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Epistemic and interpersonal dimensions of peer argumentation: Conceptualization and quantitative assessment

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INTRODUCTION

The past two decades have witnessed growing interest in argumentation for educational purposes. Based on distinctions made by several theorists (van Eemeren et al, 1996; Walton 2006), argumentation is defined here as a social activity in which interlocutors attempt to strengthen or weaken the acceptability of one or more ideas, views, or solutions through engagement in reasoning. Researchers in several domains of the psychological and educational literature have recognized that argumentation may serve important functions in learning and development and should therefore receive a more prominent role in classroom activities. For example, science educators have identified argumentation to lie at the basis of scientific inquiry, thinking and practice and have called for a more prominent role of argumentation in science classroom activities (e.g., Driver et al, 2000; Duschl & Osborne, 2002; Erduran & Jimenez-Aleixandre, 2007; Osborne, 2009). Research in developmental and educational psychology has shown that participation in dialogical argumentation can improve students' critical reasoning skills (e.g., Frijters et al, 2008; Kuhn, 1999; Reznitskaya et al 2001). Finally, there is

accumulating evidence that under certain conditions participation in argumentation can also support the learning of complex academic content (e.g., Asterhan & Schwarz, 2007, 2009a; deVries, Lund & Baker, 2002; Nussbaum & Sinatra, 2004; Schwarz et al, 2000). In the present chapter, I will mainly focus on the latter category, that is: the role of argumentation in knowledge building.

Whereas much attention has been given to the cognitive and epistemic dimensions of argumentation, the socio-relational, socio-emotional and motivational aspects of it have been largely neglected. I will put forward the claim that research on argumentation, learning and education can benefit from considering these dimensions, and that it may uncover some of the reasons behind the difficulty to elicit productive argumentation among students. In the first part, I will describe how ‘productive argumentation’ is commonly defined as an activity that is co-constructive and critical at the same time. We call it *co-constructive, critical argumentation* (Asterhan & Schwarz, 2009b). In the second part, I will try to uncover why it is not easy to elicit this particular type of productive discourse among students, and why they often resort to discourse that is void of either criticism or of co-construction, even when specifically instructed to engage in argumentation. In part three, different attitudes towards conflict resolution are described, each resulting in a distinctively different type of discourse, namely *consensus seeking* and *adversarial argumentative discourse*. Short protocols will illustrate the difference between them and how they are likely to inhibit learning. Finally, in part four I will present an assessment scheme that attempts to capture key elements of the epistemic as well as the interpersonal dimensions of argumentative discourse. This chapter concludes with outlining several ways in which the presented conceptualizations and the coding scheme may be used to offer new insights into the social and cognitive processes of learning through peer argumentation. The overall goal of the current paper is to suggest a conceptual framework and a quantitative assessment procedure to capture the differences between different types of argumentative discourse so as to enable empirical research into the antecedents of these different types of argumentative discourse and to further explore their relation with learning.

ARGUMENTATIVE DISCOURSE AND KNOWLEDGE BUILDING

Even though the study of argumentation and education has strong roots in Vygotskian theory as well, research on the more specific field of learning academic content through argumentation is probably most influenced by the neo-Piagetian notion of socio-cognitive conflict (Doise & Mugny, 1984; Doise et al, 1975). As outlined in detail by Baker, Andriessen and Jarvela in the opening chapter (here) socio-cognitive conflict theory predicts that students are more likely to experience conflict and therefore more likely to learn, when this conflict has a social origin, that is, when (s)he is interacting with peers that present different views. In a nutshell, the incongruence between solutions or ideas introduces doubt concerning the correctness of one’s own knowledge, which is then hoped to cause learners to reconsider and/or reconstruct this knowledge (Doise & Mugny, 1984).

However, as a recent study by Asterhan and Schwarz (2007) has shown, merely being exposed to a different view may not yield learning gains, especially when it concerns complex academic content for which students have robust misconceptions. In argumentative discourse, on the other hand, students actively explore their diverging views and try to settle the conflict through rational reasoning. When doing so they engage in a host of activities that are thought to scaffold knowledge construction: First of all, through articulating and publicly presenting their ideas, students make their own, often erroneous or incomplete understanding of key concepts explicit and open to evaluation. Both the anticipation (Tetlock, 1992) as well as the actual act of explaining one's own ideas to another human being (e.g., Chi et al, 1994; Coleman, 1998; Webb et al, 1995) have been found to improve student learning. In addition, exchanges with a disagreeing peer requires of students to try and understand alternative positions, to answer questions and to address discrepancies in their personal and in their collective understanding (Nussbaum & Sinatra, 2003). Finally, by addressing these differences and to explore their respective and relative validity, students have to consider which view, idea or explanation is more acceptable than another and why. Among others, they have to consider whether a certain idea is or is not warranted by the right data, or whether a proposed counterargument does or does not successfully challenge a certain idea. Through the combination of these processes, engagement in argumentative discourse is believed to result in better cognitive processing and to more meaningful and elaborated knowledge structures (see Schwarz & Asterhan, 2010 for a more complete review).

