

# Fallacies

formal, informal,  
rhetorical & statistical

# Formal fallacies

- A logical *argument* that is not *valid*
  - Valid: The premises fit & prove the conclusion
  - For example:
    - All S is M.
    - All P is M.
    - ✗ Therefore, all S is P.

# Formal fallacies

- A logical *argument* that is not *valid*
  - For example:  
All rabbits run fast.  
Homare Sawa runs fast.  
✗ Therefore, Homare Sawa is a rabbit.

# Formal fallacies

- A logical *argument* that is not *valid*

Compare a valid example:

All rabbits run fast.

Homare Sawa is a rabbit.

Therefore, Homare Sawa runs fast.



# Rhetorical (informal) fallacies

- (Some) Attempts to convince without logic
    - People instead of premises, data

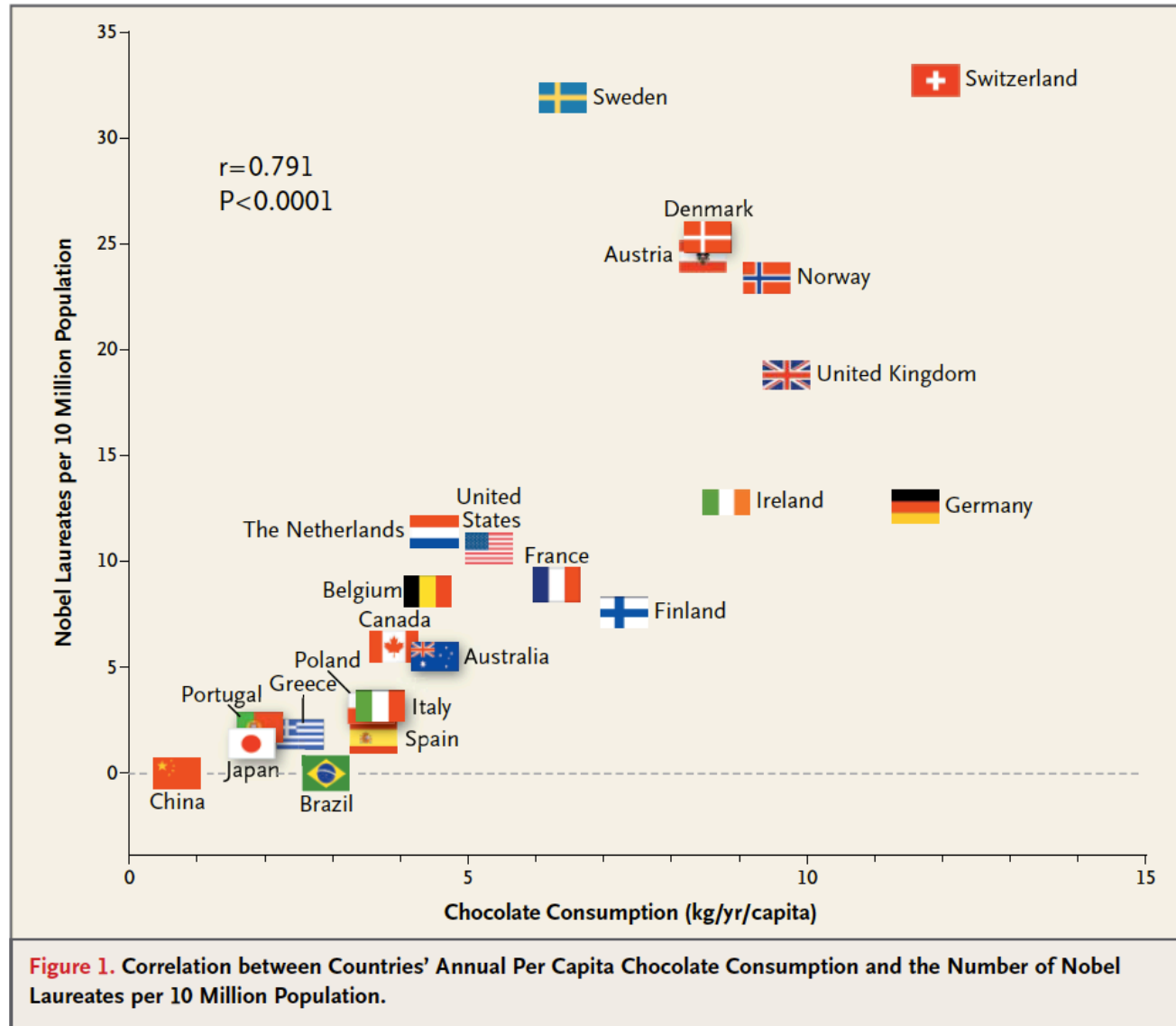
Everybody says it, so it must be true.

Stupid people say it, so it must be false.
  - Ignorance/knowledge instead of logic
- We don't know it's *not* true...
- This is a good idea, so it must be true.

