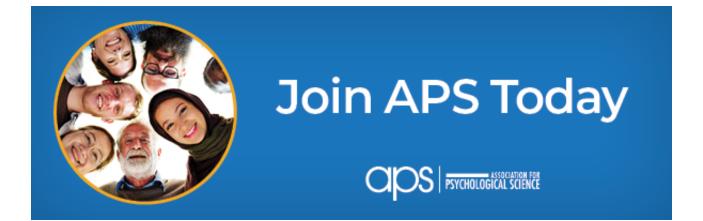# A New Twist on a Classic Puzzle

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"A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?"

Take a minute to think about it … Do you have the answer? Many people respond by saying that the ball

must cost 10 cents. Is this the answer that you came up with? Although this response intuitively springs to mind, it is incorrect. If the ball cost 10 cents and the bat costs $1.00 more than the ball, then the bat would cost $1.10 for a grand total of $1.20. The correct answer to this problem is that the ball costs 5 cents and the bat costs — at a dollar more — $1.05 for a grand total of $1.10.

So why do so many people answer incorrectly? The answer is that people often substitute difficult problems with simpler ones in order to quickly solve them. In this case, people seem to unconsciously substitute the "more than" statement in the problem (the bat costs $1.00 *more than* the ball) with an absolute statement (the bat costs $1.00). This makes the math easier to work with; if a ball and bat together cost $1.10 and the bat costs $1.00, then the ball must cost 10 cents.

Time and again research using the bat-and-ball problem has shown that that this intuitive process leads people astray. But are intuitions always detrimental to problem solving? In a 2014 Journal of Cognitive Psychology article, Université de Toulouse researcher Bastien Trémolière and Université Paris-Descartes researcher Wim De Neys sought to answer this question.

Trémolière and De Neys point out that the intuitively generated response to the bat-and-ball problem (that the ball costs 10 cents) is neither highly believable nor highly unbelievable. It is not unreasonable to think — especially for someone who isn't an expert in baseball — that such a ball could cost 10 cents. They wondered how a person might respond if a similar problem cued an intuitive — but unbelievable — response. What would happen if the intuitive response contradicted other intuitions such as past knowledge about the cost of an item?

To find out, the researchers had participants answer a classic or a modified bat-and-ball-type problem. In the classic problem, participants were asked the following question:

"A Rolls-Royce and a Ferrari together cost $190,000. The Rolls-Royce costs $100,000 more than the Ferrari. How much does the Ferrari cost?"

In the modified version of the problem, participants were asked the following question:

"A Ferrari and a Ford together cost $190,000. The Ferrari costs $100,000 more than the Ford. How much does the Ford cost?"

As in the original bat-and-ball problem, people often will try to make the problem seem easier by unconsciously removing the "more than" wording in the problem, leading them to read the problem as saying either "The Rolls Royce costs $100,000" or "the Ferrari costs $100,000."

The intuitive but incorrect answer is that the less expensive car (either the Ferrari or the Ford, depending on the problem) costs $90,000; however, in the modified version of the problem this answer (that the Ford costs $90,000) conflicts with people's prior knowledge about Ford cars: The idea of a Ford being that expensive is not believable. This conflict is not present in the classic problem, as the thought of a Ferrari costing $90,000 would seem reasonable to most people.

The researchers found that significantly more people correctly answered the modified version of the problem than the classic version of the problem. The authors posited that when intuitive answers conflict

with other intuitions, such as those based on past knowledge, people are more likely to engage in more deliberate and reflective reasoning leading to a higher likelihood that they will answer the problem correctly.

Reference

Trémolière, B., & De Neys, W. (2014). When intuitions are helpful: Prior beliefs can support reasoning in the bat-and-ball problem. *Journal of Cognitive Psychology*, *26*, 486–490.