Indeed, a growing body of empirical evidence has now accumulated that supports the claim that peer-to-peer argumentation improves learning complex scientific concepts (e.g., Asterhan & Schwarz, 2007, 2009a; Chin & Osborne, 2010; deVries et al, 2001; Nussbaum & Sinatra, 2003; Nussbaum et al, 2008; Schwarz et al, 2001). Moreover, recent findings show that individual conceptual gains on particularly complex content are primarily predicted by the presence of critical-dialectical aspects of argumentative discourse (i.e., contradiction, challenges, rebuttals, opposition), and less so by consensual reasoning moves (such as providing supporting reasons, explanation and elaborations) (Asterhan, 2007, 2009a; Howe, 2009).

Most researchers agree, however, that in order to be conducive to learning, argumentation should not only be characterized by criticism and dialecticism. Students should not only try to break down erroneous ideas, but should also try to collaboratively construct better ones. They should not only try to find the flaws in each others' reasoning, but also be able to identify, accept and integrate successful ideas into their own reasoning. In other words, they should be critical and constructive at the same time. This type of ideal argumentative discourse, one that balances between critical reasoning and collaborative construction, is described by a number of researchers and surfaces under different names in the literature, i.e., 'collaborative argumentation' (Nussbaum, 2008), 'exploratory talk' (Mercer, 1996; Wegerif et al, 1999),

‘critical discussion’ (Keefer et al, 2000), deliberation (Kroll, 2005), and ‘co-constructive, critical argumentation’ (Asterhan & Schwarz, 2009b). In this paper, I will use the latter term, co-constructive, critical argumentation (CCA hereafter). In spite of the different labels, the descriptions of these idealized types of dialogue are strikingly similar and can be characterized by the following common features:

- (1) A general willingness to listen to and critically examine all the different ideas that are proposed in the course of a discussion and to search for alternative perspectives that have not been considered yet.
- (2) A willingness to make concessions in response to persuasive arguments.
- (3) An atmosphere that is characterized by collaboration and mutual respect.
- (4) The activity is perceived as a competition between ideas and not between the individuals that proposed them. As Keefer and colleagues (2000) put it, the discussion is *issue-driven* and not *position-driven*.

Unfortunately, however, this ideal type of argumentative discourse is not easily elicited among students. Even task designs that maximize differences in perspectives or opinions and provide explicit instructions to engage in critical argumentation cannot assure that students actually will (Asterhan & Schwarz, 2007). In the next section, some of the reasons behind this difficulty are explored.

THE SELF, THE OTHER AND THE SOCIAL IN ARGUMENTATIVE DISCOURSE

Early research on individual differences in argumentative performance focused on cognitive skills, age and schooling (e.g., Kuhn, 1991; Means & Voss, 1996). Whereas cognitive ability and development may indeed be part of such differences, it cannot be the entire story. In group learning settings, students are not only concerned with mastering the academic content, but also with issues such as social belongingness, interpersonal relations, self- and other-perceptions and how their performance reflects on competence, to name a few (Hijzen et al, 2007). These concerns often coexist simultaneously and may lead to conflicts between different goals. In line with these distinctions, I propose that the request to engage in a critical discussion with a disagreeing peer may be perceived by many students as conflicting or even incommensurate with the desire to maintain pleasant, harmonious relationships with co-actors and the desire to be perceived as competent and knowledgeable, leading to different (less productive) discourse types.

First of all, students need to feel comfortable in articulating and sharing their own, incomplete solutions to complex problems with others in the group. An increasing body of evidence underlines the important role of students’ independent grappling with complex materials and proposing their own, often faulty and incorrect, solutions before receiving information on the correct procedures and answers (e.g., Kapur, 2008; Schwartz & Martin, 2004). However, to do

so in a public, social context requires of students to (temporarily) put their egos aside and propose explanations and answers that are likely to be proven wrong later on and about which one has little confidence to begin with. In addition, the expectation of others critiquing these ideas may enhance subjective uncertainty (McGarty et al, 1993) and threaten self-competence (Butera & Mugny, 2001; Pool et al, 1998). Then there is the actual confrontation with an alternative, competing solution and/or having to deal with critique on one's own solution. Darnon et al (2007) proposed that interacting with a disagreeing peer introduces a 'double uncertainty': an uncertainty about the validity of an answer and an uncertainty about (relative) personal competence. This uncertainty about relative competence may be further enhanced in a competitive context (Butera & Mugny, 1995). Darnon et al (2007) showed that when a disagreeing peer expressed his/her disagreement in a way that emphasizes competition and superiority, students reported more frequently that their partner threatened their self-competence than when this disagreement was phrased in neutral terms.

In order to protect themselves from such uncertainties and threats to perceived competence, some students may then choose to avoid the conflict altogether and seek a quick consensus without much cognitive engagement and without further exploring the differences between the different solutions and conceptions (Smith et al, 1981). This discourse type, which is in fact void of critical-dialectical argumentation, may be further encouraged by a third uncertainty: uncertainty with regard to inclusion and acceptance by the group. The prospect of having to disagree with one's partners and critique their ideas may raise concerns about being able to maintain a positive relationship with them and be accepted by them.

