



RESEARCH ARTICLE

# Neutralizing misinformation through inoculation: Exposing misleading argumentation techniques reduces their influence

John Cook<sup>1,2\*</sup>, Stephan Lewandowsky<sup>2,3</sup>, Ullrich K. H. Ecker<sup>2</sup>

## Abstract

Misinformation can undermine a well-functioning democracy. For example, public misconceptions about climate change can lead to lowered acceptance of the reality of climate change and lowered support for mitigation policies. This study experimentally explored the impact of misinformation about climate change and tested several pre-emptive interventions designed to reduce the influence of misinformation. We found that false-balance

# Global Warming Petition Project

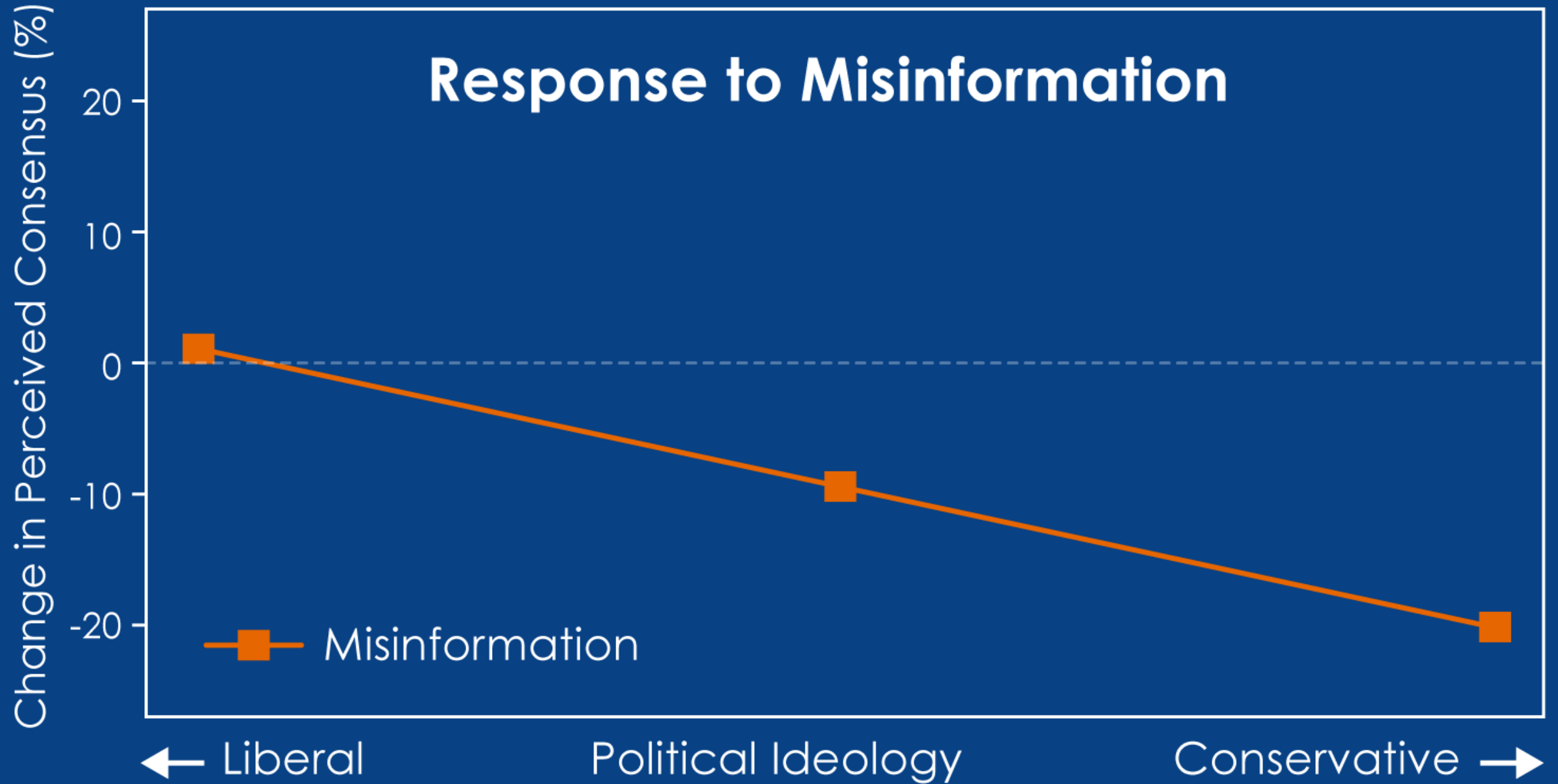
*31,487 American scientists have signed this petition,  
including 9,029 with PhDs*

## Petition

We urge the United States government to reject the global warming agreement that was written in Kyoto, Japan in December, 1997, and any other similar proposals. The proposed limits on greenhouse gases would harm the environment, hinder the advance of science and technology, and damage the health and welfare of mankind.

