas coded by the two judges (inter-judge reliability .79). Of the eight ideas presented in the text, summarizers expressed around six ideas ($M = 5.94$, $SD = 0.96$).

Perceived Degree of Confrontation

Perceptions of the degree of viewpoint confrontation (independently of the way confrontations were regulated) were assessed by four questions. Seven-point scales (ranging from 1 = little time to 7 = much time) measured how much time

Table 1. Zero-order correlations among variables (pilot experiment)

	(1)	(2)	(3)
Quality of summary (1)			
Number of ideas expressed (2)	.62***		
Perceived degree of confrontation (3)	-.07	.14	
Perceived competition (4)	-.36*	-.15	.51***

* $p < .05$; *** $p < .001$.

students felt their dyad had spent confronting different points of view, defending ideas and arguing about them, trying to impose points of view and trying to understand alternative points of view ($\alpha = .70$). The four items were aggregated in a single mean score.

Perceived Competition

Two questions assessed competition, namely the perceived degree of competition and the perceived degree of conflict in the relationship with their partner, $r(88) = .44$, $p < .001$ for these two variables. Students answered on a seven-point scale from 1 (very weak) to 7 (very strong). The two items were aggregated in a single mean score.

Zero-order correlations among the dependent variables are presented in Table 1.

Results and Discussion

Measures of summary quality and of the number of ideas were standardized (z -scores) in order to perform a 2 (resource distribution) \times 2 (discussion aids) MANOVA on the summarizers' input (quality and number of ideas). This analysis indicated two effects with a large effect size (Cohen, 1988): A main effect of discussion aids, $F(2, 37) = 6.47$, $p < .01$, $\eta^2 = .26$ and a marginal interaction between the two factors, $F(2, 37) = 3.10$, $p < .06$, $\eta^2 = .14$. The resource distribution effect was not significant, $F(2, 37) = 0.93$, n.s., $\eta^2 = .01$. Means and standard deviations are presented in Table 2. The summarizers' informational input was judged to be better when summarizers relied on discussion aids than when they did not; this was true for both the quality of summary ($M_{\text{discussion aids}} = 5.02$ versus $M_{\text{no-discussion aids}} = 4.48$), $F(1, 38) = 4.12$, $p < .05$, $\eta^2 = .09$ and the number of ideas ($M_{\text{discussion aids}} = 6.39$ versus $M_{\text{no-discussion aids}} = 5.46$), $F(1, 38) = 13.26$, $p < .01$, $\eta^2 = .25$. Univariate analyses also revealed that the interaction between resource distribution and discussion aids was significant only for the number of ideas, $F(1, 38) = 4.74$, $p < .05$, $\eta^2 = .11$. Scheffe tests indicated that discussion aids affected the number of ideas expressed by summarizers more when information was different ($M_{\text{discussion aids}} = 6.68$ versus

Table 2. Assessment of the quality of summarizers' informational input and student perceptions of the interaction (pilot experiment)

		Discussion aids		No discussion aids	
		Identical information	Complementary information	Identical information	Complementary information
Assessment of informational input		$N = 10$	$N = 11$	$N = 11$	$N = 10$
Quality of summary	<i>M</i>	4.82	5.20	4.36	4.60
	<i>SD</i>	0.98	0.59	0.96	0.83
Number of ideas expressed	<i>M</i>	6.10	6.68	5.73	5.20
	<i>SD</i>	0.61	0.68	1.10	0.79
Student perceptions of interaction		$N = 22$	$N = 21$	$N = 22$	$N = 22$
Perceived confrontation	<i>M</i>	2.98	2.06	1.96	2.16
	<i>SD</i>	1.22	0.93	0.93	0.81
Perceived competition	<i>M</i>	1.89	1.14	1.39	1.23
	<i>SD</i>	0.91	0.39	0.86	0.37

$M_{\text{no-discussion aids}} = 5.20$), $p < .01$, than when information was identical ($M_{\text{discussion aids}} = 6.10$ versus $M_{\text{no-discussion aids}} = 5.73$), $p > .78$.

