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## SHIFTING FROM A MONOLOGICAL TO A DIALOGICAL PERSPECTIVE ON CHILDREN'S ARGUMENTATION. LESSONS LEARNED

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### ABSTRACT

*When two- to six-year-old children contribute to argumentative discussion, how do they reason? Can Argumentation theory, a discipline that up to now has largely focused on adult expert productions, contribute to a psychological understanding of the child? And, in turn, can a close examination of children's argumentative moves contribute to the study of inference in argumentation? Our interdisciplinary research program ArgImp, at the crossroads of psychology, education and argumentation theory, tries to enrich these two lines of enquiry by conducting empirical studies with young children involved in argumentative activities and by analyzing them with models and methods borrowed from Argumentation theory (in particular, Plantin, 1996; van Eemeren & Grootendorst, 2004; Rigotti and Greco, 2010).*

*Analyses of the efforts to introduce argumentation in learning activities at school reveal the theoretical and practical complexity of such ambition (Rapanta & Macagno, 2016; Schwarz & Baker, 2017). However, little is known about the psychological difficulties met by children in developing such skills, and the existing evidence seems contradictory. This has led us to a theoretical shift from argumentation seen as a "skill" to argumentation seen as a "contribution to a critical discussion". Our results show that a consideration of the dialogical (and not just individual) nature of argumentation and attention to argumentation as a process can help understand young children's reasoning activity and how it is embedded in their larger psychological activity. Adults tend to be centered on specific linguistic or cognitive behaviors expected from kids taking part in argumentative discourse, while our analyses reveal complex symbolic and relational work that children also accomplish in order to produce argumentation. They are active contributors to critical discussions using multiple argumentations and introducing issues. Often the inferences that children make are not the ones that adults expect and the latter then tend to interrupt them.*

*Children help us to shed a developmental light on argumentation: issues and standpoints are not always fixed but are likely to evolve in time; discussion issues are likely to be transformed as they are talked about; and standpoints are not always present before being co-constructed in the on-going dialogue.*

### 1. INTRODUCTION

When two- to six-year-old children produce argumentation, how do they reason? Our interdisciplinary team of linguists and psychologists has two aims in addressing this question. One is to contribute to the study of inference in argumentation: we are interested to see whether studying how a child engages in argumentation can in some way contribute to Argumentation theory, a discipline that up to now has largely focused on adult expert productions. Our other aim is to contribute to research in developmental socio-cultural psychology by investigating how children produce argumentation; thereby, we hope to enrich the psychological understanding of children's reasoning. In the "Analyzing children's implicit argumentation" or ArgImp project (see Acknowledgments), we have undertaken to study the inferences that children make. As we are not studying their language but their thinking as it appears in verbal and nonverbal, explicit and implicit elements of discourse, we are interested in delineating as much as possible not only their

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explicit verbal productions but also the implicit components of their reasoning in the contexts in which they occur.

To this aim, we use some models taken from Argumentation theory as interpretive grids or "lenses" that help to pay minute attention to the argumentations produced by children in the hope of getting novel descriptions of some aspects of children's reasoning processes. We will see that these models can also help to critically scrutinize whether young children have opportunities to actively participate in argumentative discussions with adults and to observe what happens when they do so. Studying the inferences young children make when they engage in argumentative discussions is a means both to gain insights into their reasoning and to appreciate their argumentative contributions in a detailed way, which is made possible through the use of fine-grained argumentation models. In our study, children were observed in a variety of contexts, such as everyday family discussions, interactions with adults in designed activities and discussions among children themselves or between children and the adult who asked them to resolve a technical problem. We will see that our findings, while showing that the argumentation models used were important analytical tools, invite extending these existing models to better account for children's argumentation.

The remaining sections of this article are arranged as follows: Section 2 will present the theoretical shift that has been needed to carry out this research as well as our methodological choices. After that, section 3 presents some of the main empirical findings of the ArgImp research project with detailed examples or references made to published data. Finally, section 4 is dedicated to a discussion of the findings and an opening for further research.

## 2. THEORETICAL FRAMEWORK AND METHODOLOGY

### 2.1 *From a psychological and educational perspective*

When some of the authors started investigating argumentation in children from a psychological and educational perspective, our first attempts were mostly relying on what we will call here "Approach 1". The focus of attention was on argumentation *skills* and their promotion in students (Schwarz, 2008; Muller Mirza and Perret-Clermont, 2009), a line of research to which Kuhn (1991, 1993; Felton and Kuhn, 2001) and many scholars have contributed (for reviews see e.g., Golder, 1996; Rapanta *et al.*, 2013; Schwarz and Baker, 2017). Pedagogical activities based on creative inquiry-based approaches, accurate design and adequate teacher training have proven that it is possible to support the acquisition of argumentation skills in students and to rely on argumentative activities to promote learning. Nevertheless, a recurrent question still remains open in Approach 1: why is it so difficult to get students to produce argumentation in the classroom when our feeling as parents is that youngsters already have argumentation skills from an early age? Therefore, we set out to explore children's "proto-argumentations" (as we used to call them when we were not *a priori* convinced that we would observe "real" argumentations). Our main questions at the start were the following: can two- to six-year-old children contribute to argumentative discussions? And when they contribute to argumentation, how do they reason?

Thus, "Approach 1" considers argumentation a "skill", namely a competence that the student has or does not have and that is manifested through verbal productions. The focus of attention is on the individual child (and not on the conversation in which the argumentation takes place), and the verbal productions are assessed according to various criteria that allow for a comparison between the child's skills and advanced (or even expert) adult skills. Children are usually observed and assessed at school; the expert skills that are *de facto* assumed as terms of comparison have traditionally been those of professionals who have to make decisions or try to convince their partners (politicians, lawyers, scientists, etc.) or those who are interested in argumentation *per se* (logicians, philosophers, psychologists such as Piaget).

Educators inspired by "Approach 1" often aim at teaching elaborated linguistic skills that will allow students to make explicit complex inter-relations, take into account different standpoints, pros and cons, and express standpoints backed up by structured argumentations (thus constructing elaborate argumentative productions, such as written argumentative essays, and others). Of course, the hope of educators is that such skills, once acquired through specific school activities on specific tasks and contents, will then transfer to other situations, in and out of

school. However, the issue of transfer raises important methodological questions that have not been the focus of much research yet.