Others may choose to address perceived or expected threats to self-competence by trying to hold on and defend their initial position to "win" the argument. They may address the situation as some sort of debating contest, characterized by competitive, verbal sparring between two (or more) opponents. Such adversarial, competitive argumentative discourse is not likely to be as beneficial to learning as its critical, co-constructive counterpart (Johnsson & Johnsson, 2009; Keefer et al, 2002; Nussbaum, 2009). When focused on 'winning the argument', students tend to ignore or discount potentially useful ideas proposed by others without further consideration (Butera & Mugny, 1995; Tjosvold & Johnsson, 1978). A study by Carnevale and Probst (1998) shows that anticipating a competitive interaction causes an unintentional alteration in underlying cognitive organization. They found that expecting conflict instead of cooperation in a negotiation task negatively impacted individuals' cognitive flexibility and their performance on individual problem-solving tasks that were unrelated to the negotiation task or topic. Therefore, students are likely to miss crucial opportunities for learning in adversarial argumentation, since they are not open to considering alternative views or to revising their own reasoning in response to critique.

In sum, concerns about self-competence, self-presentation and interpersonal relations may divert students' attention away from the epistemic dimension of the conflict (a conflict between ideas)

and heavily focus on the interpersonal dimension of the conflict (a conflict between persons) and all its implications, often resulting in argumentative discourse that is either void of critical discourse (*consensual discourse*) or void of collaborative construction of knowledge (*adversarial argumentative discourse*).

I do not mean to claim that it is *impossible* to reconcile the social and the epistemic-cognitive dimension of socio-cognitive conflict, and that they are by definition incommensurate. In our 2007 data set (Asterhan & Schwarz, 2007), we found several dyads that managed particularly well to preserve the delicate balance between critically examining each others' ideas while maintaining a collaborative atmosphere and avoiding face threats (Brown & Levinson, 1987) with a variety of self-invented techniques. In some instances, they engaged in spontaneous role-playing and agreed that each was only a role representing a certain side in the discussion. The technique of role-playing provides an excellent opportunity to introduce critique, alternative positions and even unpopular ideas, without risking the social consequences of such actions. In other instances, dialogue partners articulated hypothetical "What if.." questions that explored the boundaries of another person's explanation with an inquiry, instead of directly opposing or refuting them (see Asterhan & Schwarz, 2009b for detailed descriptions). I do propose however that without further support, explicit instructions or guidelines, many students may *conceive* them as incommensurate and find it therefore difficult to be both critical and co-constructive.

In the next section, I will provide examples from consensual and adversarial argumentative discourse and present anecdotal evidence of how they are less likely to lead to learning gains.

ARGUMENTATIVE DISCOURSE THAT IS VOID OF CRITICISM OR OF CO-CONSTRUCTION

All protocol excerpts presented here are taken from studies in which undergraduate students with no formal background in Biology and Earth sciences were shown a short educational movie that presented the Darwinian account of animal and plant evolution, after which they were paired in dyads and asked to collaboratively solve a set of novel items through engagement in argumentation. Students' individual understanding of natural selection was assessed with the help of pre-tests and delayed post-test. The communication formats were either, face-to-face and oral (Asterhan & Schwarz, 2007) or computer-mediated and textual (Asterhan et al, submitted). Natural selection has been extensively documented as a topic in which intuitive misconceptions are abundant and extremely robust to instruction (e.g., Bishop & Anderson, 1990; Greene, 1990; Jimenez-Aleixandre, 1992; Ohlsson, 1992; Shtulman, 2006).

Consensual dialogue and quick consensus-seeking

As aforementioned, the willingness to make concessions in the face of convincing arguments is an important feature of productive argumentation. A general aim to reach consensus at the end of the discussion is also valued, provided this is achieved through reasoned argument. However,

empirical research has shown that whether students actually reach an agreement or not, does not predict whether they actually learn from the interaction (Asterhan & Schwarz, 2007; Howe, 2009). Moreover, too strong an emphasis on consensus seeking may be counterproductive and undermines the main goal of argumentation, especially when students are willing to accept the first solution that is proposed without any critical exploration of the different viewpoints (Keefer et al, 2000). The latter has also been referred to as *quick consensus seeking* (Weinberger & Fisher, 2006).

The following short excerpt shows how two students, who proposed two very different accounts for the evolution of ducks' webbed feet failed to explore the differences and therefore missed important learning opportunities.

Excerpt 1.

Alicia: Okay. Do you have an idea?

Ella: Ah, yes. Because the area was flooded with water and those with legs that suited the water actually survived.

Alicia: Humhum.

Ella: And then those that survived, developed and continued themselves.

Alicia: That is, that ducks developed webbed feet especially to survive/

Ella: /Yes/

Alicia: /in areas that once
were dry and became flooded with water?

Alicia: Yes, that sounds reasonable.

First, Ella proposes a Darwinian account of the evolution of the webbed feet of ducks, based on principles of intra-species variability and differential survival rates. Alicia then apparently paraphrases Ella's account, but actually proposes a very different account, based on the idea that ducks intentionally developed these traits *in order* to survive. Neither Alicia nor Ella capitalizes on this difference and further explores it. They quickly settle on an agreement and move on.

