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Group Emotions: The Social and Cognitive Functions of Emotions in Argumentation

Claire POLO, Kristine LUND, Christian PLANTIN, Gerald P. NICCOLAI

Abstract The learning sciences of today recognize the tri-dimensional nature of learning as involving cognitive, social and emotional phenomena. However, many computer-supported argumentation systems still fail in addressing the socio-emotional aspects of group reasoning, perhaps due to a lack of an integrated theoretical vision of how these three dimensions interrelate to each other. This paper presents a multi-dimensional and multi-level model of the role of emotions in argumentation, inspired from a multidisciplinary literature review and extensive previous empirical work on an international corpus of face-to-face student debates. Bringing together argumentation studies and research on collaborative learning, we employ a linguistic perspective in order to specify the social and cognitive functions of emotions in argumentation. The cognitive function of emotions refers to the cognitive and discursive process of *schematization* (Grize, 1996, 1997). The social function of emotions refers to recognition-oriented behaviors that correspond to engagement into specific types of group talk (e. g. Mercer, 1996). An in depth presentation of two case studies then enables us to refine the relation between social and cognitive functions of emotions. A first case gives arguments for associating low-intensity emotional framing, on the cognitive side, with cumulative talk, on the social side. A second case shows a correlation between high-intensity emotional framing, and disputational talk. We then propose a hypothetical generalization from these two cases, adding an element to the initial model. In conclusion, we discuss how better understanding the relations between cognitive, social and emotional phenomena can inform pedagogical design for CSCL.

Keywords Argumentation * Collaboration * Emotions * Group Cognition

Introduction

In the last twenty years, two major theoretical shifts renewed cognitively oriented research on learning, and questioned argumentation theory. The first

consisted of the extension of the concept of cognition from an individual to a collective, socio-cultural perspective, with the emergence of research on ‘group cognition’ (Stahl, 2006), and the pragma-dialectic model in argumentation theory (Eemeren & Grootendorst, 2004). The second is the so-called ‘affective turn’, characterized by the inclusion of the affective dimension of learning, with a view on cognition that does not separate emotions from reason. In argumentation studies, some authors also took this turn, or claim that it is necessary to include emotions in argumentation models (e. g. Gilbert, 2004; Plantin, 2011), although they remain a minority in the community. The book edited by Baker, Järvelä and Andriessen, *Affective Learning Together* (2013) is emblematic of this renewed conception of learning processes as consisting of 3 key components: cognitive changes, social practices and emotional behaviors. However in practice, studies in CSCL focus on only one of these dimensions, or at most try to articulate two of them. Computer-supported argumentation systems, for instance, often take for granted an idealized, monological and unemotional version of Toulmin’s model (1958) to describe arguments (Scheuer, Loll, Pinkwart, & McLaren, 2010). Of course, such approaches fail in addressing the socio-emotional dimensions of actual group argumentative practices. This may result from the absence of theoretical models of how they interrelate to each other. This paper proposes to contribute to this challenge, the exploration of which has only recently begun, by presenting a model of the social and cognitive functions of group emotions in argumentation. As we aim at encompassing a variety of group reasoning settings, our model is based on the typical face-to-face argumentative interaction, but we believe that it is easily adaptable to the specificities of CSCL or CSCW contexts.

Our perspective is situated at the crossroad of argumentation studies and research on collaborative learning, and mostly inspired by linguistics. However, we are aware that only long-term dialogue between several disciplines can successfully achieve this goal. Insights from social psychology, for instance, would undoubtedly enrich this first model. Still, this contribution aims at offering a theoretical basis of discussion to the interdisciplinary and international community of computer-supported collaborative learning, to foster integration into a coherent, multi-dimensional and multi-level vision of collective reasoning.

Our work on group emotions began with an empirical study of class activities aimed at producing group reasoning. Herein, we propose a model that we believe applicable to a wide range of group reasoning settings, including professional contexts. For a heuristic purpose, we present not only the model itself, but also empirical analyses to show how the model can be applied and potentially adapted to interpret authentic data. First, we present the pedagogical situation and data in depth. A second section then specifies our theoretical model and presents the multi-disciplinary literature that inspired it. The third section of this paper is organized around two case studies that led us to refine the relationship between the social and

the cognitive functions of emotions for group reasoning. The first case (4.1) shows that low-intensity emotional framing on the cognitive side tends to be associated with consensual footing and disagreement avoidance on the social side. Case 2 (4.2), on the contrary, establishes a link between high-intensity cognitive emotional framing and social engagement with disputational talk, when a competitive footing and rivalry prevail. These cases generate a global hypothesis interpreted in reference to the initial model (4.3). In conclusion, we discuss the potential and limitations of the final, refined model specifically for CSCL design.

1. Educational context and dataset

We believe that achieving a high transparency about the context in which this model was developed permits others to appraise how our conceptual tools can be applied or adapted to other contexts. Moreover, the two case studies described in section 4 are based on data that were part of the same global corpus. Thus, we first specify the pedagogical situation, and then present the nature of the videotaped data.

1.1 Pedagogical situation: the *YouTalk* 'scientific café' activity

The *YouTalk scientific café*-type activity was co-designed by our research group in collaboration with a non-profit, informal science education organization *Les Petits Débrouillards*, under a grant from the regional government. It consists of an extra-curricular activity held at school, during the school day, and while the students (aged 12-14) are grouped as in an existing class (often a science class), even though the event requires modification of their regular class schedule. The activity is generally justified to the students as providing environmental or citizenship perspectives on other subjects. The event lasts between 1h30 and 2h. A key aspect of *YouTalk* is that elder students¹ (aged 15-16) lead the activity. The spatial organization of the class seeks to reproduce the 'café', that is in a large room with chairs arranged around tables with each table defining a working group of 3-5 students. Students are generally allowed to choose where and with whom they are seated. The macro-script of the café alternates between class discussion, working-group discussion, group vote and individual vote, and the whole activity is based on a multiple choice questionnaire slide show. Some questions, called 'knowledge questions' represent stable knowledge for which there is a recognized correct answer. These questions aim at mobilizing certain types of knowledge and providing basic information on the topic. Other questions, called 'opinion questions', for which all of the options presented are potentially true, are used to stimulate socio-scientific debate. The general topic was current and future drinking water resource management.

1.2 International corpus of videotaped data allowing multiple-scale analysis

Seventeen *cafés* were videotaped in Mexico, the USA, and France using the same general macro-script. A complex recording setting allowed the researchers to do multiple-scale analysis and to study what was occurring at both individual, small group, and class levels. The data for each *café*, include: a global view of the classroom and moderators' activity, a screen capture of the slide show, and local views of 2 to 4 table-groups. Ten *cafés* were selected for analysis based on criteria of completeness and coherence of the entire event (no technical or logistical issues) and in order to obtain a reasonable volume of commensurable data. Several aspects of students' argumentation were analyzed: type of collaboration in small group, use of different argumentative resources (knowledge, norms and emotions), and a comparative study of debate framing along the three countries (Polo, 2014). This extensive empirical work led us to develop conceptual tools to characterize emotional and social aspects of students' discourse in relation to cognitive-focused educational goals, which we now propose to integrate into a global model.

2. Emotions in argumentation: a multidisciplinary literature review

In this second section, we provide a multi-disciplinary literature review on the role of emotions in argumentative interactions, focusing on the aspects that inspired our theoretical model, notably perspectives on emotions coming from argumentation studies and considerations of emotions drawn from the literature on collaborative learning. Table 1 summarizes the key features of these two lines of research. Our model of group emotions in collective reasoning is then introduced.

2.1 Emotions in empirical approaches to argumentation

The institutionalization of argumentation studies as a field, in the end of the 20th century, has been accompanied by the development of a critical stance on emotions, perceived in a normative perspective as fallacious or potentially fallacious (e. g. Hamblin, 1970, Walton, 1992). Nevertheless, a recent approach in argumentation studies, reviving perspectives from Ancient Rhetorics, takes a descriptive perspective on authentic discourse and empirically studies how people use emotions as resources to argue (e.g. Micheli, 2010; Plantin, 2011; Hekmat, Micheli, Rabatel, 2013; Plantin, 2015).

Adapting work from psychology (e. g. Cosnier, 1994) into linguistics, Plantin (2011) proposes diverse indicators for studying emotions more or less explicitly invoked in argumentative discourse. While the critical analysis approach names and denounces fallacious appeals to participants' emotions, such analysis does not necessarily imply precise labeling. Instead, affects are rather characterized along the axes of valency (whether it is pleasant or unpleasant) and intensity (referring to

the strength of the affect) (e. g. Plantin, 2011; Cahour, 2013). Plantin (2011) specified for each axis several ‘emotioning parameters’. On the intensity axis, the emotional distance to the issue is considered (in terms of people concerned, space and time), the degree of control over the situation, agentivity and causality from which the situation is described as resulting. Other parameters contribute to the construction of the valency axis: life-death continuum, anticipated consequences, analogies and conformity to established norms. Such emotioning parameters are studied in discourse, and might appear more or less explicitly. They can be analyzed by examining the use of a specific emotional lexicon (indignation is necessarily related to the accusation of a responsible agent, for instance, while sadness is not), or in reference to cultural *topoi* (for example, in Western culture, a burial is expected to be sad). As a consequence, this type of analysis does not claim to apprehend people’s actual feelings, but rather the emotions that they *express* through discourse about themselves, others, or the topic².