A sub-line of research within "Approach 1" focuses on "arguing to learn", i.e., exploiting argumentation to learn specific contents related to school disciplines. This focus considers the argumentative activity as a request that will make the students explore the sphere of disciplinary knowledge at stake, in particular the information at their disposal (e.g., texts, feedback, etc.), and listen to their partners with the decentration and social interactions that argumentation requires. In this perspective, students are invited to use linguistic, reasoning and rhetorical resources as instruments to explore the multidimensionality of pedagogical objects (scientific phenomena, historical events, moral issues, etc.) and hence learn to inquire about them, reason and formulate hypotheses. Findings within this approach showed that these processes are likely to contribute to a deepening of the understanding of the issues that students are expected to learn (Schwarz and Baker, 2017), including their epistemological status (Kuhn, 2005). We should note that, in this approach, students are often offered theories in which to situate their hypothesis (for instance: evolution in Asterhan and Schwarz, 2007). By this, students are indirectly asked two things: to check that their hypothesis can be deduced from the theory they have been confronted with and to check that their empirical findings are compatible with the hypothesis; or, vice-versa, they have to produce empirical data, draw a hypothesis from their empirical observations, and then check that this new hypothesis fits into the theoretical framework well enough to be deduced from it. Hence, in such a school context, theory construction and explanation of facts are often described as a combination of "abductive" and "deductive" processes, favoring the training of these broad types of reasoning patterns and paying less attention to specific types of inferences (in terms of argument schemes).

Social and emotional conditions that are necessary for decentration to occur are considered (Muller Mirza *et al.*, 2009; Muller Mirza, 2010; Baker *et al.*, 2013; Schwarz and Baker, 2017) but no one has paid much attention to a fine-grained analysis of children's cognitive moves within argumentation yet.

The school activities foreseen by the "arguing to learn" approach require very careful designing (Andriessen and Schwarz, 2009). Commitment from the students is not always a given, and in no way can it be simply "prescribed" by a teacher (Schwarz and Baker, 2017).

Although our ArgImp project started on the backdrop of previous studies conducted in the framework of "Approach 1", it rapidly shifted to "Approach 2" for different reasons, among which is the important problem of some contradictory evidence: very young children were producing "spontaneous" argumentations in daily life settings (Schär, 2018), but *not* in our activities around technical problems, i.e., when we wanted them to produce argumentation (Convertini, 2019, in line with Greco Morasso *et al.*, 2015; Miserez Caperos, 2017). What was the reason behind this conflicting evidence? This question invited us to explore a different theoretical grounding for our study.

"Approach 2" considers argumentation a contribution to a critical discussion and not as an "isolated" individual product – that is, it assumes a very different theoretical framework than Approach 1. Argumentation is understood as a *dialogical activity* (Nonnon, 1996, 2015; Plantin, 1996, 2005; Eemeren and van Grootendrost, 2004; Rocci 2005 and 2008) within a specific context that binds, more or less explicitly, the issues, mutual expectations, interactions, rules and scripts. Centering on a fine-grained analysis of the children's reasoning within this argumentative activity, the approach thus assumed by ArgImp distinguishes two components in argumentative inference: the information (or taken for granted aspects of reality) and the reasoning process that is operated on this information. This distinction is to some degree analogous to the Piagetian distinction between "factual knowledge" about reality (i.e., physical or social-conventional knowledge) and what Piaget calls "operator knowledge" (he also calls it "logico-mathematical knowledge"), which operates on factual knowledge (Piaget and Inhelder, 1967).

An argumentative discussion is always an event situated socially and historically in a context i.e., an activity setting: there are issues, mutual expectations, social or professional roles, interactions rules, and scripts. "Approach 2" does not expect an argument to keep all its meaning if abstracted from the context and imported into another activity setting with different characteristics – in this sense, "Approach 2" relies on research on contextualized argumentation that has been flourishing for more than a decade in argumentation studies.

Whereas many studies of "Approach 1" are concerned with the relation between language and thought, "Approach 2" is concerned with the relation between argumentative activity and

thinking, as it is manifested in discourse and dialogue. It considers the goals (e.g., decision-making, knowledge building, problem solving, etc.) and the audience addressed. Research has illustrated how even very short socio-cognitive conflicts are likely to foster cognitive development (Carugati and Perret-Clermont, 2015). Hence, from an educational perspective, it is important to understand the socio-cognitive conflicts that occur in critical discussions with children: between adult and child or between children. In "Approach 2", there is no *a priori* normative model of what an educational intervention that enhances argumentation should look like. "Approach 2" is monographic, descriptive and explorative both in designed or in "naturally occurring" situations. Its intent is to identify early forms of argumentation in their context in order to observe how, why and when children try to raise or contribute to argumentative discussions and to explore whether (non) existing common ground allows (or does not allow) their reasoning to unfold in a given interaction (Trognon *et al.*, 2011).

From a psychological perspective, "Approach 2" is inspired by cognitive psychology and its studies of reasoning. However, most of the studies in this field have focused on the study of perception and deductive processes. ArgImp tries to contribute to an extension of this tradition along two axes: 1) a focus on children's structures of inference, somewhat similarly to Banks-Leite (1998) but with a revisited understanding of argument schemes or loci (cf. Rigotti and Greco, 2019); 2) special attention devoted to the context of argumentation, including the interpersonal and institutional relationships that frame the argumentative situation, as well as existing or challenged cultural premises. In ArgImp, we consider these components not as "biases" that can affect or "disturb" the child's rationality but as (often implicit) premises that are part of the child's reasoning.