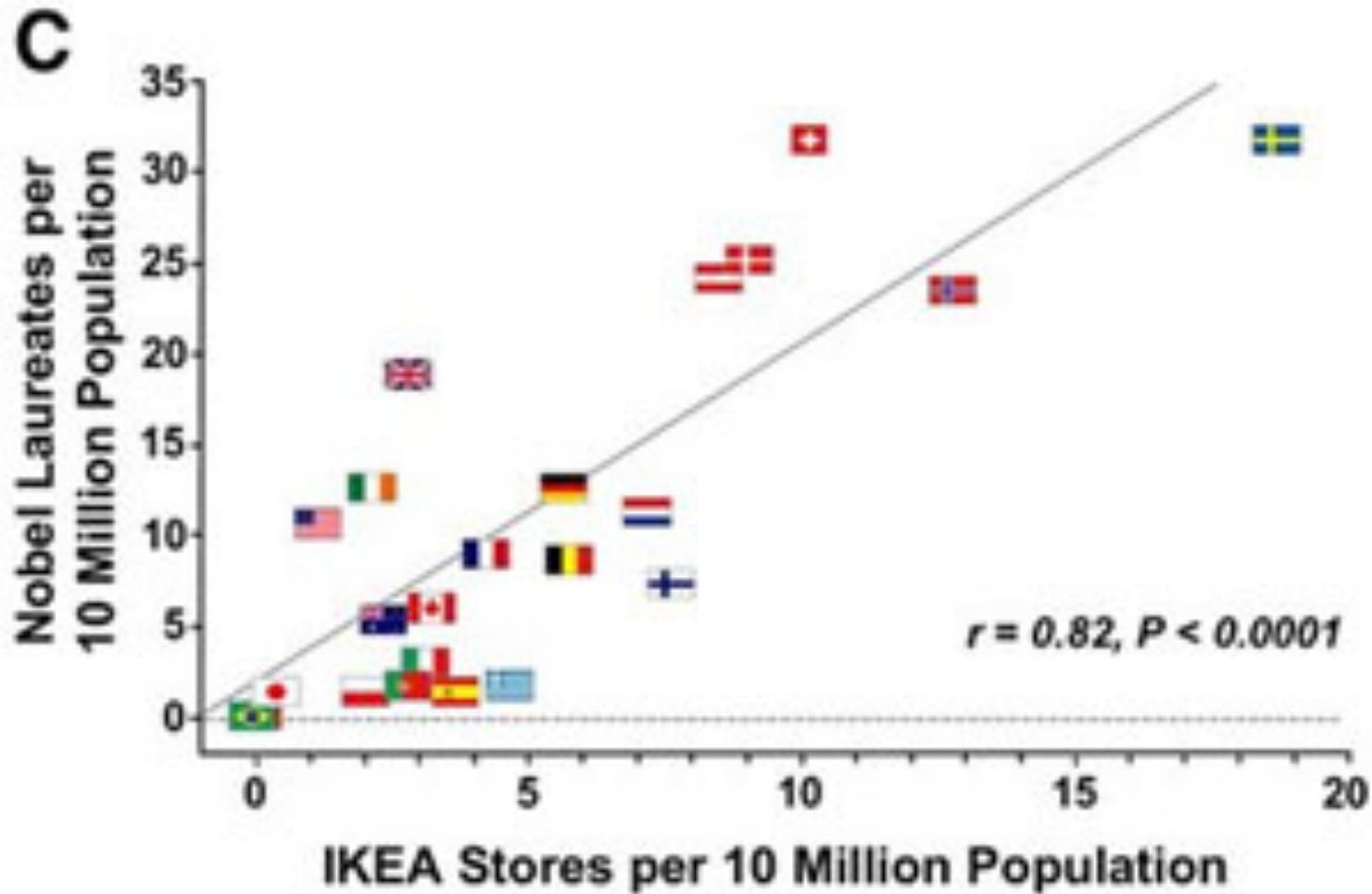
# Statistical fallacies

- Misunderstanding / misrepresenting statistics  
It's significant ( $p < 0.01$ ), so it's important.  
The temperature has been going down since September. By June we'll be freezing.
- Calculating incorrectly, improperly  
All my friends agree with me.  
Therefore, everyone agrees with me.

