How Can Rationality Empower Children?

Anne Brel Cloutier

If you had superpowers, would you use them to help yourself or to help the world? When asked this question, this 10 year-old girl made the following deduction: "Since I am part of the world, if I do something to help the world, then I am helping myself." She avoided the false dilemma fallacy in which you have to choose between only two options. She was able to reason in such a way as to produce a third option without compromising the first two. This is not only a logical deduction, but also the type of reasoning that the world arguably needs for positive progress on environmental and political issues. Once people understand that helping the world is helping humanity and that they are, themselves, part of humanity, they might feel that is it their duty to do whatever they can to help the world.[1]

Some might assume that children are too young to have rational thoughts and that philosophy might be more likely to confuse them than achieve any good. In more traditional views of education, the goal is for them to learn facts, rules and techniques. Some may fear that asking them to put things in perspective or challenge the foundations of their knowledge could lead to relativism and cause harm to their development. A possible cause may be the theoretical work of Jean Piaget, the first psychologist to study reasoning from a logician's point of view as well as the first to conduct studies on rationality based on direct observations of children. His theory on the development of rationality claims that children are not born logical and that logical reasoning only appears progressively in adolescence. Though his theory has been criticised on numerous fronts, the false belief about children being illogical has remained strongly anchored in our conceptions of rationality.[2]

In this article, we will argue that since Piaget, many advancements have been made in psychological studies about reasoning. Even though some parts of his theory are still very helpful to understanding the development of rationality, it is a mistake to view children as illogical beings. On the contrary, they happen to be logical at a very young age, as our argument and examples will show. Educational psychologist David Moshman offers a new reading of Piaget's work by explaining the development of rationality at a metalogical level, not only in childhood but in adulthood as well. Metacognition is the mental act of thinking about thinking and is a fundamental cognitive process for the development of reasoning.

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[1] This example is drawn from a summer philosophy camp run in July 2014 by Brila (www.brila.org), an educational charity based in Montreal, Canada. The participant's name has been omitted to protect her privacy.
[2] Moshman, 1998-a.

First, we will briefly summarize the main theories of reasoning, introducing Moshman's pluralist rational constructivism theory.[3] On his view, rationality develops through our increased metacognitive understanding, which occurs during peer interactions. We will therefore argue that the Community of Philosophical Inquiry (CPI) method that forms the basis of the Philosophy for Children (P4C) program, when practiced with a special focus on metacognition, can constitute the perfect pedagogical approach to put Moshman's theory into practice. A close examination of some of the behaviours that occur in a CPI can link to his theoretical approach of rational development: In P4C, not only do we regularly witness children expressing rational and logical thoughts, but we also see how the CPI's metalogical aspects offer multiple strategies that can help foster their development. These metacognitive and metalogic strategies come from observations of children practicing P4C dialogues, from which adults could greatly benefit too.

Developing Rationality: From Piaget to Moshman—Logic and Metalogic

Piaget's contribution to the psychology of reasoning is significant. He was the first to combine logic and psychology, and the first to understand reasoning as developing during childhood through understanding rather than the mere memorizing of facts. According to Piaget, we are born without logical capacities. At first, children do not have access to their cognitive operations–for example, the conservation of quantities. At four or five years old, children will perceive a flattened piece of dough as bigger than its original form, only because it seems larger. The same thing occurs with liquids: a single amount of juice presented in two different glasses will be interpreted as different because of the appearance of the glasses. At this age, children do not understand the transformation, even if it occurs in front of them.[4] They therefore tend to explain the transformation by reference to magic. This clash between the phenomenon and their interpretation represents a logical contradiction. At first, children do not even realize the contradiction, but at about five or six, they start to sense a cognitive conflict. This conflict is essential to their development: it will motivate them to work toward understanding the origins of the contradictions.

Different factors help children develop this understanding: maturity, repeated experience and social transmission. They repeat the operation until they finally understand the transformation that occurred–this is the condition for them to acquire reversibility, or the capacity to think through steps in reverse direction. However, they must be mature enough to possess the operational structure required for understanding and they need help from their social environment to be confronted to their contradictions. Balance between all these factors will eventually resolve the conflict; children then complexify their structure of understanding, acquiring a higher level of logical skill.[5] As we will see in Moshman's reading of Piaget, the principles of conflict and self-regulation are key to ensuring deeper levels of reasoning.