There is no convincing scientific evidence that human release of carbon dioxide, methane, or other greenhouse gases is causing or will, in the foreseeable future, cause catastrophic heating of the Earth's atmosphere and disruption of the Earth's climate. Moreover, there is substantial scientific evidence that increases in atmospheric carbon dioxide produce many beneficial effects upon the natural plant and animal environments of the Earth.

# Response to Misinformation





# Promoting “fake experts” to manufacture doubt about science

Sometimes, inconvenient scientific facts threaten the interests of industry groups and organisations. For example, the scientific evidence linking smoking with lung cancer threatened the profits of the tobacco industry. Similarly, scientific evidence linking fossil fuel emissions with global warming threatens the profits of the fossil fuel industry.

According to a recent nationwide survey:

## MORE DOCTORS SMOKE CAMELS THAN ANY OTHER CIGARETTE

**YOUR “T-ZONE” WILL TELL YOU ...**  
**T for Taste ...**  
**T for Throat ...**  
that's your proving ground for any cigarette. See if Camels don't suit your “T-Zone” to a “T.”



• Not a single branch of medicine was overlooked in this nationwide survey made by three leading independent research organizations. To 113,997 doctors from Canada to Mexico, from the Atlantic to the Pacific went the query — *What cigarette do you smoke, Doctor?*  
*The brand named most was Camel.*  
Like anyone else, a doctor smokes for pleasure. He appreciates rich, full flavor and cool mildness just as any other smoker. If you don't happen to be a Camel smoker now, try Camels. Let your “T-Zone” give you the answer.

# Camels

Costlier  
Tobaccos

In these cases, a common tactic for industry groups and organisations is to manufacture doubt about the science through the promotion of “**fake experts**”. Fake experts are spokespeople who convey the impression of expertise in a given area without possessing actual relevant experience. Groups wishing to cast doubt on science often use fake experts to convince the public that the science isn't settled.



# Promoting “fake experts” to manufacture doubt about science

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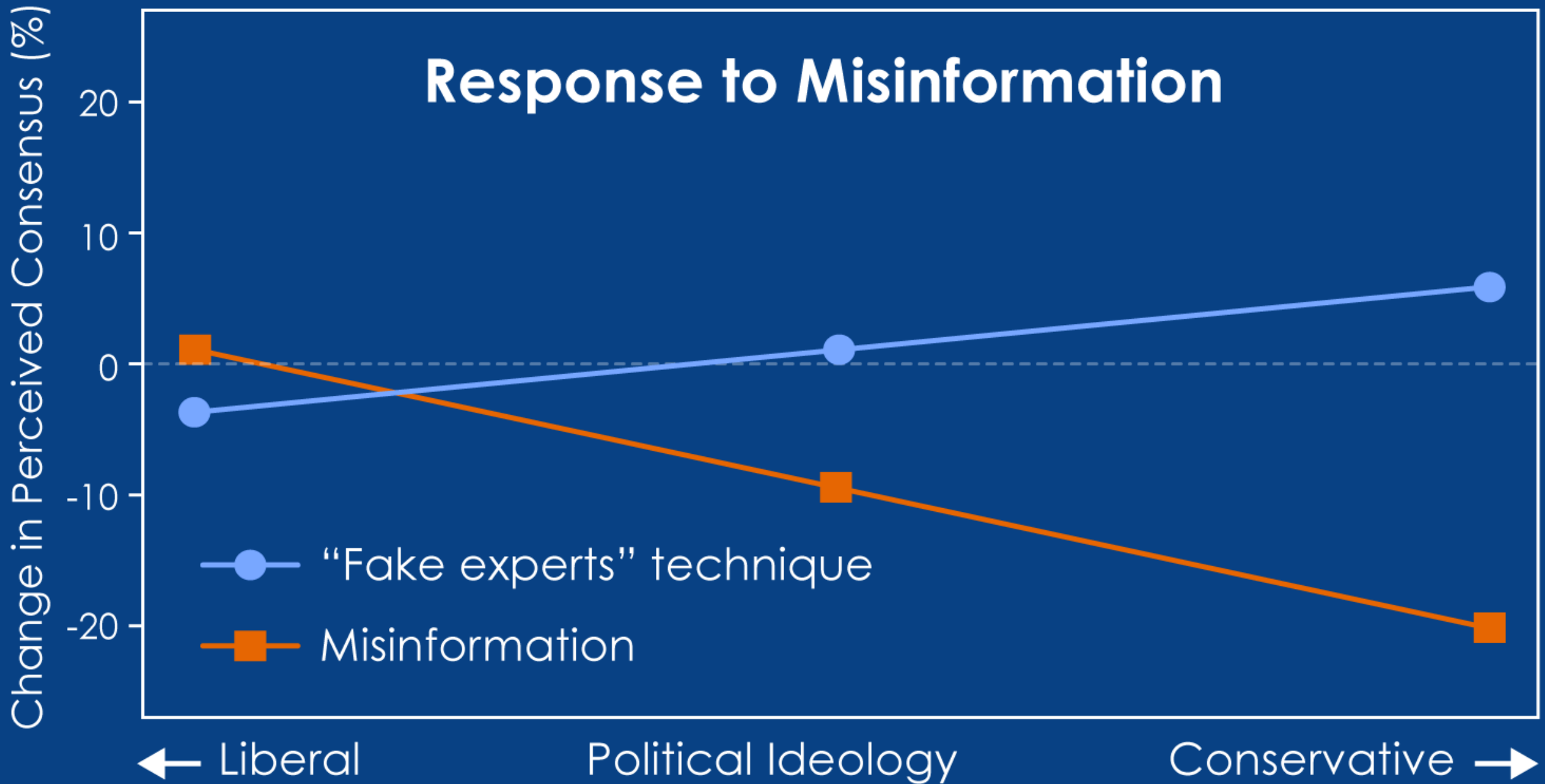
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# Response to Misinformation