# Chocolate & Nobel Prizes



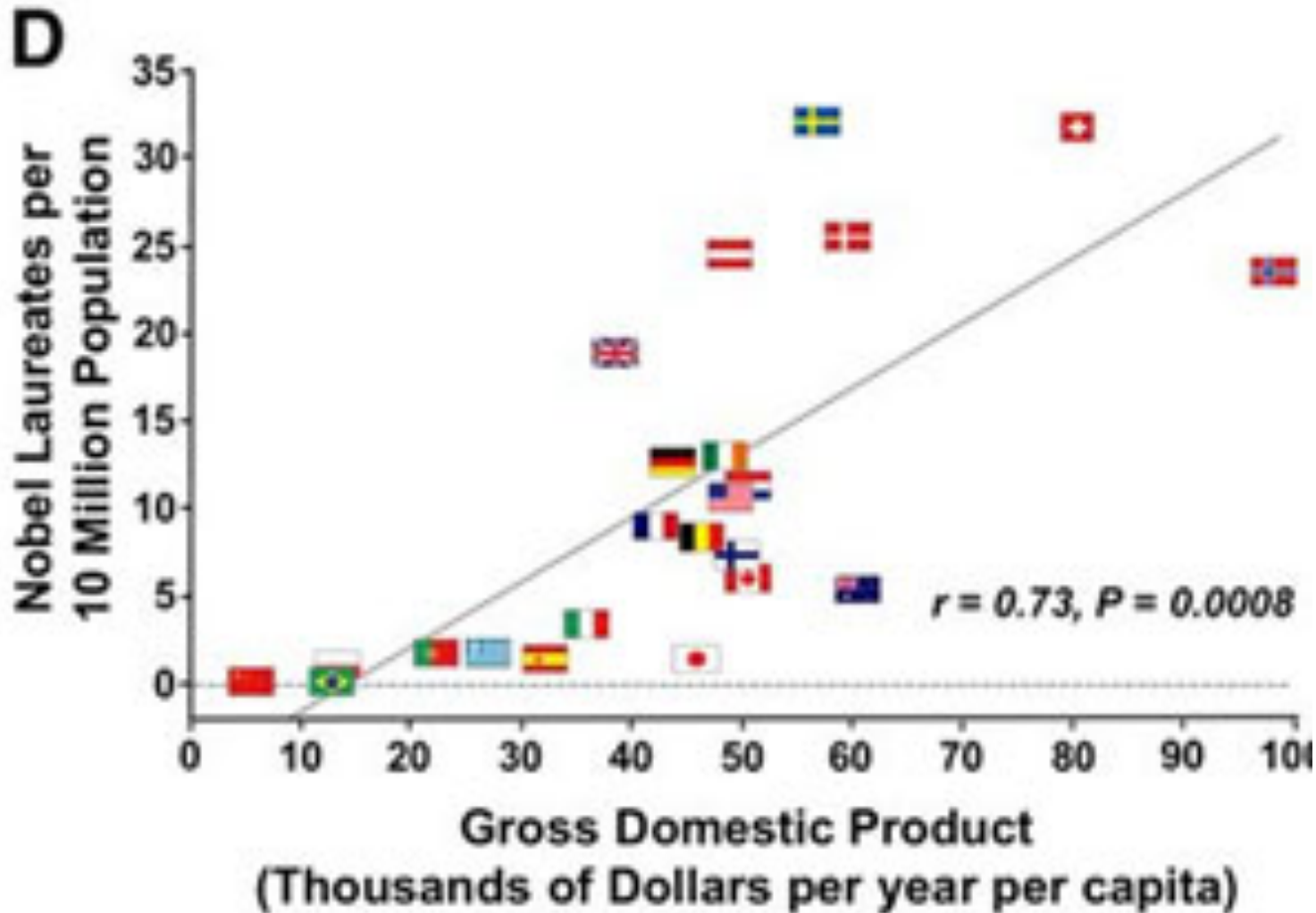
# Chocolate & Nobel Prizes



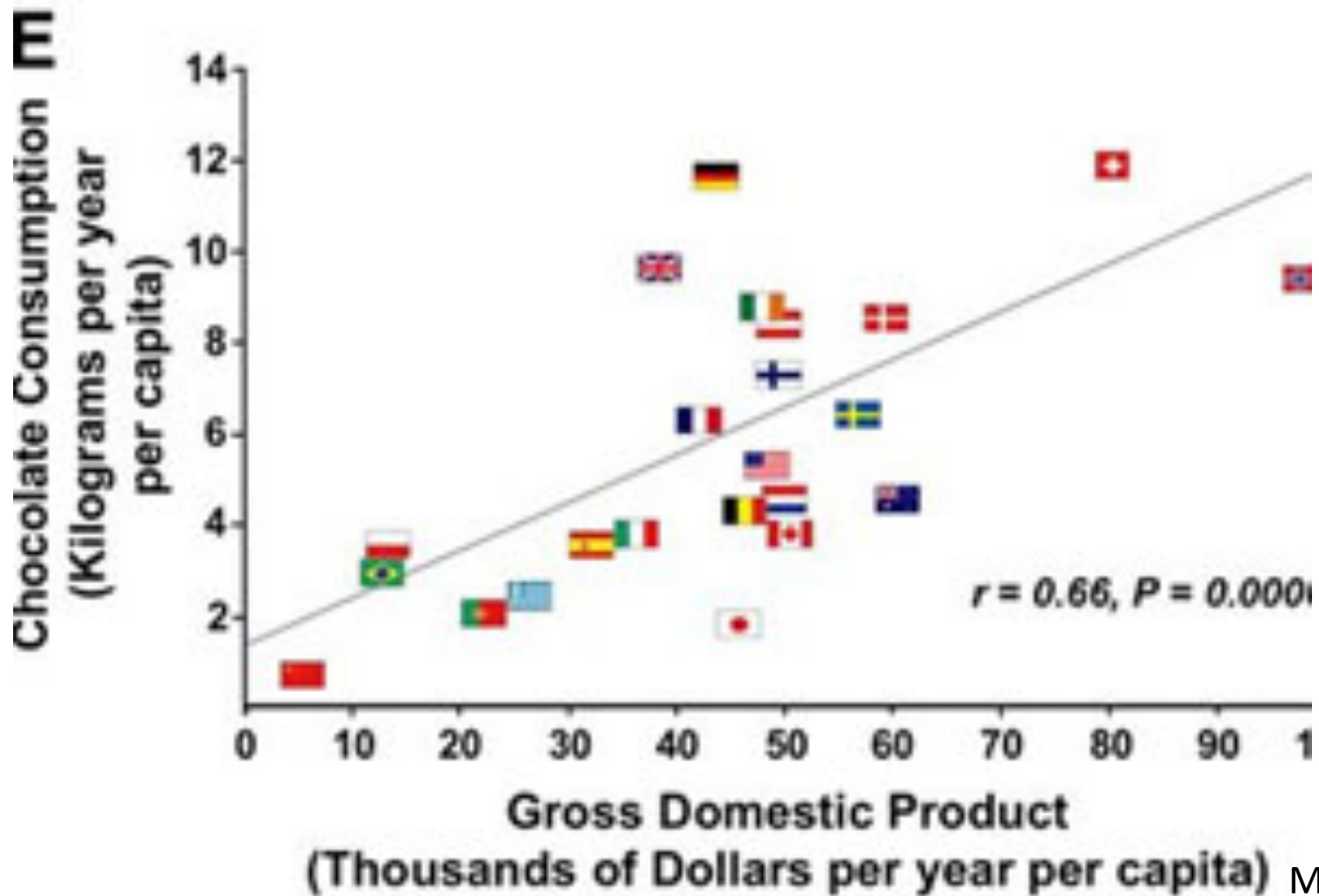
Maurage  
et al.  
2013



# Chocolate & Nobel Prizes



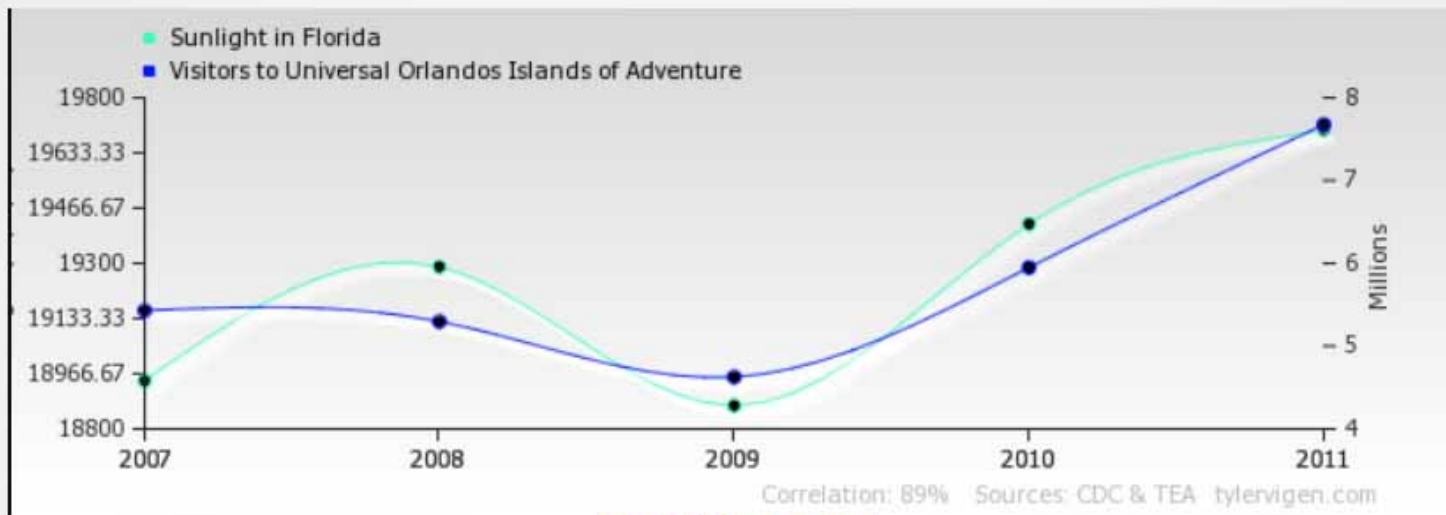
# Chocolate & Nobel Prizes



Maurage  
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# Sunlight correlates with vacations

