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EFFECT OF BELIEF ADHERENCE AND ARGUMENTATION ON BELIEF FLEXIBILITY DURING CHILDHOOD, ADOLESCENCE AND YOUNG ADULTHOOD

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Abstract

Argumentation is everywhere in social life, in debates, controversies, and daily discussions, and the most persuasive individuals are not the most "logical" but those who best justify their beliefs. Indeed, beliefs often bias reasoning and lead to systematic errors called cognitive biases. We rely on an alternative, more "ecological" model than the classical dual-process (Analytic-Heuristic) model; the argumentative theory, in which reasoning would have a primary function – argumentative – (Mercier & Sperber, 2011) and an important role when an individual must justify their beliefs; it would appear afterwards to justify an intuitive response (Mercier, 2008). We want to observe if participants justify their beliefs preferentially with argumentation based on Heuristic or Analytic reasoning. Moreover, when they fail to justify their beliefs, subjects may change their minds thanks to counterarguments (what we call “belief flexibility”); so, in children, adolescents, and young adults, does the way of justifying one's beliefs impact changing one's mind? 78 children (mean age: 11.3 years), 83 adolescents (mean age: 16.89 years), and 88 young adults (mean age: 24.65 years) participated in this study in which measures of adherence and flexibility were carried out, as well as the analysis of the production of justifications of the subjects' beliefs. This study shows that children justify their responses more with Heuristic reasoning because they rely more on their beliefs to understand the world than adolescents and young adults. Furthermore, the effect of age on flexibility is more significant for subjects with Heuristic justification; adolescents who argue their beliefs with "less logical" Heuristic reasoning would question their opinion more than others, while those who argue Analytically would have a reasoning style more similar to adults. Overall, adolescents revise their beliefs more after exposure to contradictory arguments; they are more likely to change their minds than adults when their reasoning is no longer "strong" enough, whereas young adults are less likely to question their opinions (even if it’s not well justified). In other words, adolescents argue as well as adults but are more likely to question their opinion when necessary, while adults are more "rigid". The END Conference will be an opportunity to present this work, discuss these results in light of reasoning and its development models, argumentative theory, and the implications that these results may have in terms of critical thinking education.

Keywords: *Argumentation, reasoning, beliefs, critical thinking.*

1. Introduction and background

Argumentation is everywhere in social life, and it appears that the most persuasive individuals are not those who have the most "logical" reasoning, but those who best justify their beliefs. Argumentation is one of the ways in which someone can be led to spread or revise a belief, because human beings like to be able to find justifications for their beliefs and actions (Mercier, 2021). [In Psychology, a belief does not necessarily refer to religion or spirituality; a belief refers more broadly to information to which one adheres that is not supported by empirical knowledge].

Reasoning is defined in psychology as a mental activity that enables the processing of information in order to produce or evaluate a conclusion, a knowledge, an argument or a proof (Mill, 1843; Rossi & Van der Henst, 2007; Tricard, 2018). Reasoning can be defined as epistemologically “self-constrained thinking”, i.e., thinking that aims to reach justifiable conclusions (Moshman, 2004, 2011).

The classic model for representing information processing, reasoning and beliefs is the so-called dual process model (Kahneman & Frederick, 2002; Kahneman, 2011; Evans, 2003), which states that there are two modes of reasoning: analytical and heuristic. A first heuristic system would be cognitively inexpensive, based on the individual's prior emotions and beliefs, sensitive to the context of the situation, its role would be to produce the most appropriate intuitive automatic response as quickly as possible, without seeking coherence and based on simple associations between the elements available to it. A second system, analytical, slower and more resource-intensive, conscious and controlled, based on the use of logical rules, would aim to produce a conclusion that conforms to the normative rules of formal logic, by analyzing the validity of the premises available to the subject.

In this study we also rely on an alternative, more "ecological" model than the dual-process theory; the argumentative theory, in which reasoning would have a primary function - argumentative - (Mercier & Sperber, 2011). Reasoning would thus have an important role when an individual has to justify his beliefs; according to the argumentative theory, it would come after the fact to justify the intuitive response (Mercier, 2008). A Heuristic or Analytic argument used by a subject to justify his belief would account for the quality of the internal reasoning produced to justify his adherence to this belief. Moreover, these argumentative skills (both in the production and evaluation of arguments) are central to the construction of a critical mind, enabling us to distinguish between knowledge (i.e., a verified and true assertion) and a belief, which must be supported by arguments (Petraglia, 1998; Nussbaum, 2008).

