

Validity of Conjectures

In the first 130 cases the Innocence Project overturned, eyewitness testimony played a part in 78 percent of those wrongful convictions.

Why Science Tells Us Not to Rely on Eyewitness Accounts

Eyewitness testimony is fickle and, all too often,
shockingly inaccurate

<https://www.scientificamerican.com/article/do-the-eyes-have-it/>

Our brains are not as good as we think they are. You believe that you know something that you saw first hand... but did you?

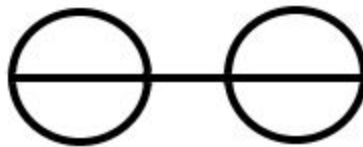
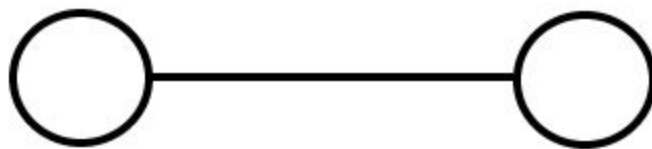
Ever see a shadow that you thought was a deer? A tree stump that looked like a person? Our brains tend to look for the general form and then fills in the blanks with what it is likely to be and then that is the image that you see. This is not necessarily what was there...

Besides this - memories change. Have a favorite story you like to tell about something that happened to you? Do you tell the story every couple of years? The details will change and you will not even be

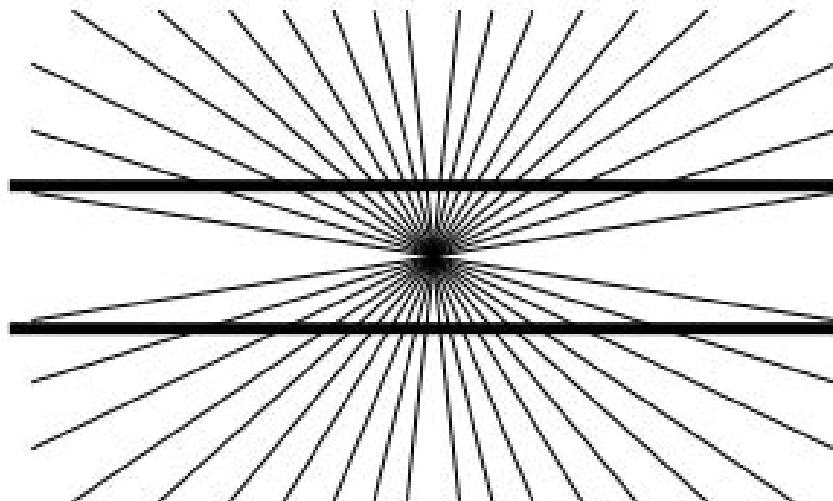
aware. You may think the car was red but when you see a picture of that car 10 years later you see that it was clearly blue. Your memories change inside your head.

Math is studying what is infallibly true. Sometimes this goes against what we want or feel to be true.