ArgImp follows in the footsteps of different lines of research, ranging from Piaget's studies on children's reasoning, and Vygotsky's attention to the role of interpersonal coordination for the development of thinking, to the studies of the architecture of intersubjectivity in communication tasks (Rommetveit, 1976; Hundeide, 1985; Linell, 2009), the role of cultural practices (Bruner *et al.*, 1966) and the contribution of pragmatics to the psychology of language acquisition and cognitive development (Veneziano, 1999; Bernicot *et al.*, 2002). Jean Piaget had hypothesized that children's "wrong" or "seemingly illogic" answers are in fact quite rational if the different logic of the child is taken into account. Piaget (1926/1929) started dialoguing with children in open-ended conversations by means of which he tried to follow their reasoning and to question it in order to provoke counter-argumentation and hence access their deeper thoughts. Piaget then engaged in describing how, when building on the logics of their actions, children then develop different levels of logico-mathematical structures. Piaget's theory remains mainly centered on the study of deductive reasoning and causal demonstrations (Piaget and Inhelder, 1966). ArgImp tries to extend the theory to a careful consideration of inferential structures. Grize (1996), a former collaborator of Piaget, was critical of this latter's logico-mathematical description of thinking and offered an alternative with his own model, called "Natural logic". Grize's endeavor is to account for any speaker's expression of thinking by considering it not as an abstract entity, but as a "schematization" (a schematized discourse) addressed towards a specific audience. Indeed, the early Piaget (1926/1929) was aware of the role of the audience and of how very difficult it is to access children's thinking because their thoughts are always likely to be affected by the interlocutor's questions. However, Piaget seems to have neglected this in most of his later studies (with rare exceptions: e.g., Piaget, in his contribution of 1972, considers the role of context and social experience). ArgImp and other on-going research projects within our team (Kohler, in preparation) are re-assuming Grize's suggestion to consider the expressed reasoning of the child (i.e., the argumentation) as a schematization addressed to an audience and, hence, based on implicit premises that need to be acknowledged in order to understand such argumentation. Recently, a similar perspective has also been fruitfully applied to explore children's "failures" in a Theory of Mind test (Lombardi, Greco & *al.*, 2018). In the words of Pramling and Säljö (2015), we could say that the effort in ArgImp and in our above-mentioned related research activities is to consider "the child as a partner in conversations" and not as "an object of research". As illustrated by Anderson *et al.* (1997), a new understanding of the child's logic can be made possible by charitable approaches to their argumentation that reconstruct the implicit by taking into account the status of the children's speech acts and the reality they take for granted.

Contemporary theories of argumentation invite us to consider forms of reasoning that put the reasonableness (not just certitudes or opinions) at the center of attention. This is particularly

interesting from a psycho-developmental perspective, as children do not often need to carry out demonstrations and provide proof; contrariwise they have to continuously make inferences in order to find their way in a world that they are discovering. They take decisions, look for similarities, construct images of the world for themselves (leaving them often implicit); they learn to understand the consequences of their actions and to decipher the expectations of the people they meet. How do they reason and engage in argumentation in such circumstances, which are quite different from those of adult professionals or experts?

## 2.2 From the perspective of theories of argumentation

Up to now we have described the origin and interest of the ArgImp project from a psychological and educational perspective; but of course, in our interdisciplinary team, we set out with the aim of advancing argumentation studies as well. Since the beginning, we have been interested in seeing whether studying how a child engages in argumentation may in some way contribute to the study of inference in argumentation. We therefore focused not only on the explicit part of the children's argumentation that becomes evident and "audible" in a discussion, but we made an attempt to reconstruct their entire inferential process, taking into account also what is left implicit during their contributions to argumentative discussions. This requires reconstructing these implicit components of children's argumentation in order to gain a better understanding of the entirety of their argumentative contributions.

To this aim, ArgImp borrowed models from Argumentation theory. First, argumentative discussions are reconstructed by means of the analytical overview from Pragma-dialectics (van Eemeren and Grootendorst, 1984, 2004), a dialogical approach that considers argumentation as a critical discussion, recently considering also the specific context in which argumentation takes place. Second, in order to understand what remains implicit in children's argumentative contributions at the level of inferential moves (i.e., at the level of the standpoint-argument relations), the Argumentum Model of Topics (henceforth AMT, Rigotti and Greco Morasso, 2009, 2010; Rigotti and Greco, 2019) is used. The AMT reconstructs two parts of any single argumentation: the material-contextual and the inferential-procedural.

The material-contextual component constitutes the part of the inference that is rooted in the context of the interaction. The major premise of this syllogism, the *endoxon*, alludes to a premise that is typically shared in a (local or broader) cultural community. The Aristotelian definition of endoxon, as reported in Rigotti and Greco Morasso (2009: 45), defines it as "an opinion that is accepted by the relevant public or by the opinion leaders of the relevant public" (ibid., 45). In the AMT, Rigotti and Greco (2019) take away the component of the "opinion leaders" and state that the *endoxa* to which arguers appeal are expected to be shared by all the relevant interlocutors involved in a specific argumentative discussion. There might be endoxa shared in a family, in a classroom, but also broader endoxa relevant to a cultural community and so on. Because endoxa tend to be shared knowledge for the interlocutors, they may remain implicit in a discussion for reasons due to the pragmatics of conversation. However, in the settings we are considering, since children and adults have different knowledge of the world, it is possible that they may not always share the same endoxa (see e.g., Greco *et al.*, 2017). This is partially similar to what can happen in intercultural argumentation, where the perceived "lack of logic" or the perception of a "different logic" can often be traced back to the inability to recover implicit premises appealing to culture-specific endoxa (see Rocci, 2006). The minor premise of the material-contextual component of the reasoning is called *datum*. The datum refers to physical facts that are observable in the situation in which the discussion takes place (see Rigotti and Greco, 2009) or anyway to factual evidence, which may be made explicit in the argumentation or be available to the arguers in some other way. In argumentative interactions, data might be explicitly stated, but they might also be left implicit, in particular when the speakers have relevant perceptual-factual evidence before their eyes.

The procedural-inferential component constitutes (to adopt Piaget's distinction as defined in section 2.1) the "logical" part of the reasoning, or the source from which the inference present in a single argumentation is drawn. The procedural-inferential component is directly based on a *locus*, i.e. a semantic-ontological relation (e.g., cause-effect, witness-position to know, opposite-opposite, to name but a few) on whose basis standpoint and argument are connected (Rigotti and Greco Morasso, 2010). Several *maxims*, or inferential rules, are associated with each locus; a maxim functions as the major premise in the inferential-procedural component of the reasoning.

The maxim, associated with a minor premise, concludes with the culmination of the reasoning, which coincides with the standpoint that was to be proven (Rigotti and Greco, 2019). The minor premise associated with the maxim is the result of the material-contextual component, i.e., it is the proposition derived from the association of endoxon and datum: through this proposition, the material-contextual and the procedural-inferential components of argumentation are connected. The characteristic of the AMT, namely the conjunction of two different components in each reasoning, was particularly suited to respond to the needs of the ArgImp project, because we wanted to reconstruct children's implicit premises without neglecting to distinguish not only their operational-inferential moves but also the worldview and knowledge they start from when they construct their reasoning.

Using these models as an analytical grid, we proceeded to analyze children's argumentation in various settings (see the next section).