Polo and her colleagues combined Plantin (2011)’s tools with Grize’s (1996, 1997) concept of *schematization* to better understand how emotions work as resources to argue, and play a role in the cognitive process of arguing (Polo, Plantin, Lund, Niccolai, 2013). A schematization corresponds to both a cognitivo-linguistic process of characterizing-and-appraising an object, and the resulting product of its representation in discourse. The schematization of a discourse object involves cognitive moves which are visible through linguistic operations, and which cast light on selected aspects of the object, producing a specific representation of it. This representation is not neutral (Grize, 1996, 1997), but argumentatively oriented. The term ‘orientation’ refers to the work of Anscombes and Ducrot on argumentative value of language itself (Anscombes & Ducrot, 1997), which is here expanded to larger discursive units. Part of this ‘argumentativeness’ of the schematization of discourse objects relies on its emotional framing (Polo et al., 2013). Any emotional tonality associated to a discourse object, more or less positive, negative, strong, slight, or even neutral, results from active discursive work conveying a specific, argumentatively-oriented vision. This notion of emotional schematization corresponds to one of the cognitive ways emotions can function. According to Lipman, “emotions highlight; they make things stand out; they are sources of *salience*” (2003, p. 129).

In summary, this line of research studies two types of research objects: emotional tonality attached to discourse objects, and emotional feeling attached to an *experiencer* (Plantin, 2015). In the first case, a specific emotional framing is associated to an argumentative claim. In the latter, the discourse signifies someone’s feelings.

2.2 Emotions in research about collaborative learning

CSCL, and, more generally, research on collaborative learning, generally accepts that emotions play a role in the socio-cognitive processes related to learning. This literature recognizes two different impacts of emotions on collaborative learning.

On one hand, emotions appear to have a positive impact on learning by fostering socio-cognitive conflict (Roschelle & Teasley, 1995). Such effects have been studied for conceptual or practical change, deepening of the space of debate, or even improvement in knowledge (e.g. Andriessen, Pardijs, Baker, 2013; Baker, Quignard, Lund, van Amelsvoort, 2002; Sins & Karlgren, 2013). On the other hand, some studies show that emotions related to argumentative interactions can be detrimental to group achievement. Facing a socio-cognitive conflict implies disagreeing. This can lead to some tensions as thematizing disagreement corresponds to an undesirable move in ordinary conversation (Traverso, 1999; Pomerantz & Heritage, 1984), which can be difficult to manage³. The cognitive process can be disturbed by these tensions and participants might use relaxation strategies that do not foster argumentation and learning (e. g. Andriessen, Pardijs, Baker, 2013). These results concerning the potential negative impact of emotions led educational researchers and practitioners to claim that there is a need to develop studies and tools for emotion awareness and emotion regulation (e.g. Järvenoja & Järvelä, 2013).

CSCL authors generally apprehend emotions as participants' actual feelings. Nevertheless, they mostly rely on discursive clues to assess group reasoning, identifying the type of collective talk developed among the students or co-workers (e.g. Mercer, 1996; Asterhan, 2013; Michaels, O'Connor, Sohmer, & Resnick, 1992). In this field, two oppositions structure the study of emotions: a focus on individual emotions (shame, motivation, etc.) versus a focus on emotional events occurring at the group level (trust, group efficacy feeling, etc.); and the distinction between timescales (long-term collaborative climate and group history versus local emotional constructs occurring during a specific task).

	Argumentative studies	Collaborative learning
Focus	Fallacious strategies vs argumentative resources	Effects on reasoning Individual level & group level
Method	Discourse analysis	(Mainly) Discourse analysis
Object	Expressed emotions	
	people's feeling	objects' tonality
		Felt emotions
		long-term
		local constructs

Table 1. Emotions in research on argumentation studies and collaborative learning: key points.

2.3 Group talk and social recognition-oriented emotions

We would like to point out here that some research in collaborative learning, which studies the quality of student talk in groups, addresses phenomena that can be interpreted in terms of group emotions (without being named as such). We do not have space for an exhaustive literature review here, but we would like to mention a work that we find useful to address the sociocognitive process of collective reasoning, notably Mercer and his colleagues categories of *exploratory*, *cumulative* and *disputational* talk (Fernández, Wegerif, Mercer, Rojas-Drummond, 2002; Mercer, 1996, Mercer & Littleton, 2007; Mercer, Neil, Wegerif, Dawes, 1999; Mercer and Sams 2006; Wegerif, Littleton, Dawes, Mercer, Rowe, 2004; Wegerif & Mercer, 1997).

Exploratory talk, considered of higher educational value, is defined as an efficient and explicit form of collaboration in which ‘reasoning is visible in the talk’ (Mercer, 1996, p. 363). Thanks to the sharing of evidence and explicit reasoning, this type of talk provides a basis for what Gouran (2004) calls a ‘constructive conflict’, focused on issues rather than personalities. On the contrary, disputational talk corresponds to little sharing of information and reasoning and ‘disagreement and individualized decision making’, embodied in ‘short exchanges consisting of assertions and counter- assertions’ (Mercer, 1996, p. 369). Cumulative talk is also considered of low educational value, even if it is highly collaborative, because it is limited to a discussion in which speakers accumulate ideas uncritically, through ‘repetitions, confirmations and elaborations’ (Mercer, 1996, p. 369).

In addition to the necessary cognitive ability, a group would engage in exploratory talk only if it corresponds to the perceived socially relevant form of talk, identified on the basis of specific emotions expressed in the interaction. These emotions are associated to how social recognition is ensured in the dialogue. This is strongly related to linguistic politeness. Engaging in argumentation implies changing one’s way of seeking face preservation³, and, in particular, a change in the status of disagreement, considered as an undesirable move in ordinary conversation. The students might experience uncertainty about the ongoing politeness rules (ordinary or argumentative). In this context, the expression of recognition-oriented emotions work as clues for the group members to engage in a common type of group talk. When a participant expresses emotions about whether her/his face is well preserved or endangered by a given interactional move, others can adjust their behavior accordingly.

In cumulative talk, the participants seek face preservation through agreement rather than by elaborating on the objects under discussion, and avoid disagreement. In disputational talk, face is strongly attached to the individual’s opinions, and criticisms are seen as offenses and lead to counter-attacks. Exploratory talk is

precisely characterized by the fact that social recognition does not rely on agreement to individual opinions, but rather on cognitive group achievement through the discussion process (Wegerif & Mercer 1997). Engaging in high-quality group interaction requires the students to adopt a politeness system in which there's no shame in expressing ill-structured ideas or changing one's mind, nor aggressiveness in criticizing others' views, nor sadness at not convincing everybody that one's initial idea was the best. Students rather experience happiness at shifting from individual initial arguments to collective stronger ones, which corresponds to intrinsic motivation (Ryan & Deci 2000). In Lipman's (2003) terms, we can say that exploratory talk requires the students to become 'self-corrective' as a group, self-correctiveness being a key feature of critical thinking.

3. A model of group emotions in collective reasoning

In figure 1, we present a model that articulates these theoretical backgrounds in order to propose a global picture of the role of emotions in the discursive, socio-cognitive process involved in reasoning together. For research purposes, a clear distinction is made between their social (dark boxes) and cognitive (white boxes) functions, but, of course, these are in reality occurring together as part of the same global sociocognitive activity.

An interaction never starts from scratch. Each student or participant comes to the table with his or her own preexisting internal emotional state, which includes a priori feelings about the objects to be discussed, and the subjects to be involved in the task. On the cognitive side, the initial formulation of the issue to be debated by the group also constitutes an a priori framing of the activity, which is not emotionally neutral. When the interaction starts, some aspects of these pre-existing entities are selected and filtered, adopting a discursive form to be shared among the participants. Then, two phenomena, one social, the other cognitive, take place gradually and give birth to two types of emotional discursive entities: the semiotization of participants' feelings and the emotional framing of discourse objects. These two emotional entities are unceasingly recreated during the debate, in real-time, with each participant monitoring his own and others' manifested feelings, and specifying the vision of the problem that he is acquiring through an appropriate emotional schematization. We refer to these two phenomena as the social and the cognitive functions of group emotions.

3.1 Social and cognitive expressions of emotions at the individual level

On the social side, the politeness system and, more specifically, the obligation to preserve one's and others' face (facework) (Goffman, 1974; Brown and Levinson, 1988), constrains which emotions the subjects manifest, if and how they thematize

their own and others' feelings. At the individual level, participants manifest and interpret feelings in relation to their choice of adopting a more or less collaborative self-identity footing, which can either be a) *consensual*, and avoid thematizing disagreement to preserve their own and others' faces; b) *constructively critical*, seeking face preservation through group achievement; or c) *competitive* and try to have their own ideas win over others'.

On the cognitive side, participants define and categorize the problem in the course of discussion, insisting on some aspects more than others. This schematization process is partly emotional: the objects, as they emerge in discourse, are given an emotional tonality (Polo et al., 2013). This process orients the discourse toward the defense of an argumentative claim. At the individual level, one decides to argue for one alternative, competing, within the debate, with one or several other options (here, options A, B, C, D, E or F). To simplify the model, in figure 1, we only represented two options: claim C and claim -C.

