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# Thinking about the unknown

**Paul L. Harris**

**A long tradition of research suggests that children and adults with no formal education are prone to reason only on the basis of their first-hand experience, and do not encode and reason from novel generalizations supplied by other people. However, recent research reveals that when given simple prompts, even pre-school children can reason from adults' unfamiliar claims. A radical implication of these findings is that young children arrive at school with a pre-existing capacity for thinking and reasoning about the unknown. The assumption that early learning should be rooted in children's own empirical experience could be mistaken.**

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In the early 1930s, the Russian psychologist Alexander Luria embarked on a research expedition to Uzbekistan in Central Asia. Years later, Luria became internationally known for his pioneering work in neuropsychology but at this early stage in his career, he was interested in what he and his close colleague L.S. Vygotsky thought of as the 'historical nature' of psychological processes – the extent to which reasoning, memory and categorization are shaped by the social and economic practices of a given era[1,2]. Faced with the upheavals throughout the Soviet Union under Stalin, Luria and Vygotsky realized that a vast social experiment was taking place that would allow them to test their ideas. Peasants who had never been to school and had always worked in a traditional, non-technological economy involving animal husbandry, gardening and cotton crops were being given one or two years of basic education, taught to read and write, and inducted into collective farming. More generally, a cultural transformation that might ordinarily take several generations was being compressed into a few short years. In Uzbekistan, Luria and his colleagues gave a number of cognitive tests to two groups of peasants on either side of this historical chasm: 'traditional' peasants who had never been to school and continued to work within the pre-Revolutionary, peasant economy, and 'educated' peasants who had received a basic education, learned to read and write, and were working within a collective.

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Some of the most striking differences between the two groups emerged on tasks of reasoning. Faced with an initial premise that lay outside their experience (for example, '*In the Far North, where there is snow, all bears are white*') the traditional peasants typically balked at using it as a basis for reaching a new conclusion. Thus, when one 30-year-old was asked: '*Novaya Zemyla is in the far North. What colour are the bears there*?' he refused to draw the straightforward conclusion that they must be white. '*You've seen them – you know*' he protested, '*I haven't seen them – so how could I say*!?' The educated peasants, by contrast, were willing to reason from such unfamiliar premises. Luria concluded that the revolution had transformed the reasoning process, or rather the contexts in which people were willing to engage in reasoning. Traditional peasants were reluctant to go beyond first-hand experience whereas educated peasants were willing to take another person's claims on trust and to infer novel conclusions[3].

Luria's findings were later replicated in Western Africa by Michael Cole, Sylvia Scribner and their colleagues[4,5]. Again, participants with no schooling made many errors on the reasoning problems but two or three years of schooling produced a dramatic improvement in accuracy. Analyzing the pattern of findings, Scribner identified two different intellectual orientations[6]. Educated participants displayed an 'analytic' orientation: they paid careful attention to the premises, even if they lay outside their experience, and justified their conclusion with comments such as, '*To go by your words…*' or '*If you say that…*' Uneducated participants adopted an 'empirical' orientation, using their own experience to supplement, distort or even to reject the premises. In justifying their reply, they often mentioned some empirical observation or insisted they lacked the relevant experience to reach a conclusion – as in the case of the traditional Uzbek quoted earlier. More broadly, the findings suggest that education precipitates a conceptual revolution in how people think that new conclusions can be reached. Those who have not been to school focus on conclusions derivable from first-hand experience. Those with a modest amount of schooling accept that other people's assertions can be a starting-point for the reasoning process.

These findings, stretching as they do across different continents, raise profound questions about the human tendency to rely on first-hand experience as compared to the testimony of others. David Hume wrote: '*…there is no species of reasoning more common, more useful, and even necessary to human life, than that which is derived from the testimony of men and the reports of eye-witnesses and spectators.*'[7] Yet, the findings of Luria, Cole, Scribner and their colleagues imply that throughout most of human history adults have not actually found such reasoning either useful or necessary. They have positively resisted it and relied instead on first-hand experience rather than other people's testimony.

