From inference processes to situations of misunderstanding

A case study

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In this paper, we describe inferences on a school task, which are reconstructed by the mean of two perspectives from argumentation theory: The pragma-dialectical model and Grize's natural logic. Both analyses focus on the same item of mathematics, issued from a PISA survey, in order to discuss their specific contribution in elucidating the actual reasoning involved in both the student's answer and the evaluator's expectations. The mismatch between these two points of view allow us to discuss the potentiality of a situation of misunderstanding.

Investigating how specific tasks in particular contexts are interpreted provides a contribution to methodological approaches treating thinking processes as situated and socially negotiated from a diversity of points of views, as for example Inhelder's (1962) microgenetic approach. In order to extend such analysis to interpretations of *discourse*, an interdisciplinary approach combining argumentation theory and socio-cognitive psychology is needed.

Here, we observed for instance that students may provide the expected answers and still interpret the question or problem differently from the task's designers (or "teacher"). The meaning of language and other signs, such as graphs or mathematical symbols, cannot be taken for granted when several interlocutors are involved. This issue chiefly concerns argumentation theory, since it raises the question of the integration of specific contexts and points of view in the analysis of argumentation. Therefore, argumentation should be analysed also as a process, and not only as a product; For more detail on this distinction, see for instance Grize (1996) and Kuhn & Udell (2003, 2007).

Keywords: argumentation, education, inference, meaning, misunderstandings, points of view

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1. Introduction

1.1 School tasks interpretation: Inference processes, argumentation and misunderstanding

In educational settings, it is common for a task designer to set specific expectations about the task's interpretation, on one hand, and about the answer or solution students should produce, on the other hand. However, students do not always succeed in inferring the designers' expectations. In this case, the responsibility of the failure is generally attributed to the students' knowledge or skills. Yet, before attributing failure in a task to students' knowledge or skills, one must verify whether the task has been understood in the same way as intended, and wherever unexpected answers or solutions would not be acceptable. Otherwise, there is a risk to attribute a cognitive deficit to students who are actually answering a different question or problem. In this case, the failure of the task is due to a *situation of misunderstanding* rather than to a lack of cognitive ability. The question raised by this methodological precaution addresses the field of argumentation studies, both for the task's interpretation and the question of the acceptability of a student's answer. This is precisely the point of this article, to provide methodological ways to support precise hypotheses about the teacher making inferences on the inferences made by students. In other words, we present an approach exploring possible student-teacher misunderstanding and its sources, stressing the importance of such analysis before proceeding to any assessment of student's (lack of) skills.

Moreover, when students must provide justification to their answers, their production are generally evaluated in reference to norms and rules of the "good reasoning": If they are not even explicitly required to produce an "argumentation", the process of questioning, responding and evaluating is *de facto* some kind of argumentative discussion in which students are expected to convince teachers about their skills. While this seems relatively clear to teachers using the term "argumentation" in a common sense, a more precise and in-depth definition of argumentation raises many issues, of which some are specific to the educational context (e.g. Muller Mirza & Perret-Clermont, 2009; Nonnon, 2015; Schwarz & Baker, 2017). The diversity of definitions of argumentation found in the literature raises a most obvious issue in educational context, since it is difficult to communicate efficiently to students what the expected "argumentation" is, when its mere definition is problematic for scholars. Voss and van Dike (2001) stress the variation of definitions in literature as moving from a focus on the process of convincing an audience about a controversial issue, to a focus on reasonableness or rationality. This continuum goes from the entirely context dependent pragmatic

criteria – the argumentation is good if it has convinced the audience there and then – all the way to models defining formal norms of reasoning out of any context, in a way that often focuses on fallacies. On the one side, the concern with controversial issue is relatively rare in school context, except for a recent interest in socio-scientific controversial questions (e.g. Zeidler, 2003). On the other side, argumentation in school context raises the problematic question of authenticity (e.g. Kohler, 2020b): Does the student engage in classroom discussion with her own opinion, when this one may be evaluated, or does she provide recorded speeches she believes to be expected by the teacher?

Investigating such processes of interpretation about specific tasks in particular contexts – here in education – provides a contribution to a theoretical need raised long ago (e.g. Donaldson, 1982; Hundeide, 1985, 2010; Perret-Clermont, 1980; Säljö, 1991; Schubauer-Leoni & Grossen, 1993) of methodological approaches treating thinking processes as situated and socially negotiated from a diversity of points of views. Inhelder's (1962; Inhelder et al., 1992) *microgenetic analysis* provides such methodology and many examples of detailed step-by-step reconstructions of children's specific points of view when dealing with material tasks. In order to extend such analysis to interpretations of *discourse*, an interdisciplinary approach combining argumentation theory and socio-cognitive psychology is needed. A descriptive analysis of the link between the student's cognitive abilities and discourse production and interpretation (see Kohler, 2020a), as generally studied in argument theories, may contribute to better understand what happens when the children's answers or performances to a task are not matching the expectations of the school system (e.g. Bautier & Rochex, 2004, 2007; Greco, Mehmeti, Perret-Clermont, 2017; Kohler, 2015; Mehmeti & Perret-Clermont, 2016).

Moreover, argumentation focused on rationality is central in educational context, not only in the teaching of argumentative skills but also across disciplines, with the aim of fostering critical thinking or rationality in society (e.g. Lipman, 2003). Despite the central importance of rationality at school, the formal approach centred on the study of fallacies is rarely useful for teachers in school context, given the importance of the semantic content of the argument provided by students, and because the domain-specific criteria for a rational argument may greatly differ from one teaching matter to another. For instance, defending the quality of a painting in History of Arts does not rely on the same norms than justifying the solution to a problem with experimental data in Physics. Hence, formal criteria for distinguishing correct inferences from fallacies are not sufficient, when evaluating student's answers in school context.

In this paper, we will only tackle one aspect of the complex issues raised by the study of argumentation in educational context: The consequence of the artic-

ulation of various points of view in the evaluation of the quality of a student's production. Starting from the hypothesis that norms or criteria of a good reasoning are, in educational context, dialogically established by the interlocutors themselves through various shared situations, this case study attempts to distinguish wherever a student's answer is wrong in respect to some general rules for rationality, or more specifically in respect to a communication process that fails to establish a sufficiently precise shared understanding of the teacher's expectations.

The problem we are dealing with here, has been pointed out by Vergnaud (2015), when he is stressing that "the argumentation, as an activity, is not only made of statements and explicit arguments, but also of implicit identifications which concern the meaning given to what the other says" (*idem*, p.390). Hence, studying only language may turn the whole endeavour to describe natural and contextual use of argumentation into an impossible task. Without consideration given to implicit meaning, not only through logical analysis but also through an in-depth study of the context, the description of argumentation may remain an abstract assimilation of discursive data to the models made by researchers. In other words, without taking into consideration the interplay of inferences made by interlocutors throughout the course of interaction – the coordination of points of view – teachers and researchers merely assimilate the way students use language to their own use, and to their own schematization of the topic.

If the reconstruction of implicit meaning is well accepted (e.g. Perelman & Olbrechts-Tyteca, 1958; Grice, 1979; Grize, 1982; Perret-Clermont, 1992; Forman & Larrenamendy-Joerns, 1998; Greco et al., 2018), analysing interlocutors' own interpretations brings a new and additional challenge for researchers (Plantin, 2011). This study is an attempt to take up this challenge with a double analysis of a single case, which can bring a methodological contribution to the reconceptualization of argumentation Plantin calls for (*idem*).

1.2 A perspectivist epistemology

Why are we presenting a double analysis of the same case in this paper? This choice is an attempt to concretely adopt a perspectivist stance. Using argumentation theories for an investigation in psychology about the way a particular student is making inferences of various types while performing at a school task raises the issue of the relation between psychology, logic and argumentation. Grize (1982) comments this point as particularly problematic in the Western tradition: The attempts of Pascal, Boole or others to study the "law of thought" raised the fear of "psychologizing", i.e. of a reductionism of the mind to psychological investigations, and was strongly opposed by scholars such as Frege. This issue is not one of argumentation theory nor of psychology, it is rather an issue of epistemology, and thus requires a response in epistemology. For the sake of this study, our

response to this issue consists in making our epistemology explicitly perspectivist (Giere, 2006; Kohler, Lordelo et Carriere, 2017; Kohler et Donzé, 2017; Kohler, 2018, Kohler, 2020c). In the perspectivist epistemology, scientific models and theories constitute each a specific perspective on the object under investigation. Perspectivism should not be confused with relativism (Bruner, 1990), for which any perspective is equally valuable. A specific perspective may be more or less relevant for a specific research question, yet most often several perspectives are better than one. Perspectives can provide complementary knowledge or provoke fruitful debates, while critical discussion are made useless with a relativist epistemology. Moreover, perspectives as such can be the object of the investigation: Can a specific model or theory contribute to shed light on what remained out of the scope of previous perspectives on the same phenomenon?

This perspectivist epistemology motivates not only an interdisciplinary approach, yet also a combined presentation of two analyses of the same case, using two different theoretical models for a similar research question and data. This confrontation of perspectives on the same object of study not only provides descriptive results about the particular case we have analysed, it also allows for a methodological discussion about the specificities of each perspective when used as models for the description of situations of misunderstanding. This paper is only a first contribution to a discussion of the specificity of each presented perspectives, both limited to what can be presented in a single paper.

2. Theoretical framework

2.1 A situated approach

Inference is generally studied under the scrutiny of logic, checking the validity of the move from premis(es) to conclusion(s), from perception to judgment or belief, or as a (neuro-)cognitive mental act producing judgments, beliefs or statements. For instance, Gigerenzer & Todd (1999) showed the limitation of classical model of rationality, arguing for more context dependant "heuristics"; yet, in their book, they nevertheless present these heuristics with the tools of formal logic. Such logic allows to identify and formulate general rules for the move inferences operate, and consequently these rules allow to check on the general validity of particular inferences. Inferences can notably be related to argumentation theory by such rules, in an inquiry for the definition of sound rationality. Yet, inferences also constitute a psychological process: As pointed out by Freeman (2018), Peirce considers for instance that belief are biological habits leading human from one belief to another by way of inference. Examining such processes opens a new field of investigation on rationality, that Grize (1982) calls *natural logic*.