Piaget identifies four stages of logical understanding, the highest of which is acquired at adolescence and remains optimal in adulthood–namely, the *formal operational stage*. This aspect of his theory is problematic since subsequent research has shown that children are able to accomplish logical

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[3] Moshman, 2004.
[4] See Inhelder, Sinclair & Bovet in Piaget, 1974.
[5] Piaget, 1974.

tasks at an earlier age than Piaget predicted.[6] Moreover, adult rationality is hardly always optimally logical: psychologist Peter Wason developed a selection task to detect logical fallacies that most adults cannot avoid committing, namely the affirmation of the consequent. This logical fallacy consists in understanding a conditional (A implies B) as if it were an equivalence (A equals B). The conditional "If A, then B" does not imply that if B (the consequent) occurs, then A (the antecedent) will occur too. In contrast, for the equivalence "A equals B," when B occurs, A will occur too. Applied to children, this selection task could take the form, "If you want dessert, you have to eat your vegetables." Empirical studies show that children will understand that in order to get dessert, they must eat their vegetables, but also that even if they ate their vegetables, they do not have to eat dessert (affirming the consequent does not imply that the antecedent will occur). In this case, they will eat dessert only if they want to, but eating the dessert is not part of the rule, only eating vegetables is. This task has the same logical form as the Wason task, but with different content. If the development of reasoning consists in the acquisition of logical skills, then some empirical studies would prove that kids have a logical understanding while Wason's selection task shows that adults do not.[7] Would logical understanding drastically drop with age? This does not seem entirely accurate.

To explain these variances in logical understanding, Moshman points to the distinction between logic and metalogic. Logic requires us to be able to make simple inferences in familiar contexts, whereas metalogic requires us to be able to think and coordinate multiple inferences in unfamiliar contexts. We may be able to make valid logical inferences at a very young age, but reasoning is not restricted merely to capacity of making inferences.[8] Children are perfectly capable of making logically valid inferences; they just do not know it yet. The development of reasoning requires awareness of inferences and explicit metalogical thinking. For Moshman, reasoning begins with logic and progresses without a final maturity state. Reasoning begins with the capacity to make inferences, then develops into the capacity to apply these inferences to specifics goals—what Moshman calls thinking. Thinking then develops into the ability to coordinate different inferences, thus creating new knowledge—what he calls reasoning. Reasoning is thinking with epistemic prudence, that is, with concern for accuracy and adherence to appropriate inferential norms. [9]

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[6] Hawkins & al., 1984; Markovits & al., 1989.

[7] A version of his selection task consists of showing four cards, each holding a letter on one side and a number on the other side. Since we can only see one side of each card, the subject sees cards with an A, a 7, a B and a 4. The experimenter gives a rule to the participant: "If there is an A on one side, there is the number 4 on the other side." Then, the participant is asked which card must be turned over to make valid or invalid the rule. Most of the participants choose to turn over the "A" card (which is correct) and the "4" card (which is a fallacy). In fact, in order to verify if the rule has been respected, one must turn over the "7" card, to make sure that there is no "A" on the other side since the rule applies to what is behind a "A" cards, but doesn't mention anything about what is on the other side of a "4" cards. This selection task, when presented to adults is rarely correctly solved, even with subjects having a IQ higher than average (In « Regression in reasoning? » (Wason, 1969), one of the participants who failed at the selection task admitted being a member of Mensa, the International High IQ Society.). This demonstrates that logical reasoning is neither relative to age nor to competencies.

[8] Logical tasks correctly performed by young children are presented in familiar context, whereas correctly performed selection tasks, like Wasons', appear in a formal context that requires a fully developed understanding of logical inferences, in order to make predictions and to coordinate diverse possibilities.

[9] Moshman, 2004, p. 224.