### 3. EMPIRICAL DATA

The ArgImp project works on a variety of newly collected and already existing data. In particular, two multilingual *corpora* in two different settings were collected. Corpus 1 consists of "spontaneous" argumentation in the family. This means that these discussions that occurred in everyday family interactions were not induced in any way. A researcher (Rebecca Schär) visited 12 families in their homes in three different linguistic regions of Switzerland and registered their natural talk. The researcher intended to take a marginal position and not interfere in the interactions that occurred within the families. However, as the researcher was physically present, sometimes she was asked by the children to participate in different interactions, such as playing a game.

Corpus 2 was collected by another researcher (Josephine Convertini) in two kindergartens, one in French-speaking Switzerland and one in Italy. This corpus consists of semi-structured play activities that are inspired by Piaget's studies (1974, 1980) and by activities proposed by the foundation *La main à la pâte*. In the cases collected within this corpus, children are asked to help resolve a technical problem by constructing specific artifacts with building blocks and toys.

The interactions of both corpora were audio recorded. In addition to the audio recording, the semi-structured play activities of corpus 2 were also video registered. The oral data were transcribed according to an adapted version of the transcription signs proposed by Traverso (1999) (see Appendix).

### 4. FINDINGS

What have we learned by shifting our perspective from "Approach 1" (argumentation seen as a skill) to "Approach 2" (argumentation seen as a contribution to a critical discussion)? This section will present some of the findings of the ArgImp research project that are of interest to psychologists and educationalists but also to scholars of argumentation; when relevant, we refer to previous publications in which more detailed observations and discussions of our findings can be found. Because this paper is a retrospective overview of the main findings of the ArgImp project, some of the examples we discuss have already been published, in a more extended and detailed form, in previous papers as well as in two hitherto unpublished PhD dissertations. When this is the case, we clearly indicate it.

#### 4.1 *Children's argumentations are often interrupted by the adult*

Audio and video recordings have made us quickly aware that adults very often do not grasp children's argumentative contributions, and they even go so far as to interrupt their contributions. This confirms our earlier observations of pedagogical activities (Greco *et al.*, 2017) and Piagetian clinical interviews (Greco Morasso *et al.*, 2015; Miserez Caperos, 2017). Sometimes, adults inadvertently forget to always leave space for the full development of the child's argumentation, even when they intend to do so.

#### 4.2 Children are active contributors to critical discussions using multiple argumentations and introducing issues

Our data reveal that, especially when given a space to do so, children are not "proto-arguers" but actively engage in argumentation. We observe that children even raise new discussion issues or sub-issues in already ongoing discussions. They do so in different ways, as for instance when they problematize an utterance of an adult or of a peer in order to raise an issue or a sub-issue via a callout (Aakhus, Muresan & Wacholder, 2017; Jackson, 2018); or when they anticipate a difference of opinion and put forward a standpoint and an argument supporting that standpoint (see the proposal of a typology of the emergence of issues in adult-children discussions in Greco and Schär, 2018 forth.; Schär, 2018). The fact that children open up new issues shows that they are not only able to "play the game" of an argumentative discussion initiated by an adult, but they are also interested in setting up their own discussions. Once an issue is raised, young children engage in argumentative discussions by putting forward their standpoints and supporting them with arguments. In our data, children not only recur to single arguments to support their standpoints, they also use complex argumentation (coordinative, subordinative, multiple) (Miserez Caperos, 2017; Convertini, 2019). Children also initiate completely new issues (Schär, 2018), and sometimes argue to question the issue... making the issue an issue (Greco *et al.*, 2017)!

The analysis of children's argumentation in our corpora shows that, in most cases, the inferential-procedural part of the children's reasoning may be reconstructed as a correct inference: children employ a variety of loci and competently rely on different maxims (Convertini, 2019). The loci on which children's reasoning is based are often those that the researcher indirectly expects when she introduces the task; but children also bring out other kinds of reasoning (new loci or new maxims) that were neither requested nor expected by the adult. On this point, the AMT analysis of the relationship between loci and maxims helps us to recognize the sophistication of children's argumentation, the variety of alternatives they are able to use, and the children's capacity to take initiative in reframing adults' tasks and finding creative ways to solve them (Convertini, 2019).

#### 4.3 Standpoints are often co-constructed during the interaction

In order to contribute to argumentative discussions, children need to feel legitimate to do so. This is often the fruit of a "conquest". During some of the activities, we can observe them trying to find their physical place or struggling to have their voice heard (Convertini *et al.*, 2017). Children try to understand what is happening and what it means, and they test their explorative "hypotheses" (Iannaccone *et al.*, in preparation); they also defend themselves when they feel neglected or offended; they try to convince others to "ally" with them (Danish and Enyedy, 2015); to "go against" their peer's contribution, or to coordinate their own perspective with that of their partners'. Argumentation emerges within these processes. Very often children do not have a pre-existing standpoint on an issue (see Greco *et al.*, 2015; Schär, 2018), either because the issue is proposed/imposed by the adults or because the issue arises in response to an "emerging problem" in the reality of the conversation. When argumentations are co-constructed in the course of the discussion, it seems that the issue has precedence over the standpoint because the interlocutors do not have pre-existing standpoints on that issue (as shown in Schär, 2018). The co-construction of an argumentative discussion appears then to be a dialogic process; but this is possible only if the *freedom rule* of a critical discussion is fully respected. In this sense, we reinterpret the concept of freedom rule as discussed by van Eemeren and Grootendorst (2004) and note that full freedom in argumentation includes not only the possibility to advance standpoints and arguments, but also the possibility to raise, reframe or object to the raising of issues or their specific framing (Schär, 2018).

#### The jigsaw example

The "jigsaw example" (from Corpus 1, analyzed in greater detail by Schär, 2018) illustrates this point. A discussion (transcribed in Table 1) occurs when Amélie<sup>1</sup> (5:8-year-old), as requested

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<sup>1</sup> Names have been changed.

by the rules of the board game she is playing with the researcher, tries to add a puzzle piece to a jigsaw. But Amélie seems to hesitate. The researcher asks "should we check below?" (turn 2, referring to the model of the jigsaw depicted on the game board). When the researcher asks (probably thinking that she is suggesting a strategy to deal with the difficulty) whether they should check the model, Amélie *interprets this as an issue*, although the researcher originally did not intend to advance a standpoint (see the discussion in Musi and Aakhus (2018) on this point). Amélie supports a standpoint that they should *not* check the model of the jigsaw by advancing two coordinative arguments: 1.1a "we are a bit stupid" (turn 9) and 1.1b "it is much too difficult" (turn 10). More precisely, the arguments put forward by Amélie appear to support the *contrary* standpoint that rather than following the model they should do the jigsaw puzzle in an "anything goes" fashion (turns 3, 5 and 10), as signaled especially by the marked use of French *n'importe quoi* in turn 5. Hence, both the standpoint and argument that Amélie put forward emerge out of the interaction.