In this paper, we adopt a psycho-sociological approach on inference processes, which means that the research objects we focus on are situated processes.[1] In other words, the cognitive operational process of inference is the inference of *someone, somewhere, doing something*. We consider inferences processes that actors are conducting in relation to specific tasks and specific situations, set within a particular historical, cultural, social and material context, and oriented towards a finality which may be given by the context, chosen or negotiated throughout social interactions. The way these processes are conducted by interlocutors may also be, sometimes, socially negotiated. In particular, what counts as a valid answer to a question in school context may occasionally proceed from a negotiation between students and teacher. Yet, when this negotiation fails, or simply does not occur, there are risks that students and teachers do not share the situational norms for a valid answer. This is the case in the situation of misunderstanding we propose to analyse in this paper. Drawn on two argumentation theories, we illustrate this point with psychological investigations on the different points of view on the same task, in order to compare them and discuss the construction of (inter)subjective inferences.

As socio-cognitive psychologists, we will focus on inference as particular psychological acts – and in the specific context of the studied task – without discussing the relation between the various theories about inferences and the methodology of analysis we propose. However interesting it may be, it would require another paper to compare the approach of situations of misunderstanding proposed here, and the extensive literature on inferences. Yet, in order to make such relation with the literature on inferences possible, we will now specify which inferences we are working on. We have found inferences at three moments at least, in the process of teaching and learning at school.

2.2 Moments for the investigation of inference processes at school

The first moment where we find inference processes, is when students are reading the instruction for the task, most often transmitted through a written paper or electronic support. Graph or sketches may be included, as it will be the case for the example analysed below. When reading verbal or non-verbal instructions, students are making inferences for constructing her/his "problem representation"

1. This approach takes a fundamentally different theoretical ground than most cognitive science, based on the information processing metaphor which assumes that meaning is contained in the signs, and therefore completely overlooks the diversity of interpretations that may be made by actual interlocutors performing inferences within specific contexts and situations (Weil-Barais, 1993).

(Greeno, 1987). Yet, such "problem representation" is not directly observable, since it is most often reconstructed by researchers in psychology *from* the student's answer, as the frame within which the student is thinking about her answer. Hence, we will rather focus on what Greeno (2006) refers to as "representational practices", i.e. the actual construction of a representation of the question by the student engaged in school practice. For Greeno (2006), representation is treated in a situated approach as "a relation between signs and aspects of situations, resulting from interpretations by people in their activity" (*idem,* p. 86), a "representational practice" (*ibidem*). In conversational pragmatics (Ghiglione & Trognon, 1993), such representational practices are studied as a communicative process, in an interlocutory context, in which specific inferential processes can be investigated. We are interested in studying situations of misunderstanding, particularly because these specific inferences on the meaning of the task may be confused by researchers with unexpected ways of reasoning, lack of domain-specific knowledge, or with the inferences produced at another moment addressed below.

The second moment where a student may make inferences, is during her reasoning for producing the answer, considering she would have understood the task. The mere fact the student engages in a reasoning or not, obviously depends on the task, and is more probable for problem-solving tasks or any tasks relying on domain-specific knowledge previously acquired by the student. These inferences are most often the target of evaluation: When stating that an answer is correct or wrong, teacher often hope to qualify the student's *reasoning*, rather than her interpretation of the task or the quality of her verbal expression, or mere information recording. Yet, these inferences are not directly observable, and are usually investigated indirectly through the communication processes in which other inferences occur.

The third moment where a student is, quite certainly, making inferences is when she produces an answer using language (or other semiotic means such as a sketch, a graph, etc.). Often overlooked in cognitive psychology, the use of semiotic means requires complex reasoning, not only sensori-motor and operative but also deductive, and inferential. In particular, the organization of the discourse relies on inferences about what should be said for the audience to recognize the illocutory intentions, to share the references to designated object, etc. This particular process of construction of a logico-discursive representation is called *schematization* by Grize (1996). The schematization itself, both product and process, can be directly investigated from the written or oral traces laid by the student, notably when following its construction step-by-step. If the inferences made by the student when producing a schematization are never directly observable, the analysis of the construction of the schematization provides clues that allow researchers to disentangle inferences from the three moments defined here.

Inferences involved in students' schematization may be made on what the interlocutor will understand, i.e. the anticipation of the inferences made by the teacher when reading the answer. Such inferences are somehow different in school context, since the answer is actually already known by the teacher. Students may assume the teacher knows what they are phrasing, and therefore neglect to address their message with the careful attention we usually take in the schematization of a content considered as new for the interlocutor. Even when the message is addressed properly, there is a high degree of implicitly shared knowledge (or supposed to be shared) between a teacher and students, since all the time spent together in teaching and learning, officially focuses on the construction of shared knowledge. The usual care taken to address the audience in the communication may, in this context, become somehow artificial. At the other extreme, when students reduce that much their message to provide a single keyword to the teacher, the communication may fail altogether. Hence, the didactic contract is potentially problematic for the efficiency of the communication, "playing tricks" to the usual rules of communication and increasing the chances for misunderstanding. Consequently, teachers frequently ask students – and must insist to get any degree of success in this request – to provide "explanation", "full sentences" or even "arguments" to explicit their answers.

2.3 Points of view

However well-defined and designed a school task may be, it leads to a variety of interpretations, reasoning and, eventually, productions. This issue is overlooked as long as the various points of view are not seriously taken in consideration by human sciences. This is the reason why we argue, here, for a *psychology of points of view*, i.e. the practice of psychology that provides a differentiated description for each of the various actors involved in the situation, minimally. Hence, the three moments distinguished above must be crossed with at least two points of view: The point of view of the teacher, who has her own processes of inference at the three moments, and the point of view of the student, which could of course be multiplied by the number of individuals engaged in learning in this particular situation. Crossing the various points of view with the time consideration of several moments in which inferences are made by the actors on the task, we obtain the set of *momentary points of view* on the task, represented in Table 1 (see below), that is minimally required for a psychology of points of view on the interpretation of a school task. This closer look on points of view led us to introduce a fourth moment, from the point of view of the teacher only.

When the inference processes of the student are evaluated by the teacher, the teacher bases her evaluation on her own inferences in the three moments when

Table 1. The minimal set of momentary points of view to take in consideration for studying inferences processes on a school task

Momentary points of view Actors:	**First moment: Interpreting the question and / or task instructions**	**Second moment: Reasoning, problem solving, etc.**	**Third moment: Schematization of an answer, addressing the teacher or evaluator**	**Fourth moment: Interpreting the student's answer**
– teacher	*expected inferences*	*expected inferences*	*expected inferences*	*hypotheses about inferences (observation)*
– student 1	*hypotheses about inferences (observation)*	*hypotheses about inferences (observation)*	*hypotheses about inferences (observation)*	
– student 2	…	…	…	
– …				

she performed the task – if she did so – or at least on the first moment if she is only reading the question and the correct answer. Yet, when she evaluates, the teacher is not only referring to her own interpretation of the task and reasoning in producing her own answer, she is also making inferences about the inferences of the student, which constitutes a fourth moment in the process: The moment of the evaluation of the student's answer by the teacher. Inferences made at this occasion by teachers in educational practices are often confusing all three previous steps into a single one. These inferences made by teachers (or researchers) are of the type studied in conversational pragmatics, chiefly concerned with the communicative processes, and rely not only on reasoning, domain-specific knowledge, but also heavily on contextual elements, such as the knowledge the teacher has about what she's been teaching or not, about the skill students should have, or even about personal knowledge of the specific student providing an answer. These inferences bring out a specific problem, which is a problem of attribution. Since the student's answer is given as a whole and unique trace for all three moments of inferences distinguished earlier, the teacher should be attributing any unexpected answer to a difference in the inferences made by the student with her own, at the first, second or third moment, in order to evaluate if the inferences made by the student are valid or not. More simply stated, a teacher may attribute to a fallacious reasoning of the student what is only a mistaken inference on the teacher's communicative intent (for more details, see Kohler, 2020a).

In professional practice, teachers most often have nor the time nor the tools to carry any investigation on this question, and simply assume all inferences valid if the answer is correct, and any inference incorrect if the answer is not. Under the constraints of educational practice, the differentiation between a student misinterpreting the task instruction (first moment), a student using fallacious reasoning (second moment) or lacking domain-specific knowledge (second moment), and a student lacking communicative skill to value her answer (third moment), is left aside as a secondary question, or just an ethical issue, with low priority. However, it is precisely what provides the bed for sociological processes such as the reproduction of inequalities of chances (Bourdieu & Passeron, 1970; Bernstein, 1975; Bautier & Rayou, 2009; Rochex & Crinon, 2011).

When the inference processes of students and teachers are studied in research, as it is the case here, a third point of view must be added: The point of view of the researcher. The researcher is also involved in the fourth moment, in making inferences about the inferences made by students and teachers. Considering the complexity raised by taking points of view in consideration, we stress in this paper the importance of a methodological *modus operandi* to support the researcher production of hypotheses about the inferences made by teachers and students. Such *modus operandi* requires an analytical approach which can account for the various actors' points of view, as situated in their context, and cross it with the chosen theoretical perspectives. In this paper, we propose a descriptive approach of the subjective points of view, aiming at a description of the specific inferences made by the student, making hypothesis about its content and moment, in a way that distinguishes unexpected answers due to a failing process of communication – situation of misunderstanding – and unexpected answers due to a lack of knowledge or flawed reasoning.

This focus raises a challenge, both methodological and theoretical: How can we describe subjective inferences about meaning with a precise distinction between situation of misunderstanding and flawed reasoning, lack of knowledge, and other issues?

Although inferences at the three moments we have defined may be addressed as different types of inferences in literature, or may be defined differently, we consider quite obvious, in educational context, that all inferences at all three moments are supposed to match if the student's answer is to be considered valid by the teacher. Hence, in the educational context, the evaluating practice constitutes a very specific scenario in which there is an explicit demand on congruence throughout the interaction. Such demand obviously exists in other contexts, yet the congruence is often assumed without careful verification, or more loosely assessed. Despite this demand, in psychology we are lacking the methodological mean to conduct a careful verification – and in particular to distinguish at which

moment a problem may occur when the student's answer is not satisfying. This is precisely the methodology to which we wish to contribute, by proposing a specific way to use two theories of argumentation in an analysis supporting hypotheses describing precisely at which points a student's answer differs from the expected answer(s).

Moreover, a better understanding of inferences made by students on a school task as both psychological (e.g. social interaction and reasoning) and argumentative processes (e.g. skills at making and interpreting discourse) may contribute to studies on argumentation for at least two points: First, it is a way to bridge argumentation and its cognitive, social and cultural ramifications, and second, it provides a methodological mean to account for all the points of view engaged in an argumentation.