A 2 (resource distribution) \times 2 (discussion aids) \times 2 (roles) MANOVA was performed on perceived degree of confrontation and competition.¹ Roles did not influence these measures and did not interact with other factors, all F s < 1 . Thus, the role factor was dropped from the analyses. A 2 (resource distribution) \times 2 (discussion aids) MANOVA was performed. Means and standard deviations are displayed in Table 2. Results indicated a main effect of resource distribution, $F(2, 82) = 4.74$, $p < .05$, $\eta^2 = .10$, a marginal—although with a moderate effect size—effect of discussion aids, $F(2, 82) = 2.49$, $p < .10$, $\eta^2 = .06$, and an interaction effect, $F(2, 82) = 3.90$, $p < .03$, $\eta^2 = .09$. Students working on identical information tended to report more confrontation ($M_{\text{identical}} = 2.47$ versus $M_{\text{different}} = 2.11$), $F(1, 83) = 2.85$, $p < .10$, $\eta^2 = .03$, and more competition ($M_{\text{identical}} = 1.64$ versus $M_{\text{different}} = 1.19$), $F(1, 83) = 9.46$, $p < .01$, $\eta^2 = .11$, compared to those who worked on different information. Regarding discussion aids, the fact of not relying on discussion aids significantly reduced the perceived degree of confrontation ($M_{\text{discussion aids}} = 2.52$ versus $M_{\text{no-discussion aids}} = 2.06$), $F(1, 83) = 4.77$, $p < .04$, $\eta^2 = .06$, but did not significantly affect perceived competition ($M_{\text{discussion aids}} = 1.52$ versus $M_{\text{no-discussion aids}} = 1.31$), $F(1, 83) = 2.00$, $p > .17$, $\eta^2 = .02$. The interaction between the two factors was significant both for perceived confrontations, $F(1, 83) = 7.05$, $p < .01$, $\eta^2 = .08$ and perceived competition, $F(1, 83) = 3.96$, $p < .05$, $\eta^2 = .05$. Contrasts indicated that students who worked on identical information with discussion aids reported more confrontation and competition than the three other groups, all p s $< .01$; no other difference was significant. Thus, it seems that lacking discussion aids during co-operative learning tended to reduce perceived confrontation and competition, especially when students worked on identical information.

In sum, the results of this pilot experiment underlined the fact that discussion aids are beneficial for the quality of summarizers' informational input (both in terms of summary quality and number of ideas). Having the opportunity to take notes during reading and to refer to the text during discussion had a more positive effect on the number of ideas expressed by summarizers when students worked on different information. In these conditions, taking notes and using supports (text and notes) during discussion could function as a memo board and help summarizers to express more ideas, which was not necessary when students worked on identical information because listeners could play a memo board role. These results suggest that manipulating discussion aids could be a way to test the hypothesis that, in conditions of informational dependence (when working on complementary information), listeners who work with a summarizer who does not take notes will achieve poorer learning outcomes than listeners who work with a summarizer who relies on discussion aids.

Moreover, students who worked on identical information tended to report more confrontation, and reported significantly more competition, than those who worked on different information. Nevertheless, the manipulation of discussion aids moderated this effect. Lacking discussion aids reduced the perceived degree of confrontation and competition when working on identical information. This could therefore favor learning under identical information conditions. Finally, it should be noted that students who worked on identical information with discussion aids reported more confrontation and competition than the three other groups. In other words, these students perceived a higher level of confrontation with their partner and saw this confrontation more as a form of competition than participants in other conditions. This is an important point as it sets the grounds for the third hypothesis of the main experiment.

MAIN EXPERIMENT

Predictions

The aim of the main study was to test the hypothesis that discussion aids moderate the effects of resource interdependence on perceived student interactions and on learning, and that this moderation is mediated by competitive conflict regulation. This general hypothesis can be broken down into three specific predictions:

¹In the two experiments, analyses at the dyad level would be the most appropriate. However, according to Kenny, Mannetti, Pierro, Livi, and Kashy (2002), with the present number of dyads and participants, analyses at the individual level are still valid if intraclass correlations are low. None of the intraclass correlations exceeded $\rho_1 = .30$, indicating that the effect of nonindependence on p value is low. In particular, for our main variables, intraclass correlations are as follows: $\rho_1 = .21$ for perceived degree of confrontation and $\rho_1 = .16$ for perceived competition in the pilot experiment, and $\rho_1 = .09$ for learning outcomes and $\rho_1 = .23$ for competitive conflict regulation in the main experiment. Thus, in the results section, individual students are used as the unit of analysis.

H1: Learning outcomes of students working on identical information should be better when they do not rely on discussion aids than when they do, a difference which should not appear in complementary information conditions. This hypothesis therefore predicts a discussion aids by resource interdependence interaction. Because of informational dependence, when participants are working on complementary information, the question of student roles should intervene, as illustrated by hypothesis 2.

H2a: Listeners working on complementary information—who are therefore dependent on their summarizer—should achieve poorer learning outcomes when their summarizer does not rely on discussion aids, not only in comparison with listeners working with a summarizer who does but also in comparison with listeners working on identical information without discussion aids.

H2b: Due to informational dependence in the complementary information condition, listeners without discussion aids should achieve poorer learning outcomes than their summarizer; this difference should be reduced when working with discussion aids.

Taken as a whole, hypothesis 2 predicts a discussion aids by resource interdependence by role interaction.

H3: The negative impact of discussion aids when working on identical information should be due to competitive conflict elaboration. Thus competitive conflict elaboration should mediate the discussion aids by resource interdependence interaction hypothesized in H1.