The same implication holds for young children who have not been to school. Although they presumably stand to profit greatly from information supplied by other people, they rely instead on their own first-hand experience. Indeed, this conclusion tallies with Piaget's portrait of the young child as a stubborn autodidact. Piaget ascribed virtually no educative role to the testimony that adults might offer; to the extent that children might incorporate such teaching into their cognitive repertoire, Piaget dismissed it as mere 'verbal' knowledge, rather than genuine understanding[8,9].

In this article, I re-evaluate this conclusion. A series of experiments on early reasoning has led our research group to the conclusion that young children, including those with no exposure to formal education, are able to take the claims of other people seriously and to use them as a basis for further reasoning. They do this even when those claims lie beyond or contradict their own empirical experience.

## Reasoning and make-believe

Our first set of experiments was conducted with 4- and 6-year-olds[10]. We devised problems in which the initial premise contradicted a fact that the children already knew. For example, one problem was as follows: '*All cats bark. Rex is a cat. Does Rex bark*?' Such problems served as strong test of children's willingness to reason from an unfamiliar premise. Accurate reasoning would lead children to answer *yes*. On the other hand, if children set the initial premise aside, and reason from their empirical experience of cats, they should answer *no*. Just as Luria, Cole and Scribner would have expected, both age groups did typically adopt this empirical orientation. However, in one condition, we obtained clear evidence of the analytic orientation: both age groups were quite accurate in their conclusions and justified them by reference to what the experimenter had said; for example, '*Yes, Rex barks – 'cos you told me that all cats bark.*' In this condition the experimenter had presented the premise as a description of life on another planet, and introduced dramatic emphasis into her voice, as if describing an unusual or striking scene in a story.

Our initial interpretation was that children can reason from premises that do not fit their everyday experience, provided they are prompted to treat them in a make-believe fashion: they treat the premises '*as if*' they were true, and reach sound logical conclusions as a result. By implication, a make-believe stance enables children to set aside their customary empirical orientation. To check this interpretation, we went on to examine children's performance under various conditions (see Fig. 1). As predicted, all the conditions involving any type of make-believe prompt, whether singly or in

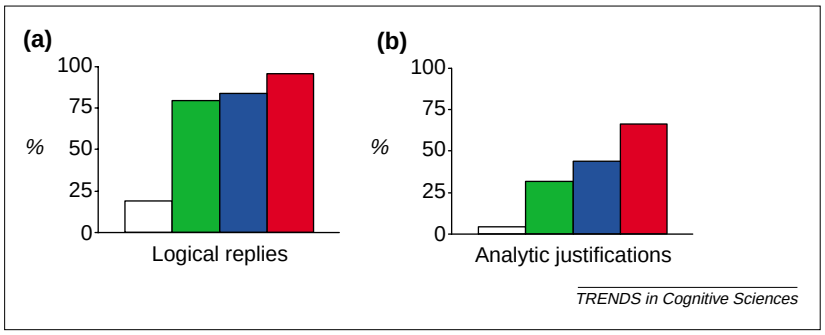


Fig. 1. Results of reasoning experiments in children. Four-and six-year-olds were asked to reason from premises given by the experimenter in different conditions. Some involved one or more specific prompts to adopt a make-believe stance toward the premises: the experimenter adopted a dramatic intonation (green bars), made reference to a distant planet (blue bars), or encouraged children to form a mental image of the initial premise (red bars). In the baseline condition (open bars) the experimenter presented the problems in a matter-of-fact tone of voice and without any extra prompts. (a) the percentage of logical replies, and (b) the percentage of analytic justifications, across the various conditions.

combination, led children to adopt the analytic orientation. By contrast, for the matter-of-fact presentation, children reverted to the empirical orientation[11]. The children we tested, especially the 4-year-olds, had received little formal education but perhaps it was sufficient to induce the kind of cognitive revolution described by Luria and Scribner. However, two subsequent studies have definitively shown that children can adopt the analytic orientation even in the absence of any schooling.