The next excerpt from a computer-mediated dialogue between two male students shows similar results, this time on a question relating to the white fur of polar bears:

Excerpt 2.

Guy: What do you think?

Yoni: I think that the bear needed to assimilate into his living environment for a variety of reasons, for hunting needs as well as because of the weather, and therefore his fur changed [from brown] to white.

Guy: Yes, maybe it prevented him from being hunted.

Guy: Even though I cannot imagine who eats polar bears.

Yoni: He is the primary hunter in his area... I meant hunting in the sense that he needs to hunt other animals, and therefore needs to disguise himself..

Yoni: *primary

Guy: Yes that sounds reasonable.

Guy: Shall we write?

Yoni: Yes.

The pretest data of these four participants showed that in both cases each dyadic partner used distinctively different explanatory schemas to explain evolutionary change. In the first excerpt, this difference is represented in the dialogue, but not further explored. In the second excerpt it is not even expressed: Even though Guy's written explanations were distinctively different from his partner's, he quickly agrees with Yoni's explanation and does not even attempt to propose his own explanation, let alone explores the differences between them. In both cases, important learning opportunities were missed.

Even though these two protocol excerpts show examples of students who quickly reached a consensus without further conversation, consensual dialogue does not necessarily have to be as short as in these excerpts. Other examples show students engage in long conversation, where they transact on each other's reasoning with elaborations, justifications in favor of their collectively accepted solution, explaining parts of the solution to each other, and so forth (Asterhan & Schwarz, 2009a). What is characteristic of consensual dialogue, however, is that they do this in a consensual manner, that they do not critically explore these solutions and do not consider alternative solutions. Mercer (1996) terms this type of dialogue 'cumulative dialogue' and describes it as dialogue " (...) in which speakers build positively but uncritically on what the other has said. Partners use talk to construct a "common knowledge" by accumulation. Cumulative talk is characterized by repetitions, confirmations and elaborations." (p. 369). In some ways the concept of consensual dialogue is somewhat similar to Mercer's cumulative talk, with the important addition that it does not always stop with simple repetitions and elaborations; Students may also engage in one-sided reasoning (providing justifications and citing supporting evidence in favor of the explanation proposed) and collaborative constructions of explanations, without actually juxtaposing them and exploring their differences.

Adversarial argumentation

In our data, several dialogues were found that were clearly dialectical in nature and had a high frequency of critical argumentation moves (i.e., reasoned challenges, reasoned rebuttals, oppositions), but lacked the collaborative, shared thinking effort and the openness to alternative viewpoints characteristic of co-constructive, critical argumentation (CCA). In these dialogues, students seemed to perceive the activity as an interpersonal competition and their dialogue partner as their adversarial. We therefore termed this type of dialogue *adversarial argumentation*. It is illustrated in the following excerpt, in which two male students, Avi and

David, discuss the evolution of webbed feet in a face-to-face discussion format. The pretest data of these two students showed that the mental representations they used to explain evolutionary change were distinctively different from each other, which also clearly surfaced in their dialogue. The short excerpt presented here is a representative sample of the entire dialogue, which lasted for a total of about 10 *min*.

Excerpt 3.

Avi: It's like we saw in the movie, that they change according to the...environment. To the weather. So they probably stayed in the water more and then developed...ehm...webbed feet.

David: I think that...those who had webbed feet survived, and they produced more offspring that also had webbed feet.
[short silence]

Avi: No, but it seems to me that before they did not have webbed feet at all.

David: But I think that they say that evolution it...it is not that an animal develops anything, but that...that those that are well adapted to the environment survive. So, let's say that there were mutations of ducks with webbed feet...and...so those that had survived and produced more offspring, because they had an advantage.

Avi: No, but they also changed. It is not that-...The change was because of the environment.

David: I don't think that an animal adapts himself to the environment. I think that it...I mean, those that are fit survive. Say, it is not like the giraffe...did a lot to make his neck longer, but that those giraffes that had a long neck survived and produced offspring.
[short silence]

David: Cause I think that an animal cannot develop webbed feet

Avi: I dunno, but let's say that...an animal...a certain animal is immune to a certain substance. It develops immunity to a certain substance.

David: I think that that...I mean, think about human beings. Imagine that we start to live in water. I don't think that...that we would develop webbed feet. I think that maybe there were mutations that had webbed feet and then these mutations...like, were more adapted and they produced more offspring.

[short silence]

David: I think that this is also what they said about the finches in the movie. Like, it is not that the finch developed a larger beak, but that those that had larger beaks produced more offspring that year.

Avi: Yeah, but...but the...the weather conditions affected the food. And that also affected, like, its change.

[...]