Theories of Human Reasoning

Evolutionist theories claim that we evolved with heuristics: although these have assured our survival, they have not always been logically correct. We reason in an adaptive rather than a logical way.[10] This does not mean we never think logically, only that we sometimes make mistakes. We can acknowledge this as a step in the right direction, given some cognitive science and psychological theories offer an ameliorative view claiming that even if we produce incorrect answers, we have the capacity to correct them.[11]

Evolutionary dual process theories offer a developmental view of reasoning where even if the biases and heuristics are really difficult—and in some cases, impossible—to avoid, we have the capacity to control them. [12] Reasoning comes from two essential processes that generally fall into two groups of proprieties. The first type, called System 1 (S1), generates heuristics, automatic and unconscious processes and do not require a lot of cognitive effort. A second type, called System 2 (S2) includes processes that are analytic, controlled and conscious, and require a lot of cognitive effort. Reasoning comes from heuristics that made us evolutionarily adapted, but not to the present time where evolution has moved too fast for us to adapt. Social, technical and scientific evolution grows a lot faster than the selection of our genes. This would explain why we are not necessarily adapted in such a way as to always provide good reasoning. S1 processes come from our evolution and even though they sometimes produce good conclusions, they are responsible for our mistakes too. S2 processes are more recent and they give us the capacity to control and correct S1 processes.[13] For example, if one produces a logically invalid deduction, S2 processes can evaluate the answer and create a new one until the good answer is achieved and the task can then be successfully completed.

In order to use S2 processes, one needs to possess adequate knowledge to produce logical answers. However, biases coming from S1 processes are deeply anchored in our reasoning; therefore, we cannot eliminate them, we can only inhibit them. This is why good learning consists not only in acquiring knowledge, but also in practicing strategies and developing awareness about possible biases that can come from S1 processes. But having strategies without knowing when to use them is pointless.[14] We must learn how to detect situations in which they are needed. Thus, practicing epistemic prudence is as important as knowledge and strategies.[15] Epistemic prudence consists in restraining ourselves from asserting with certainty when we do not hold enough information to conclude. Generally, this behaviour is observed when there is a possibility that one might have to override heuristic responses.

In neuroscience, brain imaging shows that repeating rules does not help us avoid biases. We must be alerted to the possibility of bias in order to detect and override it.[16] Identifying mistakes and

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[10] Gigerenzer & Goldstein, 1996, Cosmides, 1989.

[11] Stanovich, Toplak & West, 2008 in Beaulac & Robert, 2011.

[12] Dual process theories conceive reasoning as coming from two different systems in which different processes override others, allowing us to correct our incorrect answers. See: Evans, J.St. B.T. & K. Frankish, 2009 ; Stanovish & West, 2008.

[13] Samuels, 2009 in Evans, J.St. B.T. & K. Frankish, 2009 p. 131.

[14] Ibid, p. 687.

[15] Beaulac & Robert, 2011.

[16] Houdé et Moutier, 1996.

strategies to avoid them helps us achieve better results when solving tasks, with the success rate rising from 10 to 90 per cent.[17] We believe that from a dynamic cognitive point of view, neuronal activities can be produced by epistemic prudence, meaning once it is internalized, it becomes an automatic alert. In this article, we would like to suggest that metacognition is the procedure of coordination to override S1 processes. First, we need epistemic prudence to activate S2 processes; then, reflective reasoning—consisting of monitoring and coordinating inferences—results in overriding S1 processes toward a more thoughtful answer. We view the actual activation of S2 as a metacognitive process.

For Moshman, reasoning is much too complex to be reduced to only two different processes. However, we will see that his constructivist theory of rationalist pluralism suggests that peers' interactions is an effective way to put into practice cognitive strategies and epistemic prudence as part of a collective and internal metacognition act.

Rationalist Pluralist Constructivism

For both Moshman and Piaget, rational development begins in conflict. When faced with a contradiction between a phenomenon and its representation, children feel a discomfort that motivates them to understand what is missing in their reasoning. To find equilibrium, they must seek to understand the nature of the contradiction. Only then will they be able to achieve more complex forms of reasoning. Piaget's experiments show that a more complex understanding structure can be achieved much faster when children repeat the operations by themselves.[18] Similarly, for Moshman, children can achieve more complex reasoning by repeating the operation, but this recurrence can be understood as a metacognitive reflection on the reasoning experience. The development of reasoning progresses through explicit metacognitive reflections on their own inferences to make them clearer and more understandable.[19]

