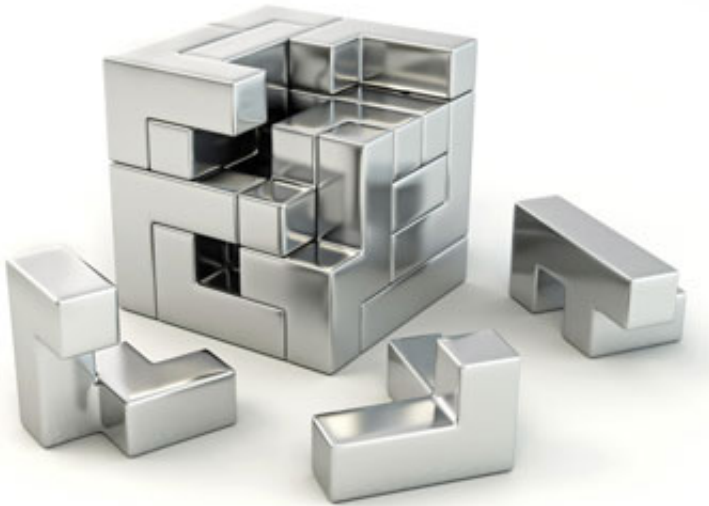# What Is Logical Isn't Always True

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In logic, an argument can be invalid even if its conclusion is true, and an argument can be valid even if its conclusion is false. It's a confusing concept, and people are easily fooled when an argument's validity and believability don't match up, especially in the case of invalid arguments with conclusions that are believable. Psychological scientists call this phenomenon *belief bias*.

For example, consider this argument.

All psychological scientists conduct empirical research.
William James conducts empirical research.
Therefore, William James is a psychological scientist.

All of the premises are true, and so is the conclusion, but it's not a valid argument. All psychological scientists do conduct empirical research, and so does William James, but that's not what tells us that James is a psychological scientist. Some people who conduct empirical research — Rosalind Franklin, for example — aren't psychological scientists at all.

To explain belief bias, scientists have developed the *selective processing model*. According to this model, human reasoning involves a superficial, associative *heuristics* component and a rigorous, rule-based *analytic* component. When we're evaluating an argument, the heuristic component of the reasoning process encourages us to accept the conclusions we believe and reject the conclusions we don't believe. The analytic component encourages us to accept or reject a conclusion based on a mental model of the argument. Even when the analytic component kicks in, it's not foolproof because our reasoning process functions in a way that is "satisficing." In other words, people naturally aim for "good enough" rather than perfect when it comes to logic.

Now, a group of scientists led by Edward J. N. Stupple of the University of Derby, UK, is suggesting

that this model should be tweaked to acknowledge the unique reasoning processes utilized by high-logic thinkers. These thinkers scrutinize problems at an analytic level that goes beyond mere satisficing, and in a study published in the *Journal of Cognitive Psychology*, Stupple and his coauthors pointed out that the current selective processing model doesn't explain what makes people give special analytical attention to some problems over others.

Stupple's team asked a group of participants to complete a logic test and used the resulting scores to split the participants into three groups: a low-logic, high belief-bias group; a medium-logic, moderate belief-bias group; and a high-logic, low belief-bias group. The low-logic groups solved the problems more quickly and less accurately than the other two groups, and they spent the same amount of time on each problem, regardless of whether validity and believability conflicted. The medium-logic group solved the problem more slowly than the low-logic group, and took somewhat more time to answer invalid-believable problems than other problems. Finally, the high-logic group showed greater accuracy than the other two groups, and it took them significantly longer to answer invalid-believable problems than all other types of problems.

The scientists think that a sensitivity to logic-belief conflict and the unique (and time-consuming) problem-solving style of high-logic thinkers is a big part of what drives the invalid-believable argument response times for *all* groups. While sensitivity to logic-belief conflict may exist to some degree in everyone, the scientists write, it is most dramatic in high-logic problem solvers.

Even though Stupple and his team propose revising the selective processing model slightly to reflect the responses of high-logic individuals, overall they think their data indicate that the selective processing model is empirically sound — maybe even the type of model that William James could get behind.

Edward J. N. Stupple, Linden J. Ball, Jonathan St. B. T. Evans, & Emily Kamal-, & Smith (2011). When logic and belief collide: Individual differences in reasoning times support a selective processing model *Journal of Cognitive Psychology, 23* (8) DOI: 10.1080/20445911.2011.589381