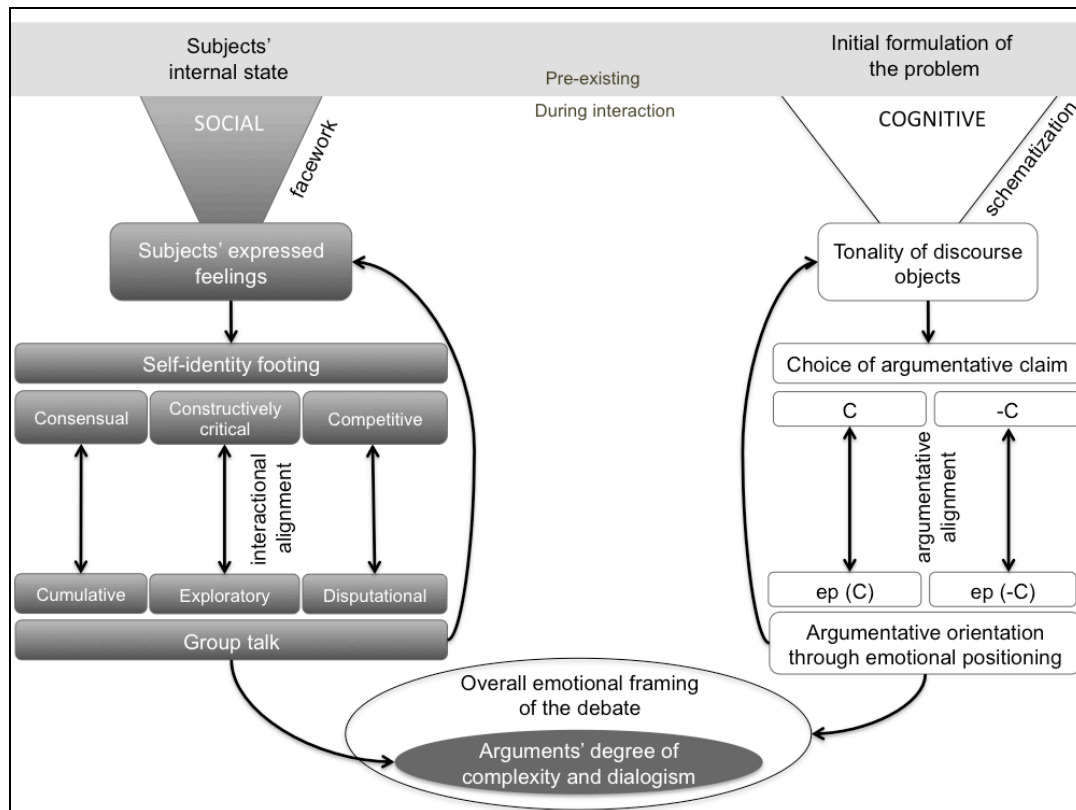


Figure 1. The functions of emotional entities in the sociocognitive activity of reasoning together.

3.2 Sociocognitive alignments and resulting group-level phenomena

In group reasoning, the participants adjust their individual positions (both social and cognitive), through processes of (dis)alignment. Through interactional alignment, the participants become engaged in a specific type of group talk, either disputational, cumulative or exploratory (Fernández, Wegerif, Mercer, Rojas-Drummond, 2002; Mercer, 1996; Mercer & Littleton, 2007; Mercer, Wegerif, Dawes, 1999, Mercer and Sams, 2006, Wegerif, Littleton, Dawes, Mercer, Rowe, 2004; Wegerif & Mercer, 1997). When each member of the table-group is aligned on a consensual footing, the group talk is cumulative; when they are aligned on a constructively critical footing, the group talk is exploratory; and when they are aligned on a competitive footing, the group talk is disputational. Exploratory talk is characterized by the fact that social recognition relies on cognitive group achievement. In cumulative talk, the discussion of the issue is restricted to a non-controversial process, the participants seeking face preservation through consensus. On the contrary, in disputational talk there is strong disagreement but little collective reasoning. Face is then strongly attached to the individual's opinions, and criticisms are seen as offenses and lead to counter-attacks.

Through argumentative alignment, the persons defending the same argumentative claim develop a similar emotional position toward the issue. An emotional position associated to the defense of claim C emerges in discourse, $ep(C)$. Its counterpart, for people defending the rival option $-C$, is the emotional position $ep(-C)$. Here, the collective configuration does not refer to the material group, but to an *ad hoc* entity based on intellectual affinity. It might group students together that are sitting at different tables. Sides arise in the whole classroom, during the debate, opposing students with different argumentative claims and associated emotional positions. Each time a participant contributes to the debate in favor of option C (or $-C$), his discourse will be argumentatively oriented toward C, through an emotional phasic move toward $ep(C)$ (or $ep(-C)$). Here the adjective 'phasic' is employed in opposition to the 'thymic' emotion: the latter corresponds to the initial affective state, disturbed by the emergence of, phasic emotional variations (Plantin, 2011). In the psychological tradition, the thymic mood refers to the 'normal state of composure' that a subject experience before the occurrence of an emotional episode, which in turn is referred to as a 'phasic' move, characterized by a raise in affective feeling (e. g. Cosnier, 1994; Wierzbicka, 1995). Once the emotional episode is over, a subject's emotional state gradually turns back to his initial thymic level, more or less quickly, depending on the intensity of the phasic emotion. In this model, as in previous work on the role of emotions in argumentation (Polo et al., 2013), we adapted these categories to qualify the debate itself rather than an individual affective experience. Methodologically, this allows one to distinguish between the global tonality of the debate, which serves as a reference for all the participants, and is called the thymic framing; and the local

moves in discourse corresponding to the use of emotional schematization strategies to defend a given option, which are referred to as ‘phasic’ variations.

3.3 Debate outcomes at the class level

In terms of outcomes, the sum of the phasic emotional moves resulting from turn-taking between people defending competing options, on the cognitive plane, gives an overall emotional framing to the debate. A resulting thymic tonality emerges, which can be different from the preexisting emotional framing due to the formulation of the problem. On the social plane, the type of group talk impacts the quality of the arguments used, in terms of complexity and dialogism. When exploratory talk occurs, for instance, the students are able to render their initial ideas more complex by integrating others’ counter-arguments, and they finally deliver stronger arguments. This reflects a deepening of reasoning. Independently of who voiced the initial idea or its critical assessment during the group discussion, the final argument made by an individual is strengthened by previous group talk. This can be described in terms of *rebuttals* in reference to Toulmin’s pattern of an argument (1958).

4. Relations between social and cognitive functions of group emotions

This section presents two case studies elaborated with reference to this model, which in turn generate hypotheses about how the relationship between the social and the cognitive functions of group emotions can be specified. More specifically, these cases constitute an argument for suggesting that the nature of group talk is related to the overall thymic framing of the debate. The first one presents a correlation between cumulative talk and low-intensity thymic framing, and the second shows a correlation between disputational talk and high-intensity thymic framing. In a third subsection, we provide a theoretical interpretation of these relationships by proposing a “zooming in” complement to the model presented in the introduction.

4.1 Case 1: correlation between cumulative talk and low-intensity thymic framing

In the available data, cumulative talk was correlated with low-intensity emotional framing of the issue. In small groups, the students do not necessarily focus on the goals set by the exercise: *“while working in classroom groups, children use talk to do much more than engage in curriculum tasks: they form relationships, develop social identities, and pursue ‘off-task’ activities which may be more important to them than the tasks in which they officially engaged – and, as Wegerif (2005) has argued, may be essential to the process of establishing good relationships so that effective ‘on-task’ activities result”* (Mercer & Sams, 2006, p. 517). A clear case

shows that they are little centered on the objects of debate as the thymic emotional tonality is low. The group of Louise, Pamela, Sabrina and Kelly, in the US school, illustrates this correlation.

During the first opinion question, the four girls clearly engage in cumulative talk, but, later in the café, while debating the third opinion question, they turn to emblematic exploratory talk. The two complete dialogues are provided in the appendix. To conduct a linguistic analysis of group talk, we operationalized it into a set of 5 indicators, which are all positive when the girls debate on OQ3. We do not have space here to detail all the analysis of this episode as being exploratory, but we provide an instance of compliance with each one of these indicators to show how our methodology is concretely applied with clear discursive markers.

1) Are assertions and refutations are justified? We then search for segments of discourse such as the highlighted part of the following utterance (turn 1):

LOU er: i think it should be priced by its quality **because if [you'd have better quality it's just more work to like produce it]**

2) Do the participants elaborate on the argumentative content of previous turns? Such topical alignment are sometimes embedded in gestural or verbal repetitions, as in the following example with Kelly's rephrasing of 'work to produce' into 'production', adding a referential gesture, which Louise repeats at turn 4:

1. LOU er: i think it should be priced by its quality because if [you'd have better quality it's just more work to like produce it]
 2. KEL [((nodding head in the affirmative, looking at Louise))
 3. KEL em: there's more [production <((turning hands)) for it to >
 4. LOU [((turning hands))

3) Do they critically evaluate each other's arguments? Studying this indicator usually implies large sets of dialogues. We here only reproduce two opposed turns of the conversation:

8. SAB and what about (.) family income/ you need water!
 (...)
 12. LOU they could like they could overu:se like they could (.) not pay as much and <((turning hands)) get more water>

After a collective elaboration of Sabrina's proposition, at turn 8, to have the price of water depend on family income (turns 9-11), Louise, at turn 12, expresses a concern for a potential undesirable effect of this proposition. She is then taking a critical stance on Sabrina's claim.

4) Is everybody taken into account when making a collective decision? In our data, the students have to come to a common group answer on each opinion question, which is then displayed in front of the whole class. Still, we believe that, even in other settings, this indicator is useful as long as the discussion aims at making an

explicit choice. It is essential to understand that concern to have all the group members' consent for the decision does not necessarily imply that the group reaches a consensus. Here, the students solve the problem by selecting an option but ensuring that the other option that some group members got interested in would also be expressed during the class debate:

41. PAM just put C and i'll explain like why we think D too\
42. KEL yeah\
43. SAB <((putting card C)) well i'm putting C\
44. LOU C\

5) Do the individual contributions gradually integrate the rest of the group's supporting or opposing argumentation? Or rather, do they only voice the speaker's own initial ideas? The pedagogical situation studied allows us to easily track this type of elaboration, thanks to the alternation of discussion between the group and the class level. Here, Pamela actually rephrases the different viewpoints developed earlier in the group, when she takes part to the debate at the class level:

PAM oh yeah C and D because em: like we chose C because em: like (0.9) <((opening hands, turned to the sky)) oh i can't really explain> <((hands back to the table)) but like (0.5) however like like however like much time it's putting like (0.3) prod- like producing the water/ should be like (1.0) sold at a higher price like if it's like more better quality it should be sold at a higher price but if it's just (0.5) <((skeptical face)) regular water [i guess> like it should just be (0.7) like affordable\ and then we (0.2) thought D too because em: we thought that like less fortunate families shouldn't be like (0.5) punished not really punished but shouldn't like (.) have like a: <((moving hands)) lack of water> because (.) of like their jobs or whatever their income

These indicators also make it possible to specify sequences of talk which are not exploratory. Cumulative talk, especially, is characterized by very low critical sense (indicator 3), as if the discursive and interactive exploration was restricted to the uncontroversial side of the issue. This is the case when the girls discuss about OQ1. They then all agree that the most promising source of water for the future is economizing water currently available through a more careful exploitation of existing resources. They stick to uncontroversial discourse objects, by collectively elaborating a list of environmentally friendly practices, more or less related to the question. Here, the issue does not seem important enough to them to thematize disagreement and argue about it. They rather turn to the usual environmental education doxa, which they all agree to and feel familiar with, without applying any criteria to distinguish between more or less relevant examples. For instance, when Kelly mentions the chemicals polluting the grass at washing one's car (turn 31), nobody questions how this point relates to the topic.