This dialogue opens with the presentation of two different explanations for the evolution of webbed feet: Avi presents a typological account, whereas David proposes a Darwinian-inspired explanation. This perfectly complies with the instructions according to which each participant was asked to first present his/her own explanation to the phenomenon. It is followed by a silence. Avi challenges David's explanation to argue that *before they did not have webbed feet at all*. By arguing so, he challenges the idea of survival of adapted specimens to replace it by the idea of typological development of a specimen in response to needs. David, in turn challenges Avi's claim that animals can change themselves and elaborates his Darwinian explanation in an attempt to persuade Avi (*So, let's say that there were mutations of ducks with webbed feet...so those that had survived and produced more offspring, because they had an advantage*). Avi does not really cope with David's elaboration, but simply opposes with a counterclaim that specimens also change and repeats that this occurs as a result of reactions to the environment. David reacts with an opposition of his own (*I don't think that an animal adapts himself to the environment*) and appeals to the example of the giraffe's neck to illustrate his initial claim. The silence that follows this turn is instructive. The two interlocutors stick to their initial claims and fail to integrate the arguments of their peers in their own to elaborate better arguments. In particular, they do not try to deal with the different challenges that each poses to the other. Instead, they respond to them by returning simple unreasoned oppositions and by presenting yet more analogies and information that are intended to support their own viewpoint. In addition, at no point in this entire dialogue did the two come to some sort of agreement or did they engage in some form of consensual, collaborative construction of ideas. In spite of the fact that Avi was exposed to some rather convincing arguments in favor of the Darwinian explanation for evolution, his posttest nevertheless consistently showed typological answers.

Keefer et al (2000) and Mercer (1996) refer to this type of dialogue as, respectively, *eristic* and *disputational* talk, which is characterized by a lack of concessions and lack of serious consideration of how others' challenges and arguments bear on their own viewpoints. In contrast to Mercer's descriptions, however, the dialogue exchanges do not necessarily have to be short. The dialogue in excerpt 3 shows, that these two students are not simply re-stating and re-asserting their own standpoints through repetition and without further reasoning. They are in fact offering justifications, explanations and analogies to support their own views. The crucial difference is that they are not dealing with each other's challenges and seem to be talking in parallel. An additional distinction between Mercer's and our conceptualization of adversarial argumentation and CCA is that a prevalence of disagreement and critical reasoning (e.g., counterarguments, challenges, oppositions) is not only characteristic of the former, but also a defining feature of CCA. According to our distinctions, the difference between the two lies in the way that this disagreement is regulated: In a way that focuses on the epistemic conflict (Doise & Mugny, 1984) or in a way that emphasizes conflict and competition between the persons that personify these positions.

The importance of this distinction became even more evident in several other dialogue protocols, in which students were observed to react to and build on each others' reasoning, but were doing it in a way that conveyed a competitive -and sometimes even antagonistic- interpersonal intent. Excerpt 4 illustrates this point. It presents a computer-mediated CHAT exchange between two male students, again on the evolution of webbed feet. At the beginning of the discussion, Oren proposed an explanation based on crossbreeding. He also specifically claimed that the changes in ducks' feet were not contingent on environmental changes and that they happened long before that. Eyal, on the other hand, argues that there must be a link between the two. The excerpt starts at turn 19 into the dialogue:

Excerpt 4.

[...]

Oren: I think that the duck changed a long time before global warming, which has only really accelerated in the last centuries.

Eyal: After every ice age there is period of warming up.

Oren: These are not facts, but hypotheses. If that were true than we should have witnessed similar changes in the last two centuries of science.

Eyal: But it is a specific given in the question [i.e., the test item they received] that the living grounds of these proto-ducks were flooded, a very substantive change. I am not ruling out that as a result of the flooding, they met up with other species and there was a hybrid development of some sort.

Oren: Okay, but that does not answer the question why only ducks changed and why there are also other creatures that have webs.

Eyal: But webs are mainly used for swimming, that's a pretty solid fact. These webs make it hard to walk. There is clearly a direct influence of an environmental change here.

Oren: How would I know, I haven't tried..

[...]

This excerpt shows two students that are building and transacting on each others' reasoning, integrating aspects of each other's arguments into their own reasoning and even making concessions (*I am not ruling out that...*). However, even in this short excerpt there are still subtle indications in their choice of language that seem to convey a competitive, rather than a collaborative intent. For example, they use specific rhetoric to strengthen their own standpoint (e.g., *that's a pretty solid fact; these are not facts but hypotheses; clearly*) or resort to sarcasm to dismiss their partner's arguments (*How would I know, I haven't tried..*). Also, their challenges and counterarguments are posed straightforward, without any attempt to soften the conflict and in a way that leaves no doubt about the fact that their viewpoints are directly opposed to one another. The dialogue continued for another 41 conversational turns, and by the end of the

dialogue they even came very close to a Darwinian account of evolution. However, neither showed any learning gains on their respective individual posttests.

Thus, the difference between CCA and adversarial argumentation is not always only a matter of different epistemic moves (i.e., more disagreements, less consensual construction), but also a matter of *how* the interpersonal interaction is regulated: Are students perceiving and treating the interaction as a collaborative activity in which they work together to achieve superior understanding through critical reasoning, or are they viewing it as a situation in which two antagonists compete to win an argument and only one of them can prevail?