Participants

This study took place during the normal program of second-year social psychology workshops in a French University. The aim of the study was to respect as much as possible the regular learning setting. Thus students were not videotaped during discussions, and notes taken by students were not collected. Students were required to work with a same-sex partner whom they did not know before the workshop. Only students who were present and who worked with the same partner for the three experimental sessions were included in the experimental sample. Of these 74 students, 66 were present at the fourth non-experimental session when the delayed learning test was administered: 30 students worked with discussion aids—12 on identical information and 18 on complementary information (the same groups as in Buchs, Butera, & Mugny, 2004, study 2) and 36 students worked without discussion aids—16 on identical information and 20 on complementary information. The only masculine dyad worked on identical information without discussion aids. Results did not change significantly when this dyad was removed from the analysis.

Procedure

Students worked in co-operative dyads with the same partner for three 2-hour sessions. In each session, they were requested to work on two psychology texts and share their ideas. Positive goal interdependence and role interdependence were again included: Students were asked to work co-operatively and to try their best to promote both their own learning and that of their partner. Participants were randomly assigned to conditions in a 2 (resource interdependence) \times 2 (discussion aids) \times 2 (roles) factorial design. They had 20 minutes to read and 10 minutes to discuss each text. After the discussion, students filled in a questionnaire about their perceptions of the interaction they had just had with their partner. Then, they answered an individual MCT on the texts studied during the session. A follow-up test took place 4 weeks after the third session of dyadic work. The learning tests were presented to the students as formative assessments that would help them to prepare for the final exam. The content of the texts studied during the experiment was part of the general area to be reviewed for the final social psychology exam, but students were informed that the results obtained during the training would not be included in their final evaluation mark.

Materials

Students worked on six social psychology texts (each text presented one mechanism intervening in manipulation, extracted from Cialdini's, 1987 book: Rule of Reciprocity, Commitment and Consistency, Social proof, Liking, Authority,

and Scarcity) related to the topic of the course, but never previously used in the course. Moreover, we checked that the specific content of these texts had not been addressed in any other course in the students' curriculum. The content of the texts was therefore unfamiliar to the students. The six texts were formatted in such a way that they could be read independently in less than 20 minutes without taking notes (from $M = 7.25$ to 8.14 minutes, $F(5, 40) = 0.28$, n.s.). These texts had been pre-tested by Buchs, Butera, and Mugny (2004); students perceived them as relatively easy and accessible ($M = 5.56$ on a scale from 1 = difficult to 7 = easy).

Independent Variables

Resource Interdependence

In the *resource independence* conditions, students worked on identical information. For each session, the two students belonging to a dyad read the two texts silently and then discussed them following the assigned roles. More specifically, they both had 20 minutes to read the first text; then one student played the summarizer role while the other played the listener role during the 10-minute discussion. After that, they both were given 20 minutes to read the second text and the roles were reversed for the 10-minute discussion. In the *positive resource interdependence* conditions, students worked on complementary information. For each session, each student read only one of the two texts and accessed the other text via the summary presented by her/his partner. One of the students read the first text during the first 20-minute period and played the summarizer role during discussion. After that, the other student read the second text and played the summarizer role. Thus, for each session, the participants in each dyad were interdependent as regards resources because they switched roles for the second text and the test assessed knowledge of both texts. In other words, the text information can be considered as complementary because students were aware they had to master the content of the two texts in order to answer the questions in the individual MCT which they knew followed the exercise. In order to sustain a good level of attention from the listener during the reading period, this student was asked to read a newspaper article (students were informed that the purpose was to maintain their attention during the reading period and that the newspaper article would not be discussed).

Roles

As in the pilot experiment, two roles were introduced: *Summarizer* and *listener*. In the present experiment, however, the order and roles for each text were actually counterbalanced.

Discussion Aids

As in the pilot experiment, students were either directed to rely on discussion aids (all of them did) or directed not to rely on discussion aids.

Dependent Variables

Perceived Student Interactions

In order to assess how students perceived their interaction with their partner during the experiment, a questionnaire was handed out between the discussion and the MCT. This questionnaire was constructed to assess the dimensions suggested by Darnon et al. (2006) as well as Lambiotte and colleagues (1987). It was also based on questionnaires developed by Buchs, Butera, and Mugny (2004). In this section the items are presented as a function of *a priori* categories, based on the literature, but the actual structure was tested with an exploratory factor analysis (see below and in Table 4).

Perceived Quality of the Relationship Students were asked to assess the quality of relationship with their partner, the degree of co-operation inside the dyad, the degree of collaboration, and the degree of spontaneous agreement. Students answered on a seven-point scale from 1 (very weak) to 7 (very strong).

Reported Involvement in Information Transmission Four questions were designed to measure involvement in information transmission during co-operative learning: The amount of time dyads devoted to asking questions or seeking clarifications, providing clarifications, checking that both partners had understood the information (from 1 = little time to 7 = much time). One other question asked the frequency with which students tried to summarize information as clearly as possible (from 1 = very infrequent to 7 = very frequent).