3. Methodology

3.1 A descriptive approach in psychology

Piaget and Inhelder (e.g. 1948; 1966) set an approach which consisted in being interested in the actual reasoning of the child – his own "logic" in Piagetian's terms – independently from any adult-centred judgement about its rationality. The theoretical tools used by Piaget to describe this "logic of the child", i.e. Boole's logic and predicate logic, were not made for it and laid the ground to critique, which misunderstood his scientific project (Apostel et al., 1963). If the theoretical tools were not fitted to the function Piaget made them play, we have reason to think that the perspective itself is not only valuable – in particular for education – but remains a most promising challenge for future research. Indeed, not only the child uses various rationalities, but also any layperson: If formal logic is relevant for computer programming, choosing your menu at the restaurant may indeed require quite a different rationality.

Taking children's' points of view in consideration, provided Inhelder and Piaget (e.g. 1955) the data to show that children's "natural" or "situated" rationality is qualitatively different from the rationality described by formal models, or used by experts among adults. This rationality is not necessarily flawed, and it is precisely one of the most interesting outcome of genetic epistemology, to show that what makes sense for the child, regarding a specific situation, is sometimes quite different from adults and from formal logic, and nevertheless coherent. For instance, children do not always consider contradictions problematic in the sense it would require *a solving* in favour of one of two contradicting standpoints. These standpoints can co-exist in a child's reasoning, at a given point of his develop-

ment, and only lead to further development under specific conditions. Among these conditions, social features of the situation play an important role, as firstly demonstrated experimentally with research on socio-cognitive conflicts (Perret-Clermont, 1979), and later developed as a socio-genetic psychology (Perret-Clermont & Carugati, 2001; Psaltis, Duveen & Perret-Clermont, 2009; Psaltis & Zapiti, 2014). Hence, the relevance of inferences depends not only on formal criteria, but also on the situation and on the actual question or problem reflected upon.

More particularly, our descriptive approach is focused on the discrepancies between the inferences made by the student and the one expected by the teacher or evaluator. This confrontation of two points of views is based on a reconstruction of the student's inferences and the evaluator's inferences by methodological means which are constitutive of a third point of view, the point of view of the researcher (Kohler, 2015). Since the researcher has not participated in the situation as for the student and the evaluator, the methodological means used for the construction of this third person point of view must rely on a detailed analysis that takes into consideration the particular situation and context in which the inferences are made. Such analysis may lead to consider that a failed school task constitutes a situation of misunderstanding rather than the evidence of a lack of knowledge or skills on the student behalf. In this approach, "misunderstanding" is not considered a merely linguistic or pragmatic phenomenon, but a situational configuration at a specific moment in the process of social interaction. We believe the situation to be the most micro level of analysis at which cognitive processes, such as inferences can be analysed while taking into account the context, and subject's point of view. Our researcher third person point of view will be based on chosen perspectives, i.e. models or theory of argumentation, in order to include cultural, historical and social processes which fully contribute to the relevance of students' inferences.

Such a descriptive approach is fitted for specific questions, as for example the ones listed below for this study:

1. What is the relation between the expected interpretations of a school task and the actual interpretations made by students?
2. Is there an argumentative discourse in students' answer that was not anticipated by the evaluators? Does the answer to this question depend on the model of argumentation we have chosen?
3. Do interlocutors need to share the issue for their discourse be considered "argumentative"? Or, to the contrary, may the recognition of students' argumentative discourse through the analysis, provide the mean to establish a situation of misunderstanding?

More specific to educational context, we will address the question wherever a critical discussion is positively evaluated according to the correction guidelines. This research may point out the need for new ways of evaluating school performance, in order to foster critical thinking.

3.2 Data collection and selection

In this paper we will analyse one example of situation of misunderstanding, by the mean of two models from argumentation theory that allow for detailed descriptions of the mismatch between the expected inferences and the actual inferences made by students. The example presents a student's answer in an item of mathematics from the Programme for International Student Assessment ("PISA"), an international survey that aims to assess students' competencies at the end of compulsory school. According to the official purposes announced by its stakeholders, PISA "assess the extent to which 15-year-old students have acquired key knowledge and skills that are essential for full participation in modern societies » (OECD, 2014, p.3). Students participating in this survey answer to items designed by PISA in specific domains (reading, mathematics, and science). Their answers are evaluated according to a coding scheme also established *a priori* by the designers, but unknown from the students. Although PISA surveys still appear as relevant in educational, media, and politics debates, a body of research has open important discussions towards its methodological limits and its pretended relevance for informing about more or less good educational systems and students' competencies (e.g. Bautier, Crinon, Rayou, & Rochex, 2006; Le Hebel, Montpied, & Tiberghien, 2014, 2016; Rochex, 2006; Serder & Jakobsson, 2015, 2016). In this paper, we are not discussing further these aspects. However, these recent discussions around PISA highlight the necessity of a better understanding of what happens during the evaluation, i.e. of students' reasoning processes.

The case that we analyse here is part of a corpus of data collected in an on-going research (Mehmeti, in preparation) conducted in classrooms in French parts of Switzerland. Altogether, the data concern written answers from 15 students aged from 12 to 15 years old in the official mathematical item of PISA called "Robberies" (see Figure 1 below) and two modified versions of it. Four teachers accepted to take part in the study and were asked by the researcher to distribute the item of mathematics to their students and ask them to resolve it. In order to present the activity, the most possible as a usual school task, researcher's presence during the tests was not considered necessary. Thus, the researcher addressed the same demand to all the teachers regarding the introduction to the test; they were invited to introduce the activity by telling the students that a doctoral student in psychology wants to understand how students resolve school tasks and her aim

is not to assess their performances, nor to mark their test, yet to understand how students reason and deal with school tasks.[2] Almost all the teachers followed this instruction, except one who told her students that she wants to help a friend who wants to criticize PISA. First analysis did however not show evidence that this different framing played a crucial role in answers provided by her students in comparison to others, and we will then no further discuss these implications here.

3.3 Procedure for the analyses

The two following analyses aim at describing separately two different points of view on a same task. In the task description provided by the designers, the task should deliberately promote one specific type of reasoning or argumentation. Yet, from various points of view the task can lead to multiple interpretations. The designer's point of view is reconstructed based on the PISA item, on the related comments from the designers, and the evaluation criteria (see Figure 1 and 2 for all these elements). The student's point of view is reconstructed from her written answer. Both points of view are reconstructed with an argumentative analysis which allows a careful description of the various inferences made by the interlocutors, with a focus on inferences that are divergent between the two points of view, if any, in order to identify a situation of misunderstanding. The analyses follow three steps (Kohler, 2020a):

– Firstly, the analyst identifies a critical incident (see for instance: Hughes, Williamson & Lloyd, 2007) in reference to the context, based on general case-study methodology. This first step of the analysis consists in taking into account the designers' pre-established evaluation of what are considered good answers. In the example below, the critical incident is an answer that looks inconsistent with itself (the student replies "yes" and then "no"), and that looks wrong according to the evaluation criteria, yet there is some sort of explicit reasoning that is not so far from the intention of the task. Several reasons can lead to a wrong answer, and a situation of misunderstanding is only one of them. Here, the student's answer is not easily explained by a common mistake. This first step is common to both analyses presented below, since it does not yet rely on an theoretically grounded analysis. The critical incident is

2. We can also add that in order to stay at the closest to the original PISA survey, it was not specified to the students that the item concerned mathematics. Although it is the general principle for PISA items to blend school matters into daily life situations, we did not find any published nor direct source describing the instructions that are given to students tested in the PISA survey by the test's administrators.

only used for raising questions and selecting the case, for showing the interest of a more in-depth investigation.

– Secondly, a detailed examination of the collected data is carried for a micro-genetic analysis (Inhelder, 1962; Inhelder et al., 1992), or for the reconstruction of micro-histories (Tartas, Perret-Clermont & Baucal, 2016) for each point of view. The main feature of this step is to take time into consideration in the analysis, in a way that provides clue on the process of construction of the student's or teacher's answer. This concern with time, as an essential dimension of the process under investigation, directly echoes to the several moments at which inferences are made by the student we discussed earlier. Therefore, this step in the analysis should propose a reconstruction of the process differentiating the various moments at which there are inferences. Such moments are not controlled experimentally. They are chosen after data collection and according to the actual opportunities provided by the course of events and the natural setting. Hypotheses made by the researcher on the student's and teacher's inferences are the result of the analysis and rely here on the argumentation theory used for performing the analysis to identify the specific element(s) from discourses, and more generally from the situation which appears divergent from two (or more) points of view. These hypotheses can lead to either support or drop the hypothesis of a situation of misunderstanding in the case under study.
– Thirdly, a micro-scale analysis with a chosen theory of argumentation provides a description of what the situation of misunderstanding is about, if any, resulting from the confrontation between the points of view as represented by the model(s) used for the analysis.

The analyses presented in the next section add a layer of interpretation to the evaluation by the PISA team, taking the correction guidelines as expected answers in an analysis that compares it with the student's answer. In this practice, the discourse is approached as a process of reasoning through language, as it is in argumentation theory. The result, presented below, is descriptive. Yet, in order to stress the impact of the chosen theory in the description it permits, the two analyses draw from two different theories on the same situation and have been performed independently one from the other, each by one of the authors. The first analysis draws on the pragma-dialectical model proposed by van Eemeren and colleagues (in particular van Eemeren & Grootendorst, 1992, 2004; van Eemeren, Grootendorst, Jackson, & Jacobs, 1993), while the second analysis uses Grize's model of natural logic (Grize, 1996) to provide a micro-scale description of the diverging logico-discursive operations between the expected answers and the stu-

dent's answer. In order to leave you free to start your reading with either analysis, the PISA item and the student's answer are presented first, in the next section.

4. The case

4.1 The PISA item

The official item "Robberies" (see Figure 1) concerns a mathematical problem, in which students are invited to answer to a question around a fictive situation, presenting a journalist who makes a statement on a graph that contains data on the recent increase of robberies. The reference to a journalist commenting a graph we find in this item, comes from a PISA principle in the design for which the skills testing should occur in reference to a "real life context", and not through tasks we only perform at school.