# 5 CHARACTERISTICS OF SCIENCE DENIAL

**F**



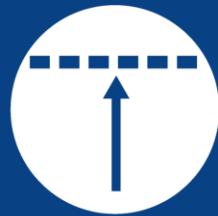
**Fake  
Experts**

**L**



**Logical  
Fallacies**

**I**



**Impossible  
Expectations**

**C**



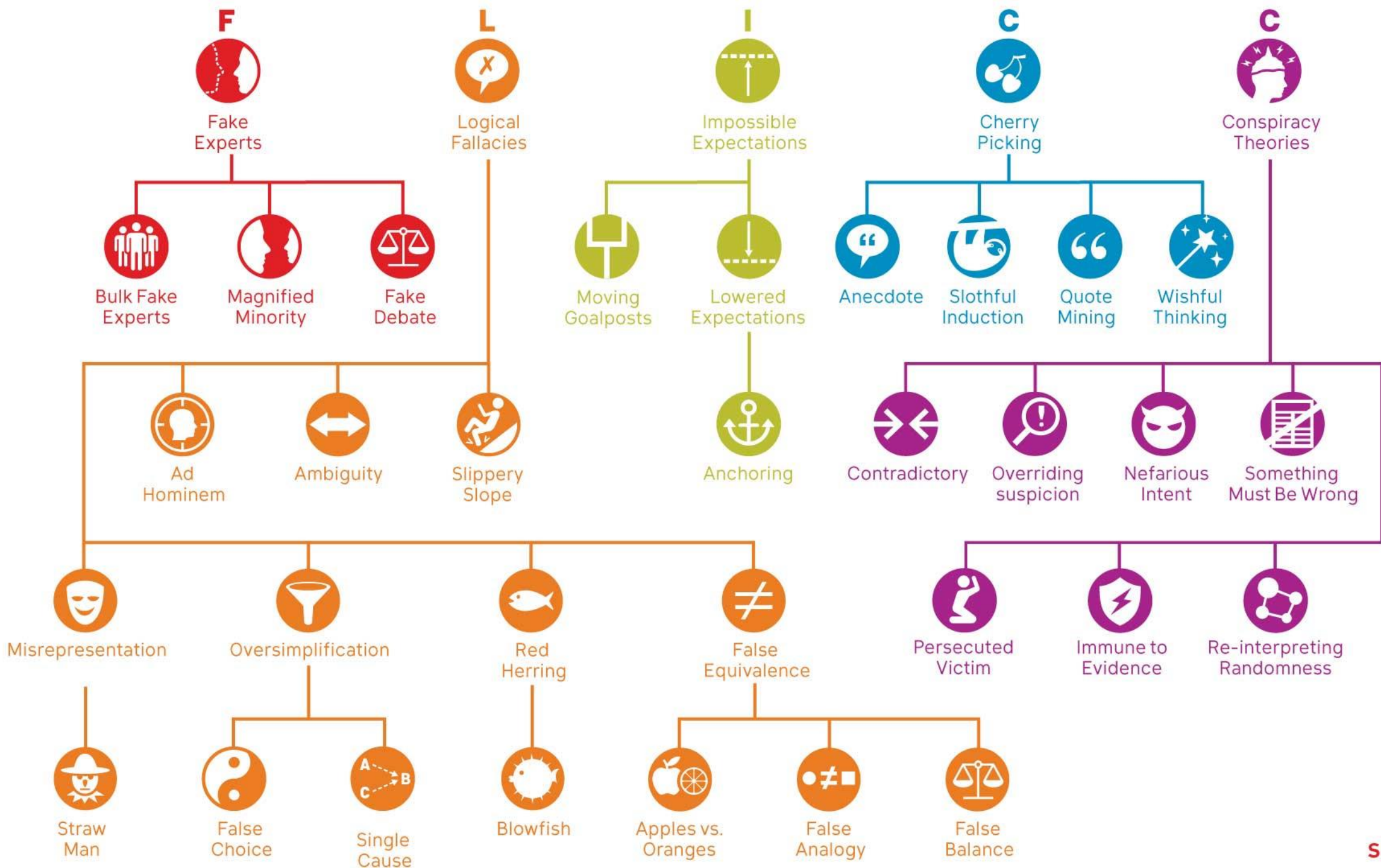
**Cherry  
Picking**