The first study was conducted in Recife in Northeast Brazil. Adopting the same procedure of comparing a standard matter-of-fact presentation and a make-believe presentation, Dias found that unschooled 5-year-olds displayed the by now familiar pattern: given a make-believe prompt they successfully adopted the analytic orientation (M. Dias, PhD thesis, University of Oxford, 1988). The second study obtained, if anything, even more striking results. Richards and Sanderson tested 2-, 3-, and 4-year-olds[12]. All three age groups reasoned accurately from premises that contradicted their everyday knowledge so long as they were given a make-believe prompt – either to use imagery or to treat the premises as descriptive of a distant planet.

Summing up this series of experiments, we can conclude that young children, are able to approach reasoning problems in an analytic fashion. Indeed, contrary to the conclusions of Luria and Scribner, children with no experience of formal schooling, can display the analytic orientation. When given a premise that does not fit in with, and may indeed violate, their everyday empirical experience, they are nonetheless prepared to treat that premise as a basis for reasoning, and justify their conclusion by referring back to the premise in question. However, this disposition appears to emerge only in restricted circumstances, namely when children are led to adopt a make-believe stance. By implication, children reason consequentially from such premises provided that they are prompted to treat them *as if* they were true. The next set of experiments led us to revise this interpretation.

## Reasons to be doubtful

The first unequivocal sign that our focus on the power of make-believe was inadequate emerged in new experiments where we looked at the persistence of the effects that we had observed. In our initial studies, children had been prompted to adopt a given stance toward the problems, be it a make-believe stance or a matter-of-fact stance, and received the problems all within the same session. We wondered what would happen if we re-visited the children a week or two later and gave them a further set of problems – this time with no particular prompt. Would children revert to the empirical orientation or would they persist in adopting the analytic orientation as in the first session? To our surprise, children persisted with the analytic mode and accurately solved the problems – indeed, there was no detectable decrement in their accuracy[13,14]. Yet it seemed bizarre to suppose that our initial intervention had led children to adopt a make-believe stance for up to two weeks. Our initial intervention had apparently prompted some more profound change than a temporary willingness to engage in make-believe.

In reviewing our early studies, another problem with our emphasis on make-believe came to light. As noted above, we had used patently false premises (e.g. '*All cats bark*' or '*All fishes live in trees*') as a strong test of children's willingness to abandon an empirical stance. Their readiness to do so following a make-believe prompt could be plausibly interpreted as a step into a pretend world and a setting aside of interfering, empirical knowledge. However, children almost certainly perceived some of the other premises that we had used in our early studies as unfamiliar rather than false. For example, we told children that: '*All molluscs live in shells*' or '*All leukocytes are white*'. In a pre-test, children displayed little knowledge of either molluscs or leukocytes. We also presented made-up premises, for example, '*All pongodaps have stripes on their backs*' or '*All mib is black*'[15]. Presumably, children had no prior knowledge about either 'pongodaps' or 'mib'. Nevertheless, a make-believe presentation helped children perform more accurately on both the unfamiliar and the made-up premises. These premises do not obviously contradict children's empirical knowledge, so any benefit conferred by a make-believe prompt cannot be ascribed to the inhibition of contradictory, empirical knowledge. We were faced, therefore, with the implication that although a make-believe prompt does indeed help, this is not necessarily because it induces a make-believe stance in which everyday empirical knowledge is held in abeyance.