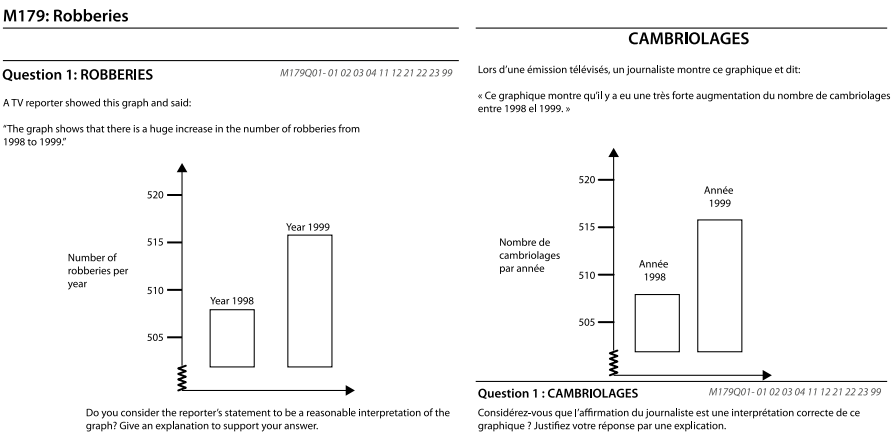
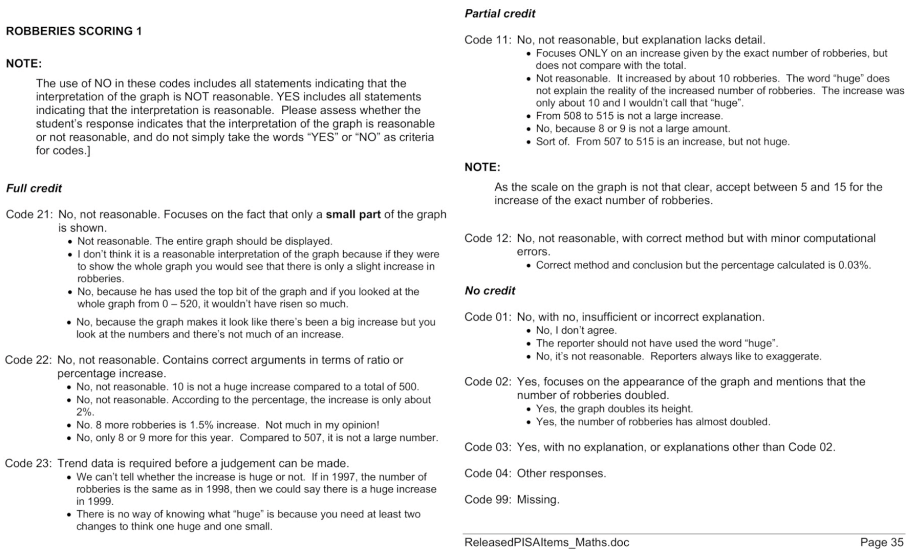


Figure 1. Original PISA item "Robberies", (OECD, 2006, p. 34),[3] with its official French translation

3. Note that in our study, we used the French version of the item (called "Cambriolages"). In the French version (OCDE, 2011), the exact statements are, as translated by us: "During a TV show, a journalist shows this graph and says: "This graph shows that there was a huge increase in the number of robberies, between 1998 and 1999." and the question asked is "Do you consider that the journalist's statement is a correct interpretation of this graph? Justify your answer with an explanation". For writing and reading purposes, we chose to show the English version of the item, but we however suppose that the French and English version could draw to slightly different interpretation as in the English version, it is explicitly required to discuss the "reasonableness" of the reporter's statement, and not its "correctness" (French version).

This item was chosen for two main reasons. First, PISA designers themselves consider it as a particularly difficult item and found an important rate of low achievement in it (OECD, 2009, p.300). Second, and as we will develop in the next section, this item is a case of multiple cognitive demands (Mehmeti, Perret-Clermont & Iannaccone, 2016) addressed to the students. This means that although multiple inferences could co-exist in solving this problem, only some are valued as acceptable by the designers (see the correction guidelines on Figure 2), without clear evidence that these inferences are aligned to the task itself.



ROBBERIES SCORING 1

NOTE:

The use of NO in these codes includes all statements indicating that the interpretation of the graph is NOT reasonable. YES includes all statements indicating that the interpretation is reasonable. Please assess whether the student's response indicates that the interpretation of the graph is reasonable or not reasonable, and do not simply take the words "YES" or "NO" as criteria for codes.]

Full credit

Code 21: No, not reasonable. Focuses on the fact that only a **small part** of the graph is shown.
- Not reasonable. The entire graph should be displayed.
- I don't think it is a reasonable interpretation of the graph because if they were to show the whole graph you would see that there is only a slight increase in robberies.
- No, because he has used the top bit of the graph and if you looked at the whole graph from 0 – 520, it wouldn't have risen so much.
- No, because the graph makes it look like there's been a big increase but you look at the numbers and there's not much of an increase.

Code 22: No, not reasonable. Contains correct arguments in terms of ratio or percentage increase.
- No, not reasonable. 10 is not a huge increase compared to a total of 500.
- No, not reasonable. According to the percentage, the increase is only about 2%.
- No. 8 more robberies is 1.5% increase. Not much in my opinion!
- No, only 8 or 9 more for this year. Compared to 507, it is not a large number.

Code 23: Trend data is required before a judgement can be made.
- We can't tell whether the increase is huge or not. If in 1997, the number of robberies is the same as in 1998, then we could say there is a huge increase in 1999.
- There is no way of knowing what "huge" is because you need at least two changes to think one huge and one small.

Partial credit

Code 11: No, not reasonable, but explanation lacks detail.
- Focuses ONLY on an increase given by the exact number of robberies, but does not compare with the total.
- Not reasonable. It increased by about 10 robberies. The word "huge" does not explain the reality of the increased number of robberies. The increase was only about 10 and I wouldn't call that "huge".
- From 508 to 515 is not a large increase.
- No, because 8 or 9 is not a large amount.
- Sort of. From 507 to 515 is an increase, but not huge.

NOTE:

As the scale on the graph is not that clear, accept between 5 and 15 for the increase of the exact number of robberies.

Code 12: No, not reasonable, with correct method but with minor computational errors.
- Correct method and conclusion but the percentage calculated is 0.03%.

No credit

Code 01: No, with no, insufficient or incorrect explanation.
- No, I don't agree.
- The reporter should not have used the word "huge".
- No, it's not reasonable. Reporters always like to exaggerate.

Code 02: Yes, focuses on the appearance of the graph and mentions that the number of robberies doubled.
- Yes, the graph doubles its height.
- Yes, the number of robberies has almost doubled.

Code 03: Yes, with no explanation, or explanations other than Code 02.

Code 04: Other responses.

Code 99: Missing.

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Figure 2. Coding scheme for the item "Robberies" (OECD, 2006, pp.34–35)

Following PISA discourse on the analysis of this item, this requires from students:

> (...) the analysis of a graph and data interpretation (...) understanding and decoding of a graphical representation in a critical way, making judgements and finding appropriate argumentation based on mathematical thinking and reasoning (although the graph seems to indicate quite a big jump in the number of robberies, the absolute number of increase in robberies is far from dramatic; the reason for this paradox lies is the inappropriate cut in the y-axis) and proper communication of this reasoning process. (OECD, 2004, p.82)

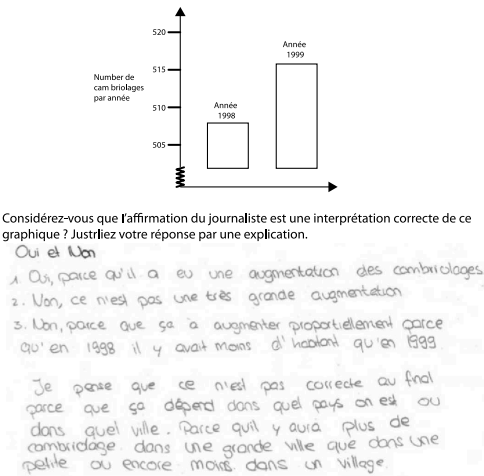
Let us examine how a particular student deals with these objectives.

4.2 A student's answer

Among all the answers provided by students, we present here a student's answer considered as an "extreme case" (Miles & Huberman, 2003, p. 60) of the variety of arguments and issues addressed by students. Indeed, we found in this student's answer many attempts to make the implicit expected inferences explicit, which is of particular interest and not common to most of the students' answers, which generally require from the research to unpack the implicit students' reasoning. This thus echoes to Flyvbjerg's interest on extreme or atypical cases:

> ... atypical or extreme cases often reveal more information because they activate more actors and more basic mechanisms in the situation studied. In addition, from both an understanding-oriented and an action-oriented perspective, it is often more important to clarify the deeper causes behind a given problem and its consequences than to describe the symptoms of the problem and how frequently they occur. (Flyvbjerg, 2006, p. 229, also quoted in 2011, p. 306)

Figure 3 includes the transcription of the students' answer (in French) and its translation.



Translation

Yes and No

1. **Yes, because there has been an increase in the number of robberies.**
2. **No, it is not a huge increase**
3. **No, because it has increased proportionally because in 1998 there were less inhabitants than in 1999.**

I think that finally it is not correct because it depends in which country or which city we are. Because there will be more robberies in a big city than in a small one or even less in a village.

Figure 3. Student's complete answer, with English translation

5. First analysis

5.1 Introduction to the analytical model

Our aim in this section is to show how the use of the pragma-dialectical approach developed by van Eemeren and colleagues offers an important tool for understanding the process of interpretation and production of answers. Thus, our point here is not to present all the model can offer, but rather to show how specific essentials of the model are relevant for our analysis, and already brings much to the understanding of inferences in school context. Before presenting this first analysis, we present the selected essentials from van Eemeren and colleagues' analytical approach.

Firstly, argumentation is approached within a critical discussion, modeled as resolution of conflict between a *protagonist* and an *antagonist*, in which the acceptability of the protagonist's opinion is questioned by the antagonist, leading her to argue for convincing the other (e.g. van Eemeren & Grootendorst, 1992, 2004; van Eemeren, Grootendorst, Jackson, & Jacobs, 1993; van Eemeren, Grootendorst, & Snoeck Henkemans, 2002; van Eemeren, Houtlosser, & Snoeck Henkemans, 2007). This model seems relevant for the chosen PISA item, since students are explicitly required to evaluate the acceptability of the journalist's statement.