Reported Information Processing Strategies Four questions concerned the amount of time dyads devoted to proposing strategies in order to remember information (from 1 = little time to 7 = much time), the frequency with which students wondered how to reconcile different viewpoints, integrated information with previous knowledge, and thought about concrete examples (from 1 = very infrequent to 7 = very frequent).

Perceived Degree of Confrontation Perceptions of the confrontation of different points of view (independently of the way differences were dealt with) were assessed by five questions. Students were asked to report how much time (from 1 = little time to 7 = much time) dyads spent confronting different points of view, defending ideas and arguing about them, trying to impose points of view, and trying to understand alternative points of view, and the degree of agreement reached after discussion (from 1 = very weak to 7 = very strong).

Perceived Competition Students assessed the degree of competition and the degree of conflict in the relationship with their partner (from 1 = very weak to 7 = very strong), as in the pilot experiment. Moreover, they estimated evaluative pressure by assessing how frequently they checked that what their partners said was correct, evaluated their partners' competence, tried to present themselves as more competent than their partners, and wondered how to appear competent (from 1 = little time to 7 = much time). The latter two categories will be the basis for studying competitive conflict regulation.

Learning Outcomes

Individual learning was assessed at the end of each session by a MCT composed of 10 questions per text. Each test was developed by social psychology teachers and perfectly matched the normal exam format. The tests included both questions about the text content (regarding the theory and the related experiments) and comprehension questions (questions requesting generalization to new situations). One point was allocated for a correct answer, 0 for no answer and -0.25 for mistakes (to discourage students from answering at random). These criteria are the ones used in the official evaluation carried out in the regular courses, and were explained again to students before the MCT. Thus, immediate learning scores ranged from -2.5 to $+10$ for each text. The measure of immediate learning for summarizers was computed as the mean score for the three texts they had summarized (-2.5 ; $+10$), and the listeners' measure of immediate learning represented the mean score for the three texts for which they had played the listener role (-2.5 ; $+10$). A MCT (four questions per text) was also administered before they started a fourth —non experimental— session occurring 4 weeks after the last session of dyadic work (-1 ; $+4$). Students were not forewarned about this test, which was used to obtain the delayed learning measure.

Results

Learning Outcomes

In order to test our predictions we carried out a 2 (resource interdependence: Identical information, complementary information) \times 2 (discussion aids: Yes, no) \times 2 (roles: Summarizer, listener) \times 2 (time of test: Immediate, delayed) mixed ANOVA with repeated measures on the two last factors. Immediate and delayed scores have been standardized (z -scores).

The analysis revealed a resource interdependence by time of test interaction, $F(1, 62) = 12.19$, $p < .01$, $\eta^2 = .16$, a resource interdependence by role interaction, $F(1, 62) = 6.83$, $p < .02$, $\eta^2 = .10$, a discussion aids by time of test by role interaction, $F(1, 62) = 4.07$, $p < .05$, $\eta^2 = .06$. More interestingly for our predictions, the analysis also revealed two

Table 3. Mean performance [-3.5; +14] regarding learning outcomes (main experiment)

		Discussion aids		No discussion aids	
		Identical information <i>N</i> = 12	Complementary information <i>N</i> = 18	Identical information <i>N</i> = 16	Complementary information <i>N</i> = 20
Summarizers	<i>M</i>	7.38	8.00	8.53	8.40
	SD	1.48	1.72	1.81	1.46
Listeners	<i>M</i>	7.55	7.75	8.78	6.98
	SD	1.14	0.96	1.25	1.39

significant effects with a moderate effect size: A resource interdependence by discussion aids interaction, $F(1, 62) = 5.52$, $p < .03$, $\eta^2 = .08$, and a resource interdependence by discussion aids by role interaction, $F(1, 62) = 4.39$, $p < .04$, $\eta^2 = .07$. No other effect was significant.

Let us first inspect the unpredicted findings. For the resource interdependence by time of test interaction, Scheffe tests indicated that students working on identical information performed better on the immediate test ($M = 0.32$) than on the delayed test ($M = -0.13$), $p < .05$, while student working on complementary information performed the same in the two tests (respectively $M = -0.16$ and $M = 0.09$), $p = .32$. The resource interdependence by role interaction suggested that summarizers performed more poorly ($M = -0.08$) than their listeners ($M = 0.28$) when they worked on identical information, while the reverse was observed when they worked on complementary information (respectively $M = 0.07$ and $M = -0.13$). Scheffe tests, however, reveal that no difference reached significance. Regarding the note-taking by time of test by role interaction no one difference reached significance (Scheffe tests).