Reasoning serves to produce arguments to convince others, but also to convince oneself (Mercier & Sperber, 2011); when they are no longer able to produce sufficient arguments to justify their beliefs, subjects are likely to change their minds (what we call belief flexibility) thanks to exposure to counter-arguments (i.e., arguments contrary to their basic beliefs) (Trouche et al., 2014). According to this model, the more firmly anchored a belief is in a subject, the more capable he or she would be of justifying it with logical arguments; and therefore, the individuals who would adhere most to the belief would give it more analytical justification. However, when heuristics are based on beliefs and knowledge that are too deeply rooted, they are an "impenetrable module" (Fodor, 1983), and cannot be challenged by the Analytical System, so the reasoner persists in his belief, even if it's an error.

Furthermore, if we justify our belief with heuristic argumentation, we would be more easily able to question it and thus change our mind when faced with arguments contrary to our belief, because our arguments are no longer sufficient to justify our beliefs. On the contrary, subjects who justify their beliefs in a more "logical", analytical way would be less likely to question their position and change their mind.

In a developmental perspective, children would use more heuristic (versus analytic) arguments than adolescents to justify their beliefs, and adolescents themselves more than young adults, because young people are more accustomed to having their positions challenged and called into question.

According to Siegler (1991), children from a very early age are constantly revising their beliefs in order to learn about the world around them. We therefore assume that children are more likely than adolescents to change their opinions after being exposed to arguments that don't support their beliefs (and that their beliefs will therefore be more flexible), and adolescents more so than young adults.

2. Objectives

The aim of this study is to observe how children, adolescents and young adults preferentially justify their beliefs (with heuristic or analytic arguments), and whether exposure to counter-arguments has an effect on subjects' propensity to change their opinion about their beliefs (so-called belief flexibility) depending on how they justify them.

3. Methods

This study was approved by the Tours-Poitiers Research Ethics Committee (CER-TP), Tours, France, under number 20201005. The sample of the study was composed of 235 subjects of both sexes divided into three different age groups:

- Group C (Children): composed of 78 schoolchildren aged from 11 y.o to 13 years and 2 months old with an average age of 11 years 3 months old (s.d: 0.621)
- Group Ad (Adolescents): composed of 69 highschool students aged from 15 y.o to 18 years and 7 months old with an average age of 16 years and 9 months old (s.d: 0.926)
- Group YA (Young Adults): composed of 88 subjects aged from 22 y.o to 28 years and 11 months old with an average age of 24 years and 6 months old (s.d: 2.721)

For this study, subjects were asked to respond to a questionnaire consisting of four popular beliefs: "Humans will be able to live on Mars by 2050", "Old people are too old to learn", "At school, some subjects are more important than others" and "You have to work hard to succeed in life". For each

belief, the subject was first asked to rank his or her opinion of the belief on a Lickert scale, from "Strongly disagree" to "Strongly agree": Measure of belief adherence; and then to produce arguments to justify why they thought so. There were then two possible scenarios; if the subject adhered rather positively to the belief (i.e., had ticked "Rather agree", "Agree" or "Strongly agree"), he or she was presented with four arguments opposing the belief, but if the subject rather disagreed with the belief (i.e., had ticked "Strongly disagree", "Disagree" or "Rather disagree"), he or she was presented with four arguments supporting the belief: Exposure to counter-arguments. To ensure that subjects correctly read and understood the arguments of different strengths presented to them, they were asked to rank them from most to least convincing. Finally, a new measure of belief adherence was performed. Belief Flexibility, i.e., the propensity of individuals to revise their beliefs, was defined as the difference between the two measures of adherence, before and after exposure to opposing arguments.

4. Results

First, we sought to observe whether the effect of age on the type of argumentation preferred to justify these beliefs with a generalized linear model. This analysis first revealed a significant effect of Age Group ($\chi 2 = 14.27$; ddl = 233; $p<0.001$) on Preferred Argumentation. To go a step further, we then performed Post-Hoc tests to specifically observe contrasts between the Children-Adolescents and Adolescents-Young Adults age groups. There was a significant difference in the type of Argumentation preferred between the Children and Adolescent groups ($Z = -2.817$; $p < 005$; OR = 0.354), but not between Adolescents and Young Adults. Children justify their beliefs significantly more with Heuristic than Analytic arguments than Adolescents and Young Adults.

We performed a factorial ANOVA to observe the effects of Age Group and Preferred Argumentation on Belief Flexibility. This ANOVA revealed effects of each of the observed variables, but no significant interaction between Age Group and Preferred Argumentation on Belief Flexibility. Post-hoc t-tests were then performed to specifically observe comparisons between the Child-Adolescent and Adolescent-Young Adult age groups. This test revealed a significant difference in Belief Flexibility between the Adolescent and Young Adult groups ($t = 2.657$; $p = 008$), but not between Children and Adolescents. The results of this analysis are presented in *Table 1*.

Table 1. Summary of post-hoc tests presenting inter-age group comparisons on Belief Flexibility.