## Sunlight in Florida correlates with Visitors to Universal Orlando's Islands of Adventure



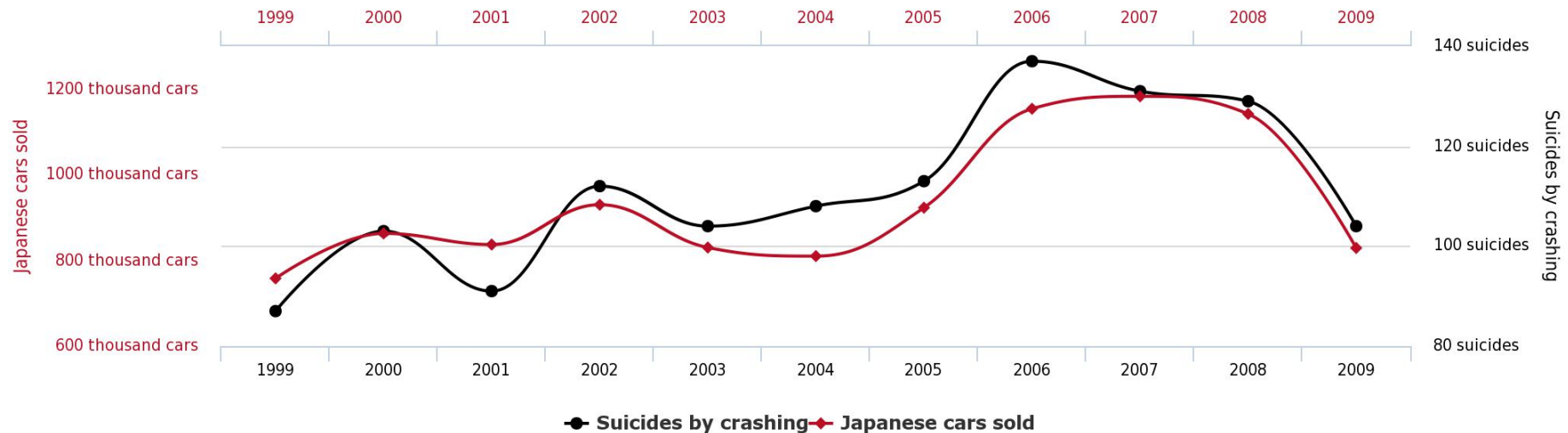
Upload this image to imgur

	2007	2008	2009	2010	2011
Sunlight in Florida Sunlight (KJ/sq.m) (CDC)	18945.54	19289.68	18870.38	19418.7	19700.78
Visitors to Universal Orlando's Islands of Adventure Millions (TEA)	5.43	5.297	4.627	5.949	7.674
<b>Correlation: 0.89205</b>					

Courtesy of  
tylervigen.com

# Japanese cars & US suicides

**Japanese passenger cars sold in the US**  
correlates with  
**Suicides by crashing of motor vehicle**



tylervigen.com

Courtesy of  
tylervigen.com

# Government

Can you spot the fallacy?

# British politicians' bargain

- 2011: British politicians say government wastes £10bn (¥2兆) per year
- Ben Goldacre read the report to check their calculation.

<http://www.badscience.net/2012/04/is-this-the-worst-government-statistic-ever-created/>

# British politicians' bargain

Government workers' mobile phones are from an expensive company. If their mobile phones were from a different company, they would be 20% cheaper.

City government spends £50bn per year on all programs. If they can save 20%, that is £10bn.

# British politicians' bargain

Government workers' mobile phones are from

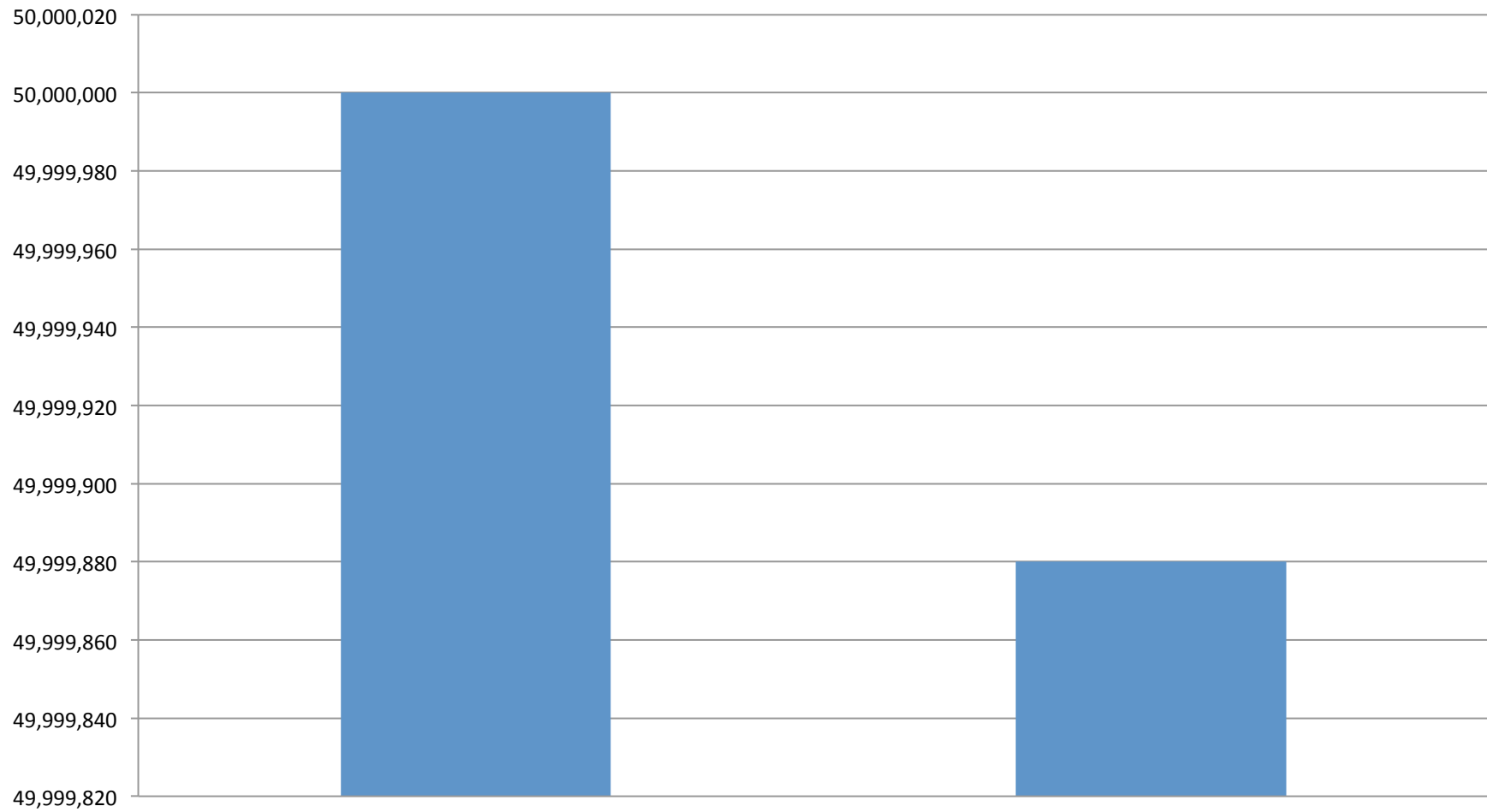
Most spending is not for mobile phones. Phones cost the government £600,000 per year. If they save 20%, that is £120,000 (£0.00012bn).