Results regarding the predicted interactions were tested with standardized scores (see above) but are presented in Table 3 in terms of the mean total learning performance (sum of immediate and delayed learning test scores, ranging from -3.5 to +14) to enhance readability and to give a sense of the differential in learning outcomes. These two measures were aggregated since delay was not involved in the interactions. The resource interdependence by discussion aids interaction indicated that students working on identical information learned more when working without discussion aids ($M = 8.65$) than when they worked with discussion aids ($M = 7.47$), $F(1, 62) = 5.77$, $p < .02$, $\eta^2 = .09$, consistent with H1 (see Figure 1). Moreover, they learned more than students working on complementary information without discussion aids ($M = 7.69$), $F(1, 62) = 7.71$, $p < .01$, $\eta^2 = .11$. In contrast, when students worked on complementary information they learned about the same whether they could rely on discussion aids ($M = 7.69$) or not ($M = 7.87$), $F(1, 62) = 0.36$, $p > .54$, $\eta^2 = .00$ (as we will see below, this can be explained by informational dependence).

Results regarding hypothesis 2 are presented in Figure 2. In line with H2a, listeners working on complementary information achieved poorer learning outcomes when their summarizer did not rely on discussion aids ($M = 6.98$), as

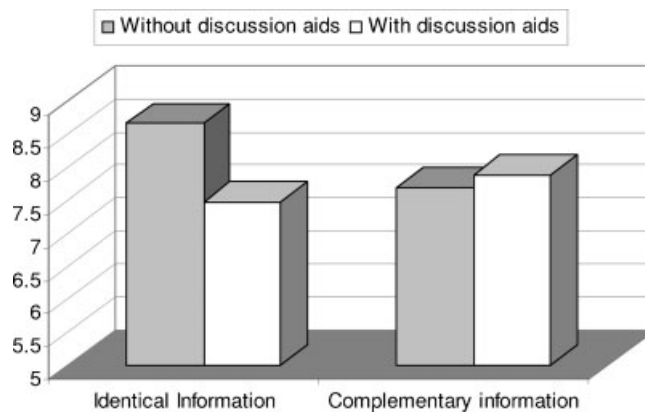


Figure 1. Learning outcomes as a function of resource interdependence and discussion aids (main experiment)

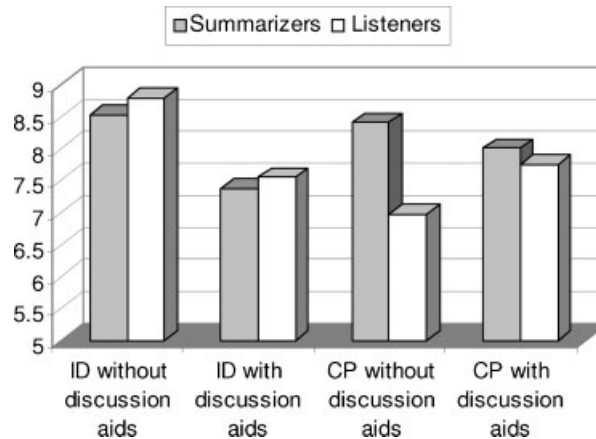


Figure 2. Learning outcomes as a function of resource interdependence (ID: Identical information, CP: Complementary information), discussion aids and roles (main experiment)

compared to listeners working with a summarizer who relied on discussion aids ($M = 7.75$, $F(1, 62) = 3.88$, $p < .06$, $\eta^2 = .06$). The effect was only marginally significant, but there was a moderate effect size (Cohen, 1988). Moreover, without discussion aids, listeners learned less when they worked on complementary information ($M = 6.98$) than when they worked on identical information ($M = 8.78$), $F(1, 62) = 19.89$, $p < .001$, $\eta^2 = .24$. Listeners working with summarizers who relied on discussion aids learned as much when they worked on complementary information ($M = 7.75$) as when they worked on identical information ($M = 7.55$), $F(1, 62) = .19$, $p > .66$, $\eta^2 = .01$.

In line with H2b, working on complementary information without discussion aids led listeners to learn less ($M = 6.98$) than their summarizers ($M = 8.40$), $F(1, 62) = 17.33$, $p < .001$, $\eta^2 = .22$, while with discussion aids, listeners working on complementary information learned just as much ($M = 7.75$) as their summarizers ($M = 8.00$), $F(1, 62) = .50$, $p > .48$, $\eta^2 = .01$.

The Mediation Role of Competitive Conflict Regulation

The perceived student interaction items were submitted to a factor analysis using principal-component extraction with varimax rotations. Five factors explained 66% of the variance, and almost perfectly patterned the *a priori* categories (see the “Dependent Variables” Section), namely perceived competition (15%), perceived quality of relationship (15%), reported information processing strategies (14%), reported involvement in information transmission (12%), and perceived confrontations (10%). The items and their factor loading are presented in Table 4.

A series of 2 (resource interdependence) \times 2 (discussion aids) ANOVAs were performed on the five factor scores. Means and standard deviations are displayed in Table 5.

