How easily and accurately can young children recognize logical fallacies?

To gauge the capacity of young children to find weaknesses in logical reasoning, I compiled a list of five common logical fallacies and an example of each. I introduced the concept to my participants by asking them to tell me what, if anything, they thought was wrong with these statements, but that if they thought nothing was wrong, they could tell me so. I interacted with each participant alone, so they could not influence each other's responses. Once I had heard their initial reactions, I briefly explained the fallacy demonstrated in general terms and, if necessary, how it specifically applied to each case. After they had indicated understanding, I asked them if they could come up with an example of their own.

My participants were a 12-year-old boy and a 7-year-old girl, hereafter referred to as "12" and "7." Details of each fallacy, the examples used, and each participant's reaction are listed below.

Composition: because X is true of the *parts* of something, X is necessarily true of the *whole*.

Example: "We use better ingredients than anyone else, so our pizza is better than anyone else's."

12: Immediately identified the fallacy; ingredients were not enough to improve pizza and there is no comment of the skill involved in the pizza's creation.
7: Expressed that the statement "sounded wrong," but could not explain.

Appeal to Authority: X must be true if a person regarded as an authority says it is true.

Example: "Colgate is the best toothpaste to use. I know because Michael Phelps said so."

12: Pointed out that Phelps could have been paid or might be lying, then identified Phelps as not a reliable expert on toothpaste.
7: Expressed that Michael Phelps is unrelated to toothpaste.

Appeal to Popularity: X must be true if X is a widely held belief.

Example: "Why even listen to the case? Everyone has already come to the conclusion that this man is the murderer, so he must have done it."

12: Expressed that large groups can still be wrong and specifically stated that a belief being common doesn't make it right.
7: Expressed that the general opinion is not the same as fact and pointed out that the defendant could have been framed (so public opinion could have been manipulated).

Appeal to Emotion: X must be true if there is an emotionally appealing argument presented for it.

Example: "You have to finish your food- don't you know there are children starving in Africa?"

12: Pointed out that eating won't help hungry people and thus the two statements are not connected; offered the alternate sentiment that children starving should make you "appreciate" your food instead.
7: Expressed that the premise is unrelated to the conclusion but could not explain further.

Straw Man constructs the weakest possible argument that could be inferred from the opponent's statements in order to discredit them.

Example:
"Person 1: Want to come over after school?
Person 2: I think I'm going to hang out with Jessica tonight.
Person 1: So you like Jessica better than me?"

12: Pointed out that keeping to a prior engagement is a matter of etiquette, not personal preference, and that Person 1 could like Person 2 better and still pursue an activity with someone else.
7: Identified this as a false dilemma and pointed out that both people could go to hang out with Jessica together; did <u>not</u> argue that Person 1 is incorrect in their assessment that Person 2 likes Jessica better.

My participants were attentive and willing to listen to what I had to say, and enjoyed the change to be part of an "experiment." They had a noticeable openness to being taught new ways of thinking, something that older people often seem resistant to.

I found it heartening that my participants were able to instinctively say that *something* was wrong with each line, even if they couldn't always explain it or came up with explanations unrelated to the fallacy. I had expected the 7-year-old to have more trouble identifying illogical reasoning, but she did remarkably well and in one case