## **Extrapolation fallacy**

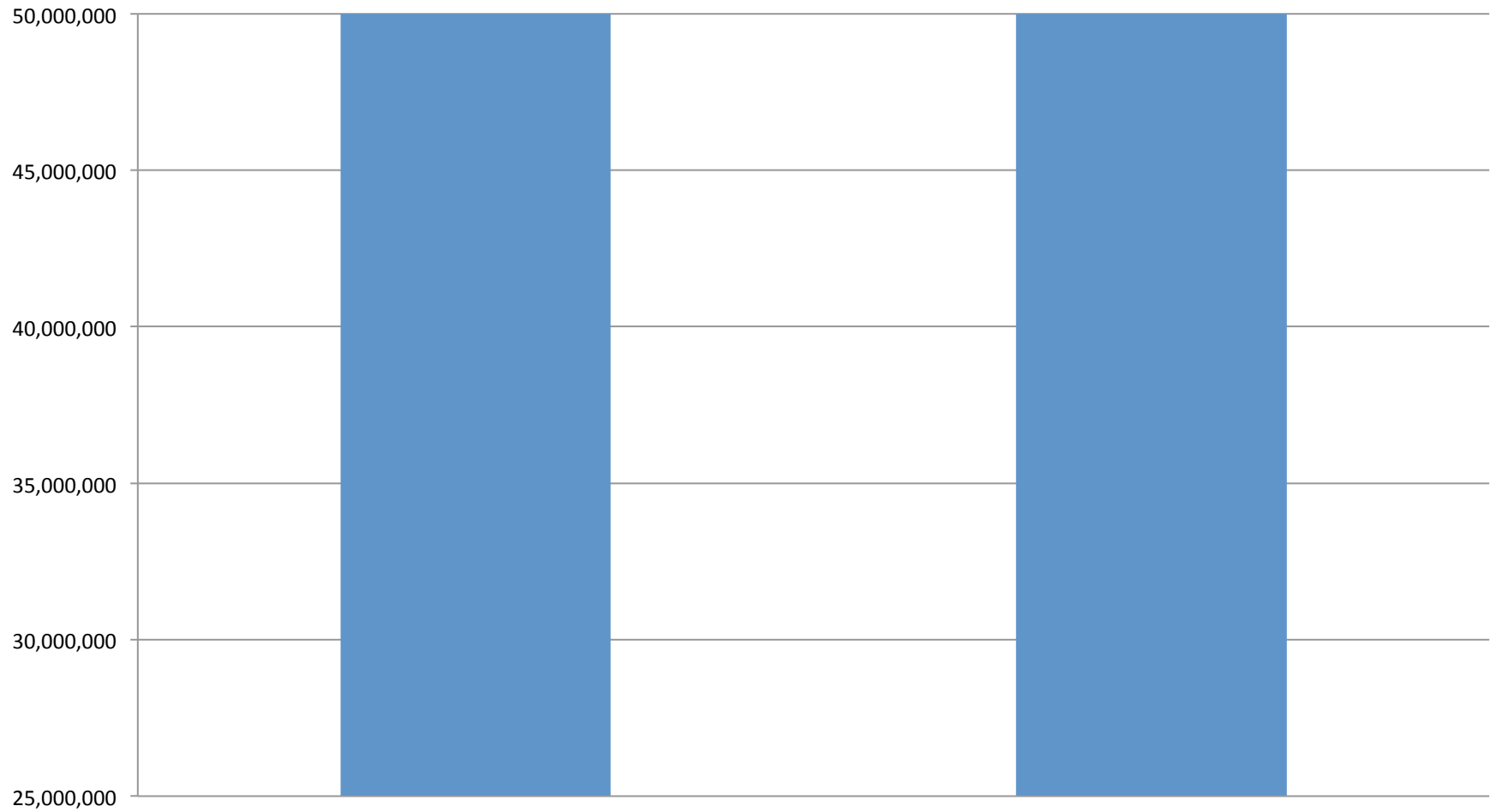
programs. If they can save 20%, that is £10bn.