Summary

The previous examples illustrate how consensual discourse and adversarial argumentation each lack some of the defining features of co-constructive, critical argumentation, or CCA: Consensual discourse is constructive and collaborative, yet even though conversational partners often engage in one-sided reasoning and provide elaborate explanations, they do not critically examine their own and each others' ideas. Adversarial argumentation on the other hand is critical, but not constructive, both in the sense that they do not collaboratively construct new explanations, and that their verbal interaction is characterized by interpersonal competition. The anecdotal evidence presented here show how these types of dialogue do not fully exploit the learning opportunities that socio-cognitive conflict has to offer: In consensual reasoning, students fail to consider alternative perspectives to their own and to explore possible flaws in their reasoning. In adversarial argumentation, on the other hand, students rigidly defend their own positions without genuinely trying to incorporate the other's ideas or critique in their own reasoning or to collaboratively work towards a more satisfying solution. In both cases, students are then likely to miss important opportunities for improving their understanding of complex concepts.

More tightly controlled empirical research is needed to (1) further investigate the relation between these different types of argumentative discourse and learning gains; and (2) to study the conditions, instructions and settings that will elicit these different types of discourse. Before such studies can be undertaken, however, the issue of assessment should be addressed: How can these different types of argumentative discourse be reliably distinguished in a systematic manner? In order to quantitatively link dialogue characteristics with learning gains, a coding scheme should be developed that is capable of capturing the critical features of these different dialogue types.

In the remainder of this paper, I will describe some of our current efforts to develop a coding scheme that is capable of capturing the key features of the epistemic as well as the social-interpersonal dimension of argumentative discourse.

THE EPISTEMIC AND THE INTERPERSONAL DIMENSIONS OF ARGUMENTATIVE DISCOURSE IN SITU: AN ASSESSMENT TOOL

The previous review and examples show that the difference between consensual dialogue, adversarial argumentation and CCA is defined by *what* students are saying about the concepts and solutions (i.e., the epistemic dimension), as well as by *how* they communicate with each other (the interpersonal dimension). In order to quantitatively distinguish between these three types of dialogue, we developed a coding scheme that aims to identify and quantify aspects of both the epistemic as well as the interpersonal dimensions of the dialogue.

The data on which this coding scheme was developed consisted of 19 CHAT-mediated, dyadic dialogue protocols (Asterhan et al, submitted). The protocol transcripts included only verbal, written dialogue, without any additional discourse and interaction properties. Turns were automatically parsed by the software interface, that is: each time a discussant posted a new written entry by hitting the “enter” button. As a first step, a distinction was made between turns that directly related to the topic of discussion (on-task) and those in which participants engaged in off-task dialogue or task-regulation efforts (such as, for example, regulating turn-taking, courtesy exchanges, social talk). Then, two complementary, independent coding schemes were applied: The first, which focused on the epistemic dimension of the dialogue, was developed in a previous study (Asterhan & Schwarz, 2009a). The second was developed with a bottom-up verbal analysis approach similar to that described by Chi (1997) and assesses selected aspects of interpersonal regulation. Both schemes use turns as the unit of analysis and both are non-exhaustive. Two independent, trained coders coded 16% of the dialogue transcripts. Measures for inter-rater reliability are $\kappa = .87$ (for on/off task), $\kappa = .80$ (for epistemic dialogue), and $\kappa = .79$ (for interpersonal regulation).

The epistemic dimension

This coding scheme assesses the prevalence of different types of epistemic dialogue moves (De Vries et al, 2002, Ohlsson, 1995) in a conversation. Epistemic dialogue moves are moves in a conversation that are “concerned with the knowledge and the concepts underlying problem solving rather than the execution of problem solving actions” (De Vries et al, 2002, p. 64; see also Ohlsson, 1995). Asterhan and Schwarz (2009a) distinguished between two different categories of epistemic dialogue moves:

- (1) Dialogue moves that reflect *critical reasoning* (hereafter referred to as CR) in which the validity and strength of a thesis or an attack on that thesis is disputed, or any other act of reasoning that is embedded in a dialectical constellation (i.e., challenges, raising doubt, counterarguments, rebuttals, simple oppositions);
- (2) Dialogue moves that reflect *consensual construction and validation of explanations* (hereafter referred to as CCVE): These include verbal acts in which ideas are developed, explained and constructed, or in which students provide reasons that are intended to strengthen

and validate the epistemic status of a certain explanation in a non-dialectical constellation (i.e., elaborations, explanation construction, justifications, agreements).

This coding scheme does not consider whether the dialogue move is posted in response to a posting by the other or the self. In other words, it only codes the epistemic nature of on-task content: For example, a move of CR could be a challenge to an idea proposed by either the partner or the self. Other dialogue moves, such as for example simple claims, requests for information or clarification, and repetitions, are not by themselves classified as either CCVE or CR (see Asterhan & Schwarz, 2009a, for more details).