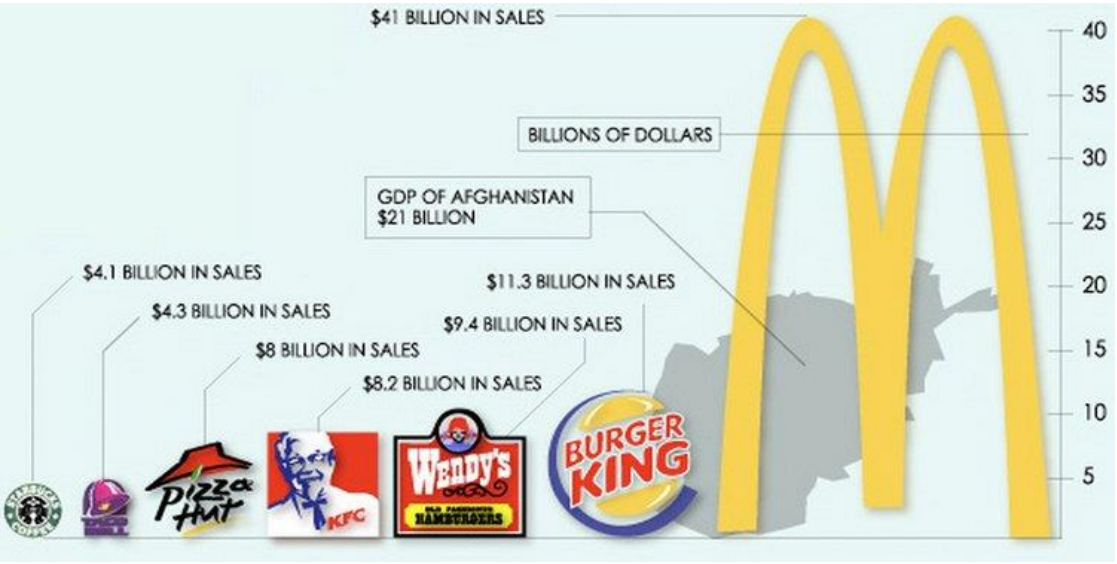
(appeal to authority), even arrived more quickly at identifying the logical fallacy than the 12-year-old.

Both my participants were able to understand and repeat a simple explanation of each fallacy, but neither was able to consistently and satisfactorily come up with their own examples; the 12-year-old, as expected, made more sophisticated attempts than the 7-year-old. I am not particularly concerned by this; I find it comforting to know that even at such a young age, we are able to reason (and therefore argue) with the capacity to recognize fallacious logic in ourselves and others.

How easily and accurately can young children recognize poor visualizations of data?

To similarly assess the same participants' abilities to recognize misleading visual representations of data, I showed them two graphs. After checking to ensure that they had a basic understanding of what the charts were attempting to communicate, my instructions were deliberately vague, simply asking them to tell me *what, if anything, they thought looked wrong or confusing*. Once they had listed everything they found, I pointed out whatever presentational issues they had not noted and explained why each of these was a poor visualization of the data.

Visual 1



[This graph features bars that grow in width as well as height, creating confusion about proportions, and the image of Afghanistan is covered up and visually confusing.]

12: Was able to understand what the image tried to communicate. Observed that the y-axis was not tall enough, and should go up another 5, since the McDonald's bar went above the y-axis.
7: After some explanation, was able to understand what the image tried to communicate. Made no observations of things she found unusual or confusing.

Visual 2

[This graph proudly features no y-axis, four randomly chosen months to use as data points, disproportionate vertical distance between each point, disproportionate horizontal distance between each point, and a lowest value that is not zero.]

12: After some explanation, was able to understand what the image tried to communicate. Observed that the creator of the graph cherrypicked months to use instead of taking data from the whole timespan and that the distance between the data points was manipulated to make the line look straight.
7: After some explanation, was able to understand what the image tried to communicate. Expressed that the numbers seemed "wrong" to her, but couldn't explain why.

As expected, my participants had more trouble looking for problems with data visualization than they did with finding poor logical leaps. The 12-year-old did significantly better than the 7-year-old, which indicates that early adolescence is when the necessary skills for critiquing data visualization start to be developed. Both of them were able to understand when I explained what the problems were and why they were

bad for the person trying to view the chart, but the 7-year-old took longer to fully grasp all the concepts.

Ultimately, more valuable than innate skills is an excitement for learning and a willingness to listen, and it would be useful to take advantage of the presence of this trait in children, who can be more logical than we give them credit for and are generally happy to absorb new knowledge.