Coming back to our issue of examining the relations between the social and cognitive functions of emotions in group argumentation, a striking result is also that these two dialogues strongly differ in terms of thymic emotional framing and display of signs of (dis)engagement. In the cumulative discussion about OQ1, the 'cold' framing of the issue allows the girls to formally deal with the task in a very scholarly way, but with minimal effort and personal engagement. On the contrary,

the whole group is more engaged in debate about OQ3, which shows higher thymic tonality. More specifically, in their discourse about OQ1, a key emotional parameter, the distance to the people concerned, contributes to the development of a low thymic intensity. Throughout the discussion, the girls discursively present the problem as quite far away from them. They rarely involve themselves into the discussion, and mainly use the third person (turns 7,9, 14, 19, 25), talking about the 'people' who waste water (turn 5). They only use the second person 'you' twice, in a general meaning (turns 19 and 26). The inclusive pronoun 'we' (first person plural) is only used during the following class debate, to report their previous discussion, still with a general meaning. The pronoun 'they' only appears, in their discourse, as members of a collective entity who wastes water, and who should provide some effort in order to avoid wasting too much, but the girls never present themselves as potential victims affected by a lack of water. This parameter is very different when the girls debate about the third opinion question. The distance to the issue is much shorter, producing a much more intense, or 'warmer' thymic framing of the discussion. The girls present the problem of determining the price of drinking water as a matter that they are directly concerned with, as much as anybody ('*all people*', turn 14 ; '*everyone*', turn 18). The two general formulations are made using the second person, more engaging than the third person (turns 1 and 8). A great part of the debate is about whether or not every one should, including poor people, have access to drinking water. At this point, Louise is the only one using the third person, which is consistent with her opposition to the proposition that the price of water should depend on family income. This precise phasic increase of the distance to the people concerned is clearly an argumentative strategy. On the contrary, when Louise suggests considering family income, at turn 8, Sabrina sticks to the use of the second person: '*you need water*'. In doing so, she does not present the financial accessibility as 'other people's problem', but frames it as a global concern involving everybody, including her. Sabrina's utterance also tends to 'warm the debate up' by referring to the idea of necessity. It is not only a matter of moral positioning or ecological principle, but also a concrete problem of material survival, tending to the extreme 'death' pole, on the valency side (a consequence schematized as very unpleasant). Similarly, aligned with Sabrina's phasic increase, Pamela, at turn 9, presents the risk of lacking water in a radical version, as not having water at all ('*not get water*').

Moreover, when they discuss the first opinion question, the students display signs of disengagement, which are absent in the exploratory debate about the third opinion question. During the cumulative discussion, they produce several long pauses, check the time, stretch, yawn (turns 35, 36, 37, 41). Therefore, one could be tempted to conclude that the emotional distance to the issue, discursively created on the cognitive side, mirrors the students' actual emotional degree of engagement. Nevertheless, these data do not provide us with any insight about the students' real

emotional state, but only the image of this state as manifested by the students in their discourse and behavior. Moreover, in psychology, there is still a debate about whether or not an internal emotional state can be disconnected from its external expression, and, if so, about the direction of causality between the two⁴. Our interpretation is rather that the emotional schematization of the problem contributes to the argumentative orientation of the debate and structures potential interactional behaviors in a way that constrains expression of (dis)engagement. One cannot easily start yawning in front of someone who is talking about a matter of life or death, no matter how little one may *sincerely* feel concerned about the topic.

4.2 Case 2: correlation between disputational talk and high thymic framing

A clear case of disputational talk was found in the French sub-corpus. A group consisting of four girls, Klara, Samira, Isabelle and Asa starts disputing during OQ 2, and engage in disputational talk again during OQ 3. Still, they manage to soften the conflict and organize a de-escalation during the rest of the café, avoiding another typical dispute during the last group debate on the main question. To do so, they mainly use a disengagement strategy. Even when confronted with a real sociocognitive conflict, the students solve associated tensions by social-only relaxation rather than sociocognitive strategies. This is consistent with previous work showing that group effective collaboration needs an optimal alternation of tension and relaxation phases (e.g. Baker, Andriessen, Lund, 2009). Actually, it seems that the four friends fail in managing a high-intensity emotional framing at the cognitive level by engagement in exploratory talk, and ‘solve’ the conflict by avoiding the issue, and backing away from the exercise, at the meta-discursive level.

In reference to the above mentioned indicators used to operationalize the analysis of group talk, disputational talk is characterized by a rather negative indicator 1 (repetitions instead of justifications), intermediate indicator 2 (topical alignment), strong but unconstructive use of critical sense (indicator 3) and negative indicator 4 (decision-making practice seeking collective consent) and 5 (actual sharing or ideas into more complex, dialogical arguments collectively owned). We here provide a few examples taken from the discussion of the four French girls on OQ2. The students repeat propositions and counter-propositions (2), without elaborating on the reasons for choosing or rejecting an option, which is necessary for constructive discussion (3), as in the following excerpt:

8	KLA	pff moi j'dis F\ (pff I say F\)
9	ISA	pas F quand même\ (not F\)
10	KLA	mais moi j'fais pas l'C hein\ (I do not do the C ok\)
(...)		
13	KLA	moi c'est F hein\ (I am F\)

14	ISA	moi j'mets la E hein\ (I put E\)
15	KLA	oh non moi j'fais F\ (ah no I do F\)

When it comes to making the final decision, no discursive work is undertaken to get everybody's consent (4). Instead, without previously asking the others, Samira individually decides to put letter F on the stand, at turn 20, and tell them :

SAM	bon j'ai mis F hein démerdez-vous\ (so i put F, just deal with it).
-----	---

Klara, who agrees with Samira, is aligned with her attitude and displays overt disinterest in what the two other girls think, since her decision is already taken. This is embedded in turns 33 and 34:

33	KLA	nan mais ça <((geste de la main désignant Samira et Klara)) c'est notre avis à nous deux\> <((geste de la main vers les 2 autres)) vous euh mettez c'que vous voulez\> (no but this <((pointing gesture at herself and Klara)) is the opinion of the two of us\> <((pointing at the others)) you er put whatever you want\>
34	SAM	((remet la F)) ((puts F on the stand again))

Much later, at the end of the debate, when the moderator actually asks the students to put their chosen letter up, there is still no seeking for collective consent, but very conflicting gestures. Samira starts the de-escalation strategy by disengaging herself and holding a letter corresponding to Isabelle and Asa's choice, even if she does not agree, just to get rid of the debate. See what happens then:

171	KLA	<((prenant le carton de la main de Samira et le donnant à Isabelle)) nan c'est pas toi qui l'soulèves toi t'es pas E c'est vous qui l'soulevez> <((taking the card from Samira's hand and giving it to Isabelle)) no YOU don't hold it up you're not E YOU hold it up>
172	SAM	<((en levant le F)) nous on est F\ [klara nous on est F\ ((<((pulling lette F up)) we are F\ [klara we are F\
173	ISA	[<((en cherchant à baisser la main de Samira)) nan: mets-en pas deux\> ((<((putting Samira's hand down\)) no: don't put two\>

Finally, during the following class debate, this group only contributes twice on the basis of what was earlier said during the group discussion, each time with a student rephrasing her own initial idea, not enriched by a consideration of counter-arguments. When they do so, the other students are simultaneous criticizing what is being said, with a low voice at the group level displaying no collective sharing and ownership of arguments. When Samira contributes to the class discussion, Asa even whispers to her:

ASA	°tu mets pas ma bouche dedans° (°don't put my mouth in that°)
-----	---

This disputational talk was correlated, both in OQ2 and OQ3, with a very high thymic tonality. A complete inventory of students' utterances concerning three parameters of emotional intensity is available in appendix B: people concerned, responsible agents, and spatio-temporal distance. At first sight, there is a contradiction between the way students present the people concerned, and their spatio-temporal framing of the topic.

Spatio-temporally, the issue is presented as fairly far away from the students. The main places mentioned as affected by the water issue are Russia, different parts

of Africa, and places characterized by a dry climate, which is not the case in the area where the students live. The mention of Dakar is special in this perspective, since it is related to Asa's family. Even if the place is geographically distant from where the discussion is taking place, to Asa, it may be nearer in terms of emotional distance due to the fact that it is where her grandparents live (a fact explicitly referred to). Still, on the temporal dimension, the students also build significant distance from the issue. In other words, the time when the situation would become threatening is presented as belonging to the future. Nevertheless, some variations appear: it is sometimes a near future, so close that the students themselves can imagine 'the consequences' of their current 'acts' will occur during their life; others represent the consequences further in the future more likely to affect the next generations, for example their 'grandchildren'. An interesting feature of the temporal distance construction is that the current time is only explicitly mentioned as the moment when the acts causing the water issue are committed.