Secondly, protagonist and antagonist's impulse in the critical discussion are analysed, in this model, through four components:

1. a *standpoint* they defend, typically a contradictory standpoint for the protagonist and the antagonist;
2. (counter-)*arguments* to move towards or against the standpoints;
3. (implicit) *premises*, such as implicated by the arguments;
4. various *issues*, that may be distinguished when the discussion moves on different topics or subtopics.

Analysing these basic components of the pragma-dialectical model of argumentation may already bring insightful findings, since it tackles both the pragmatic and logic levels of argumentation: "to establish precisely what someone who has advanced argumentation can held to if the argumentative is analysed as a critical discussion, an analysis must be carried out both at a pragmatic and at a logic level" (van Eemeren & Grootendorst, 1992, p. 60). The authors stress the relevance of logical analysis for reconstructing the implicit: "if in the argumentation, parts of the arguments are implicit, then a logical analysis is indispensable" (*ibidem*). This is particularly relevant in cases where the interlocutors' statements are assessed only on their explicit answers (e.g. in written tests at school). Indeed, it has the

potential to reveal the interlocutors' reasoning which, in turn, allows to identify whether it follows the expected reasoning or not. In the argumentation model, such analysis of the implicit is mostly leading to formulate unexpressed premises (van Eemeren & Grootendorst, 1992; van Eemeren et al., 2002; Gerritsen, 2001).

In order to analyse standpoints and arguments, the pragma-dialectical model proposes four stages of an "ideal argumentative discussion" (e.g. van Eemeren et al., 1993, p. 26).[4] The reconstruction of these stages should allow "(1) identifying disagreements (2) establishing agreements between two parties as to the means by which the disagreement will be settled (3) providing for indefinite exploration of the merits of the competing positions, as needed, and (4) ending with either a resolution of the disagreement or a mutual recognition that no agreement is (currently) attainable" (*ibidem*). Here is a summary of these four stages:

1. The "confrontation stage" (*idem*, p. 26), where the disagreement is identified;
2. The "opening stage" (*idem*, pp. 26–27), where the parties seek for the common ground they share for the sake of a resolution-oriented discussion;
3. The "argumentation stage" (*idem*, p. 27), where argumentation is advanced by a protagonist and questioned by the antagonist, leading to the productions of more or less complex argumentation;
4. The "concluding stage" (*idem*, pp. 27–28), where we observe the result of the discussion, and wherever it has come to a resolution or not, or to a mutual agreement that no resolution is possible (van Eemeren et al.,1993; van Eemeren & Grootendorst, 2004).

In addition, the model lies on the reconstruction of the "process of resolving a difference of opinion occurring in an argumentative discourse or text" (van Eemeren & Grottendorst, 2004, p. 95). All elements – discursive, argumentative moves, speech acts – are taken into account (*idem*, pp. 95–96). This reconstructive approach aims at producing an analytic overview of the resolution of conflict or difference of opinion (*idem*, p. 96). More specifically to our purpose in this paper, the reconstruction of the process of resolving difference will allow us through the analysis to stress inferences made by the student for adopting a standpoint, bringing an argument forth, identifying the issues, etc. and to stress the difference in the way all this is done by the student in comparison to the evaluator's point of view. This model allows to describe the structure of the argumentation put forward by each party, as well as the argument schemes used in the individual arguments (*idem*, p. 118).

4. See also the following references that we also mobilised but decided not to quote in the text in order to preserve its fluidity: van Eemeren & Grootendorst, 1992, pp. 34–35; van Eemeren et al., 1993, pp. 26–28; van Eemeren & Grootendorst, 2004, pp. 59–62; van Eemeren et al., 2007, pp. 10–12.

The following section will present the reconstruction of both PISA designers' point of view and student's point of view. By doing so, we will more particularly be interested in both the opening stage and argumentative stage, since the critical discussion is truncated in the case of a PISA item: There are no "opening stage" nor "concluding stage", since the dialogical adjustment taking place in oral verbal interaction are not available here. The interaction is reduced to three minimal speech turns, and yet asynchronous: Handing over the question (the written item), producing an answer (for the student), and evaluating the student's answer according to the coding scheme (for the evaluator). In such a situation, it cannot be taken for granted that the issue raised from the point of view of PISA designers and evaluators is indeed taken as a starting point for the student's argumentation. Thus, this analysis will pay a particular attention to the diversity of issues.

In the work of van Eemeren and colleagues the concept of issue implies "determining the propositions with respect to which standpoints are adopted and called into question" (van Eemeren et al., 1993, p. 60). Even if the concept of "issue" is therefore present in the pragma-dialectical model, there is a growing interest on deepening this concept in various field such as public debates (Greco & de Cock, 2021), everyday family interactions (Schär & Greco, 2018; Schär, 2018, 2021), and in learning, development, and school-situations (Greco, Miserez-Caperos, & Perret-Clermont, 2015; Greco, Mehmeti, & Perret-Clermont, 2017; Greco, Perret-Clermont, Iannaccone, Rocci, Convertini, & Schär, 2018; Mehmeti & Perret-Clermont, 2016). As highlighted in previous works (see Greco et al., 2017; Schär, 2018; Schär, 2021), we find two interesting perspectives on the concept of issue, that can be relevant for analysing students' and children's argumentative contributions. Indeed, as we have chosen to understand what the students take as starting point to bring out their standpoint – which "propositions" to recall to the pragma-dialectical model – we are interested in understanding *what* the students argue *about*. Thus, on the one side, we mobilise Goodwin's (2002) definition: "the issues, in sum, are what the trial is supposed to be *about*" (p. 81). She goes on further by defining issues as "a more or less determinate object of contention that is, under the circumstances, worth arguing about" (*idem*, p. 86). On the other side, Plantin's (2005) dialogical approach sees the "typical argumentative discussion as defined by the development and the confrontation of opposing viewpoints in response to one and the same question" (p. 53). Schär (2021) makes a review of the different definitions of issues in argumentation studies, and interestingly sums up her understanding of the concept of *issue* as follow:

> the issue is a question around which a discussion revolves (and) allows for a broader range of answers that are not constricted to a positive or negative dichotomy. It is important to keep in mind, however, that even though the issue

> is being discussed among the interlocutors, it may not always be entirely shared among them (…). (*idem*, p. 24)

In order to analyse issues, we will observe wherever the arguments are still addressing the same issue, from the PISA item designers and evaluator, on one side, and from the student, on the other side. Although a shift in the issue is generally considered as a constitutive part of the process of defending a standpoint, in this particular context where no opening stage allow to clearly frame the debate, a change of issue may also indicate a *situation of misunderstanding* (Kohler, 2020a). When the student is adopting an issue different from expected – or even several issues –, it may not be a conscious argumentative move to support her antagonist standpoint, but may rather indicate her difficulty in making inferences on the meaning of the question addressed to her by the PISA item (inference at the first moment). In this case, the diversity of issues may reveal a situation of misunderstanding, rather than an argumentative strategy.

5.2 Evaluator's point of view

We start by presenting our argumentative analysis of the designers' coding scheme for students' answers (see Figures 2 above), before confronting it to the analysis of the student's answer. First, if we observe what PISA designers consider as an answer allowing to get full points, we may observe that they privilege students' answers that explicitly use arithmetical and geometrical models, or refers to incomplete data. Students who do not use such models are considered as failing the item.

A first important point to observe in the coding scheme for full points (called credits in the PISA survey) is that the student must answer by "no", and then different arguments are considered as valid.

Thus, according to the

- code 21, arguments must consider that only a limited part of the graph is presented;
- code 22, arguments must be in terms of ratio or percentage increase;
- code 23, arguments must highlight that trend data is required before a judgment can be made.

The analysis of all expected issues, standpoints and arguments from the coding scheme, show that different issues, standpoints and arguments are raised, of which some are valued and others considered "wrong". Table 2 (see below) provides an overall view of this reconstruction.

Table 2. Issues, standpoints, arguments and premises reconstructed from the coding scheme

Credit (value) and codes	Issues	Arguments	Unexpressed premises
Full credit code 21	I_1: Is the interpretation of the TV journalist correct?	S*: No $A_{E.21}$**: Only a part of the graph is visible	$P_{E.21}$***: A graph should display x and y axis from the 0 value.
Full credit code 22 (or partial credit if partial or calculation error, code 12)	I_1: Is the interpretation of the TV journalist correct?	S: No $A_{E.22}$: insufficient increase percentage or ratio	$P_{E.22}$: A certain amount of percentage is required for stating "a huge increase".
Partial credit code 11	I_1: Is the interpretation of the TV journalist correct?	S: No $A_{E.11}$: [5–15] robberies is not a "huge increase"	$P_{E.11}$: A certain amount of robberies is required for stating "a huge increase".
No credit Codes 01	I_1: Is the interpretation of the TV journalist correct?	S: No $A_{E.01}$: The reporter should not have used the word "huge"	$P_{E.01/03}$: The evaluation of the journalist's statement does not need to take into account the graph, ratio or lack of data.
No credit Code 03	I_1: Is the interpretation of the TV journalist correct?	S: Yes $A_{E.03}$: none or any	$P_{E.01/03}$: The evaluation of the journalist's statement does not need to take into account the graph, ratio or lack of data.
Full code 23	I_2:. Can we know?	S: Yes $A_{E.23}$: We need trend data in order to make a judgment	$P_{E.23}$: Trend data over more years is required for stating "a huge increase".
No credit Code 02	I_3: Is the graph representing a huge increase of robberies, between 1998 and 1999?	S: Yes. $A_{E.02}$: The number of robberies doubled	$P_{E.02}$: I can compare the plots visually represented on the graph.
No credit Codes 04 or 99	none or any		

* S= Standpoint ** A = Arguments *** P=Premise

As shown in Table 2, codes include one main issue, namely "is the interpretation of the TV journalist correct" (I_1), addressed for scoring the full credit, partial credit and no credit. Codes scoring full credit include an additional issue, namely "Can we know?" (I_2), which ensure the validation whatever the arguments. Codes scoring partial credit include no specific issue. Codes for scoring no credits include a third expected issue, namely "Is the graph representing a huge increase of robberies, between 1998 and 1999?" (I_3). For the main issue, a variety of arguments is exemplified or detailed in the score coding scheme, in order to make the difference for the scoring. Notably, full credit is granted when arguments state that the graph is missing to show some part, or that the "ratio or percentage increase", and trend data are insufficient.