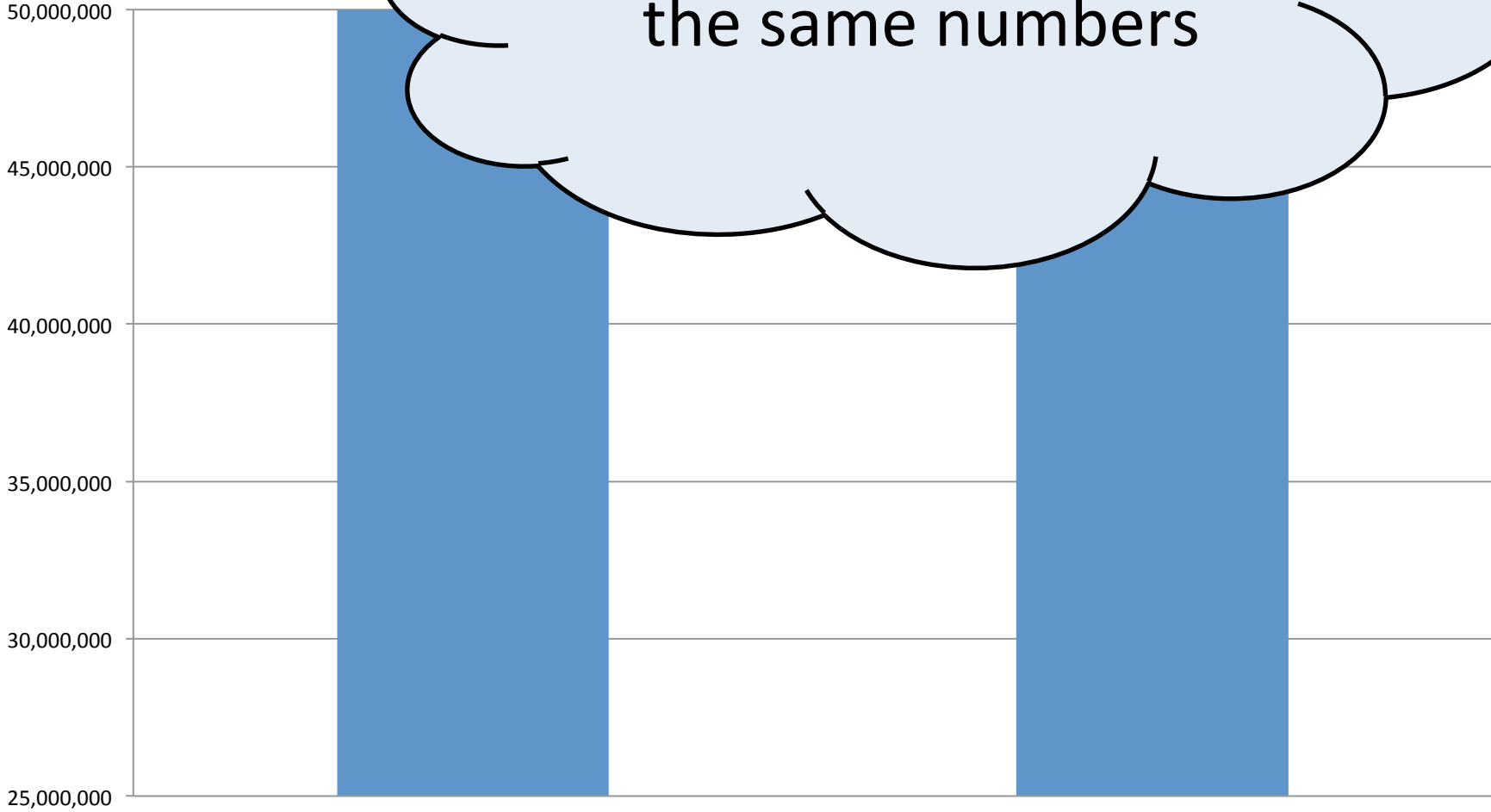
# Bad charts



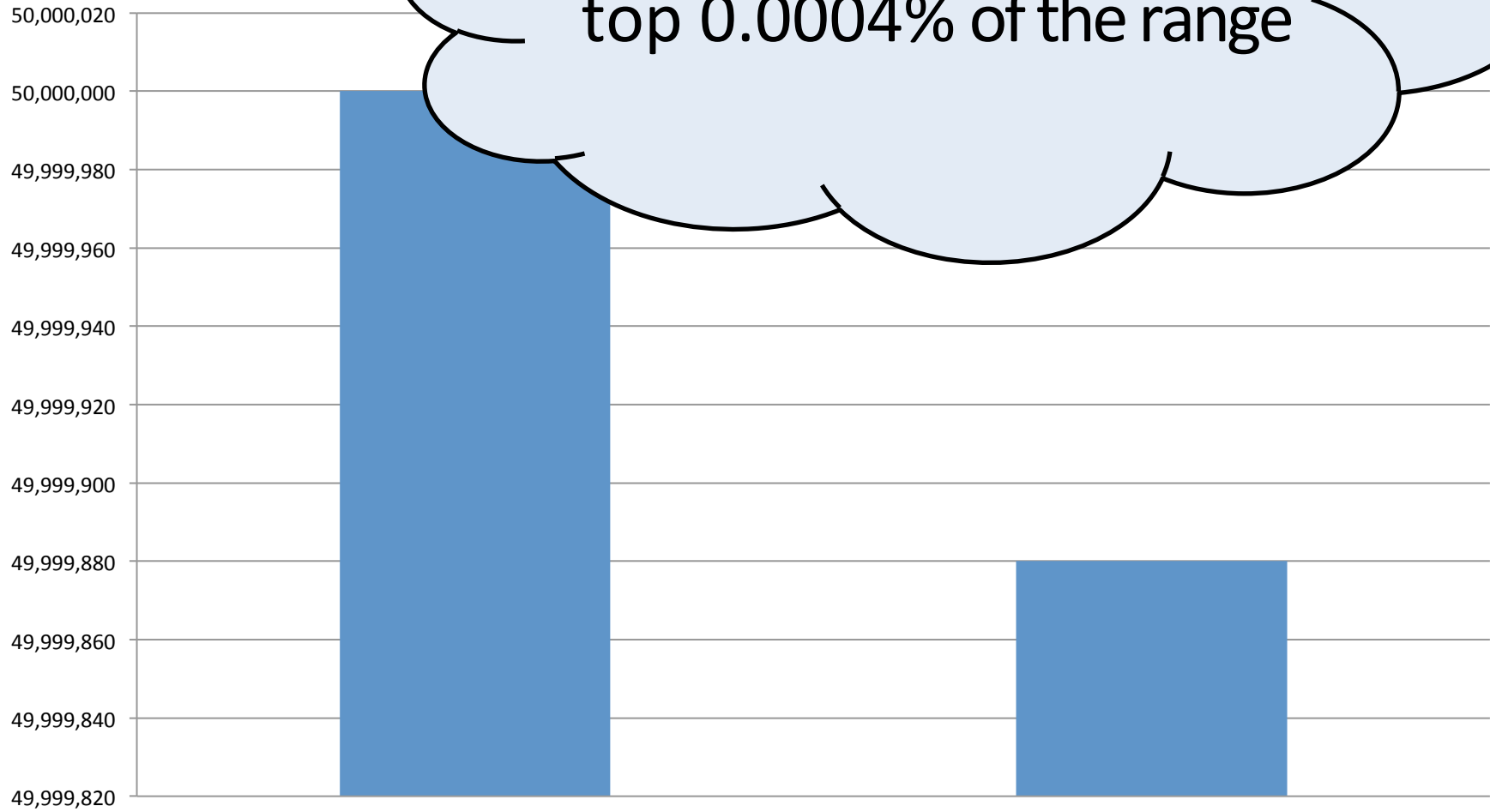
# Bad charts



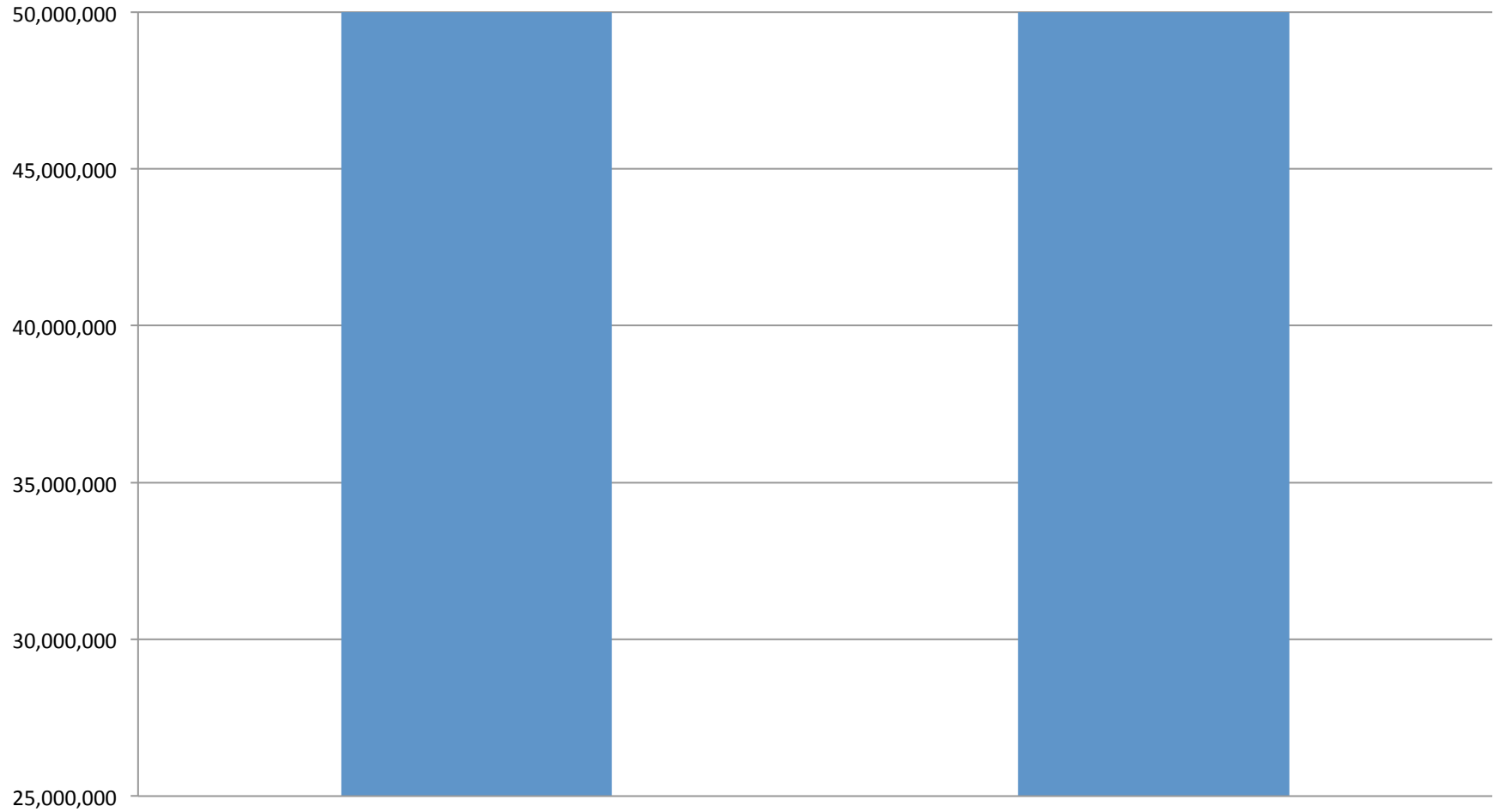
Both charts based on  