When it comes to directly depicting the people concerned by the problem of access to water, the global picture is rather different, consisting of a high emotional proximity. Out of 41 utterances inventoried, 13 correspond to a first person footing, either in singular or plural form (French *je, j', nous, on*), and 14 to the second person, mostly singular (*t', toi, tu*), with also one plural form (*vous*). Even when the third person is employed in this sequence, it often refers to close proximity to the issue. Two occurrences of *ils* (third person plural) in fact stand for the further employed *vous* (second person plural), corresponding to the present students who went to Russia on a scholar trip. The remaining four occurrences of the third person concern other close relationships: students' future children (twice) or grandchildren, or Asa's grandparents. Only 6 utterances use the third person (*ils, autres*) to refer to distant others. In terms of valency, the problem is only presented as radical and potentially leading to death in two occurrences, corresponding to distant others in danger of not having water at all ('they don't have water', 'they don't have anything'). In the rest of the utterances, the people concerned, mostly the students themselves and their family, are characterized as water consumers facing the matter of how much they have to pay for water, and how much water they can use for their daily needs and their personal comfort. Lastly, Samira makes an original contribution to the group debate on OQ3 as she extends the issue as concerning humanity as a whole: '*on est tous égaux et au fond on est tous des humains\ on a tous les mêmes droits*' (we are all equal and in the end we are all humans\ we all have the same rights\).

The contrast between the two parameters of spatio-temporal framing and people concerned show that the distance to the issue is not only determined by the objective external material conditions (the local situation with respect to water), but is truly discursively built. The students here, even if they are aware of not belonging to the most endangered population in respect to water access, do

extensive work to take the issue seriously, both as a concern for all of humanity and as their own local problem.

Lastly, the four girls spend significant time elaborating who is responsible for the evolution of the situation regarding the water issue. In total, 90 occurrences of linguistic markers qualify those taken for responsible (pronouns, names, etc). A structuring feature is the identification of the students with the agents responsible for a change leading to a better situation. This identification is made directly, by an extensive use of the first person singular (*je, j', moi*), in 17 occurrences, and expression with a value of first person plural (*on, nous*), in 15 occurrences. The identification also relies heavily on the use of the second person singular, with the students directly accusing each other of being responsible for the situation. We counted 17 occurrences of *tu* or *t'* and verbal forms in second person singular, and 5 occurrences of direct citation of some students' names (Samira and Klara). It is interesting to note that the alternation of first and second person has been proved as an effective empirically defining characteristic of the conflict genre (Denis, Quignard, Fréard, Détiennne, Baker, Barcellini, 2012), which is consistent with the fact that the students here are engaged in disputational talk.

The rest of the linguistic markers depicting the people responsible for the situation all use the third person, and present a variety of meanings. Fifteen occurrences of various forms of "he", "she", or "they" refer to the group of precursors who will initiate a change in their practices that would end up making a difference. There is a debate between the students on how many people are needed to actually have a meaningful impact, and whether or not it's worth getting personally involved in this cause. As a result, the third person here sometimes stands for a first person plural value, when the students perceive themselves as belonging to this group of precursors. Isabelle's utterance, during a side-discussion on opinion question 2, is emblematic of this figure: '*si on est trois millions ça changera*' (if there are three million of us, that will make a difference). A second group of third person utterances corresponds to a general entity that does not explicitly include the students, but from which they cannot totally stand apart: 'people'. This global, poorly determined, agent is characterized by reluctance to change habits, egocentrism and laziness, and is defined as the majority of society's members. A total of 14 occurrences refer to this entity. Several of these occurrences are embodied by the word *personne* (nobody), a radical form that also semantically includes the students themselves. A third instance of third person use consists of the people defined as the most responsible for the situation, their higher culpability due to the fact that they actually take advantage of the problematic situation (4 occurrences). Here, there is usually no identification with the students, as it mostly concerns industries making money out of the situation. Surprisingly, one isolated occurrence of the *on* (we) presents similar features, during class debate on opinion question 3: '*on la vend un peu plus cher*' (we sell it at somewhat higher price). This

can be understood as a feeling of collective culpability for the general organization of the society they belong to, a society that makes possible this kind of profit⁵.

It is interesting to note that two of these occurrences of the third person can be considered as depicting both people concerned and responsible agents. The first one refers to children's 'parents', whose lifestyle is related to the water issue, both as a cause of the environment problem and as a way in which this problem can affect them (here, they might have to clean dry toilets). The other occurrence with this double status is a third person plural ('ils', *they*) referring to the people lacking water because they might not pay for it. This sentence is ambiguous and does not enable us to decide whether such people are considered as social victims for not affording to buy water or whether they are presented as responsible for their problem, which would be to say that it's their fault is they cannot even pay for water.

All things considered, one can say that the emotional thymic tonality of the debate among the four students is very high along the intensity axis. A specificity of this case is that the proximity to the issue does not only rely on the identification with the people concerned but also, indeed mostly, with the people responsible for the evolution of the situation. Such framing implies auto and hetero accusations and culpability, favoring a feeling of being offended and needing to defend one's self. This is consistent with the emotional characteristics of disputational talk along the social dimension of argumentation.

Lastly, an interesting aspect of this dialogue is that the students produce a lot of meta-discursive commentaries on the activity they are engaged in. These commentaries are rather negative, and show that their argumentative norms associate debate with the polemical genre. Below we reproduce all of the students' utterances⁶ describing their ongoing activity, during the group debate on the second opinion question, where they must hold up the letter A, B, C, D, E or F corresponding to their group choice⁷:

ISA bah oui mais l'truc c'est [qu'on doit voter pour l'groupe\ (yeah but the thing is [that we must vote for the group\ (...)
ASA [ah: tu m'affiches pas avec ça hein\ ([ah: don't shame me by associating me okay\ (...)
ISA <((en riant)) toi tu cherches pas l'embrouille> (<((laughing)) you are not provoking the conflict>) (...)
SAM <((riant)) nous on n'est pas d'accord klara\> [on va <((pose le poing sur la table)) débattre\> (<((laughing)) we do not agree klara\> [we're gonna <((poses her fist on the table)) debate\>) (...)
KLA <((prenant le carton de la main de Samira et le donnant à isa)) nan c'est pas toi qui l'soulèves toi t'es pas E c'est vous qui l'soulevez> (<((taking letter E from Samira's hand and giving it to isa)) no it's not you who must hold it up you're not E you must [hold it up>) (...)
ISA °<((riant, à ASA)) ça sent la guerre>° (°<((laughing, to ASA)) this smells like war>°)

Both lexicon and gestures refer to the semantic field of conflict and war. The analogy used to characterize the interaction is the one of a battle. While the moderator is announcing the next group debate, about OQ3, Samira expresses anxiety about the coming phase, anticipating the conflict:

SAM °on va s'taper là° (°we are going to start fighting again°)

Similar negative metadiscursive comments at the table on the nature of the ongoing activity continue during the discussion on OQ3:

SAM bon maint'nant on fait pas d'merde hein\ (so now let's not just do shit okay\) (...)
ASA ((entoure sa tête de ses mains simulant une grosse tête)) (puts her hands around her head to simulate a big head) (...)
SAM isa tu défends ta cause\ (isa you defend your cause\) (...)
SAM on est en train d's'entretuer\ (we are killing each other\) (...)
ISA c'était d'la merde\ (that was shit\) (...)
SAM tout l'monde se dispute\ (everybody is arguing\) (...)
ASA mais c'est bon arrêtez avec vot' débat on va pas parler\ (but it's enough stop with your debate we're not gonna talk\) (...)
ISA t'arrêtes de t'exciter toi un peu là/ (you stop getting so annoyed, will you/)

This representation of the activity contributes to the shift from strong individually opposed convictions on the issue to interpersonal conflict. The debate is mainly described in terms of its (potential) detrimental effects on participants' relationships. Therefore, the activity is mostly thematized through its social implications, and very little is said at the metadiscursive level about the matter of conciliating or co-elaborating the alternative views on the topic.

The girls finally turn to a cognitive disengagement strategy, which strengthens the group by reactivating a common role of 'poor student' that they seem familiar with. The negative stigma is explicitly mentioned and used as a shared identity feature for the (re)construction of group unity. During the class debate on OQ2, the students produce a self-devaluating discourse that correlates with strengthening the feeling of belonging to the same group:

1 ISA <((en regardant l'enseignante)) madame dupont> (<((looking at the teacher)) mrs dupont>)
2 KLA eh elle va s'dire elle aura honte de notre classe\ (she's gonna think she's gonna be ashamed of our class\)
3 KLA aussi ils ont pris la pire classe comme ça euh ils ont pris les pires gens d'la classe 'fin\ (also they took the worst class and then em they took the worst people in the class in fact\)

4.3 Articulation of social and cognitive functions of group emotions: generalization

The two case studies presented in the previous sections show a correlation between the thymic framing of a debate and the tendency to engage in distinct types of talk at the group level (disputational, exploratory, cumulative). In figure 2, we propose a representation of such correlations in reference to the model presented in figure 1, zooming in to the bottom part of it, focusing on the collective configurations structured by emotions on the cognitive and the social dimensions, and on their relations to the outcomes of the global argumentation. The model here serves as a basis for conceptualizing, at a theoretical level, the hypotheses generated by these case studies about the relations between group talk and thymic

framing. If future studies confirm these hypotheses, such refinement of the model would offer a more complex symbolization of how social and cognitive functions of group emotions are intertwined.