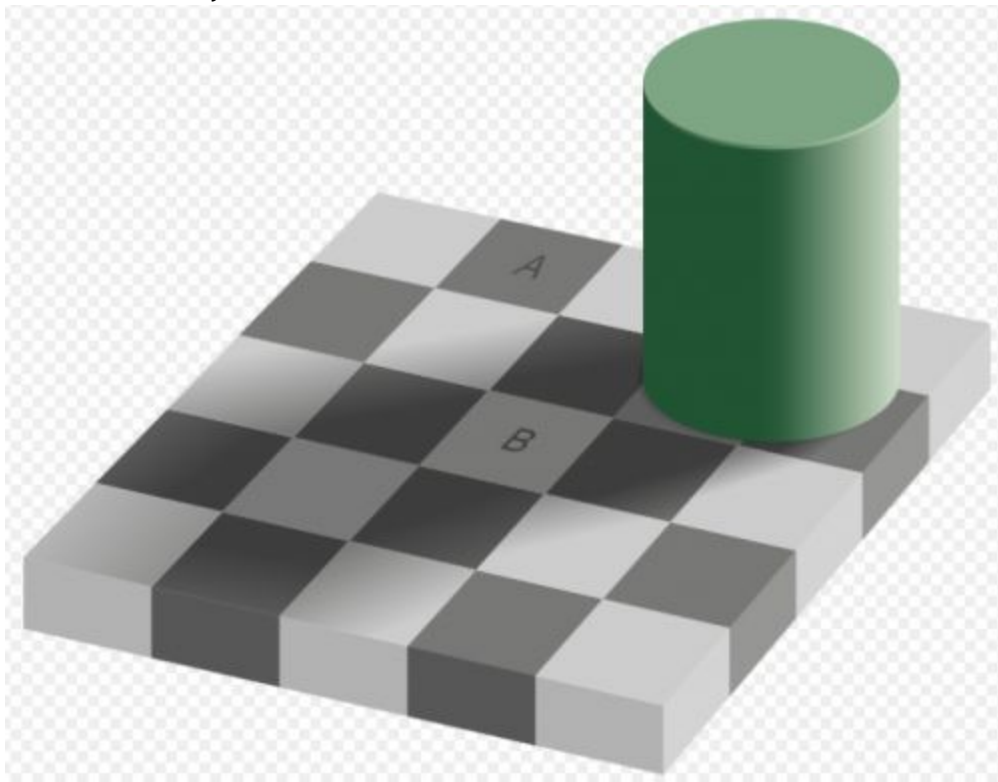
Which line is longer?



Are these lines straight?



Make a conjecture about whether A or B is darker.



This seem to scale, right?



Another angle:



Key Idea:

Some conjectures initially seem valid, but are shown not to be valid after more evidence is gathered.

Always be ready to change your mind.

Ask yourself: "What evidence would convince me that my current view is wrong."

A proof in maths is very difficult and very hard to obtain. If you find a new one - you'll be getting a PhD!

Let's look at an algebraic example:

It is my conjecture that for any value of x the following formula = 0.

$$y = (x - 1)(x - 2)(x - 3)$$

x	$(x - 1)(x - 2)(x - 3)$	y
1		
2		
3		

∴ my conjecture is true. Any problems?

Your doodling in class because your teacher is boring...

You draw a triangle, square, pentagon, and hexagon. You draw the diagonals and make a conjecture:



If a polygon has n sides, there are $(n - 2)$ triangles drawn from any given vertex of the polygon.

Is this correct?

This is why a proof is so hard to come by in maths. You can have thousands of examples that show that a conjecture is true for thousands of situations - however it only takes one counter example for it all to come crumbling down like a



Here is my favourite mathematical conjecture:

It is possible to colour any map with only 4 colours.

In other words: There is no pattern that you can draw that cannot be coloured in with only 4 colours with none of those colours ever touching.

If one of you can find one counterexample you will immediately become world famous (at least to mathematicians).

Matt found an interesting numeric pattern:

$$\begin{aligned}1 \cdot 8 + 1 &= 9 \\12 \cdot 8 + 2 &= 98 \\123 \cdot 8 + 3 &= 987 \\1234 \cdot 8 + 4 &= 9876\end{aligned}$$

What is your conjecture?

Does it hold for the next number?

Does it always hold?

Key Ideas:

- Once you have found a counterexample to a conjecture, you have disproved the conjecture. This means that the conjecture is invalid.
- You may be able to use a counterexample to help you revise a conjecture

Need to Know:

- A single counterexample is enough to disprove a conjecture.
- Even if you cannot find a counterexample, you cannot be certain that it is not one. Any supporting evidence you develop while searching for a counterexample, however, does increase the likelihood that the conjecture is true.

Assigned work: Page 22

1, 3, 5-9, 14, **16**, 17, 21