A final reason for questioning our emphasis on the power of make-believe was linked to the effects of education reported by Luria, Cole and Scribner. Our very simple intervention was producing an intellectual orientation comparable to that induced by two or three years of schooling: children were reasoning accurately and justifying their conclusions by reference to the wording of the

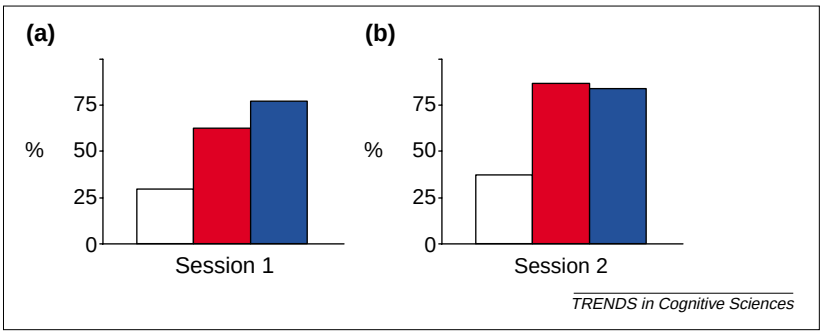


Fig. 2. Results of an experiment in which children were given problems either with a prompt to adopt a make-believe stance by using imagery (red bars), or given a very simple instruction, namely to 'think about what things would be like' if the premises were true (blue bars). There was also a baseline condition involving no special instruction (open bars). (a) the percentage of logical replies in Session 1, when children were assigned to one of the three conditions. The results show that the stripped-down prompt to 'think' was as effective as the more elaborate make-believe prompt. (b) the percentage of logical replies produced by the same children to new problems one week later in Session 2, when none of the children received any special instruction. Those children initially given the stripped-down prompt still performed as well as those initially prompted to adopt a make-believe stance.

premises. Yet it would call for an unduly sceptical – and implausible – conception of schooling to conclude that it helps children to reason effectively by getting them to adopt a make-believe attitude to what they are told. Children are expected to encode and reason from many hitherto unknown generalizations in school. Presumably, they do end up genuinely believing them and not simply pretending that they do. If that argument is correct, it was reasonable to ask whether our admittedly brief intervention was having an effect akin to that of schooling – something more serious and long-standing than the induction of a make-believe stance[16].

## A new interpretation

Thinking about the various studies that we had conducted, it was apparent that the analytic and empirical orientations differed critically in the weight given to the initial premise: children adopting an analytic orientation accepted that premise as a starting point and, as noted, often referred back to it in their justifications. Children who adopted an empirical orientation appeared to ignore the initial premise, and scarcely ever mentioned it in their justifications. Arguably, the make-believe prompt was successful, not because it led children to adopt a make-believe attitude but because it hooked children into encoding and accepting the initial premise as a starting point – in much the same way as a story-teller hooks listeners from the outset with a dramatic piece of scene setting.

To test this interpretation, we asked whether children would benefit not only when they were prompted to adopt a make-believe stance but also when they were given a very simple instruction, namely to 'think about what things would be like' if the premises were true. Somewhat to our surprise, but in line with our new interpretation, this stripped-down prompt was just as effective at the initial testing session. Moreover, when we gave children some fresh problems one week later – without providing any introductory prompt – children who had initially been given the stripped-down 'think' prompt performed just as well as those initially prompted to adopt a make-believe stance[13] (see Fig. 2).

Given these findings, we formulated our revised hypothesis as follows. When presented with a claim that lies outside or contradicts their everyday experience, young children rarely accept that claim as a starting-point for the integration of subsequent information. Nevertheless, when their interlocutor either explicitly invites them to 'think' about the claim, or implicitly asks them to do so by using various dramatic devices (such as a story-telling intonation, instructions to use imagery, or making references to a strange planet), then children do successfully treat that claim as a starting-point for reasoning, as reflected both in the conclusions that they draw and the justifications that they offer. Effectively, children shift not so much in the type of logic that they use or in the stance that they adopt but in the way that they think of their interlocutor's claims. In the empirical mode, they winnow out his or her claims if they do not immediately fit in with their own experience, but in the analytic mode they treat them seriously and consider their implications.