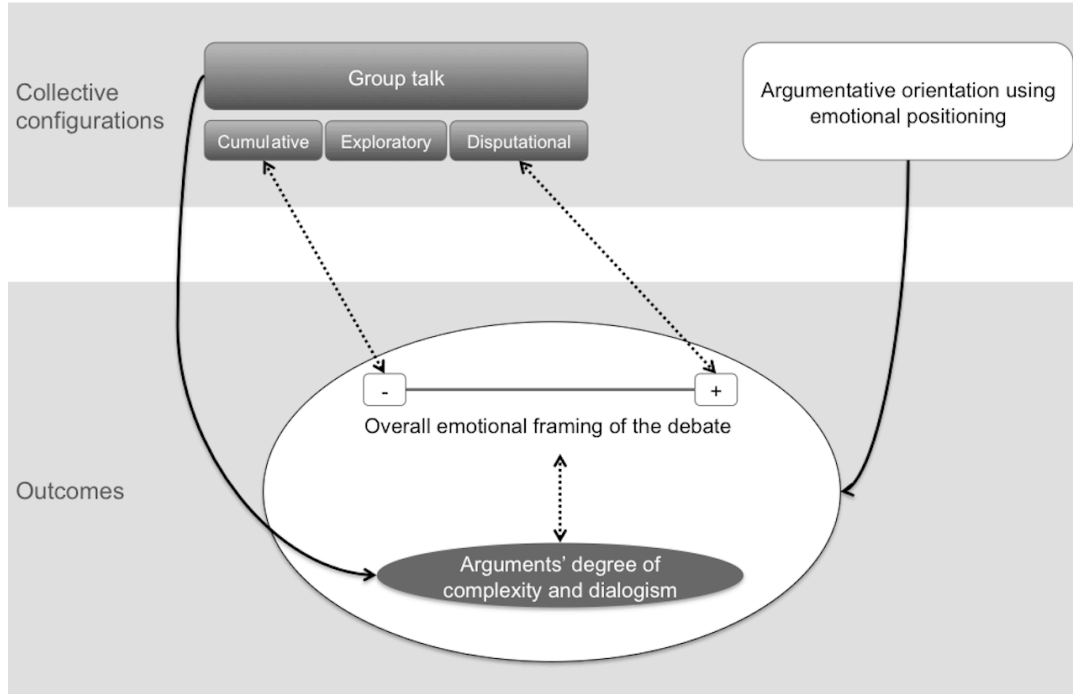


Figure 2. Relation between the cognitive and social functions of group emotions in argumentation: complexification of the model.

Group talk and the thymic overall emotional framing of the debate seem strongly linked. Our interpretation is not a one-way causal link, but rather a cycle of feedback. For instance, specific emotions that play a social function, such as feeling offended, may impact the emotional framing by influencing the participants to feel more or less concerned by, or responsible for, the issue at stake. Similarly, the construction of the distance to the issue, a key component of the cognitive functions of emotions, is likely to produce more or less intense feelings on the part of students depending on how consistent the problem appears to them. Theoretically, we represent this relationship as a continuum. In emblematic cases as those reported above, typical cumulative talk is associated with a low-intensity emotional framing and typical disputational talk corresponds to a high-intensity emotional framing. Still, many authentic interactional phases cannot be easily classified on the whole as belonging to one type of group talk (Polo, 2014, 199-238), and they may admit different sequences also in terms of overall thymic tonalities. Therefore, we have no reason to theoretically exclude any potential intermediate situation between those two poles.

In terms of educational concerns, this dynamic complement to the model has the advantage of highlighting that pedagogical tools and strategies aiming at fostering exploratory talk should address the matter of the optimal general emotional framing of the activity.

Main conclusions and discussion

In this final section, we first summarize the key conclusions of this article, and discuss the significance of our model for the theorization of group emotions, especially its implications for educational design. We then give directions for future work to build upon the present contribution.

Theoretical significance of the model and main conclusions

Distinguishing between social, motivational, affective, and cognitive dimensions of interactions aimed at reasoning together is not an easy task. For analytical purposes, we find it useful to differentiate in a dynamic model (2), the social and cognitive functions of group emotions, even if they are actually interrelated into a global sociocognitive and affective process. On the social side, group discourse can present features of different types of talk, corresponding to different types of politeness rules and facework. Participants may experience and display emotions related to the way in which their faces are engaged in such interaction. These feelings are decisive for the group process of turning either to exploratory talk, cumulative talk or disputational talk. On the cognitive side, the emotions in play do not concern the subjects (participants) of the interactions directly, but rather the objects being discussed. The emotional framing of the problem is inherent to the process of schematization, which orients the discourse towards a given argumentative conclusion.

Still, this analytic approach remains simplistic compared to authentic occurring interactions. In order to better understand what happens when groups try to reason together, it is worth addressing the challenge of specifying the relations between these categories and how they can dynamically be influencing each other. From this perspective, two case studies are presented (4), showing a correlation between the type of collaboration that the students tend to develop in small groups and the emotional tonality characterizing their debate. This attitude questions the appropriate level of signified engagement, since discursively constructing the objects of the debate as more or less distant to the students seems to be related to how constructive the group interaction becomes. These results are consistent with previous literature. On one hand, the fact that cumulative talk is associated with low-intensity emotional framing confirms the need for minimal positive tensions to stimulate group work (e.g. Sins & Karlgren, 2013). On the other hand, the fact that

disputational talk is associated with high-intensity emotional framing as well as direct implication of the subjects of the interactions reflects that people are either concerned by and/or feel responsible for the issue. This echoes the observation that feeling offended tends to inhibit group reasoning (Baker & Andriessen, 2009; Muntigl & Turnbull, 1998). These case studies led us to better integrate the social and cognitive functions of group emotions by questioning their relation. We finally propose a theorization of these results, on the basis of a representation of the links hypothesized for generalization.

Our first aim was to build conceptual tools appropriate for the study of socio-scientific debates among students, in order to make sense of our data. Retrospectively, we believe that this conceptual framework has a larger relevancy and deserves to be defined as a general theoretical approach that might be used in other contexts. This model might be useful for describing any situation in which a group is expected to reason together, either in educational or professional settings. Even if only long-term dialogue between scholars of multiple disciplines can fully achieve this goal, we consider this model as a first step toward the daunting challenge of theorizing how the social, the affective and the cognitive are intertwined in reasoning and learning.

Practical significance of the model and implications for design in CSCL

We would also like to emphasize a few implications of our model in terms of pedagogical design. First, we are doubtful of the restricted vision of emotion-regulation that promotes pedagogical strategies aiming at rescuing pure ‘cognitive processes’ by separating them from (detrimental) emotions that are considered to be markers of fallacious reasoning. Instead, it might be fruitful to make the participants aware of the social role of emotions, and provide them scaffolding for efficient collective regulation (e.g. Järvenoja & Järvelä, 2013). The benefits of emotion awareness applied to the cognitive functions of emotions are not as obvious. Case study 2, on French data (4.2) shows that group awareness of ‘warm’ cognitive conflict can lead to social-only relaxation strategies, encouraging disengagement.

We rather believe that consideration of the socio-affective dimensions, together with the cognitive, as fully integrated to the learning process must be embedded in the pedagogical situation itself. From a designer’s perspective, understanding the cognitive emotions underlying students’ engagement in more or less valuable forms of talk for educational goals is promising for fostering high quality student interactions. But in order to accomplish this, designers do not necessarily need to implement emotion-awareness tools, as extra marginal functions in their pedagogical environment. Indeed, optimal thymic framing should be reached as a cognitive necessity relying on the didactical challenge itself. Therefore, scaffolding

students' optimal emotional engagement in the activity can be addressed, for instance, by a careful choice of topics as well as attention to how the target knowledge is contextualized. Designers should also include socioaffective concerns in their global *scripting* of the activity (Weinberger, 2003; Dillenbourg & Jermann, 2007), and not as an additional complementary tool.

Discussion and directions for future work

The proposed model has proved useful for deeply analyzing our data and has allowed us to formulate more general hypotheses on the relations between social and cognitive functions of emotions in groups trying to reason together. Some aspects still need to be confirmed by future studies. The correlation observed between group talk and the level of thymic intensity, in terms of emotional framing, is not sufficient to draw firm conclusions on the nature of causality between the two phenomena. In the presented case studies, arguing in favor of this relationship, we mainly focused on the intensity axis of emotional framing, and more specifically, on the distance from the issue. Further work on other data, and/or extending the analysis to other parameters of emotion construction on the cognitive side, including the valency axis, are needed to specify this relationship.

In addition, we would like to specifically highlight two lines of research for which our model can serve as a basis. First, at the theoretical level, the matter of building a global understanding of how cognitive, social, and affective dimensions of reasoning are integrated requires further work. For instance, a common argumentative practice is the use of ethos-based strategies to defend a claim. In such discourse, the distinction between the *subjects* and *objects* of conversation vanish, since subjects themselves become a discourse object to a great extent. Studying this type of frontier case would be interesting to better understand how cognitive and social functions of emotions get intertwined.

Our second focus for discussion and further investigation concerns educational practice. Here, the question is how can an optimal thymic framing for reasoning be defined and successfully reached in educational design? Can the thymic level of a debate be constrained, and how? On the social side, by rendering politeness rules explicit, transforming them through role play, or by choosing specific group formation (avoiding or favoring work among friends, or mixing students in terms of gender, academic results, social class, etc.) can be explored as potential ways to develop emotions beneficial for the targeted educational goals. However, it seems more difficult to find strategies that may directly influence the cognitive function of emotions in schematization. On that point, the history that the group and the individual members have with the topic, together with the media and social interdiscourse (Amossy, 2006, p. 94-99) that structures both pre-existing representations and feelings about them must be taken into account. Concerning

this aspect, research reports on experiences of how school treats socio-scientific issues involving media analysis seem particularly interesting (e.g. Jimenez-Alexandre, 2006).