Table 1. Discussion between Amélie (5:8 years) and the researcher (R.)

Turn	Speaker	Transcript (in Swiss German)	Our translation
1	Amélie	((schaut auf das von ihr hinzugefügte Puzzleteil)) öppis stimmt=	((is looking at the piece she just added to the puzzle)) something's=
2	R.	söuemer luege ungerdran↑ (3.0)	should we check below↑ (3.0)
3	Amélie	das glaub ich das mir lueged scho ich duens da aber mir duen das puzzle nid guet mache mir duend eifach das puez le nid eso mache ((zeigt auf Vorlage))	i believe that we look really i put it here but we don't do this puzzle well we just don't do this puzzle like that ((indicates the model))
4	R.	a:uso=	o:k=
5	Amélie	mir macheds <fr>n'importe quoi</fr>	we do it ((fr)) no matter what ((fr))
6	R.	okey	ok
7	Amélie	s isches e chli:	it is a bit:
8	R.	((würfelt)) zwöi=	((throwing the die)) two=
9	Amélie	xxx simmer e chli blöd	xxx we are a bit stupid
<i>Approximately 15 minutes later</i>			
10	Amélie	mir mached wie es chunnt mir mached wi h: es h: wi wi wir wölled das das puzzle mache h: wi wir das wölled du:e weisch wieso wi das wil vil z schwierig isch	we do how it goes we do ho h: it h: ho ho we want this this puzzle do h: how we this want do you know why w this because is much too difficult
11	R.	okey	ok

Beyond the co-construction of standpoints in response to an issue emerging in natural conversation, this example also hints at another aspect that recurs frequently in the data of the Arglmp project, namely that socio-material artifacts (in this case the pieces making up the jigsaw) may trigger an argumentative discussion. In this jigsaw example, it remains unclear whether the researcher is the only trigger of Amélie's argumentation or whether she would have started to argue her point of view even without the intervention by the researcher. In many cases that we have collected, children open up discussion issues because they respond to "emerging problems" derived from socio-material artifacts in their playing situations (e.g., a toy car is too big to go into a tunnel; a toy person bumps her head). Hence, not only standpoints but also issues are co-constructed during the discussion via sub-discussions initiated by the children (see Schär, 2018 for more examples).



#### 4.4 Available visual information is not verbally made explicit

In very young children, linguistic abilities could be a motive for leaving part of their reasoning implicit. However, in our analyses we find other aspects that better account for this fact. Grice's (1975) cooperative principle, stating that the interlocutors should make a verbal interaction "as informative as is required", means that repeating what is obvious to the involved interlocutors should be avoided (see Lombardi *et al.*, 2018). In our data, the fact that something perceived as "obvious" is left implicit is commonly observed in the presence of material objects that seem to have a clear meaning, as shown in the "missing pieces" and "TUC® cookie" examples illustrated in what follows.

#### The missing pieces example

In the "missing pieces example" from Corpus 2 (and discussed in greater detail in Convertini, 2019), the activity has been designed by the researcher. Three children are involved in this activity inspired by Piaget (1980). A blue poster has been glued to the table and two mannequins (and their cars) are each placed on opposite sides of the poster. The researcher presents the task and explains to the children that the mannequins are friends who live on opposite sides of a lake (the blue poster) and want to meet each other. The researcher then asks the children to build a bridge with the blocks. After they are finished building the bridge, they lift it up and place it on the blue poster to check their work (see transcription in Table 2).

Table 2. Discussion between Flavio (5:3 years) and Mattia (5:4 years)

Turn	Speaker	Transcript (in Italian)	Our translation
(0:25:44.7)			
1	Flavio	oh:: ((si avvicina Mattia e indica la costruzione del ponte fatta da Mattia)) tiriamolo su ((solleva la costruzione di ponte ed entrambi la guardano)) ma, deve essere ancora più lungo	oh: ((he goes close to Mattia and indicates the bridge construction made by Mattia)) let's lift it up ((he lifts the bridge and both children look at it)) but, it must be longer
2	Mattia	e allora aspetta ((prende dei pezzi di lego dalla scatola delle costruzioni e li attacca alla sua costruzione))	and then wait ((he takes pieces of Lego® from the construction box and puts them on his construction))
(0:25:46.6)			

The argumentative discussion between Flavio and Mattia may be reconstructed by means of an adapted analytic overview (originally taken from van Eemeren & Grootendorst, 2004) as presented in Table 3.

Table 3. Reconstruction of the discussion between Flavio and Mattia

Issue: (Does this bridge serve its purpose?)		
<u>Flavio, Standpoint 1</u>		
1	(the bridge does not serve its purpose)	
<u>Arguments in support of Standpoint 1</u>		
T. 1	1.1.	because it must be longer

The issue discussed by the children is about the adequateness of the instrument that they have built, i.e., the Lego® bridge, in relation to a goal (crossing the lake) that has been imposed

by the adult. Flavio's argument (1.1) is based on the locus from the final-instrumental cause (Rigotti and Greco, 2019), elaborating on the connection between an instrument (the bridge) and its goal (reaching the other side of the lake). Flavio's argument in turn 1 is that the bridge "it must be longer".

In this case, the instrument (the bridge) is not adequate, because it is shorter than the blue poster (the lake). This datum, a material-contextual part of the reasoning (i.e., that the current bridge is too short), has a supposedly clear meaning for the children, and it remains implicit in their discussion: they do not explicitly say that the reason why the bridge does not serve its purpose is because it is shorter than the blue poster, arguably because they can see it. However, the fact that they have in mind the goal of the task is clear from turn 1, because the children physically lift the bridge and verify whether they have done what the adult has asked them to do. Turn 2 is also interesting because, when the children see that the instrument they have built is not adequate, they immediately suggest a creative solution, i.e., to change the instrument: Mattia says "and then wait" and grabs new Lego® bricks.