Our earlier interpretation faced three different objections. How well does this new interpretation handle those objections? First, although it is unlikely that a make-believe stance would persist over days or weeks, it is certainly plausible that greater receptivity to an interlocutor's claims might persist from one meeting to the next. Second, although a make-believe stance is more obviously helpful for premises that run counter to previous empirical experience as compared with premises that are simply unfamiliar, receptivity to an interlocutor's claims should be equally helpful for both false and unfamiliar claims. Third, although it is unlikely that schooling prompts a make-believe stance it is feasible that schooling nurtures young children's receptivity to a teacher's pronouncements – however outlandish they might initially appear. Thus, on all three counts, the new hypothesis does a better job than the old one.

Nevertheless, we are left with two questions to think about. First, why exactly do unschooled children need prompting before they display the kind of receptivity to other people's claims that educated children and adults show spontaneously? Second, if young children can reason from the testimony of others in what domains is that capacity likely to manifest itself?

## Asking questions at home and at school

The evidence presented so far implies that before children go to school they usually require prompting before they adopt the analytic orientation. However, both in the original studies carried out by Luria with adults and in all subsequent studies, including our own, participants are placed in an odd situation. Following a brief preamble, they are abruptly presented with an unfamiliar piece of information and invited to reason from it. This mode of discourse has, at best, a limited relationship to the type of conversation that young children ordinarily engage in.

Although pedagogically inclined parents might supply information about the world even when their children have not asked for it, parents generally supply information not 'out of the blue' but in response to a question – often a 'why' question posed by the child. Indeed, when Barbara Tizard and Martin Hughes recorded 4-year-olds in the home, they found that on average, the children asked a question almost every two minutes[17]. More than a quarter of these questions were 'why' questions and for just over half of the children these questions sometimes led to 'passages of intellectual search' – an extended dialogue between child and caretaker sustained primarily by the child's persistent and puzzled questioning. These same children were also observed at their nursery school. Interestingly, there, they asked many fewer questions – about two or three per hour. Moreover, they asked 'why' questions only once every couple of hours and, sadly, passages of intellectual search were completely absent.

These findings offer a plausible explanation of why it is that young children, and indeed adults, with no schooling, require prompting if they are to be receptive to other people's testimony. Outside of the classroom, and especially in the company of a familiar adult, young children are likely to gather new information by their frequent and often tenacious questioning. Similarly, adults with no formal education may well seek out and assimilate information from local experts. By contrast, the classroom – and also the reasoning tests that we have used – introduce a different mode of discourse. Pupils are expected to listen to, and incorporate, unsolicited information. A plausible conclusion, therefore, is that unschooled children and adults need prompting mainly because they are unused to this exceptional mode of discourse. Although they can incorporate and reason from unfamiliar premises, they typically do so at their own pace and of their own seeking. This argument suggests (in line with Hume's dictum given earlier) that human beings have a natural disposition to be receptive to other people's testimony about the unknown – but mainly when they ask for it. Indeed, despite the received view of young children as stubborn autodidacts, they do not insistently rely on their own experience. Parents who are asked a question approximately every two minutes are likely to confirm this!

## Thinking about the unknown

Finally, we may ask about the domains in which children are likely to seek out other people's testimony. In many of the domains that are currently under scrutiny by developmental psychologists, the testimony offered by adults is likely to be a key source of information. Thus, by the age of 4–5 years, most children know that babies grow inside their mothers[18]; they know something about the brain's contribution to various cognitive processes[19]; they have a rudimentary understanding of how germs cause illness[20,21]; and they have some appreciation of God's special powers[22].

It is unlikely that children begin to understand any of these domains – which involve causal processes hidden from their view – unless they are given relevant information by adults. My hope is that, armed with a fuller appreciation of children's ability to reason about the unknown, we will be able to track the extent to which children digest the implications of such information. There is no doubt that young children do learn from their own play and from active experimentation with the world, as most nursery schools assume. Still, they also have an appetite for questioning adults about the unknown and for thinking about the implications of what they are told.

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