Interpersonal regulation

The aim of the second coding scheme was to assess the different interpersonal- relational goals that students were pursuing during the verbal interaction, and in particular to distinguish between *competitive* versus *collaborative* motives during interaction with a same-status peer. There are many different information sources that could be used to capture these two different motives, such as facial expressions, gesture, body posture, pitch and other auditory features. Partly because many of these information sources are not present in computer-mediated textual communication, we chose to focus on the rhetorical and expressive features of verbal dialogue content and the way these convey information with regard to the interpersonal goal of the speaker and the way that (s)he appears to perceive the situation at that point in the dialogue. The scheme was inspired by existing distinctions from communication theory (Brown & Levinson, 1987; Muntigl & Turnbull, 1998) and previous empirical works (Chiu & Khoo, 2003).

(1) *Competitive interpersonal goal*. This was scored when expressive and rhetorical indicators within a turn reflected a competitive focus on winning at the expense of the other. Examples include verbal content that overtly increased face threat during disagreements, linguistic markers that emphasize interpersonal rather than epistemic conflict, and ego-enhancing moves that promote the self or devalue the partner's contributions or competence.

(2) *Collaborative interpersonal goal*. This was scored when expressive and rhetorical indicators within a turn reflected a constructive, collaborative intent and a focus on joint problem solving and learning. Examples include the use of verbal content to reduce face threat in case of disagreement, self-deprecating statements, linguistic expressions of a shared goal, and expressions aimed at maintaining a pleasant atmosphere and a positive relationship with the partner.

Examples from protocols are presented in Table 1. Whereas the epistemic dialogue scheme considered only turns coded as on-task, this scheme coded all turns.

Insert Table 1 About Here

Combining epistemic and interpersonal features of verbal dialogue content

The fine-grained distinctions offered by this dual coding scheme can be useful for research in a number of different ways: First of all, the schemes provide fine-grained information on the turn level and can therefore be employed to study fluctuations in dialogue and social regulation during the interaction phase (e.g., Chiu & Khoo, 2003). Secondly, the detailed information enables empirical investigations into the contingencies between quantitative features of the dialogue and individual measures, such as student learning gains or individual perceptions, or specific task settings, such as different instructions. For example, in a recent study (Asterhan, Butler & Schwarz, submitted) we examined whether different goal instructions affect student discourse when asked to engage in a computer-mediated, argumentative dialogue on the topic of natural selection. All students were instructed to engage in a critical discussion with a same-sex peer, but the goals of this activity were framed differently: In the competitive condition, a critical discussion was presented as a means to win and prevail, whereas in the constructive condition it was framed as a means to promote learning and understanding. The results showed an overall effect on the dialogue characteristics: When instructions for argumentation were framed in terms of a competitive debate, dialogues were characterized by higher rates of critical reasoning and more competitive markers than when it was framed in terms of an opportunity for learning. Moreover, and in line with the expectation that CCA supports learning in socio-cognitive conflict settings, students whose dialogue was high on both critical as well as constructive discourse features showed substantive cognitive gains and significantly more so than the other groups.

Insert Table 2 About Here

Finally, a coding scheme such as the one presented here can be used to define more detailed profiles for the different types of discourse discussed in this paper (see Table 2): Accordingly to the distinctions proposed in this paper, consensual discourse is characterized by high frequencies of CCVE and collaborative markers and low frequencies of CR and competitive markers. The exact opposite would be true for adversarial argumentation. Co-constructive critical argumentation, on the other hand, is high in CCVE, CR and collaborative markers, and has few competitive markers. The distinctions could also be used to define other dialogue types that were not discussed in this chapter. For example, low frequencies of both CR and CCVE would be characteristic of dialogues that have almost no epistemic engagement with a dialogue partner. Examples of such types of dialogue are, among others, quick consensus seeking (as seen in excerpts 1 and 2) or dialogues in which one student dominates and imposes his/her solution on the other(s) without much further discussion. Further distinctions between different types of epistemic dialogue moves could be used to distinguish between what we termed adversarial argumentation and Mercer's descriptions of *disputational talk* (many repetitions, simple claims and unreasoned oppositions, few reasoned critical moves).

CONCLUSIONS

The study of peer collaborative learning has been a central theme in psychological and educational research and considerable progress has been made in the identification of the cognitive mechanisms that enable learning in and from collaborative settings (e.g., Asterhan & Schwarz, 2009a; Coleman, 1998; Gillies, 2004; Howe et al, 2005; Okita & Schwartz, 2006; Shirouzu et al, 2002 ; Webb et al, 1995). In spite of these advances, a considerable amount of the variance in both group productivity as well as individual learning gains remains unaccounted for. Furthermore, whereas much attention has been given to the underlying socio-cognitive mechanisms, the study of collaborative learning has often neglected the socio-emotional, interpersonal and motivational aspects of these inherently social settings (Salonen et al, 2005). In the present chapter, I have addressed this caveat in one specific subfield of collaborative learning, namely: learning through peer argumentation.