Two interesting observations can thus be highlighted here:

1. Students' answers are granted no credits when no argument is provided, even if the issue is correctly inferred, and more specifically arguments must relate to the graph or missing data.
2. The reconstruction of arguments validated for full credit allowed the reconstruction of two unexpressed premises concerning the norms of graph presentation and the data necessary for stating a "huge increase" ($P_{E.21}$ and $P_{E.22}$), completed with unexpressed premises functioning as negative criteria or "critical flaw" in students' answers ($P_{E.01/03}$ and $P_{E.02}$).

Also, taking the standpoint "Yes" to the issue "Is the graph representing a huge increase of robberies, between 1998 and 1999?" is seen as an error because the student is somehow trapped by the visual aspect of the graph, drawn to mislead.

What emerges from the contrast of both "full credit" and "no credit" coding schemes, is the inferences (second moment) students must make in reference to norms ruling the construction and presentation of a graph. Such inferences require from students to decontextualize the symbolic scenario proposed in the task itself, focused on a journalist commenting a graph, all the more so as media often disrespect the norms we identified as unexpressed premises. Interestingly, expected answers to which no credit is granted, nevertheless share correct inferences (first moment) about the issue, and some other logical aspects underlying the arguments proposed for the full credit coding.

The pragma-dialectical model of argumentation allowed us to observe multiple difficulties, when modelling the PISA evaluation as a critical discussion. First, as the task consists in an asynchronous written test, the opening and concluding stage of the critical discussion are missing. Yet, the coding scheme seems to take for granted that students succeed in the opening stage: The issues expected for wrong answers are the same as for successful answers. The concluding stage is

one-sided (monological), since the evaluator cannot adjust her/his interpretation by addressing further questions to the student. In addition, the coding scheme does not provide specific guidelines for the evaluator inferences (fourth moment) on alternative issues to the expected ones: Code 99 ("other response") regroups all unexpected issues. The model stresses the importance of this point, since what is identified as the object of disagreement (the *issue*) play an important role in the ensuing argumentation, and in this case in the evaluation of students' performances.

Therefore, we observed that identifying the good issue and developing a logical reasoning do not ensure students to provide the valued argumentation, which rather relies on unexpressed premises. This invites us to highlight the interest of considering further the hypothesis that although students are invited to "justify" their answer with "an explanation" (arguments), students may encounter difficulties in identifying their role in the critical discussion.

In the evaluator's point of view, the role of protagonist is attributed to the journalist, and the role of antagonist falls to the student. Yet, students are expected to rely on norms about how to draw and present a graph, despite TV real practices. For instance, should the journalist not be considered an authority for applying such norms? Students may also encounter difficulties on identifying the issue at stake: Is the main point the increase of robberies, the way the journalist is doing is job, or the graph and available data? Thus, we can make the hypothesis that the task itself requires important efforts on the students' side to infer (first moment) what is the issue, which standpoint may be considered correct, and which arguments should be provided to support it.

We will now turn to the analysis of a students' answer, and analyse the issues addressed by the student, the underlying arguments and unexpressed premises.

5.3 Student's point of view

In the student's answer presented in Figure 3 (see above), we can observe that the student both approves and disapproves the journalist's interpretation ("yes and no"), at first. She goes on by providing arguments about the increase of robberies, its qualification as "huge" and about a more contextual issue: The increase of inhabitants. She concludes that the journalist's interpretation is not correct, providing the following explanation:

– "It depends on which country or city one is. Because there will be more robberies in a big city than in a small one or even less in a village".

As the analysis of the evaluator's point of view revealed, one of the unexpressed premises ($P_{E.23}$) states that the there are missing trend data (code 23). We observed

in a majority of students' answers that part of this premise is often shared by students, but instead on referring of the lack of trend data, the missing information on the graph or the weak ratio of the increase, students make an issue out of what remains a premise for the evaluator, providing unexpected arguments which are not in the coding scheme. Such arguments often integrate additional information or premises to the ones available in the task's instruction. The case chosen for the analysis below, is one of these answers: The student introduces the number of inhabitants to the discussion.

Table 3 (see below) provides the standpoints, issues, arguments and unexpressed premises reconstructed for the analysis. The numbering of the various issues continues Table 2 numbering, in order to use the abbreviation (e.g. "I_1") as univocal references in the commentary. Codes corresponding to standpoints and arguments are mentioned, based on the coding scheme and yet attributed by the researchers, since the official evaluation of the student's answer is not available in research data.

Table 3. Reconstruction of students' issues, arguments and implicit premises (English translation by the authors)

Issues	Standpoints and arguments	Unexpressed premises	Corresponding credits and codes
(I_4) Is there an increase in the number of robberies, between 1998 and 1999?	**$S_{4.1}$:** Yes. $A_{S.4}$: There has been an increase in the number of robberies	$P_{S.4}$: The graph shows there are more robberies in 1999 than in 1998	Code 03
(I_5) Can the increase in the number of robberies, between 1998 and 1999, be considered as a **huge increase?**	**$S_{5.1}$:** No $A_{S.5}$: The increase is not huge	$P_{S.5}$: The quality "huge" is incorrect	Code 01
(I_6) Has the number of robberies increased proportionally to the number of inhabitants?	**$S_{6.1}$:** No $A_{S.6a}$: It has increased proportionally $A_{S.6b}$: Because in 1998 there were less inhabitants than in 1999	$P_{S.6}$: The question of proportionality depends on the proportion of the increase of inhabitants between 1998 and 1999	Code 01 or Code 22

Table 3. *(continued)*

Issues	Standpoints and arguments	Unexpressed premises	Corresponding credits and codes
(I_1) Is the journalist's interpretation correct?	$S_{1.1}$: No $As._{1.}$: It depends in which country or city we are $As._{1.1}$: There will be more robberies in a big city than in a small one or even less in a village	$P_{S.1}$: Since we don't know where the robberies happened, it is wrong.	Code 01

As we can notice in the analytical overview of the student's argumentation, she has difficulties in taking a clear standpoint, but assumes this difficulty and makes it explicit by adopting first both standpoints (yes and no), and then by providing arguments for both, one after another with numbered points, and concluding with a final standpoint.

The reconstruction of the issues, standpoints and unexpressed premises allows to observe that, the student infers (first moment) correctly the general issue of the PISA item, that is "Is the journalist's interpretation correct?" (I_1). Despite this general understanding of the question, she writes an unexpected answer in which she argues for multiple standpoints. Her argument for her standpoint "Yes", namely that "there has been an increase", differentiate the main issue into two: One about the increase (I_4), and the other about this increase being "huge" (I_5). If we follow the evaluators' coding scheme on this part of her answer, the code 03 ("Yes, with no explanation, or explanations other than code 02") would probably be attributed. However, the student brings the second differentiated issue (I_5) on which she takes the opposite standpoint: "No, the increase is not huge". Corresponding to the expected answer, this part would nevertheless be attributed no credit (code 01), since the argument does not explicitly refer to the graph nor to missing trend data.

A third issue appears (I_6), focused on the proportionality of the increase. While the coding scheme expects a proportionality in reference to the total number of robberies, the student refers here to the number of inhabitants, providing two coordinated arguments:"it has increased proportionally" and "in 1998 there were less inhabitants than in 1999". This explanation by the student is close to an important issue raised in the coding scheme for full credit (see Figure 1: "we cannot tell wherever the increase is huge or not", code 23), to which the argument

is "We need trend data in order to make a judgment". However, the premises of the student' arguments show that the proportionality she refers to is not about the available numbers on the task and in the graph *per se*, but appeals to extra information, that is the increase of inhabitants between 1998 and 1999. Moreover, the student does not argue data is missing in order to take a standpoint: She states "no" in reference to the unknown number of inhabitants. Thus, although these arguments seem logically close to what is expected in answers getting the code 22 (full credit), the coding scheme proposed in PISA would probably rather lead to attributing a code 01 (no credit) for this part of her argumentation.

Finally, the student concludes in the same vein, taking a standpoint against the journalist's statement on the main issue (I_6), arguing that "it depends in which country or which city we are" and "because there will be more robberies in a big city than in a small one or even less in a village". Here again, the student infers that missing information should be considered (as expected for the full credit), yet she takes a standpoint in the critical discussion instead of moving it to the issue "Can we know?" (I_2).

5.4 Conclusion of the first analysis

The comparison of the student's argumentation with the expected argumentation based on the evaluators' coding scheme, show that this particular student would probably have failed in the PISA item. Yet, if the student's answers did not provide the expected arguments related to norms of usage of graphs, she shares the premise of a lack of trend data, somehow. The pragma-dialectical model allowed us to show that the difficulties the student encounters, are specifically related to the truncated critical discussion, and more particularly to the role she is expected to play in it. Confused, the student tries to make the whole critical discussion alone, playing both the protagonist and the antagonist in her answer. Obviously, such task is too difficult for her, notably because of the lack of data available. In this sense, we can hypothesize that both the type of activity (an asynchronous written test) and the symbolic and narrative elements introducing the task (the story about the journalist) contribute to blur the students' inferences about her role when answering, despite an accurate identification of the main issue addressed by the PISA item. Thus, we have observed that identifying the issue does not ensure students to provide the arguments expected by the evaluator for full scoring, on one hand, while the difficulty encountered by the student is nevertheless related to the inferences on the argumentative situation, and not necessarily a lack of domain-specific knowledge (norms about graphs in mathematics, in this case). Moreover, the specificity of the pragma-dialectical model of argumentation, is in this case to stress the effort required from the student for replacing

the opening and concluding stages of a critical discussion. As we observed in the extract of a student's answer, these efforts may lead her to make explicit all possible standpoints – a task far too complex – and eventually leads her to support a standpoint considered wrong by the coding scheme, despite addressing interesting and relevant issues.

According to the perspective of this model, the hypothesis of a situation of misunderstanding is supported by the multiple standpoints, issues and arguments addressed by the student, who even proposes a synthesis, as in the French tradition of *dissertation*,[5] while the PISA item designers only expected the student to point out the missing information on the graph. The move of specific elements of the critical discussion (e.g. from a premise to an issue), as it is unexpected by the coding scheme, also contributes to undervalue the student's answer.