The TUC® cookie example<sup>2</sup> (quote from Schär, 2018)

In the "TUC® cookie" example taken from Corpus 1 (see Table 4), Levin (3:2- year-old) initiates an argumentative discussion. When the researcher arrived at this family's home, Levin's mother asks him to give a cookie to the researcher. Levin answers his mother's request by arguing that these cookies are "better not (given) to adults". Thereby, not only does he express his refusal to give a cookie to the researcher, but he also raises the issue "Can TUC® cookies be given to the researcher?" In fact, with his argument Levin explains the endoxon he bases his reasoning on: "TUC® are not made for adults". At the same time, Levin leaves implicit in his argument an aspect of the reality that corresponds to the datum: namely, that the researcher is an adult, because everybody can see this. This unsaid datum is necessary to understand Levin's reasoning: it is only by taking into account this premise that Levin leaves implicit that his argument is completely understandable.

Table 4. Discussion between Levin and his mother

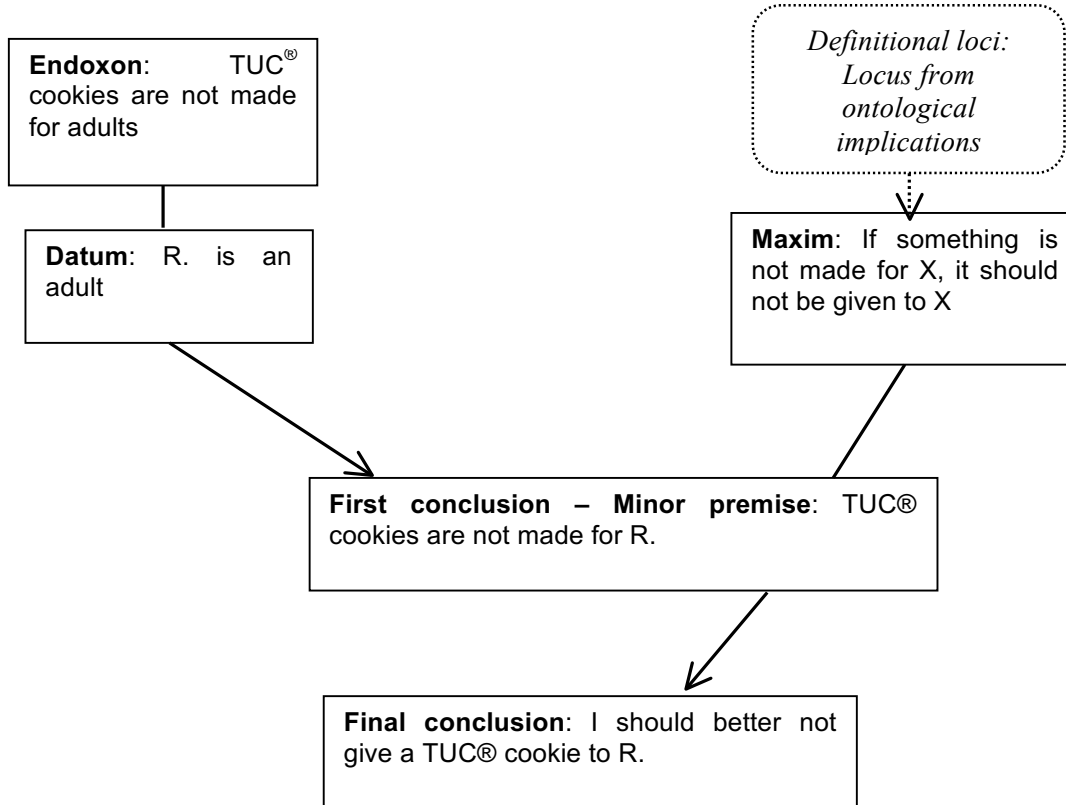
Turn	Speaker	Transcript (Swiss German)	Our Translation
1	Levin	d R. wett äu ä chli tee (1.0)	R. also wants some tea (1.0)
2	Mother	m:hm	m:hm
3	Levin	die do=	these ones=
4	Mother	und no es Tuc ((keks)) chaschere äno geh	and a Tuc ((cookie)) you can give her one too
5	Levin	es↑	a↑
6	Mother	es Tuc (3.0)	a Tuc (3.0)
7	Levin	nid ade erwachsnig gschider	better not to adults
8	Mother	momol die sind ä für die erwachsnige	yes yes they are for adults too

In turn 7, Levin answers his mother's request by arguing that these cookies are "better not (given) to adults". Thereby, not only does he express his refusal to give a cookie to the researcher, but he also raises the issue "Can TUC® cookies be given to the researcher?" The argumentative discussion between Levin and his mother can be reconstructed by means of an analytic overview (adapted from van Eemeren & Grootendorst, 2004) as presented in Table 5.

<sup>2</sup> The TUC® cookie example has been presented at the 2nd European Conference on Argumentation in Fribourg (2017), analyzed in Greco, Perret-Clermont *et al.* (2018), as well as in Schär's (2018) unpublished PhD dissertation; the excerpt and analysis presented here are quotes from the dissertation. Our readers will find in these previous publications some different and more detailed analyses. We reproduce this example here because of its representativeness in terms of how the context of the interaction impacts on the argumentation.

Table 5. Reconstruction of the discussion between Levin and his mother

Issue: Can TUC <sup>®</sup> cookies be given to the researcher?					
<u>Mother, Standpoint 1</u>			<u>Levin, Standpoint 2</u>		
T. 4	1	(yes)	T. 7	2	(no)
<u>Argument in support of Standpoint 2</u>					
T. 7	2.1	better not for adults			



In order to better understand how Levin's argument 2.1 relates to the issue, it is worth considering the material-contextual part of his reasoning, as it is analyzed in the AMT (see section 2; Rigotti and Greco Morasso, 2009; Rigotti and Greco, 2019). In fact, with his argument Levin explains the endoxon he bases his reasoning on: "TUC<sup>®</sup> are not made for adults". At the same time, Levin leaves implicit in his argument an aspect of the reality that corresponds to the datum. The datum, namely that the researcher is an adult, in this case is "visible" to all involved. It is only by taking into account this premise, which Levin leaves implicit arguably because it is physically visible, that his argument "these cookies are better not given to adults" is completely understandable.