**C**



**Conspiracy  
Theories**







# Fake Experts

# Global Warming Petition Project

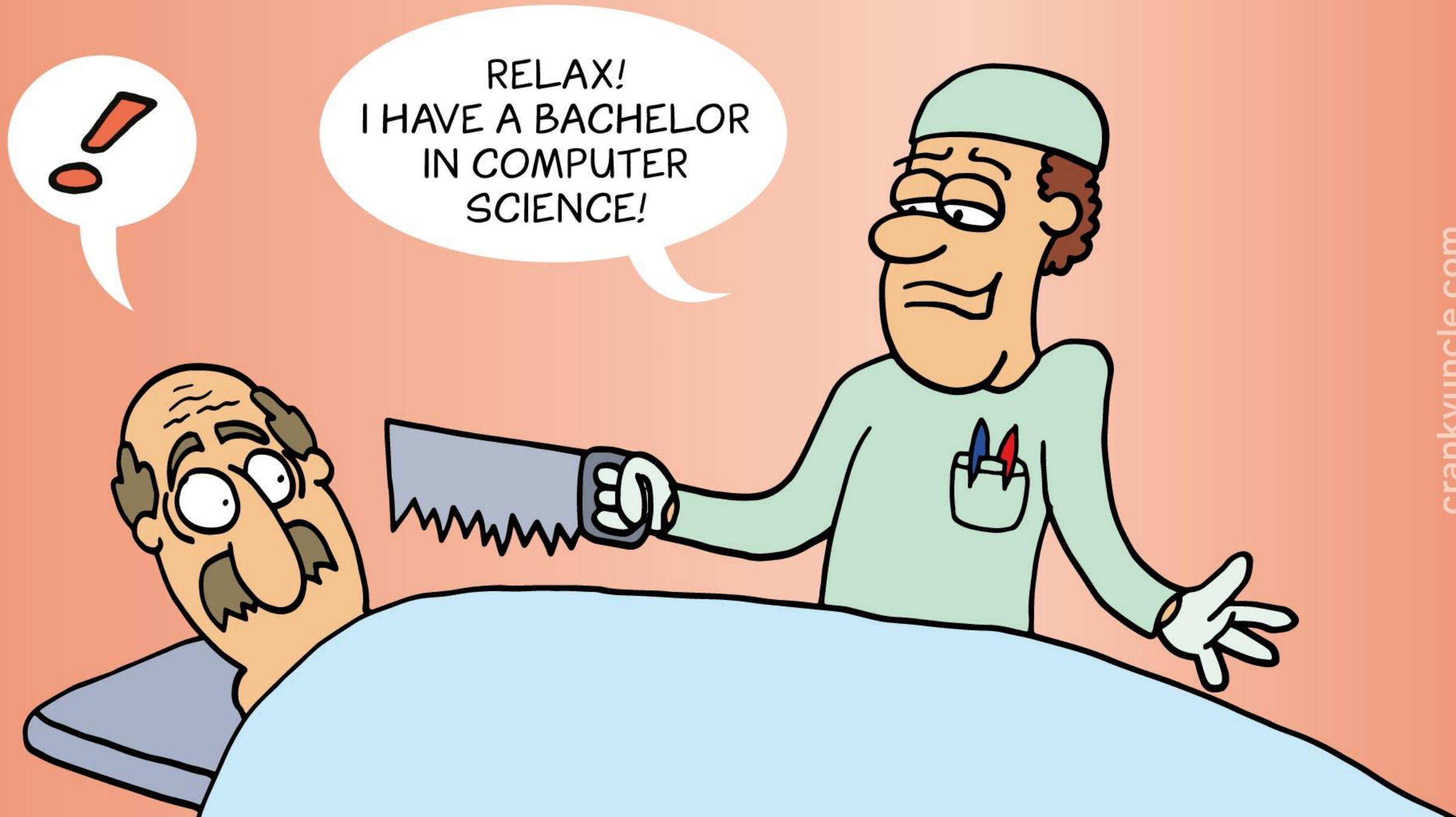
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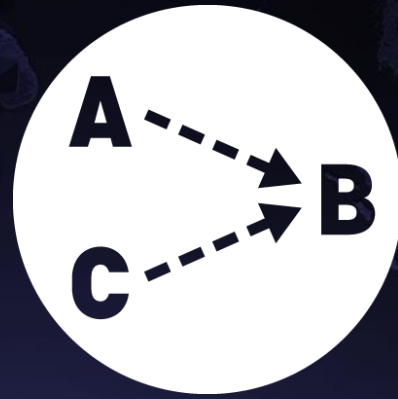
RELAX!  
I HAVE A BACHELOR  
IN COMPUTER  
SCIENCE!