Appendices

A. Transcripts of two discussion phases at table 2, Kenosha, USA, May 2012.

A.1 Kelly, Sabrina, Louise, Pamela's debate on OQ1:

1.	AMY	[&and it starts now\
2.	PAM	[i think it's
3.	LOU	B:\
4.	PAM	(((looks at LOU then the screen))
5.	KE	(((looks at the screen))
6.	LOU	cause i feel like people waste a lot of water
7.	KEL	yeah
8.	LOU	like washing [their dishes like&
9.	PAM	[yeah:\
10.	LOU	&before they put them in the dishwasher [brushing your teeth
11.	KEL	[or showers
12.	SAB	yeah\
13.	LOU	[showering
14.	PAM	[sho[wers yeah\
15.	KEL	[they take long (.) showers
16.	SAB	((nods head in the affirmative))
17.	SAB	<((nodding head in the affirmative)) uhuh>
18.	PAM	or like=
19.	LOU	=or just like other stuff
20.	PAM	people like when they brush their teeth (.) they leave the water running/ or like you wash your face whatever
21.	SAB	<((nodding head in the affirmative)) uhuh>
22.	KEL	((nods head in the affirmative))
23.	LOU	or like people that throw away like bottled water [or half the time like it's like it's not even finished and they'll just throw it away
24.	KEL	<((nodding head in the affirmative)) [yeah>
25.	LOU	[so i think it's [B
26.	SAB	[or they dump it out on the sidewalks
27.	KEL	or like washing your car
28.	PAM	yea[h:
29.	LOU	[oh yeah
30.	SAB	(((nodding head in the affirmative))
31.	KEL	[and then all the chemicals in it just go in the grass (.) <((turning head)) which is not good
32.	LOU	(((laughs)) [((rit))

33.	SAB	(((nods head in the affirmative))
34.	T2	((get away from the center of the table))
35.	SAB	(((stretches))
36.	LOU	(((stretches))
37.	LOU	<((stretching)) so do we agree [on B/ >
38.	KEL	[<((getting close to the stand)) so B\=>
39.	PAM	<((showing the stand with her finger)) put B on the thing>
40.	SAB	((puts letter B on the stand))
41.	LOU	(((stretches))

A.2 Kelly, Sabrina, Louise, Pamela's debate on OQ3:

1.	LOU	er: i think it should be priced by its quality because if [you'd have better quality it's just more work to like x it\
2.	KEL	(((nodding head in the affirmative, looking at LOU)
3.	KEL	em: there's more [production <((turning hands)) for it to>
4.	LOU	(((turning hands))
5.	LOU	yeah\
6.	KEL	yeah\
7.	KEL	[em:
8.	SAB	[and what about (.) family income/ [you need water\
9.	PAM	[yeah i also think D too 'cause like i don't think like less fortunate people should be (.) punished like you know what i mean like because they don't have money they pay for water they shouldn't (.) [not get water
10.	LOU	[yeah
11.	SAB	[xx time it's not their (fault)=
12.	LOU	=they could like they could overu:se like they could (.) not pay as much and [<((turning hands)) get more water>&
13.	PAM	[and take advantage of that yeah: it's true
14.	LOU	&take advantage of it\ (.) when like it should be [<((swinging hands)) equal for all people>&
15.	KEL	(((nodding head in the affirmative))
16.	LOU	&you know what i mean/ 'cause like in like it's their fault that they are (.) poor\ in a way because they could go find a job but they didn't like you know what i mean/
17.	PAM	yeah
18.	LOU	like i think it should be equal among everyone\ (3.8)
19.	KEL	er:
20.	LOU	er: i would say C but what are you guys [saying/
21.	SAB	[what did you x the quality that was
22.	LOU	like [in a xxx water
23.	KEL	[that's bad water or [the water
24.	LOU	[xxx water is like more expensive than our like (gross) water which is more expensive than like

25.	LOU	(((shrugs))
26.	KEL	[it's because like it's like [processed more and like
27.	LOU	[xxx water\
28.	SAB	(((nodding head in the affirmative))
29.	LOU	it's processed more [and
30.	SAB	[yeah\ i think it's either C or D\
31.	LOU	it actually takes work to go like get it and find out xx
32.	MAR	okay so: [if you guys actually wanna pull up your letter now/ let's get started
33.	SAB	[maybe C AND D\ 'cause [like
34.	PAM	just pu- just put C:\
35.	SAB	((taking card C))
36.	KEL	put D\ no put C
37.	MAR	you guys put your letters [up xx\
38.	SAB	what/
39.	KEL	i don't know:\
		(0.8)
40.	SAB	[we should put
41.	PAM	[just put C and i'll explain like why we think D too\
42.	KEL	yeah:\
43.	SAB	<((putting card C)) well i'm putting C\>
44.	LOU	C\

B. Distance to the issue: key features from Klara, Isabelle, Asa and Samira's debates on OQ2 and OQ3.

In the following tables, are reproduced the parts of the transcript corresponding to the students' discursive construction of their emotional distance to the issue. Three parameters are studied: the description of people concerned, the identification of people responsible for change, and the spatiotemporal distance to the issue.

During the group discussion about OQ2, no key marker of the spatiotemporal distance to the issue was identified.

Only one utterance described the people concerned:

OQ2 group discussion – people concerned	
speaker	utterance
ISA	c'est qui s'rait moins pollué/ <((se désignant)) c'est nous > (who would be less polluted/ <((gesture to herself)) it would be us\>)

On the contrary, the students extensively describe, during the group discussion on OQ2, the people presented as responsible of the evolution of the situation:

People responsible for change – OQ2 group discussion	
speaker	utterance

KLA	nan jamais moi \ (no i would never ever\)
SAM	<((à KLA)) arrêtes de faire aucun effort> (<((to KLA)) stop making no effort>)
KLA	moi j' fais pas l'C (i don't do the C\)
KLA	moi j'fais aucun des efforts hein\ c'est pas une personne qui va tout changer hein\> (i don't make any effort okay\ it's no one person who's gonna change everything okay\)
ISA	moi c'est la E\ y'a plusieurs personnes qui changent/ ça va changer\ (me it's E\ if several people change/ that would make a difference\)
KLA	moi j'en f'rais pas partie\ (i would not take part in it\)
SAM	si une personne (if someone)
KLA	c'est pas deux personnes qui vont tout changer quoi\ (it's not two people who are gonna change everything\)
ISA	plusieurs personnes ça va changer\ (several people that will make a difference\)
SAM	des gens ils sont feignants\ (some people are lazy\)
KLA	moi j'le f'rai pas\ (i would not do it\)
ASA	les gens (the people)
SAM	ils continuent à faire des véhicules et ils en achètent (they keep on making cars and they buy them)
ASA	on s'appelle pas tous samira et et klara hein\ (we're not all called samira and klara okay\)
ISA	qui commencent à l'faire (who start doing it)
SAM	j' s'rais pas capable (i would not be able)
KLA	j'pourrais pas ne pas les changer (i could not not change them)
ASA	on va prendre moins d'douches (we're gonna take fewer showers)
ISA	si tu fais ces efforts-là (if you make that kind of effort)
ASA	le monde il est entouré d'vous (...) mademoiselle klara et mademoiselle samira (the world is surrounded by you (...) miss klara and miss samira)
KLA	moi j'f'rai aucun effort\ (i would not do any effort)
ISA	si on les arrêtaï (...) si on les écoutait (if we stopped (...) if we listened to them)
SAM	mais ils arrêtent pas (but they don't stop)
SAM	personne n'arrête (nobody stops)
KLA	c'est pas nous qui changerions l'monde (it's not us who could change the world)
ISA	faut qu' t' essaies (you must try)
KLA	personne fait des efforts (nobody makes any effort)
ISA	qui commencent à arrêter (who starts to stop)
ISA	si on arrête (if we stop)
SAM	si on f'sait (if we did do it)

During the class debate that follows the group discussion on OQ2, the students keep on talking at their table. Below are reproduced the elements of their speech that contribute to the specification of an emotional distance to the issue:

speaker	utterance	key feature
KLA	ça va pas changer qu' y ait deux ou trois personnes (it will make no difference if there are only two or three people)	near future responsibility of others
SAM	y'aurait moins que la moitié (there would be less than half)	responsibility of others
ISA	trois millions d'personnes ça va changer (three million people that will make a difference)	responsibility of others near future
KLA	y'en aura mille alors (so there'd be a thousand)	future responsibility of others
KLA	si on est trois millions ça changera (if there are three million of us that will change)	future own responsibility
ASA	nous chronométrer dans la douche\ (timing us when we're having a shower\)	1 st person as both victim & responsible agent
ISA	si y'a plusieurs millions d'personnes (if there are several million people)	responsibility of others
ISA	s'ils le f'raient (if they'd do it)	responsibility of others
SAM	c'est la nouvelle génération on est pourri gâté (it's the new generation we're totally spoiled)	current time own responsibility
SAM	à c't'époque (in these days)	current time
KLA	va trouver la foi en les gens (go find faith in people)	responsibility of others
ISA	y'en a plein qui le font (a lot of people do)	responsibility of others
SAM	on pense pas\ on pense à la vie\ (we do not think\ we do not think about life\)	own responsibility current time
KLA	moi mes besoins j'les f'rai (me my needs i will do them)	own responsibility
SAM	ma douche j'y passe trente minutes j'la ferai (i spend thirty minutes in my shower i'll do it)	own responsibility
ASA	s' chronométrer dans la douche\ (timing someone when he's having a shower)	people concerned: others
ASA	j' me réveille dix minutes tulutulu (i wake up ten minutes tulutulu)	1 st person concerned