Regarding the *perceived quality of relation*, the analyses revealed that students reported a better quality of relation without ($M = .37$) than with discussion aids ($M = -.36$), $F(1, 54) = 9.54$, $p < .004$, $\eta^2 = .15$). The main effect of resource interdependence was not significant, but the resource interdependence \times discussion aids interaction, $F(1, 54) = 6.58$, $p < .02$, $\eta^2 = .11$, indicated that students who worked on complementary information without discussion aids reported the best quality of relationship ($M = 0.78$, for all post-hoc comparisons, $p < .05$). As far as *reported information processing strategies* are concerned, only the effect of resource interdependence was significant, indicating that students working on identical information reported more information processing strategies ($M = .33$) than those who worked on complementary information ($M = -.37$), $F(1, 54) = 8.08$, $p < .007$, $\eta^2 = .13$). No significant effects were found for *reported involvement in information transmission*.

Results also indicated a resource interdependence \times discussion aids interaction marginally significant for *perceived degree of confrontation*, $F(1, 54) = 3.43$, $p < .07$, $\eta^2 = .06$, but with a moderate effect size, and significant for *perceived competition*, $F(1, 54) = 8.56$, $p < .006$, $\eta^2 = .14$, with a large effect size. More specifically, the contrast opposing students working on identical information with discussion aids and students of the other conditions was marginally significant, but

Table 4. Interaction perception items and their factor loading via principal-component extraction with varimax rotations (main experiment)

	COMP	QUAL	STRA	INVO	CONF
Frequency with which students evaluated their partners' competence	.82				
Frequency with which students tried to present themselves as more competent than their partners	.81				
Degree of competition	.74				
Degree of conflict	.66				
Frequency with which students wondered how to appear competent	.62				
Frequency with which students checked that what their partners said was correct	.50		.51		
Quality of relationship		.89			
Degree of collaboration		.93			
Degree of co-operation		.81			
Degree of spontaneous agreement		.80			
Amount of time dyads devoted to try to understand alternative points of view			.81		
Amount of time dyads devoted to propose strategies in order to remember information			.77		
Amount of time dyads devoted to defend and argue ideas			.69		.50
Frequency with which students wondered how to conciliate different view points			.57		
Frequency with which students integrated new information to previous knowledge			.47		
Amount of time dyads devoted to provide clarifications				.89	
Amount of time dyads devoted to ask questions or seek clarifications				.74	
Amount of time dyads devoted to check that both partners had understood the information				.74	
Frequency with which students tried to summarize information as clearly as possible				.59	
Frequency with which students think about concrete examples				.54	
Amount of time dyads devoted to confrontation of different points of view					.77
Degree of agreement reached after discussion					.63
Amount of time dyads devoted to try to impose their own point of view	.43				.63
Proportion of explained variance	.15	.15	.14	.12	.10

Note: COMP = perceived competition, QUAL = perceived quality of relationship, STRA = reported information processing strategies, INVO = reported involvement in information transmission, CONF = perceived confrontations. Only loadings higher than .40 are displayed.

Table 5. Interaction perceptions (factor scores), main experiment

		Discussion aids		No discussion aids	
		Identical information <i>N</i> = 14	Complementary information <i>N</i> = 14	Identical information <i>N</i> = 16	Complementary information <i>N</i> = 14
Perceived competition	<i>M</i>	0.50	-0.53	-0.18	0.24
	<i>SD</i>	1.27	0.82	0.66	0.96
Quality of relationship	<i>M</i>	-0.17	-0.56	-0.04	0.78
	<i>SD</i>	0.78	0.93	0.90	0.98
Processing strategies	<i>M</i>	0.17	-0.18	0.50	-0.56
	<i>SD</i>	0.41	0.84	1.36	0.82
Involvement in transmission	<i>M</i>	0.04	-0.02	-0.02	0.00
	<i>SD</i>	0.97	1.17	0.99	0.97
Confrontation of viewpoints	<i>M</i>	0.39	-0.32	-0.15	0.11
	<i>SD</i>	0.94	0.78	1.18	0.99
Competitive conflict regulation	<i>M</i>	0.88	-0.85	-0.33	0.35
	<i>SD</i>	1.22	1.12	1.45	1.31

with a moderate effect size, for perceived confrontation $F(1, 54) = 2.78, p = .10, \eta^2 = .05$, and significant for perceived competition, $F(1, 54) = 5.06, p < .03, \eta^2 = .08$. In other words, as was the case in the pilot experiment, students working on identical information with discussion aids reported the highest degree of perceived confrontation ($M = 0.39$) and the highest degree of perceived competition ($M = .50$). No other effects were observed.