!





# Logical Fallacies



Single Cause



**“One of the reasons  
why the climate is  
changing is climate  
has always been  
changing.”**

**MARCO RUBIO**



One of the reasons why the climate is changing...



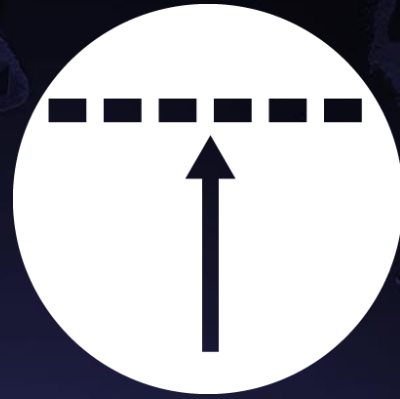
...is climate has always been changing.

This person died of natural causes...



...because people have always died of natural causes.





# Impossible Expectations



**You'll hit the ground  
in 12 to 15 seconds.**

**Get back to me when  
you have more certainty!**



# Cherry Picking





IT'S  
COLD...

...GLOBAL  
WARMING DOESN'T  
EXIST!





IT'S  
DARK...

...THE  
SUN DOESN'T  
EXIST!



# Conspiracy Theories

# TRAITS OF CONSPIRATORIAL THINKING

C



Contradictory

O



Overriding  
suspicion

N



Nefarious  
Intent

S



Something  
Must Be  
Wrong

P



Persecuted  
Victim

I



Immune to  
Evidence

R



Re-interpreting  
Randomness



# SEE PATTERNS EVERYWHERE

A  
SATELLITE  
CRASHED...

...WHAT  
ARE THEY  
TRYING TO  
HIDE?



# IMMUNE TO FACTS

DING!

PTANG!

MY TINFOIL  
HAT IS MORE THAN  
A MATCH FOR THEIR  
MIND-CONTROL  
RAYS...

...AND  
THEIR PESKY  
FACTS!







# Testing the Effectiveness of Correction Placement and Type on Instagram

Emily K. Vraga<sup>1</sup> , Sojung Claire Kim<sup>2</sup>,  
John Cook<sup>2</sup>, and Leticia Bode<sup>3</sup>

## Abstract

Despite concerns about misinformation across social media platforms, little attention has been paid to how to correct misinformation on visual platforms like Instagram. This study uses an experimental design on a national sample to test two features of user-based correction strategies on Instagram for a divisive issue

# Fact-based

Instagram

Prof.Mason.Green

### Debunking the myth "CO<sub>2</sub> is plant food"

Climate change caused by CO<sub>2</sub> results in heat waves and increased flooding. While plants do use CO<sub>2</sub> to grow, CO<sub>2</sub> emissions ultimately harm plant growth. Plants are fussy—they need a comfortable temperature range and the right amount of water to flourish.