We build our own metacognitive theory at a very young age, even if it is not fully conscious at first. Though we understand a metacognitive act as a conscious one, as children, we are able to understand how behaviours may impact our environment, even if we do not consciously view it as metacognitive understanding. This comprehension is therefore the tacit starting point of children's own metacognitive theory construction. Making an inference does not require metacognitive awareness, yet inferring that "When I do this, that will happen" and acting accordingly constitute a form of metacognitive theory. Since a theory is simply the active use of knowledge to predict and explain empirical phenomena, developing our own metacognitive theory then consists in being able to build our own knowledge structure—it is a growing capacity to theorize and act on our own cognitive behaviours. The more we understand our thinking and organize it in reasoning structures, the more complex our comprehension structures will become. Thus, metacognition increases our level of reasoning, giving us more control on further reasoning—and our rationality development depends on it.[20]

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[17] Ibid.
[18] Piaget, 1974, p. 59.
[19] Moshman, 2004.
[20] Schraw & Moshman, 1995, p. 356.

By becoming aware of our inferences, we are able to coordinate and control them appropriately. For Moshman, awareness and control of our inferences take place most often in social interactions: when we interact, we must justify ourselves and this justification process requires making our argument explicit. As he writes, "Reflection and coordination, moreover, often take place in the context of social interaction, and especially peer interaction."[21]

Moshman's theory of rational development is based on a dialectic constructivist account, which holds that the construction of reasoning results from an interaction between external factors—like learned strategies and social environment—and internal processes—like maturation. For Moshman, metacognition depends both on the social environment and internal factors, so they complete each other, making both of them fundamental and richer. Internal construction explains metalogical comprehension, giving the capacity to understand foundations of logical strategies and to have a richer grasp on their integration and coordination. In the same way, external factors may help learners to have a better metalogical understanding, thus helping them to coordinate and reconstruct their thoughts at a deeper level.

Control and coordination of inferences is a conscious metacognitive process made possible by three factors: cultural learning, individual construction and peer interaction.[22] Through social learning, children internalize conceptions about the nature of cognition. Individual construction is a spontaneous attitude towards learning, in order to use strategies in an efficient way.[23] Self-regulation, for example, could be an internal process used to improve their comprehension of their own cognition. When dialoguing in social contexts, we interact to justify ourselves, so that we may understand each other better. In order to be better understood, we must make our argument clear to others, but first of all, to ourselves. Most of the time, it is while arguing that we realize the weaknesses and strengths of our arguments, making dialogue crucial not only to being well understood but also to becoming aware of our own inferential processes as a metacognitive act. [24] Social interactions bring about the need to understand our own reasoning and others, to combine them and coordinate them toward a shared reality.

Empirical studies have shown that collective thinking leads to better and more sophisticated answers.[25] Dialogue generates better understanding of problems and better clarification of concepts, therefore facilitating the resolution of sophisticated tasks. However, let us imagine a situation where a child is dialoguing with her tutor. There is a very low possibility that she will doubt his conclusions since he has epistemic authority. In order to question her reasoning, she would need to interact with peers she deems as equals in terms of rational skills.

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[21] Moshman, 2004, p. 233.
[22] Schraw and Moshman, 1995, p. 362.
[23] Ibid., pp. 363-364.
[24] Moshman, 2004, pp. 233-234.
[25] For example, the rate of success rises from 9% to 75% for Wason selection task in collective thinking (Geil & Moshman, 1994 in Schraw & Moshman, 1995, p. 364). In this specific experiment, in order to make sure that the group was not relying on a group's expert, some data reveal good results for groups that found the good answer collectively without anyone having found it individually. This shows the importance of a level of equality between participants. For an adequate coordination and reflection process, inferences must be understandable for every member of the group.

Reasoning is much more complex than applying mere logical rules—it requires dialectical reasoning, or the ability to reflect on inferential diversity. Dialectical reasoning represents a mindful and intentional effort to reconstruct our own rules, principles, intuitions and conceptions in order to achieve coherence and conceptual progress.

> We may define dialectical thinking as the deliberate coordination of inferences for the purpose of making cognitive progress. Thus, the development of dialectical reasoning involves increasingly explicit knowledge about the nature of cognitive development, and increasingly deliberate efforts to further that process.[26]

Since metacognition acts on itself, there is seemingly no limit to its development. Moreover, since awareness of mind begins at around three years old, the development of metacognitive understanding can start early in life and continue into adulthood.[27]

CPI as a Pedagogy to Foster Logical Reasoning

In light of the aforementioned theories, let us briefly summarize how logical reasoning works in five steps:

- Learning adequate knowledge and strategies for logical answers.
- Being alerted about the risk of being mistaken by possible biases.
- Practicing epistemic prudence by doubting when we are not sure of an answer.
- Thinking about our way of thinking, reviewing the information through a critical use of dialectical reasoning—that is, metacognition.
- Correcting our mistakes when applying appropriate procedures toward an appropriate answer.