Table 6. Mediation role of competitive conflict regulation, main experiment

Predictors	Equation 1 (learning)		Equation 2 (competitive conflict regulation)		Equation 3 (learning)	
	<i>b</i>	<i>t</i>	<i>b</i>	<i>t</i>	<i>b</i>	<i>t</i>
IV: Resource interdependence	-.28	-.92	-.53	-1.55	-.36	-.89
MO: Discussion aids	-.50	-1.65	.01	.01	-.50	-1.51
IV × MO	1.37	2.27*	-2.42	-3.57**	-.14	-.17
ME: Competitive conflict regulation					-.41	-2.86**
ME × MO					-.15	-.51

IV = independent variable; MO = moderator variable; ME = mediator variable.
* $p < .05$; ** $p < .01$.

The two latter scores, namely perceived level of confrontation and perceived competition appear to be particularly interesting to test H3. Indeed, hypothesis H1 predicted that learning outcomes of students working on identical information should be better when they do not rely on discussion aids than when they do, because discussion aids in identical information conditions can focus the attention of the two partners on relative competence and on competition. If this assumption holds true, the moderating role discussion aids play in the relationship between resource interdependence and learning outcomes should be mediated by competitive conflict regulation. This specific prediction is in line with the socio-cognitive conflict literature that has pointed out that competitive conflict regulation has detrimental effects on learning (Darnon et al., 2002; Doise & Mugny, 1984; Johnson et al., 2000). In this respect, it is particularly interesting to combine the perceived confrontation score, which essentially measures perceptions of intellectual and cognitive confrontation, and the perceived competition score, which focuses on the degree to which the regulation of discrepancies between partners is handled competitively (see Darnon et al., 2006 for a similar score of competitive conflict regulation). Thus we summed the two factor scores to compute a competitive conflict regulation score: The higher the score, the more participants perceive confrontation and the need to outperform the partner in their interaction. It is expected that this variable will mediate the moderating role discussion aids have on the relationship between resource interdependence and learning outcomes.

In order to test whether the negative impact of discussion aids on learning outcomes when working on identical information is due to competitive conflict regulation, a mediated moderation analysis, following Muller, Judd and Yzerbyt's (2005) approach, was conducted with competitive conflict regulation as the mediator (see Table 6). The first equation confirmed the significant effect of the resource interdependence (coded -0.5 for independence and $+0.5$ for positive interdependence) × discussion aids (coded -0.5 for no discussion aids and $+0.5$ for discussion aids) on learning outcomes, $b = 1.37$, $p < .03$, $\eta^2 = .08$. The second equation confirmed the significant effect of the same interaction on the mediator (competitive conflict regulation), $b = -2.42$, $p < .001$, $\eta^2 = .19$. In the last equation, we entered the main independent variable (resource interdependence) the moderator (discussion aids), the interaction between the two, and the mediator variable (competitive conflict regulation), as well as the interaction between the mediator and the moderator, as predictors of learning outcomes. This last analysis showed that the resource interdependence × discussion aids interaction was no longer significant, $b = -.14$, $p = .86$, $\eta^2 = .01$, whereas the effect of competitive conflict regulation was significant, $b = -.41$, $p < .01$, $\eta^2 = .15$. Thus, it appears that competitive conflict regulation mediated the effect of the resource interdependence × discussion aids interaction on learning outcomes (see Figure 3).

Discussion

The results of the present study support the three hypotheses we formulated and contribute to the existing literature in two major ways. The first contribution of the present paper concerns the role of the differing dynamics of pro-learning student interactions in conditions of resource independence versus positive resource interdependence. The results of the first two hypotheses show the relevance of our analysis regarding the diverging mechanisms occurring when relying on discussion aids or not during co-operative learning with identical versus complementary information.

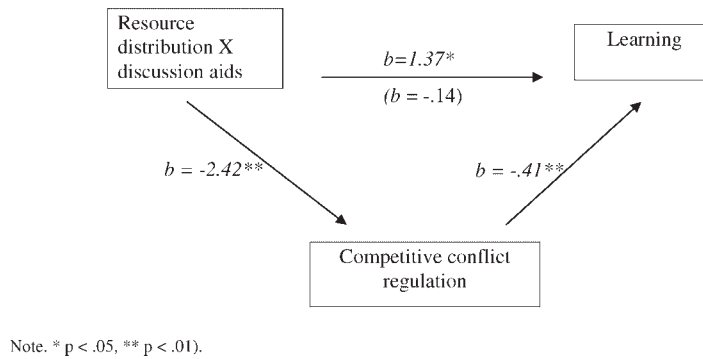


Figure 3. Competitive conflict regulation as a mediator of the resource interdependence by discussion aids interaction on learning outcomes (main experiment)

Competition During Work on Identical Information

Firstly, our pilot study indicated that perceived confrontation and competition were highest when students worked on identical information with discussion aids. When students worked on identical information, being directed not to rely on discussion aids reduced confrontation and competition. Thus the pilot study allowed us to predict that when students worked on identical information, they would perform better without discussion aids than with. Results of the main study regarding learning outcomes confirmed that for students working on identical information it was more beneficial not to rely on discussion aids. Indeed, in line with H1, the resource interdependence by discussion aids interaction indicated that students working on identical information learned more when working without discussion aids than when they worked with discussion aids, while this difference did not appear to be significant for students working on complementary information.