A cartoon illustration of a cactus sitting on a blue lounge chair by a swimming pool. A waiter in a white shirt and black bowtie stands next to it, holding a tray with a glass of water. A woman in a red dress is looking at the cactus. The cactus has a speech bubble that says: "I'D LIKE SOME CO<sub>2</sub>, SOME WATER BUT NOT TOO MUCH WATER, A SIDE OF NUTRIENTS... AND TURN THE THERMOSTAT DOWN 2 DEGREES!". The waiter has a speech bubble that says: "HE'S SO PRICKLY!".

Prof.Mason.Green This pic debunks the myth "CO<sub>2</sub> is plant food" #climatechange #science #misinformation

13h

# Logic-based

Instagram

Prof.Mason.Green

### Debunking the myth "CO<sub>2</sub> is plant food"

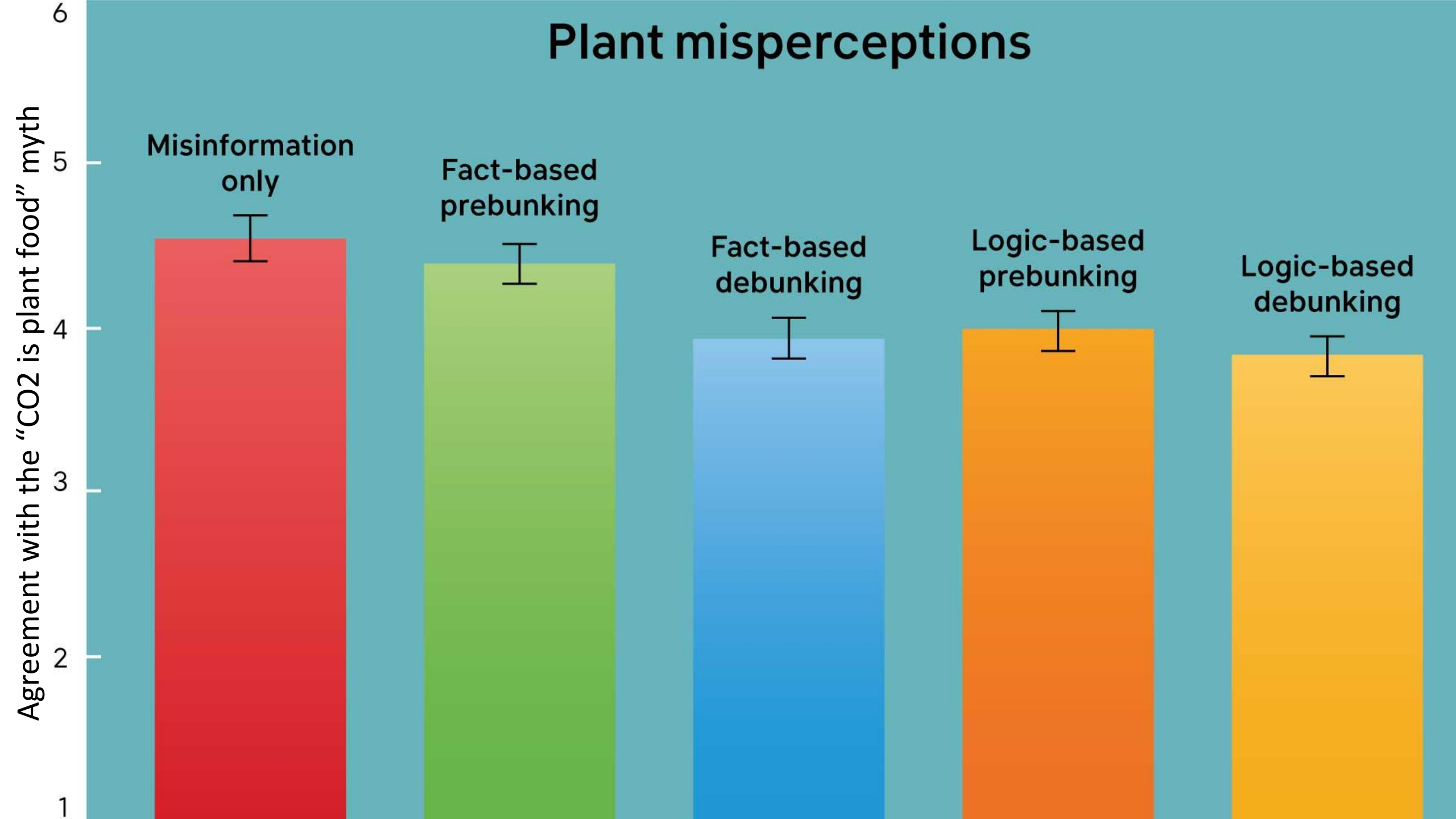
Climate change caused by CO<sub>2</sub> disrupts the environment, with heat stress and increased flooding harming plant growth. This myth is an oversimplification—it's like saying humans need calcium so all we need to eat is ice cream.