In this section, we will argue that the CPI method used in P4C is well suited to put the reasoning process into practice, because: i) its curriculum includes logical rules and procedures; ii) its dialogical approach regularly creates confrontations between different ideas and viewpoints, highlighting possible errors; iii) it fosters epistemic prudence, and iv) it constitutes in itself a metacognitive process. If practiced with metacognitive development in mind, P4C therefore stands a good chance of contributing to the development of logical reasoning, helping children grow in their capacity to apply appropriate procedures and arrive at appropriate answers.

Logic in Education and P4C

In the learning process, being open-minded is important in order to accept new information, but accepting too much without any process of doubting may lead to epistemological dogmatism. Questioning the information we receive is a necessity in order to protect ourselves from indoctrination. On the other hand, too much doubt can put us in a state of uncertainty, even when facing facts and empirical truth, thus risking epistemic relativism. Two types of logical errors are

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[26] Moshman, 1998-a, p. 961.
[27] Schraw & Moshman, 1995.

possible in reasoning: fallacies, where we add too much information to the conclusion, and suppression of valid inferences, where we doubt too much and are not able to conclude anything. Reasoning logically is being able to open our mind to information with enough doubt to prevent fallacies and enough rules to prevent relativism. This is why logic is an important tool in education: it helps to open minds for learning while protecting children from indoctrination.

This is not a way of insisting that children learn logic, but rather that the metalogical aspect of dialogue can enhance logical reasoning. Children who become progressively aware of the particular rules of reasoning and their impact on thoughtful expression gain a greater appreciation for the importance of developing thinking skills.[28] A study by Robert & al. shows that P4C has a positive impact on the development of logical reasoning.[29] Metacognitive and logic strategies in the P4C curriculum can help facilitators to guide and redirect children to enhance their thinking and help them develop their rationality on their own, while paying attention to the mental acts required to do so effectively.

P4C and Epistemic Prudence

Learning the rules of logic is not, as we have seen, sufficient to reasoning logically. Children must also be able to detect possible biases by becoming more alert and epistemically cautious. The Robert & al. study shows that children who have been practicing P4C for several years present significant signs of epistemic prudence.[30] Doubting plays an important role in P4C inquiry in the development of logical awareness. In a CPI, children are not evaluated for their answers but for their capacities to inquire and question their own claims as well as those of others for the benefit of the inquiry. As P4C theorists Michel Sasseville and Mathieu Gagnon write,

> Doubting is a very important activity in a community of inquiry. To enter a community of inquiry is to make the decision to put one's beliefs in check, that is, to accept that they may be questioned. For this to happen, it is important that we have the attitude of someone who, in the face of what they believe to be true, right or good, is willing to question some or all of their beliefs.[31]

When doubting, children practice honest thinking, as they are not trying to convince others but rather striving to find the most valid and reasonable answer together.

Inspired by socio-constructivism, which views knowledge as generated from collaboration and mutual aid,[32] CPI dialogues represent a rationalist epistemological work of co-construction, that is, the children confront each other's ideas in order to collectively evaluate arguments while building their

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[28] P4C's curriculum provides logical tools, among others, Lipman's novel *Harry Stottlemeier's discovery*, for example, tells the story of children who discover the rules of logic by themselves by learning to avoid generalizations and other common logical mistakes. Also, exercises are included in the facilitator's guidebook in order for children to practice logical notions seen in the story, such as deduction and avoiding fallacies.

[29] Robert & al, 2009, p. 21.

[30] A difference of more than 10% was noted among children who practiced P4C, compared to children who did not.

[31] Sasseville et Gagnon, 2012, p. 117.

[32] Sasseville & Gagnon, 2012, p. 85.

own knowledge.[33] Peer interactions raise objections and divergent interpretations about reality, thus engaging children in multiple reflections and negotiations, encouraging them to modify their own conceptions of knowledge.[34] In time, children participating in a CPI become more aware of their active role in knowledge construction, notably the importance of collaborative thinking and responsibility for justifying philosophical positions.