In this sense, the analysis of the implicit component of the children's argumentation in these two examples ("missing pieces" and "TUC<sup>®</sup> cookie") shows how some "obvious" contextual aspects may make the explicitation of the entire argumentation superfluous. The material object in the first example (the bridge), as well as the characteristics of the researcher in the discussion between Levin and his mother, are premises that support the children's arguments but are not made explicit, because they are available otherwise to the participants in these situations. Reconstructing the components children leave implicit in their argumentation, either because they are "visible" or because they are "taken for granted" (see paragraph 4.5), allows for a better

understanding of the role that argumentation has in this interaction and the meaning children attribute to it.

The observation of Grice's (1975) cooperative principle, hence leaving implicit what can be thought of as known by all those involved, may be at the basis of another important finding of the ArgImp project that will be discussed in the next section.

#### 4.5 Uses of the argument of authority and "Weltanschauungen"

Fine-grained analyses of argumentation can also allow us to explore the "worlds" in which children navigate. There is a lot to learn from investigating the many aspects of their *Weltanschauung*, among which are children's understanding of rules and of their legitimacy. Rules can help to comfort one's position, to avoid changing it, or to find a way out of a difficult situation. It is not by chance that in play situations we have often found children interacting in a more horizontal way with their parents and arguing to legitimize their standpoints with authoritative arguments in which parents are not the source of authority (reminding us of Piaget's famous book, *The Moral Judgment of the Child* (1932), in which he comes to the conclusion that horizontal interactions are sources of moral reflection and allow children to transform their understanding of the role of rules).

A close analysis also reveals that endoxa are not always shared by adult and child as in the "Memory board game example" (Schär, 2018; Schär and Greco, 2018). In this example, a father and his daughter are playing a board game. The father's endoxon seems to be that the game he is playing with his daughter relies on a specific set of rules (arguably, those written on the board game box), whereas the daughter appeals to a different endoxon, which is drawn from her experience (imagined or real?) in day care. In particular, Elina and her father are playing a widely known board game consisting of a number of pairs of identical cards placed upside down on a surface. The players can turn two cards per turn with the goal of finding two identical cards. If they fail to do so, they have to pass their turn. If they succeed, they are credited with two points and can turn two more cards. Suddenly, Elina realizes that she has just failed to match the card she has in her hand but realizes that the card next to the one she has just drawn would probably match the first card she turned over. Hence, she would like to continue turning over cards. Her father tries to stop her: "no hang on Elina it's not your turn=", "wait a minute you can always only turn over two per turn"). Elina continues: "but in Chrabolino<sup>3</sup> i took two again two again two again and two again=", appealing to an argument of authority that goes against her father's standpoint. In this case, the "clash" between the father's and the daughter's *Weltanschauungen* regarding authority in board games suggest a possible way to understand why they have a difference of opinion in argumentation and how to study it: comparing endoxa and their discrepancies.

#### The little Lego® blocks example

The extract presented below in Table 10 is part of corpus 2<sup>4</sup>. The activity presented here is the same as in the missing pieces example: three children have to build a bridge with Lego® blocks. Large and small blocks are available.

Mia (4:7 years) works alone, while Giacomo (5:2 years) and Fulvio (4:6) work together. Mia used large blocks and the two boys used small blocks. The construction made by Mia is longer than that of the two boys. She decides to place it on the blue poster. After placing her construction on the blue poster, she turns to the other children.

Table 10 Discussion between Mia and Giacomo

Turns	Speakers	Transcription	Our translation
(0:26:17.9)			
1	Mia	Giacomo, guarda me	Giacomo, look at me
2	Giacomo	non è mica, eh però non è	it's not, but it shouldn't be a ship),

<sup>3</sup> The day care Elina goes to is called Chrabolino (all names, including this one, have been modified for reasons of privacy).

<sup>4</sup> This example is translated and adapted from Convertini (2019).

		mica una nave, è vero? ((guarda la ricercatrice)) deve eccè un ponte	right? ((he looks at the researcher)) it must be a bridge
3	Mia	lo so	I know
4	Giacomo	grosso come questo ((guarda la sua costruzione))	Big like this one ((he looks at its construction))
5	Mia	sì, ma io l'ho già quasi fatto ((continua ad attaccare pezzi di LEGO® grandi alla sua costruzione))	yes, but I've already almost done it ((she puts large LEGO® on to her construction))
6	Giacomo	Ma (.) però (.) non ci deve fare solo con quelli ((i LEGO® grandi)), noi abbiamo preferito anche con questi ((i LEGO® piccoli), Mia (.) Perché no con questi piccoli?	But (.) (.) however (.)we should not do it only with those ((the large blocks)), we have also preferred with these ((the small blocks)), Mia (.) Why not with these little ones?
7	Mia	perché sennò ci vuole ta::nto	Because, otherwise it takes a lot of time
8	Giacomo	Perché (1.0) ma Gina (una maestra) non vuole che facciamo con quelli piccoli	Because (1.0) but Gina (one of the teachers of the day care) doesn't want us to do with the little ones
9	Mia	Sennò ci vuole ta::nto lo sai, Giacomo mio	Otherwise it takes a lot of time, you know Giacomo, my dear one
(0:27:09.1)			

The argumentative discussion between Giacomo and Mia can be reconstructed by means of an analytic overview (slightly adapted from van Eemeren and Grootendorst, 2004 to introduce the issue). It is presented in Table 11.

Table 11 Reconstruction of the discussion between Giacomo and Mia (4:7 years)

Issue: Can the bridge be made with small Lego blocks?			
<u>Giacomo, Standpoint 1</u>		<u>Mia, Standpoint 2</u>	
T.6	1	The bridge can also be done with the small Lego	2 (The bridge cannot be done with the small Lego)
<u>Does not offer supporting arguments, but only addresses a critical question (Q) to Standpoint 2 and "concedes" an argument in support of it.</u>		<u>Arguments in support of Standpoint</u>	
T.6	Q2	Why not with these little ones?	T.7 2.1 Because, otherwise it takes a lot of time
T.8	2.2	Because it is forbidden by Gina to use small Lego (in this kindergarten)	T.8 2.2 [Because it is forbidden by Gina to use small Lego (in this kindergarten)]
			T.9 2.2.1 (It is forbidden) because it takes too long