6. Second analysis

6.1 Introduction to the analytical model

In this analysis, the interlocutors inferences will be described with logico-discursive operations (Grize, 1996), which are theoretically defined in the Piagetian tradition: Taking distance with Piaget's attempt to define *implication* (Piaget & Garcia, 1987) as a concept analogue to *causality*, Grize's natural logic offers a complement to genetic epistemology with a set of concrete operations, yet operating on discourse rather than on physical objects. Logico-discursive operations are actions performed by the subject producing or interpreting discourse, and in the same time there are transformations of *objects of discourse* or of a *schematization*. While the actual thinking processes of the subject are to ever remain out of reach of direct observation, the set of operations of natural logic allows to describe the progressive construction of a discursive representation – a *schematization* – with a detailed model of logico-discursive operations, functioning like a meta-language for analysing and commenting the various interpretations of a discourse by several interlocutors. This meta-language allows to make hypotheses about the cognitive activity of the interlocutors engaged in the construction of a schematization, or in the reconstruction for understanding it. The precision and descriptiveness of this meta-language is particularly interesting for studying misunderstanding.

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5. In French speaking schools, there is a tradition in composing essay in three steps, inspired from dialectical logic, starting with a *thesis*, followed by an *anti-thesis* and concluding with a *synthesis* which hopefully goes beyond the contradiction previously stressed by the author.

The logico-discursive operations are concrete operations transforming objects of discourse (Grize, 1996).[6] Objects of discourse are introduced to deal with the content, the meaning, and are theorised as mereological classes, written in between curved bracket (e.g. {house}), which can be infinitely enriched with various operations (e.g. {house} → {house, villa}). Yet, these operations are also irreversible actions: What has been said is said. This particularity is typical of concrete operations in Piaget's theory of knowledge: Any concrete operation is both an action (i.e. pouring the liquid into a glass), irreversible as such, and a reversible transformation in relation to an invariant (the volume remains despite the various shapes of the glasses in which the liquid is poured). This last aspect of the operation introduces a certain degree of logical organization,[7] and Grize's logico-discursive operations are playing this role in the making of a schematization: The invariant is the meaning interlocutors are meant to infer from the action of choosing words, transforming them over the course of the interaction, and building a structure of relations between them.

Natural logic may thus be particularly useful for the description of potential divergence between various points of view, as realized in discourse. Since each operation is analysed and presented in relation to the specific content of the various interlocutors' discourse, and to the situation of interlocution, it may support analysis of what the situation of misunderstanding is about. This description allows to state the difference in meaning from various points of view, with the concepts and language of natural logic. These statements remain just hypotheses of the researcher (from a third-person point of view), yet the overall examination of the context, situation, and discourse at a micro-scale, may greatly support its plausibility. When accepted, hypotheses work both as a description of the logico-discursive activity of the interlocutors, and as a scientific argument for the researcher's interpretation of the situation under study, for instance argument to consider it is 'a situation of misunderstanding'. Moreover, depending on the context, such description can support comments concerning what is at stake, as for instance educational concerns about what students have learned, wherever the question was an interesting one to ask, etc. For instance, in the example below, the

6. Van Eemeren et al. (2014) proposes two different translations for the French *objet de discours*: "discourse entities" and "discourse referents". Grize first uses "objects of thought" (in French "objets de pensée"), which witnesses the focus of the concept on the meaning and content – and which is even more difficult to translate into English.

7. "Logic" is referring here to the *operational logic* of Piaget; see, for instance, how Piaget (1937/1967) demonstrates the relation between the property of mathematics (e.g. *associativity*) and the general system made of concrete operations of a child moving back and forth in a garden.

acceptance of the analysis supports comments on potential obstacles to evaluate with the PISA item, the actual skills in mathematics the students have.

6.2 Evaluator's point of view

The first discourse to analyse in order to confront the evaluator's and the student's points of view is the question addressed by the PISA item. Operations are transcribed in natural logic, with a Greek letter referring to a type of operation, and with a subscript number for naming each operation singularly. The question introduces several new objects of discourse, out of non-discursive referents, which are referred to in natural logic with something written in between bars, as a |PRIMITIVE NOTION|:

- α_1: |GRAPH| → {this graph}
- α_2: |COMPARISON OF THE TWO PLOTS| → {huge increase of robberies between 1998 and 1999}
- α_3: |...| → {journalist's statement}
- α_4: |...| → {correct interpretation of this graph}
- α_5: |...| → {answer}
- α_6: |...| → {explanation}

These α operations transform the schematization by introducing new elements, e.g. from the graph drawn on the PISA item sheet (written above "|GRAPH|"), or from general cultural knowledge (unspecified and written above "|...| "). In the PISA item, task designers also operate a *determination*,[8] which is later refer to as "the journalist's statement":

- δ_1: {this graph}, {huge increase of robberies between 1998 and 1999}, ±show → (-, that this graph shows a huge increase of robberies between 1998 and 1999)

The relevant interpretation of these logico-discursive operations is a prerequisite to the understanding of the task. Yet, it is not yet what the question is about. The question is about the locutor commitment[9] ("Do you consider that...") to this determination (δ_1), henceforth referred to with the word-class {journalist's statement}. More precisely, students are invited to put (or not) the determination

8. Unlike the concept of *proposition*, Grize's concept of *determination* has a contextualized meaning and cannot take part in truth values calculations, such as used in predicate logic.

9. In French, "prise en charge", which is an operation (σ), yet about the relation of the subject with the discourse (a logic of the subject rather than a logic of the object in the Piagetian theory).

(δ_1) into the category of {correct interpretation of this graph}. Hence, whoever answers "yes" to this question implicitly[10] perform at least two operations:

- ρ_1: {journalist's statement} → {journalist's statement, correct interpretation of this graph}
- σ_1: ... → <u>you [the student], consider</u> {journalist's statement, correct interpretation of this graph}

Do the evaluation criteria require specifically a "yes" or a "no" to the question? While the "yes" leads to "no credit", the answer "no" does not necessarily allow credits from the evaluator. Full or partial credit depend on the explanation produced by the student.

The evaluation criteria allow the full credit with three explanations (codes 21, 22 and 23), and a partial credit to a student's answer with the same explanations yet when "insufficiently detailed" or containing any "calculation mistake". To reconstruct the evaluator's point of view on the good answer, we will then limit ourselves to the analysis of the codes 21, 22 and 23.

Code 21 introduces a new object of discourse from the reading of the graph, which correspond to the following operation:

- α_n: |graph| → {limited part of the graph}

The introduction of this object of discourse is grounded on two inferences: One made when reading the task instruction (first moment), which is to infer that the graph is cut notably from the zigzag line or from reading the value of the y axis, and one made when reasoning (second moment) wherever the graph actually shows "a huge increase of the number of robberies between 1998 and 1999". More particularly, this second inference tackle the normative knowledge of the student reading the graph, the inference being grounded on a general rule that graphs should be presented completely.

Code 22 introduces a more general object of discourse (a domain, or category), in which the evaluator could categorize the student's answer (with an operation ρ):

- α_n: |...| → {correct arguments in terms of ratio or increasing percentage}
- ρ_n: {...} → {..., correct arguments in terms of ratio or increasing percentage}

The introduction of this object of discourse, and the expected operation (ρ) transforming the object by a categorisation, rely here on several inferences, some made

10. Due to the pragmatic rules and the effect of a question on the locutors, this part of the analysis does not rest on Grize's natural logic but is an adaptation of his model to the analysis of dialogical verbal interactions.

on the numbers of robberies indicated on the y axis (first moment), and others related to a proportional reasoning about the ratio between the total number of robberies (approximatively five hundred) and the difference over one year (approximatively height). Moreover, the phrasing of such proportionally reasoning (or its result) being particularly challenging, the evaluation criteria deals with a diversity of examples about the actual verbalization of this solution. Despite the openness of the phrasing itself, this is a clue that specific inferences are expected from students when expressing their answer (at the third moment).

Code 23 is particularly interesting since it accepts any answer in terms of "yes" or "no", focusing on an explanation pointing out the lack of information. Such explanation should nevertheless contain, from the evaluator's point of view, a specific object of discourse, such as:

– α_n: |...| → {tendency over time}

Since this object precisely refers to what is missing in the graph, the expected inference here is grounded on knowledge of the requirements for a statement such as the journalist's statement and on some normative knowledge about graphs in general, notably that it should not be truncated (an inference expected at the second moment). What is missing on the graph also requires external information, for example the fact the x axis displays only two years, which is insufficient to make any statement about increase or decrease of any statistics on robberies.

According to PISA evaluation, any explanation that would not be similar to these three must be considered not valid from the evaluator's point of view, and attributed no credit. Some partially similar, yet incomplete explanation of these three types can be attributed a partial credit.

6.3 Student's point of view

The student answers both "yes", and then twice "no", providing each time a supporting sentence. Finally, she writes some concluding paragraph which considers that the journalist's statement is not correct. Looking only at the answer itself – "yes" or "no" – the student's schematization seems rather congruent with the answer expected by the evaluator.

Yet, when looking at the explanations, these are not using the logico-discursive objects and operations expected in the description of codes 21, 22 and 23. The word-class {limited part of the graph} is not in the student's schematization, neither any word-class that could be associated with {correct arguments in terms of ratio or increasing percentage} (code 22). Finally, the lack of required information on the x axis is not pointed out, neither (code 23).

Instead, the student's schematization proceeds first from an ambiguity in the task, operating a distinction between {increase of robberies} and {huge increase of robberies}. The relevance of this differentiation between two word-class can be stressed by a analysis, in natural logic, of the implicit logico-discursive operation making the move from the statement "this graph shows that there have been a huge increase of the number of robberies between 1998 to 1999" to the question wherever the "journalist's statement" is "a correct interpretation of the graph" or not: Two different operations could be reconstructed by the student when interpreting the recall "the journalist's statement":

- ω_a: (-, that this graph shows a huge increase of robberies between 1998 and 1999) → {journalist's statement}
- ω_b: (-, that this graph shows an increase of robberies between 1998 and 1999) → {journalist's statement}

Said more simply, the importance of the adjective "huge" ("très forte" in French) within the evaluation of the {journalist's statement}, is ambiguous, from the point of view of the student. Does the question focus on "huge" or on "increase"? Given the evaluator's point of view, in particular in the schematization under code 22, the ambiguity raised by the student is relevant, since an explanation based on stressing that the ratio of the increase is not that big is accepted for full credit. Hence, in the point of view of the evaluator, the question actually focuses on "huge", in favour of the hypothesis of an operation ω_a rather than ω_b.

The first two student's answers (points 1 and 2 on her sheet) clearly indicates that the difficulty, from the student's point of view, is here to make the right inferences about the meaning of the task (inferences at the first moment). Confronted with two options, the student strategically proposes two different answers (once "yes", once "no") depending on which of the two interpretations matches the evaluator's point of view. In doing so, the student probably hopes to avoid taking the risk to make the wrong choice by solving the ambiguity. Yet, since the coding scheme does not allow credit on conditional answers, proposing various interpretation of the item turns out an unsuccessful strategy.