P4C and Metacognition

Peer Interactions

In a P4C setting, epistemic prudence favours metacognitive thinking in children since they must give reasons for the claims they make. This justification process contributes to metalogical thinking, requiring them to review their inferences and argumentation in order to evaluate them. When making their inferences explicit during a CPI dialogue, children gradually become aware of what an argument needs to be valid while group dynamics allow them to combine a diversity of inferences that improve one another, leading to more sophisticated forms of reasoning. As Moshman writes,

> In social contexts we may find ourselves challenged to justify our conclusions, and thus to recognize and justify our inferences. We may also be challenged to understand the inferential paths that led others to alternative views, and to coordinate those inferences and conclusions with ours.[35]

This is precisely what children are doing in a CPI: they acknowledge their own reflection processes and strategies to improve the inquiry, motivating them to excel from a cognitive point of view. The goal of this practice is not to reach consensus but to cultivate autonomous thinking—children are not only working to find thoughtful answers, but also to determine ways to achieve such answers.[36] In the words of P4C co-founder Lipman,

> The improvement of thinking involves reflection. [...] Reflective thinking is thinking that is aware of its own assumptions and implications as well as being conscious of the reasons and evidence that support this or that conclusion. Reflective thinking takes into account its own methodology, its own procedures, its own perspective and point of view.[37]

A CPI practice requires children to think about their thinking, therefore activating a metacognitive process of self-correction toward the mindful application of thinking strategies. If an

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[33] Prevalent knowledge would be objectivist epistemology, where it consists in directly and empirically observable facts, like a large proportion of what children learn at school, for example. However, subjectivist epistemology has an important role to lay in the construction of knowledge since individuals acquire information according to their cultural and social specificities. Nevertheless, a radical subjectivism could lead to epistemological relativism. Rationalist epistemology requires to evaluate, criticize and justify different standpoint without asserting one single truth, therefore is more complete and support better inferences than objectivist and subjectivist taken separately. It links one to the other, building a more adequate theory of knowledge. (Moshman, 2004, p.224)

[34] Sasseville & Gagnon, 2012, p. 86.

[35] Moshman, 2004, p. 233.

[36] Sasseville, 2009, p. 5.

[37] Lipman, 2003, p. 26.

argument is not valid, they must work to understand where it fails in order to correct it. When CPI dialogues emphasize awareness of reasoning processes, they therefore offer children the opportunity to develop their rationality, thereby collectively achieving more rigorous and coherent multidimensional thinking. The group dynamics enable children to think out loud without being afraid of making mistakes. Unlike traditional education that implores children to think before speaking, in P4C, speaking is viewed as a thinking-aloud strategy: children help each other detect mistakes and determine how to correct them. This approach challenges the dominant educational paradigms, depicting mistakes not as a source of shame but as useful tools for learning and for accepting human imperfection.

Metasubjective Objectivity

We often associate objectivity with proven facts and rigorous justification, whereas subjectivity is usually linked to emotions, individual perceptions and unjustified thoughts. Generally, subjectivity is opposed as objectivity. However, Moshman's conception of rationality is a systematic interaction of both. Rationality is a form of objectivity that emerges from the reflective reconstruction of our subjectivity. Since our perceptions come from our senses, and we interpret them with our personal conceptions, they are in part subjective. On the other hand, the objects we perceive are parts of an independent reality regardless of our perceptions. Thus, for a more objective conception of reality, we must be aware of our different ways of perceiving. Since our perceptions reflect our subjectivity, but are supported by actual reality, conscious reflection about our subjectivity helps to increase its objectivity. As a result, our conceptions are built from subjective perceptions, but supported by real facts. Metasubjectivity consists in having reflective thoughts about our subjectivity. Therefore, interactions between metasubjective thoughts and objective facts create meta-subjective objectivity.[38]

Metasubjective objectivity represents our self-reflection on our interactions with our environment, whether between subjects and objects or between subjects. The plurality of perspectives generates conflicts that motivate metasubjective reflections, thus increasing metasubjective objectivity.[39] The collision of ideas in a CPI is important as it constitutes a conflict that triggers an active process of dynamic reflection that is then deepened by collaboration through multiple cognitive acts.