Group Comparison	mean diff	standard error	df	*t*	*p*
Children - Adolescents	-0.0554	0.34	229	- 0.163	0.871
Adolescents-Young Adults	0.7985	0.3	229	2.657	**0.008****

** *: p<0.01*

We then carried out post-hoc comparisons to specifically observe the differences in Flexibility for each Age Group and each type of Preferred Argumentation (Arg). The results of these comparisons are presented in *Table 2*.

Table 2. Inter-group comparisons, effects of age group and preferred Argumentation type on Belief Flexibility.

Comparison									
Age group	Arg		Age group	Arg	mean diff	standard error	df	*t*	*p-value*
Children	H	-	Children	A	0,5554	0,509	229	1,092	0,276
		-	Adolescents	H	-2892	0,38	229	-0,761	0,448
		-	Adolescents	A	0,7339	0,414	229	1,775	0,077
	A	-	Adolescents	H	-0,8446	0,539	229	-1,567	0,118
		-	Adolescents	A	0,1784	0,963	229	0,317	0,752
Adolescents	H	-	Adolescents	A	1,0231	0,45	229	2,272	**0,024***
		-	Young Adults	H	1,2821	0,42	229	3,053	**0,003****
		-	Young Adults	A	1,338	0,398	229	3,362	**< 0,001*****
	A	-	Young Adults	H	0,259	0,45	229	0,575	0,566
		-	Young Adults	A	0,315	0,43	229	0,733	465
YA	H	-	Young Adults	A	0,056	0,398	229	0,141	0,888

*** *: p<0.001 ;* ** *: p< .05 ;* * *: p<0.01*

5. Discussion and conclusions

In the results of this study, we highlighted the effect of Age Group on Argumentation used to justifying beliefs: indeed, subjects in the Children's group justified them more in a Heuristic mode than Adolescents and Young Adults (Z = -2.817; p = 005; OR = 0.354). However, there was no significant difference in the quality of the Argumentation preferred between Adolescents and YAs when it came to explaining the reasons for their beliefs. In other words, Children justify their beliefs more with Heuristic reasoning because they rely more on their beliefs to understand the world than Adolescents and YAs. On the other hand, there was a significant difference in Belief Flexibility between the Adolescent and Young Adult groups (t = 2.657; p = 008), but not between Children and Adolescents. These results show that the youngest individuals (Children and Adolescents) are more likely to question their beliefs and change their minds than Young Adults. We thus observe that Children argue their beliefs differently from Adolescents and YAs, but that Children and Adolescents are different from YAs in terms of Flexibility towards beliefs. More precisely, the effect of age on flexibility is more significant for subjects with Heuristic justification; adolescents who argue their beliefs with "less logical" Heuristic reasoning (“heuristic adolescents”) would question their opinion more than others, while those who argue Analytically (“analytic adolescents”) would have a reasoning style more similar to adults.

Adolescents would learn to justify their beliefs Analytically as they grow up (i.e., more "logically" than Children), approaching the arguments and reasoning of Young Adults, but those who still use a Heuristic mode are just as likely as Children to revise them. Among Adolescents, therefore, argumentative reasoning profiles really do differ according to whether they manage to operationalize their thinking Analytically or Heuristically. “Heuristic Adolescents" are more like Children than YAs when it comes to argumentation skills, while “Analytical Adolescents" are more like Young Adults.

Overall, adolescents revise their beliefs more after exposure to contradictory arguments; they are more likely to change their minds than adults when their reasoning is no longer "strong" enough, whereas YAs are less likely to question their opinions (even if it’s not well justified). In other words, adolescents argue as well as adults but are more likely to question their opinion when necessary, while adults are more "rigid".

The major need to belong to a group encountered during adolescence (Nelson & Guyer, 2011) could explain why "Heuristic Adolescents" change their minds and revise their beliefs when presented with more convincing counter-arguments. The fact that individuals are convinced by counter-arguments because they can no longer justify them with "good enough" arguments confirms the persuasive purpose of reasoning (Mercier, 2008). Argumentation would be produced to justify adherence to a conclusion or belief first formed, and this is even more salient in "Heuristic" Children and Adolescents.

I would like to outline a more practical aim of this work: particularly in the field of teaching and learning about Critical Thinking. It has been shown that Adolescents in particular are more likely to adhere to false beliefs (Wineburg & McGrew, 2016) and seem to have more difficulties in correctly evaluating contradictory information (arguments and counter-arguments) than others. Moreover, they rarely benefit from learning to counter these difficulties and understand that a belief does not become true because it is well argued but because it is supported by empirical evidence. Indeed, it seems that the ability to produce and correctly evaluate the arguments presented to us (and therefore reasoning skills) are at the heart of the development of critical thinking and therefore effective decision-making (Byrnes, 1998; Klaczynski, 2004; Kuhn & Udell, 2003).

Adolescence then seems to be the perfect time to implement specific learning on argumentation and critical thinking, as this is the age when young people are still "flexible" enough to question their beliefs, and at the same time are increasingly capable of developing analytical argumentative skills.

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