the same numbers

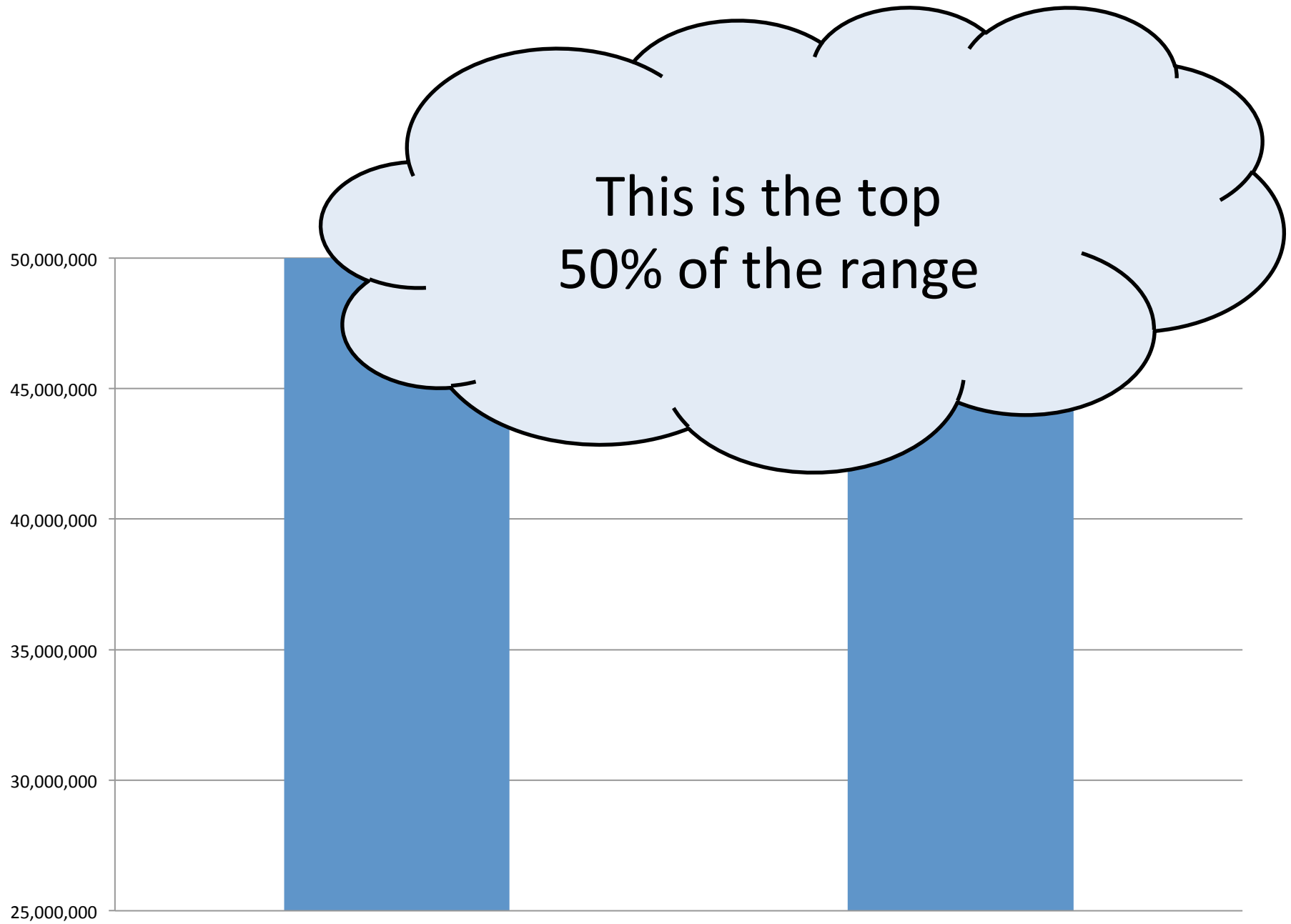


But this one is only the  
top 0.0004% of the range



# Be careful





# Language, Psychology

Can you spot the fallacy?