KLA	tu vas pas faire ça hein\ ça sert à quoi (you're not gonna do this\ what for/)	2 nd person as both victim & responsible agent
SAM	y'a du savon tu sors quand même\ (if there's still soap you still have to get out\)	2 nd person as both victim & responsible agent
SAM	mais à autrans euh nan j'sais plus quoi en russie ils étaient chronométrés deux minutes par douche\ (but in autrans er no i don't remember what in russia they were limited to two-minute showers)	far in space & people concerned
SAM	ils avaient moins d'cinq minutes\ (they had less than 5 minutes)	people concerned: others
SAM	en russie vous aviez moins d'cinq minutes (in russia you had less than 5 minutes)	far in space & time, 2 nd person concerned
KLA	t'es habituée à faire un truc tu vas pas changer (you're used to doing something your not gonna change)	own & everybody's responsibility
KLA	bah c'est la personne que t'es c'est la personne que t'es\ (that's who you are that's who you are\)	2 nd person as both victim & responsible agent
KLA	tu vas pas arriver avec en pat d'eph au bahut\ (you're not gonna come to school with bell bottom pants on\)	2 nd person as both victim & responsible
ISA	si les gens (if people)	others' responsibility
KLA	les pubs qu' ils font ça donne envie (advertisements make people want things)	others' responsibility
ASA	s' chronométrer dans la douche\ (timing someone when he's having a shower)	others are concerned
ISA	qu'est-ce que j' f rais sans mes bains moi\ (what would i do without my baths\)	1st person concerned
KLA	notre hygiène de vie (our daily hygiene)	1st person concerned
ISA	on va prendre les conséquences de nos actes \	near future, 1st person as both victim and responsible agent
KLA	moi j'vais pas changer pour les autres \ (i'm not gonna change for others\)	1st person responsible, others are concerned
ASA	pas pour les autres pour toi ta vie ta santé la santé de tes enfants \ pour tout\ (not for others for you your health your children's health\ for everything\)	future, 2 nd person as both responsible agent and victim

ISA	enfants p'tits-enfants (children grandchildren)	far future, 2 nd person concerned (through others who are near)
KLA	j'vais pas changer mes habitudes à m'faire chier à faire pipi caca dans l'truc	1st person as both victim and responsible agent
SAM	on va pas mettre un chronomètre (we're not gonna get a timer)	1st person as both victim and responsible agent
KLA	faire chier mes parents (annoy my parents)	1st person as both victim and responsible agent (through near others)
KLA	au bout d'un moment j' le fais si y'en a vraiment b'soin\ mais là (after some time i'd do it if it was really needed\ but now)	future, own responsibility
SAM	t'es plein d'savon tit tit il faut qu' je sorte là ça a sonné\ (you're full of soap tit tit but you have to get out now it rang\)	1st person as both victim and responsible agent
KLA	moi j' change pas mon mode de vie pour l'eau (me i'm not changing my lifestyle for water)	1st person as responsible agent, no real victim
ASA	les efforts c'est qu' les gens ils arrêtent de mentir\ (main effort is when people stop lying\)	others' responsibility
ISA	t'arrêtes de laver ta voiture (you stop washing your car)	own and 2 nd person responsibility
SAM	arrêter d'laver sa voiture (stop washing one's car)	everybody's responsibility
KLA	moi j' le fais pas (i'm not doing it)	own responsibility
SAM	tu vas laver avec (you gonna wash with)	own and 2 nd person responsibility, near future
KLA	tant qu't'es pas allée dans l'futur (as long as you didn't go into the future)	future

The class debate about OQ2 is also an opportunity for some of the students in the studied group to make public contributions to the discussion. The parts of their speech that frame their distance to the problem only consider the parameter of the responsible agents for the evolution of the situation. They are reproduced below:

speaker	utterance
KL	personne changera\ (nobody will change)

A	
SA M	personne (...) fait quelque chose\ (nobody (...) does anything\)
SA M	personne va l'faire\ (nobody is gonna do it\)
AS A	°samira° (°samira°)
SA M	certaines personnes vont l'faire\ mais pas la majorité \ (some people would do it\ but not the majority\)

The discussion of the OQ3 is also an opportunity for the students to elaborate on their emotional distance to the topic. First, they do so during the group debate:

speaker	utterance	key features
KL A	les gens ils font une réserve (people they make a reservation)	others' responsibility
SA M	on est tous égaux et au fond on est tous des humains \ on a tous les mêmes droits\ (we are all equal and in the end we are all humans\ we all have the same rights\)	people concerned : everybody
SA M	en Afrique ils ont pas d'eau\ (in Africa they don't have water\)	far in space and others are concerned
KL A	ils ont rien\ pourtant ils paieraient quoique (they don't have anything\ they would pay though unless)	3rd person victim and slightly responsible agent
SA M	ils ont d'eau (they have water)	others are concerned
SA M	ça dépend des états (it depends on the country)	far spatial distance
AS A	abuse pas (don't exaggerate)	2 nd person responsibility
AS A	et après on perd des et après on perd (and after we lose some and after we lose)	1st person concerned
AS A	elle veut être démocratique vas-y vas-y \ (she wants to be "democratic" go ahead go\)	2 nd person responsible
SA M	l'eau ils la vendent plus cher\ pour gagner plus\ (they sell water at a higher price\ to earn more\)	others' responsibility
SA M	ils devraient vendre au prix (they should sell it at cost)	others responsibility
ISA	ton robinet (your tap)	1st person concerned
ISA	si tu paies tout (if you pay everything)	2 nd person concerned

Klara, Isabelle, Asa and Samira, during the class debate about OQ3, either directly contributing, or making aside commentaries at the group level, keep on framing their distance to the issue:

speaker	utterance	key features
ISA	parce que si tu utilises pas beaucoup d'eau et qu' tu paies rien (because if you don't use a lot of water and you don't pay anything)	2nd person as both victim & responsible agent
ISA	si t'es t' utilises beaucoup d'eau et tu paies le même prix qu'si t' en utilisais pas beaucoup (if you use a lot of water and you pay the same price as if you were not using a lot)	2nd person as both victim & responsible agent
ISA	si tu utilises pas beaucoup d'eau (if you don't use a lot of water)	2nd person responsible
ISA	si t' utilises pas beaucoup d'eau et qu' tu paies un prix comme si t' en utilisais beaucoup (if you don't use a lot of water and you pay a price as if you were using a lot)	2nd person as both victim & responsible agent
ISA	en afrique l'eau elle coûte cher/ (in africa the water is expensive/)	far in space
ASA	après ça dépende des (after it depends on the)	far in space
SAM	on la vend un peu plus cher (we sell it a at a little higher price)	responsibility of sellers
ASA	dans une même ville y'en a qu'is'ont plus d'eau que d'autres\ (in the same city some have more water than others\)	far in space (still africa), others are concerned
ASA	d'autres (others)	others are concerned
ISA	ils paient cher/ (do they pay a high price/)	others are concerned
ISA	vu que c'est très sec (as it is very dry)	far in space
ASA	où nos grands-parents ils habitent (...) au bled (where our grandparents live (...) in the village)	near to Asa, far from others, for people concerned, far in space
ASA	(where there's no water problem): allemagne (...) amérique (...) france (...) royaume-uni (germany (...) united states (...) france (...) united kingdom)	far in space
ISA	si l'eau était chère en afrique (if the water was expensive in africa)	far in space
ASA	bah ça dépend des endroits (so it depends where -in africa)	far in space
ISA	au sénégal (in senegal)	far in space
ASA	elle est chère à dakar (is it expensive in dakar)	far in space
ASA	j'ai pas payé d'eau quand j'suis allée\ (i did not pay for water when i went there)	others are concerned

C. Transcript conventions.

Here are details the main transcript conventions used in this article:

[beginning of speech overlap
:	elongated sound
<((laughing)) utterance>	commentaries on simultaneous coverbal behaviour
&	continuation of a speech turn
=	rapid succession of words/sounds
SPE((turn))	non-verbal turn (laugh, gesture, etc)
xxx	inaudible segment
/ or \	rising or falling intonation
(word)	uncertain transcription
°word°	low voice
WORD	augmented volume
‘	non standard elision

Notes

¹ They were especially trained during 1 day (6 to 8 hours) in order to moderate the *café*.

² Caffi and Janney (1994) oppose the two adjectives *emotional* and *emotive* to distinguish between what is felt (*emotional*) and what is discursively expressed (*emotive*). In practice, the relation between *expressed* and *felt* emotions is problematic and can vary depending on the context. In this branch of argumentation studies, researchers usually claim that they focus on the *expressed* emotions, basing their findings on discursive material, but often there is no evidence that *expressed* emotions actually differ from *felt* emotions.

³ *Facework*, the activity of seeking to preserve one's own and others' face, or positive social value (Goffman 1974; Brown & Levinson 1988), is a structuring element of interactions, which leads the participants to obey a politeness code that constrains the development of the dialogue.

³ This observation can be nuanced by the concept of 'argumentative politeness' that comes from argumentation studies. The specificities of argumentative interaction with respect to the matter of face preservation led to the characterization of a particular argumentative politeness system, which follows different rules than the ordinary system (Plantin, in press, p. 368-369). Then, disagreement is usual and is neither polite nor impolite, but rather 'a-polite'.

⁴ The debate in psychology about the direction of causality between emotional symptom and felt emotion is embodied by the classical James/Cannon opposition (Cosnier, 1994). A well known psychology experiment illustrates how forcing a smile (e.g. holding a pencil in one's teeth) can create the same internal physiological phenomena as smiling naturally *because* of an emotion (Soussignan, 2002).

⁵ Two other isolated occurrences of third person use present distinctive characteristics. One is Klara's mention of the role of her parents in changing habits at home. Here we are typically in a "near other" construction. It also constitutes a transfer of responsibility, reminding the group that adults have more potential impact on the problem than the students may have. The other isolated occurrence is also attributed to Klara, during group debate on opinion question 3. Her formulation is ambiguous as she talks about the people lacking access to water in these terms: "ils paieraient quoy" (they would pay unless). It tends to present them as responsible for their exclusion to water access due to the fact that they may not pay the corresponding price. The *topos* of the poor people being responsible for their status is not developed here, but it is a *leitmotiv* in our data (XXXX, 2014, 282-298).

⁶ Conversational turns are not numbered here because it's an inventory of discontinuous occurrences. The (...) stands for the discontinuity between the reported turns.

⁷ This is our own translation from French to English, focusing on the global meaning and level of language rather than trying to literally transpose French expressions.

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