It was proposed that productive argumentation that supports learning of complex content is characterized by both critical inspection of ideas and collaborative knowledge construction, (i.e., critical, co-constructive argumentation). It was furthermore proposed that the reasons behind the difficulty to elicit this ideal type of discourse among students should not only be sought in the cognitive realm, and that researchers of argumentation may benefit greatly from incorporating theoretical concepts and empirical findings from social psychology. In particular, concerns about self-presentation, self-competence and social relations are likely to cause students to disproportionately focus on the social dimension of the conflict instead of its epistemic dimension, leading to two types of discourse that are less productive for learning complex content: consensual discourse (which is void of criticism) and adversarial argumentative discourse (which is void of collaborative knowledge construction). Based on these conceptual differences, a dual coding scheme was proposed to quantitatively assess defining features of the epistemic dimension and the interpersonal regulation of argumentative discourse.

Hopefully, the conceptual distinction and the dialogue analysis tool that were presented here will enable more systematic research into the role of socio-relational and socio-motivational antecedents, outcomes and processes of argumentative discourse. A set of studies that was very recently completed in our lab shows that this is not only feasible but also a very promising line of research: Thus far, we found that students' achievement goals are associated with self-reported differences in argumentative discourse goals (Asterhan et al, 2009), that different argumentative discourse goal instructions significantly alter the type of discourse students engage in (Asterhan et al, submitted) and that controlled differences in argumentative discourse are indeed associated with differences in learning gains (Asterhan & Babichenko, 2012).

These first findings show that the study of argumentation and learning has much to gain from considering these and other "hot constructs" (Sinatra, 2005) in future empirical research. Findings from such investigations will not only benefit theories of learning, but also have implications for the design of argumentative activities in educational practice. Over the course of

twelve school years, most students are rarely exposed to - let alone asked *to engage in* – constructive, yet critical discussions. Standard instructions for group work in classrooms emphasize the consensual, collaborative dimension of interaction and do not encourage critique, or even exploration of different perspectives. Argumentative activities in classrooms, on the other hand, are often times framed as debating contests, instead of deliberation (Kuhn & Crowell, 2011). Students’ expectations, goals and norms for argumentative discourse are shaped through participation in such activities. It may therefore be not surprising that many students do not succeed in conducting a constructive, critical discussion, even when directly instructed to do so (Asterhan et al, submitted). The design of argumentative tasks should then be meticulous and take into account the “hot aspects” of these inherent social situations, in addition to their “cold” cognitive counterparts. A mapping of the different motivational, interpersonal and cognitive factors that affect student argumentation will enable practitioners to make informed design decisions about how to elicit the type of discourse that they are aiming for. We hope to have contributed to this end by conceptually and operationally differentiating between different goals for argumentative discourse and how these may affect learning from argumentation.

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Table 1. Collaborative and competitive interpersonal regulation: categories and examples.

<i>Description</i>	<i>Examples</i>
<i>Collaborative behavior</i>	
Actions that reduce face threats during disagreements	Using hypothetical propositions (“Let’s say that ...”, “What if...”), presenting the opposing view as a third person’s (“Darwin would say that...”), presenting opposing view as an additional option (“It is also possible that...”), partial agreement and accrediting (“Yes, that makes sense, but...”), using first-person plural pronouns (“We do not have any evidence to back this up though”).
Ego-reducing moves	Hedging own propositions (“I am not sure, but it might be a matter of selection”), accrediting and acknowledging other’s contributions (“That’s an excellent point”, “Your answer is better”) and competence (“You know a lot about this stuff”), self-humoring (“Don’t give up on me yet, I’ll get there”)
Linguistic markers of shared responsibility and collaborative intent	Using first-person plural pronouns (“We should try to come up with the most plausible explanation possible”), and overt expressions of collaborative goal.
Attempts at maintaining a pleasant atmosphere and a positive relationship	Using positive emoticons (such as, smileys), encouragements and compliments, courtesies at the beginning (“Hi, how are you, my name is...”) and end of conversation (“It was a pleasure talking to you”), using funny wording.
<i>Competitive behavior</i>	
Increase of face threat during disagreements	Using linguistic markers that emphasize the disagreement, such as explicit reference (“No, that is not true”) and expressive language (“No, no, no!”, “That does not make any sense!!!!!!”)
Ego-enhancing moves	Devaluating other’s knowledge or competences, either directly (“Your assumptions are all wrong”), by using sarcasm (“And you really believe that brains can evolve...!”), “You should have your head checked”) or by emphasizing a difference in status and competences (“You just think about that for a while”); or emphasizing the importance of own contributions and attributing progress to self (“That is what I

	have been saying all along!”)
Linguistic markers that emphasize the interpersonal repartition of ideas and conflict	Using first- and second-person singular pronouns (e.g., “ <i>I</i> think that...., whereas <i>you</i> say that...”, “Do <i>you</i> agree with <i>my</i> explanation now?”, “No, you don’t understand, ...”), or overt references (e.g., “Give me a convincing explanation that will cause me to believe you”).

Table 2.
Defining different discourse types

	<i>Epistemic dimension</i>		<i>Interpersonal dimension</i>	
	Cons. Constr. & Valid. of Expl.	Critical reasoning	Collaborative markers	Competitive markers
Consensual discourse	High	Low	High	Low
Adversarial argumentation	Low	High	Low	High
Co-constructive critical argumentation	High	High	High	Low