# Word aversion

Many English speakers say they hate the word *moist*. They say they dislike its sound, but maybe they actually dislike its meaning. Thibodeau et al. (2015) asked people to rate whether they like or dislike several words. Although 21% dislike *moist*, those same people did not dislike *hoist* or *rejoiced*. Therefore, people who dislike the word *moist* dislike its meaning, not its sound.



# Word aversion

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# Word aversion

Many English speakers say they hate the word *moist*.

“A is False” does not necessarily mean  
“B is True.”

## **False Dilemma**

people who dislike the word *moist* dislike its meaning,  
not its sound.

# Economics

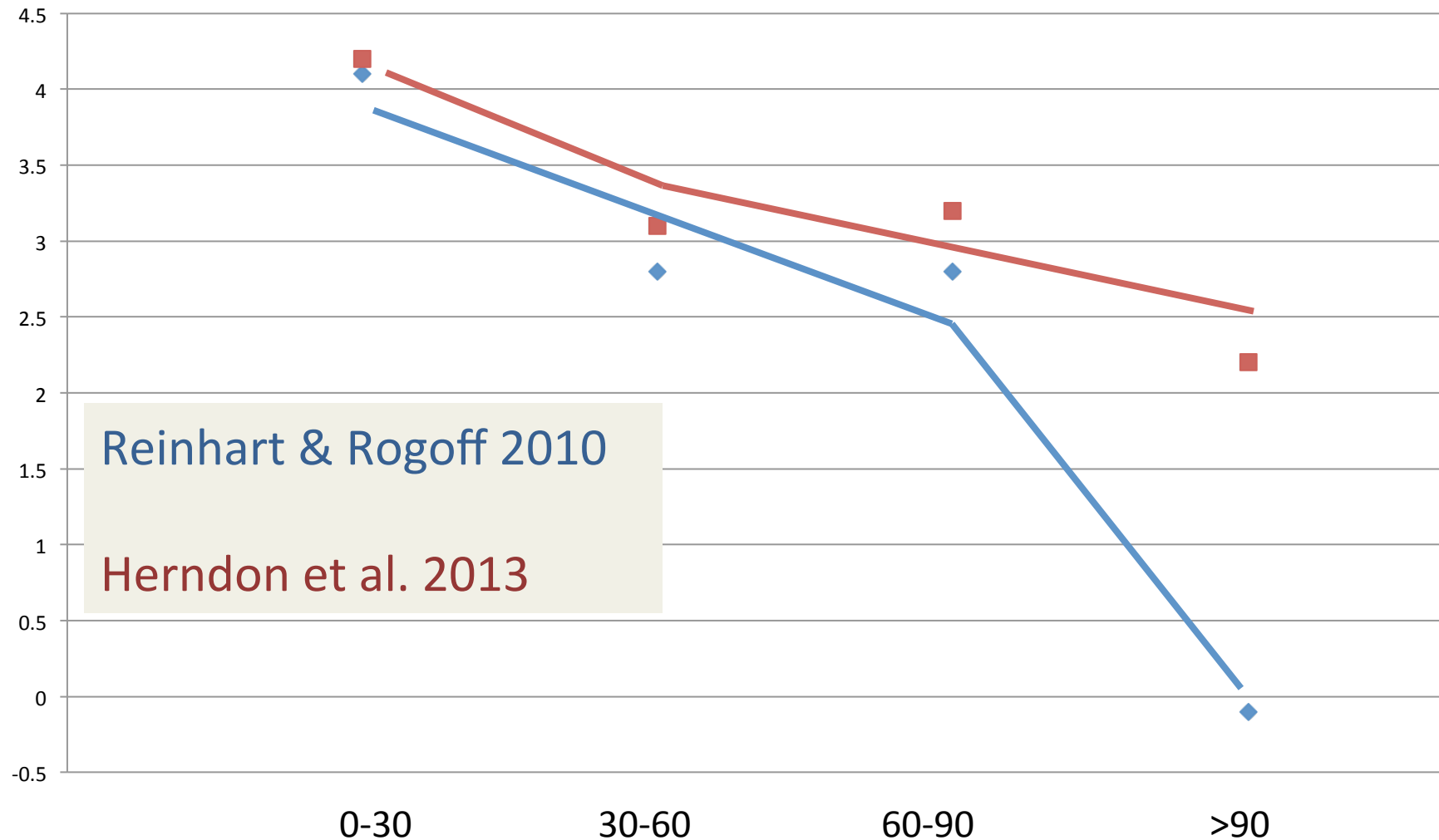
Can you spot the fallacy?

# Growth vs. debt

Reinhart & Rogoff (2010) compared economic growth and government debt. They found little connection. But when debt is more than 90% of GDP, growth drops dramatically.

Herndon et al. (2013) couldn't duplicate Reinhart & Rogoff's findings. Eventually they found that Reinhart & Rogoff had made a computer error that caused their statistics to be calculated incorrectly.

# GDP Growth vs. Public Debt



# Growth vs. debt

Reinhart & Rogoff, who oppose big debt for political reasons, found that big debt is bad.

Herndon et al. found that big debt does not have much effect. (Small debt has a good effect, but politicians don't argue about that.)

1. Garbage in, garbage out
2. Beware of finding what you are looking for.

# Sociology and Communication

Can you spot the fallacy?

# Canvassing

People rarely change their political positions. Lacour & Green (2014) found that when an interviewer says that he or she is gay, the people being interviewed are more likely to change their positions about gay marriage.



# Canvassing

This was not a fallacy – **it was a lie**. Lacour made up fake data to “prove” the effectiveness of his canvassing techniques.

The respected journal *Science* published the paper and peer reviewers accepted it in part because Green is a very well-known and respected scholar in this field. One reviewer said, “I trust anything Don Green says.”

When he discovered the lie, Green asked *Science* to retract the paper.

# The fallacy fallacy



Videos are available on YouTube from PBS Idea Channel