A CPI setting is the perfect environment to practice metasubjectivity as it invites children to exchange ideas about topics that matter to them and justify their positions by making their arguments explicit. The CPI curriculum is also full of cognitive tools that help children in their argumentation, such as giving reasons, examples and counterexamples, formulating comparisons and analogies, etc. These mental acts help children improve their thinking so as to reach more complex thinking levels as they co-construct their own knowledge. [40]

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[38] Moshman, 1994.

[39] This meets Piaget's theory on cognitive conflict and the need to find balance in solving contradictions.

[40] The curriculum in P4C contains guidebooks that help teachers and facilitators to recognize these mental acts as they occur in discussions. They also provide philosophical guidelines to make sure that dialogues reach concepts that involve thinking rather than maintaining episodic discussions.

Mental Acts

In P4C dialogues, children learn to detect the various mental acts that are at play rather than have them imposed by adults.[41] This bottom-up educational approach teaches children *how* to think rather than *what* to think, helping them become aware of how they can improve. By labelling mental acts as they occur during CPI dialogues, facilitators help to make arguments and strategies explicit to children.[42]

In the dialogue excerpt below, we underline three different mental acts that also consist in metalogical strategies:

- Pointing out assumptions enables a better understanding of assertions as they examine their foundations.[43] Making these implicit premises explicit leads to a better understanding of what works in the argumentation and what does not. Therefore, it makes it easier to correct logical mistakes while also reinforcing beliefs in correct claims.

- Identifying consequences requires thinking about the implications of a claim, thereby developing a better understanding of causality. As a metalogical strategy, understanding that there is a distinction between implication and equivalence is crucial to avoiding the affirmation of consequents and the negation of antecedent fallacies. The practice of identifying consequences allows for a better understanding of what an implication is.

- Finding counterexamples is a metalogical strategy that prevents the induction fallacy, which is one of the logical fallacies that occurs the most and almost inevitably leads to prejudice. Counterexamples consist in generating alternatives, thus engaging deeper reflections before concluding. Giving children the opportunity to challenge their own presuppositions with counterexamples helps them understand the incoherence of prejudices.

In this dialogue excerpt, Participant 2 points out Participant 1's assumption, but in doing so, he denies the antecedent fallacy:
- Participant 1: "A wealthy parent will provide a good future for his children."
- Participant 2: "I disagree! You're saying that a poor parent won't take care of his kids as well as a rich parent will?"

Following the dialogue, Participant 1 prevents Participant 2 from committing the denial of antecedent Fallacy by identifying the true consequences of his thoughts:
- Participant 1: "No, that's not what I'm saying. But when you are wealthy, you can provide a house, food and education to your children."

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[41] Tens of mental acts and behaviours have been listed in Sasseville & Gagnon, 2012.

[42] A recent study on expert dialogic facilitation suggests that facilitator moves like paraphrasing, locating, distilling, probing reasoning and identifying warrants help to clarify the inquiry process by underlining the argumentative features of children's philosophical contributions. Accordingly, it seems that facilitation moves that emphasize metacognitive are most effective at improving children's reasoning. (See, Oyler, 2015.)

[43] Gagnon, 2005, p. 41.

Then, Participant 2 gives a counter-example pointing out Participant 1's assumptions about wealth:

> - Participant 2: "But a person can also be wealthy and not take good care of his children at all."
> - Participant 3: "I am agreeing with both of you. Being wealthy does not mean that you will necessarily take good care of your children, but at least you could afford it."

When asked to give reasons, participants had to work on making the arguments explicit and accentuate their logical structure. For that to happen, they tried to review every step of their thought process and make the steps clear enough so that they could be explained to other participants. The reconstruction of an argument is a metalogic strategy that helps to gradually understand the distinction between premises and conclusions—and that the latter results from the former.

> - Participant 1: "Cars are a bad invention."
> - Facilitator: "Why do you think that?"
> - Participant 1: "Well, they cause accidents and they pollute."
> - Participant 2: "But they also help people to travel easily."
> - Participant 1: "I agree, but if traveling easily involves people getting hurt and the environment getting damaged, then it does more damage than good. And if it makes more damage than good, then it's a bad invention."

Making analogies is a metacognitive strategy that enables the development of abstract thinking by comparing actual situations to other situations, and in extracting the concept underlying them to apply them to both. Explaining abstract concepts in a more accessible way can help children to understand them better.