The third answer of the student introduces a completely new object of discourse:

- α_7: |...| → {inhabitants}

She also introduces a new determination:

- δ_2: {1998}, {1999}, {inhabitants} → (-, that in 1998 there was less inhabitants than in 1999)

If this is close to the expected answer schematized under code 22, the ratio the student refers to is not between the difference in the number of robberies between 1998 and 1999 and the total number of robberies (i.e. about five hundreds), but between the difference in the number of robberies between 1998 and 1999 and the difference in the number of inhabitants between 1998 and 1999. The student introduces a modulation to the predicate ±increase, which is an operation μ in natural logic:

– μ_1: ±increase → ±increase proportionally

Since there is no mention of "inhabitants" on the task instruction, neither in the discourse neither in the graph, we can make the hypothesis that the student operates α_7 and δ_2 from her own reasoning and knowledge (second moment), yet the knowledge used is not quite the one expected by the evaluator, i.e. normative knowledge about graphs, but somehow broader and more contextual.

The conclusive part of the student's answer provides an explanation that continues in the same vein, building on δ_2 for developing her schematization. The student introduces new objects of discourse in the schematization:

– α_8: |...| → {country}
– α_9: |...| → {city}
– γ_1: {city} → {big city}
– γ_2: {city} → {small city}
– α_{10}: |...| → {village}

In her conclusive part, the student schematizes an open answer, making her answer depend on a *ratio* between the number of robberies and the total number of inhabitants, which seems to be a way of pointing at a missing information in the task instructions: The place in which statistics have been presented, and in particular the number of inhabitants, is not provided by the PISA item.

Looking at the logical configuration of the student's schematization, we cannot ignore the analogical structure it takes in comparison with the expected answer schematized under code 23: The student points out, in her schematization, missing information in a very similar fashion as it is expected for the lack of data on the x axis of the graph. Only, the expected explanations did not require these particular objects of discourse the student is focusing on (namely {inhabitants}). The expected answer solely uses objects of discourse actually presented in the task instruction discourse and graph, while the student introduces objects of discourse from her own knowledge of the world and about which there is absolutely no mention in the task instruction. Yet, the expected answer requires normative knowledge about graphs and what should be presented, which is not explicitly

addressed in discourse as it would be with a question such as "Is the presentation of the graph compliant with standards?" The student has to infer the importance of such standards from the mere mention of {correct interpretation of this graph}. More simply stated, the student's answer is performing the expected reasoning, since she raises an issue of proportionality (code 22), and points at the lack of information (code 23), yet with another object of discourse (the {number of inhabitants}) than expected.

6.4 Conclusion of the second analysis

Two remarks can be made on the "mistake" made by the student in this case.

Firstly, the introduction of objects of discourse – and all the potential new combinations and logical configurations it brings into the task – illustrates a property of schematization stressed by Grize (1996): A schematization constitutes an open-system, and ever remain opens in the sense that any locutor participating in its construction may introduce new elements any time, which potentially modifies the meaning previously elaborated by operating on it retrospectively. If a locutor introducing a {house} in his schematization later refers to it as a {villa}, the meaning of the first {house} is now transformed into {house, villa}, which provides a qualitatively different representation of the object.

Secondly, the strict limitation to objects of discourse present on the instruction sheet (verbally or on the graph) for the evaluator's point of view on the right answer illustrates a particularity of the contract of communication in the educational context: In order to allow the evaluator to evaluate the student's inference of the second moment – i.e. her knowledge and reasoning skills – the students is meant to restrict her thinking to the objects of discourse provided in the schematization made by the PISA designers. Introducing new objects of discourse such as {inhabitants} somehow brakes the educational contract. There is here an asymmetry in the rights, in the contract of communication: Only teachers (or task designers) are allowed to introduce new objects into the (supposed to be shared) schematization. Yet, since PISA items tend to situate the questions addressed to students in "real life context", and since the expectations of the contract of communication remains totally implicit, it is not so simple for students to infer it (inference of the first moment). Moreover, the coding scheme accept external knowledge when it comes to graph standards. Only, this external knowledge is at the initiative of the task designers, or "teachers".

As a result, the evaluator pretends to evaluate inferences of the second moment (reasoning and knowledge of the student), for having restricted the communication to a set schematization, yet the student's struggle with the mere interpretation of these communication rules (and with the discursive content since in

this case the student raises an ambiguity) makes her fail on the first moment inferences. The performing of the task by the student, and its evaluation by the evaluator are thus altogether constructing a situation of misunderstanding.

Natural logic allowed us to show that this situation of misunderstanding is about:

1. The focus of the question addressed to the student on {huge increase of the number of robberies between 1998 and 1999} or on {increase of the number of robberies between 1998 and 1999} (ω_a or ω_b).
2. The permission or relevance, in the context, to introduce new word-classes (α_{7-10}) and use knowledge external to the task instructions.
3. The attribution by the evaluator, when allowing full, partial or no credit (fourth moment), of the success at the task to the reasoning and normative knowledge about graphs, while in this case the failed inferences are those made at interpreting the task instruction and not the reasoning. The coding scheme could have, alternatively to grant credit, partial credit or no credit only on student's knowledge about graph, include a code for "invalid item" when there is evidence that the student has not understood the item as expected.[11]

7. Discussion

In this paper, we aimed at understanding how students' points of view may fail to match the point of view of their teacher, task designer or evaluator. Both our analyses provide a methodology for the support or falsification of the hypothesis of a situation of misunderstanding in the case under study, in relation to the specific context of the selected example. The point in adopting two perspectives on the same case, was to conduct an analytical experiment: Perspectives should not take over the case (data) and produce mismatching results, but highlight certain aspects of the situation in the production of results, complementing each other in a coordinated way. This is what we hope to have shown.

In both analyses, the situation of misunderstanding is supported with the discrepancies elicited in the inferences made for interpreting the task (first moment), and when producing the answer (third moment), rather than in the domain-specific knowledge (second moment). Converging results of both analyses in

11. Many medical tests contain validity evaluation in parallel with the testing itself, which could inspire good practice of evaluation also in education.

favour of the hypothesis of a situation of misunderstanding, nonetheless, reveals different aspects of the situation.

The first analysis notably stresses the lack of clues for the student's inference about the role to play in the critical discussion – should she take the antagonist position or both protagonist and antagonist – and about the issue the student is meant to focus on in her answer. More particularly, the student's point of view can be shown to simultaneously respond to various issues. The pragma-dialectical model allows to stress the specificities of the educational context (opening stage and concluding stage are truncated), where the argumentative strategy in defining the issue is confused by an asymmetrical relationship: In the coding scheme, only the desired issue is specified with valid and invalid argumentation. Any alternative issue is simply dismissed as wrong (code 04 "other responses"). However, in a real critical discussion, moving the issue may constitute a good strategy in the argumentation and even lead to "complex argumentative *discussions*" (Greco, Schär, Pollaroli, & Mercuri, 2018, p.729). Moreover, we can make the hypothesis that in such asymmetrical situations, typical of tests situations and even broadly in school and learning situations, the norms of a critical discussion are easily disrupted (e.g. Baker, 2015; Greco et al., 2015; Miserez-Caperos, 2017). In particular, the pragma-dialectical model stresses the fact the student may not change the role within the critical discussion (e.g. from premise to an issue) of the elements of the expected answer without losing its recognition as a "right" answer.

Grize's logico-discursive operations, on the other hand, lead the focus towards precise formulations of the objects of discourse, in the task instruction and in the student's answer, on which inferences about the meaning of the school task and of the evaluation of the student's skills are depending. If this second analysis also stresses the problem of specific expectations in the coding scheme, when it comes to the student raising alternative issues, the focus on schematization stresses the asymmetrical relationship in a test like PISA in terms of the right to introduce new objects of discourse: When the student introduces {inhabitants}, it is considered irrelevant by the evaluator, despite an analogous reasoning on proportionality or lack of information. This point also raises a specificity of the educational context, and more particularly the communication contract for which the student should only use elements already available in the schematization provided by the item. Moreover, this analysis shows that the schematization of the question is not focused on the point under evaluation, as it could be with a question such as "Is the presentation of the graph compliant to standards?". Instead, as Brousseau (1998) explains in his theory, the communication contract of evaluative questions relies deliberately on leaving the crucial question implicit, in order to consider that the student successfully "guessing" that question can be attributed the domain-specific knowledge. Despite the expected benefits of such com-

municative frame, we have no choice but to note that in some cases, as here for this student, this principle leads to a situation of misunderstanding in such a way that makes the act of evaluating actually impossible: We cannot tell wherever the student fails to get the full credit for lacking knowledge about graphs, or for missing the point, which was deliberately implicit. Grize's semiology provides precise clues and insights to work on a different formulation and presentation of the item, that would allow more students to avoid this pitfall.

Altogether, these observations contribute to show divergence in interpretations from different points of view on school tasks with a methodology of analysis based on explicit models. These models are providing a framework for making hypotheses about the particular interpretations of the agent involved in the situation and discussing it, while keeping the particular qualitative features of the discourse and situation under study. In other terms, the analyses presented in this paper constitute an accurate methodology for describing inferences made by students and evaluators on a school task, and each of the two models of argumentation provide a complementary emphasis on the complexity of such processes, at different levels of the phenomena. The pragma-dialectical model is on a more macro level, bridging context and discourse's content based on specific expectations for argumentative discussion (stages, etc.), while Grize's model allow more micro descriptions, such as the actual processes leading the student to focus on a different issue than expected. They could be both used together for further advantage, since the difference of issue raised in the first analysis can be related to detailed semiotic properties of the PISA item in the second analysis, the importance of which is reciprocally stressed by the first analysis, through an emphasis on its pragmatic consequences. Here, we have presented such analyses *a posteriori*, based on traces from a student, yet there is also a potential for such analyses to be done *a priori*, in the design of such items, as a quality check. From the results shown in this paper, care could be taken during the design in respecting the frame of critical discussion when inviting students to provide argumentation, and also in addressing explicitly the discursive objects students are expected to work on.

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(Kohler & Mehmeti, 2018). Yet, these publications contain only previous versions of the introduction and of the first analysis. We would like to thank all the interlocutors, and in particular the two anonymous reviewers, for their encouragements and constructive critic.

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