The argumentative exchange between Mia and Giacomo is peculiar and involves, again, the childrens' positioning with respect to rules and authority. While Giacomo clearly expresses his point of view (1) in T.6, he does not follow with supporting arguments. Rather, he challenges Mia to defend the contradictory standpoint (2), which he attributes to her. Normatively, this could be construed as the fallacy of *shifting the burden of proof* (cf. van Eemeren & Grootendorst 1987). It is doubtful, however, that is this construal is an adequate characterization of the exchange. As

the immediate follow-up shows, Giacomo's moves appear to be more exploratory than persuasive or tactical. In any case, Mia does pick up the challenge and assumes the burden of proof, producing a practical argument (2.1) in T.7: it would take much more time to do the construction with small Lego blocks therefore it is efficient to work with the large ones. Unexpectedly, Giacomo in T.8 produces a second, independent, argument in support of Mia's standpoint (2.2), in what looks like a concessive move. This argument is related to the authority of the kindergarden rules (teacher Gina has enforced a rule about what building blocks can be used in the kindergarden). Yet, Giacomo has already made clear that he is not aligned with the authority of teacher Gina and with her rule ("Why not with these little ones?"). Perhaps, he attributes to Mia an implicit reference to her authority, seeing Mia's behavior as rule-following. Mia's reply in T.9 goes back instead to the pragmatic justification, either simply repeating her argument of T.7 or, on a richer interpretation, presenting the pragmatic argument subordinatively as the justification of teacher Gina's rule (2.2.1). This richer interpretation is supported by Mia's remark: "you know that Giacomo, my dear one", which is consistent with a scenario where both the rule and its pragmatic justification should be known to Giacomo – because they have been (repeatedly?) stated by teacher Gina. In the end, Mia also implicitly criticizes the two boys for having used small blocks, when they should have known better.

While in the previous example Elina used an authority to go against her father's endoxon, in this case Giacomo and Mia position themselves with respect to the teacher's authority, questioning or justifying it. In both cases, the study of endoxa seems to open a promising path to unveil the children's *Weltanschauung*, in particular what they consider 'authorities' in relation to the activities they are playing.

## 5. DISCUSSION AND CONCLUSIONS

When two- to six-year-old children contribute to argumentative discussions, how do they reason? By addressing this question, our interdisciplinary project, ArgImp, tries to contribute to the study of inference in argumentation and to the psychological understanding of children's reasoning when they produce argumentation. The research presented here has convinced us of the heuristic value of changing the level of analysis: from a focus of attention centered on the child considered in isolation and compared to the adult in terms of argumentative skills and cognitive behavior, to a consideration of the child as engaged in activities with a conversational dimension in which they take the initiative to raise issues and make (or are asked to make) argumentative contributions.

We have used fine-grained models taken from Argumentation theory (Pragma Dialectics and Argumentum Model of Topics) as "lenses" to scrutinize the children's contributions in two corpora collected during free play and designed technical activities. This has led us to recognize the complex multi-layered activity in which children become involved when they contribute to an argumentative discourse. It has made us aware that, when we look at children in pedagogical situations, we often see only the "tip of the iceberg" i.e., the verbal production considered as the performance of an individual. Thereby, we bypass the implicit premises on which these productions rely. The latter can be deciphered through a close attention paid to the precise socio-material and normative context of the conversation if we pay attention to the fact that what is being said is taking place between identified persons who have their own goals, think (rightly or wrongly) that they share common grounds, who indulge in trying to meet the others' expectations as they imagine them, and who unfold or co-construct their reasoning in interaction. From a psychological perspective, we have observed that when children argue they deploy important efforts in different directions, e.g., deciphering the goals of the adult and of the children who are partners; asserting oneself; finding one's way at the intersection of different worlds of meanings; exploring these worlds; securing one's voice or at least the acceptance by others of one's own contribution; interpreting the co-conversers statements; or even escaping the task set by the adult by finding alternatives! Our analyses reveal complex symbolic and relational work that children accomplish in order to produce argumentation. They also show how the issue discussed might not be the one that the adult asks (or expects) the children to discuss.

Contemporary theories of argumentation invite us to consider forms of reasoning that put the reasonableness (and not only certitudes or opinions) at the center of attention. While the cognitive psychology of reasoning has traditionally focused on deductions and demonstrations,

we have used new means to study inference in children. The Argumentum Model of Topics, with its distinction between material-contextual premises and inferential-procedural premises, has offered us the possibility to walk in the footsteps of Piaget when he distinguishes static knowledge (physical, conventional, cultural facts) from operational knowledge (i.e., the mental operations that are applied to the facts). Instead of admitting the static knowledge as "facts" we have distinguished endoxon and material fact, and this has allowed us to observe that endoxa are not always aligned. For the fine-grained description of the child's cognitive moves, instead of using the Piagetian concept of "operation", we have called upon the concept of "locus", and this has uncovered some aspects of children's work on meaning, in particular the variety of inferences that they can make.

In our data, we have observed young children actively participating in critical discussions. Their reasoning is traceable. It can be described as relying on maxims derived from different loci and on implicit or explicit data. "Obvious" or "visible" (in children's eyes) contextual aspects may make the explicitation of the entire argumentation superfluous. Children can produce multiple argumentations; their standpoints are seldom pre-existing to the conversation but are often co-constructed, as are the issues. If the freedom rule is respected, children introduce issues, often via sub-discussions, but only if adults do not interrupt them as they often do, even when they don't intend to. Often the inferences that children make are not the ones that adults expect and the latter then tend to interrupt them. Reconstructing the components children leave implicit in their argumentation allows for a better understanding of the role that argumentation has in their interactions: their "*Weltanschauung*" as it is experienced and transformed by them when they meet other persons with their own "*Weltanschauung*", a new perspective on socio-cognitive conflict. We are presently also fascinated to discover how children can use argumentation to explore the world or to appeal to sources of "authority".

From the perspective of Argumentation theory, because children reason and engage in argumentation in circumstances which are quite different from those of adult professionals or experts, they help us to shed a developmental light on argumentation: issues and standpoints are not always fixed but are likely to evolve in time: discussion issues are likely to be transformed as they are talked about; standpoints are not always present before being co-constructed in the on-going dialogue. The change of focus that we have operated, moving from an analysis of argumentation as a "skill" to argumentation as a "contribution to a critical discussion", allows us to introduce this time perspective and to better comprehend the social, cultural and material dimensions of the reasoning as an embedded activity. Models borrowed from Argumentation Theory have been powerful analytical instruments. They can now be revisited in the light of the specifics of children's argumentation.

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## APPENDIX : NOTATION SYSTEM

<i>sign</i>	<i>description</i>
↑	raising intonation
(( ))	non verbal component
(1.0)	pause of 1 second
=	immediately following turn
An::d	lengthening of preceding vowel
(.)	micro pause
[ ]	interruption and overlapping