> - Facilitator: "What is intelligence?"
> - Participant 1: "Having good grades at school, I guess."
> - Participant 2: "It could also be making new discoveries, like Darwin and Galileo did!"
> - Participant 3: "That's true. And they did not make their discoveries in school."
> - Participant 4: "But at their time, intelligence was not the same as today. Galileo was put in jail and we had proof of his intelligence with facts only years later."
> - Participant 5: "I think that intelligence is like cars: models can always improve with new technology."
> - Facilitator: "Are you saying that new technologies are to a car what proof and facts are to intelligence?"
> - Participant 5: "Yes, that's it… they both improve and continue to move forward with time."

The Fishbowl

These mental acts are only some of what we can observe in P4C. Participants put them into practice and regularly identify them as they move through the dialogue. However, identifying mental acts as they get used is not an easy thing to do. Lipman noted that we teach young children to recognize animals and colours by showing them pictures. In the same way, it should be possible to teach children—as well as adolescents and adults—to recognize a variety of mental acts by clearly

identifying them when they occur.[44] Thus, when participants activate a metacognitive process, it is not necessarily explicit. The fishbowl practice in P4C is an effective way to make the process explicitly metacognitive.

Fishbowls consist in dividing a class of students in two subgroups: the observers and the participants. Observers have to keep silent during the whole dialogue. They observe if mental acts are indeed made or not, and note whenever they are, linking them to their context. Here is an example of the metacognitive processes involved in the fishbowl practice:
Participants during the CPI:
-Mateo: "Dogs are dangerous; a dog bit my sister."
-John: "Well, my neighbour's dog is a good dog; he never bites anyone."

Lucy, as an observer, takes note of John's counter-example. When the CPI dialogue is over, observers are asked to share their observations with the rest of the group:
-Lucy: "John gave a counter-example when he mentioned his neighbour's dog."

By explaining the counter-example, Lucy is making it explicit to herself and to others.

Meanwhile, John thinks about the way he was thinking earlier and realizes that when he was giving his neighbour's dog as an example of a good dog, he was, in fact, giving a counter-example so Mateo could understand that not all dogs are dangerous. Here again an explicit metacognitive process is triggered: by listening to observations of the dialogue in which they participated, children are invited to think about their argumentation strategies.

Then, in the next CPI dialogue, the roles are reversed: participants become observers and vice versa. Participants who have already been observers tend to argue differently: their observation helped to make them more conscious of their own intellectual moves. In the same way, participants who become observers consciously realize what they have been asked to do in the CPI. Both Lucy and John will be more aware of what a counter-example is and will even be able to name it explicitly as they discuss:
–Lucy: "I have a counter-example for what Mary just said about…"

Why Should Rationality Be a Goal in Education?

P4C contains a broad range of metalogical and metacognitive strategies that contribute to the development of logical reasoning. We have seen that doubting is an important feature of inquiry, helping to develop epistemic prudence and that, when coupled with many other metacognitive factors and the collective nature of CPI dialogue, it can foster dialectic thinking and logical reasoning. This makes it useful across the disciplines from science and mathematics to language acquisition.

Studies in reasoning from the fields of psychology and neuroscience offer insights into possible avenues to improve our imperfect minds—hypotheses that may lead to a paradigm shift in our

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[44] Lipman, 2003, p. 142.

relationship to knowledge and education. A society that only promotes education for technical ends and labour skills misses out on the pedagogical value of rationality. As Moshman writes,

> Democratic self-government operates best if citizens are capable of making rational political decisions. Promotion of rationality, then, serves a variety of personal, community, and governmental purposes and is thus an important goal of education.[45]

As citizens, if we do not possess the tools for reflective thinking, we risk maintaining a subjective position towards our knowledge, which reduces our potential for civic contribution beyond workforce integration. It is therefore as crucial that children learn reasoning skills as literacy and numeracy skills. Otherwise, society may retain power dynamics that privilege the reasoning of a small elite, whose decision making might not benefit the entire community. A democratic society should be composed of individuals capable of autonomous political choices. To encourage rationality will not only lead to better social choices, but also to genuine political engagement in a democratic system. By promoting rationality, P4C is primed to contribute to this change.

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[45] Moshman, 1990, p. 343.

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Address Correspondences to:
Anne Brel Cloutier
Doctoral Candidate, Department of Philosophy, Université du Québec à Montréal,
Email: annebrelcloutier@gmail.com