Informational Dependence During Work on Complementary Information

The pilot study indicated that discussion aids improved the informational input provided by summarizers in both a quantitative and a qualitative way. These preliminary results allowed us to formulate the hypothesis that when listeners work on complementary information, and therefore depend on their partner to access information, listeners' learning will be better if the summarizer relies on discussion aids than if he or she does not (H2a). Results of the main study indeed indicated that, when summarizers did not rely on discussion aids in the complementary information condition, listeners tended to learn less than when the summarizer did, in fact, take notes and use backup. It is important to note that in the latter case listeners were not disadvantaged by the fact that they did not access information directly: They learned as much as their summarizer and as much as listeners who read and discussed information (under the identical information condition). Conversely, listeners whose summarizer did not rely on discussion aids learned less than their summarizer, as predicted by H2b, and less than listeners who read and discussed information (under the identical information condition). In sum, when students worked on complementary information, listeners learned more when they could rely on a partner who benefited from discussion aids.

The second contribution of the present article is to point out the mediational role of competitive conflict regulation in the effects of social interactions on learning outcomes. More precisely, the mediational analysis pointed out that perceptions of confrontation and competition are indeed the cause of the moderating role of discussion aids in the effect of resource interdependence on learning: This analysis showed that competitive conflict regulation is the mediator of the observed resource interdependence by discussion aids interaction, in line with H3.

These results represent a contribution to research on resource interdependence (Lambiotte et al., 1987), peer learning (Johnson & Johnson, 1989), and socio-cognitive conflict (Doise & Mugny, 1984). Lambiotte et al.'s work (1987) showed that positive resource interdependence can improve students' learning when they work co-operatively, but other results have shown that positive resource interdependence may in some cases reduce the transfer of information between the summarizer and the listener and thereby impair listeners' learning (Buchs & Butera, 2001). The present results show that

both effects are in fact possible and point to a variable that can moderate the effects of resource interdependence on learning, especially for listeners: The quality of informational input, operationalized in this study by manipulating discussion aids. Lambiotte et al. (1987) have already suggested that evaluative pressure could explain the poorer learning when working on identical information compared to working on complementary information, but, in their study, they offered no evidence for that interpretation. Our results indicate that perceived competition and more precisely competitive conflict regulation can be responsible for negative effects on learning in situations that involve peer learning with identical information. Our results also show that discussion aids while working on identical information can orient the partners' relationship toward competition; Johnson and Johnson (1989) have already shown that competitive activities are detrimental for learning, but their study did not show what situational factors could predict the emergence of competition.

Last, but not least, these results contribute to socio-cognitive conflict research (Doise & Mugny, 1984). As pointed out in the introduction, for 30 years, many studies have claimed that situational factors which encourage competition lead to competitive conflict regulation, which in turn impairs learning; none of them, however, have tested the complete sequence by measuring conflict regulation, which has maintained throughout the years the status of a consensual, albeit never demonstrated, theoretical explanation. The present research tests the complete sequence, and in this respect it represents the first evidence of the mediational role of conflict elaboration. Of course, this test only concerns one particular type of conflict elaboration, namely competitive conflict regulation; thus, future research should complement this first test by the study of the mediational role of other forms of conflict elaboration.

Two limitations should be noted. Firstly, in the main study, we did not verify whether the quality of the summarizer's informational input mediated the effect of discussion aids on listeners' learning when working on complementary information, as suggested by the pilot study. The reason is that the main study was intended to be carried out in a natural setting, without the interference of a video-camera that might have enhanced self-awareness and accentuated the orientation toward social comparison. Although the pilot study provided very clear-cut results on the intervening mechanisms, a future study of co-operative learning outcomes could integrate measures of informational input in order to assess their potential as mediators. Secondly, in the present study note-taking during reading was manipulated together with the use of notes and/or texts, during discussion. Future research will be devoted to disentangling the differential effects, if any, of these two elements; in the present research we were mainly interested in the effect of working with written backup during discussion.

Finally, the present work suggests two types of practical implication. First, from an educational point of view, when educators get students to work on identical information, they should be aware of the potentially negative impact of relative competence issues and the possible effects of competition. Conversely, when educators have students work on complementary information, they should be concerned with the quality of informational input. Second, from an organizational point of view, the mediational role of competitive conflict regulation comes as good news. Indeed, recent research has shown that conflict regulation can be influenced by achievement goals, and in particular that in social interaction contexts performance goals lead to competitive conflict regulation (Darnon & Butera, 2007; Darnon et al., 2006). Thus, in situations where it is difficult to intervene in the structure of group work, e.g., because resource interdependence is already fixed, it may still be possible to foster learning by reducing the promotion of performance goals or by promoting mastery goals, in the attempt to limit competitive conflict regulation.

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