A cartoon illustration of a man with a mustache and a blue shirt sitting at a table with a woman. The man is eating a pink ice cream cone. The woman has a speech bubble that says: "GRANDPA, I FEEL SICK!". The man has a speech bubble that says: "KEEP EATING THAT HEALTHY CALCIUM!". There are bowls of pink ice cream and a carton of milk on the table.

Prof.Mason.Green This pic debunks the myth "CO<sub>2</sub> is plant food" #climatechange #science #misinformation

13h

# Plant misperceptions



Misinformation only

Fact-based prebunking

Fact-based debunking

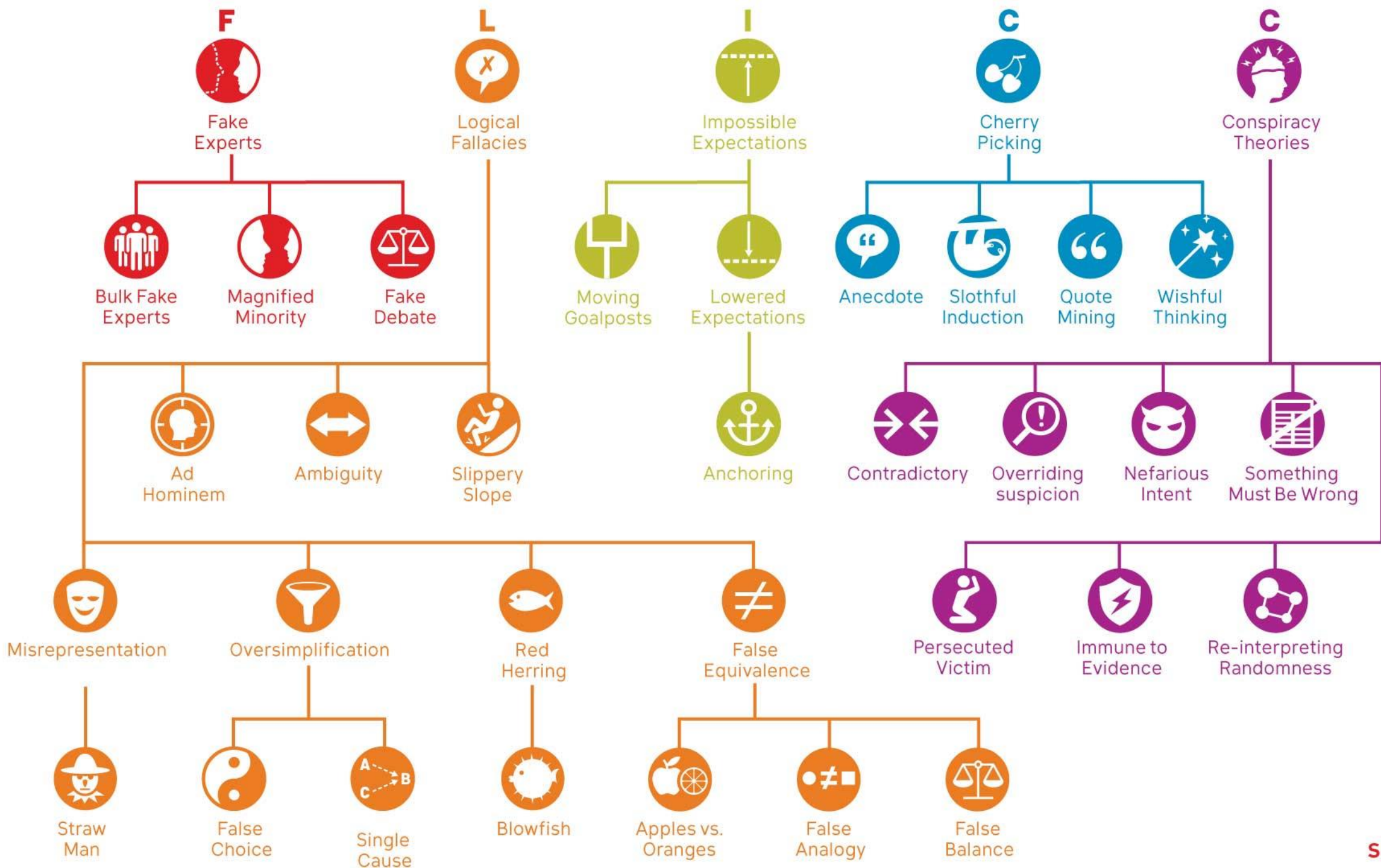
Logic-based prebunking

Logic-based debunking

Agreement with the "CO2 is plant food" myth

6  
5  
4  
3  
2  
1

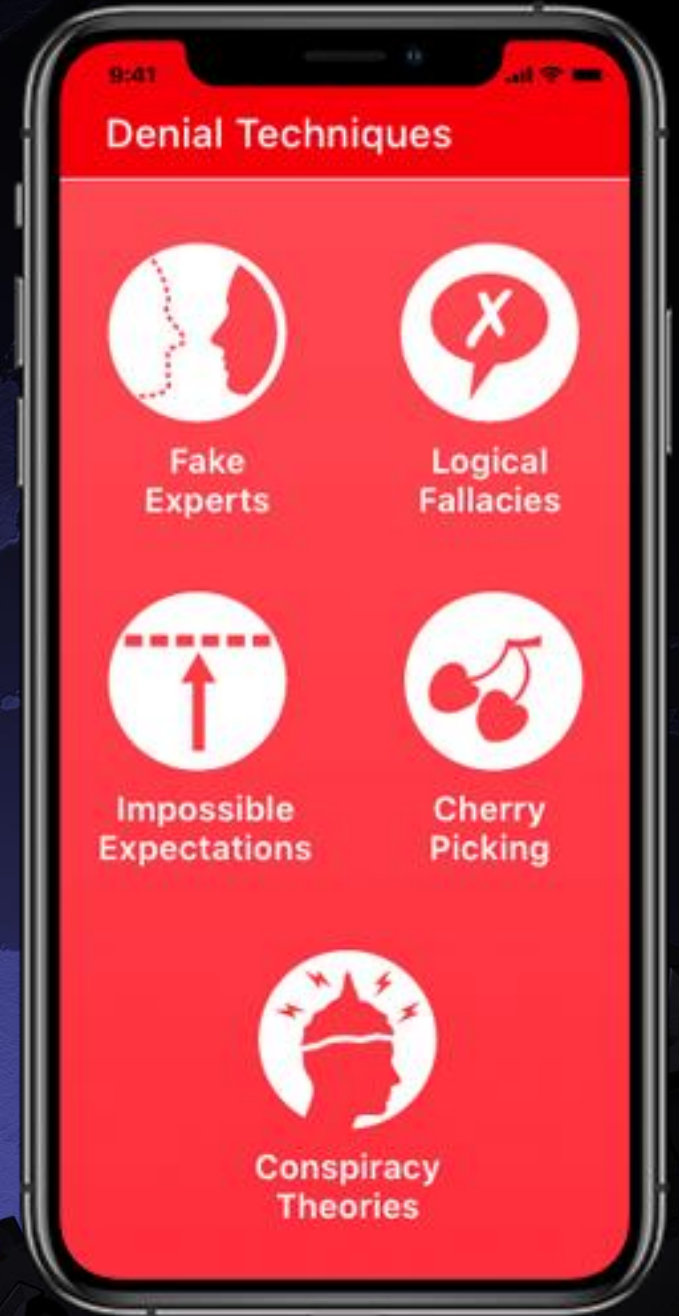




# Cranky Uncle

Digital game using active inoculation to immunize players against misinformation techniques.

<http://crankyuncle.com>





# Explanations of misinformation techniques





# Quiz questions (practise critical thinking)



Explains the science behind  
the Cranky Uncle game

Resources for class  
activities

the  
**Teachers' Guide**  
to  
**Cranky Uncle**

I PREFER  
OLD SCHOOL!



JOHN COOK



# Adoption of Cranky Uncle game across subjects

- Biology
- Chemistry
- Climate science
- Conservation impact
- Critical media literacy
- Digital media
- English
- Environmental science
- Ethics
- Geometry
- Mathematics
- Oceanography
- Physics
- Political science
- Psychology
- Reasoning
- Social studies
- Writing



# USA Classes using Cranky Uncle



<http://sks.to/crankytranslationfrm>

## Cranky Uncle Game - Help with translations



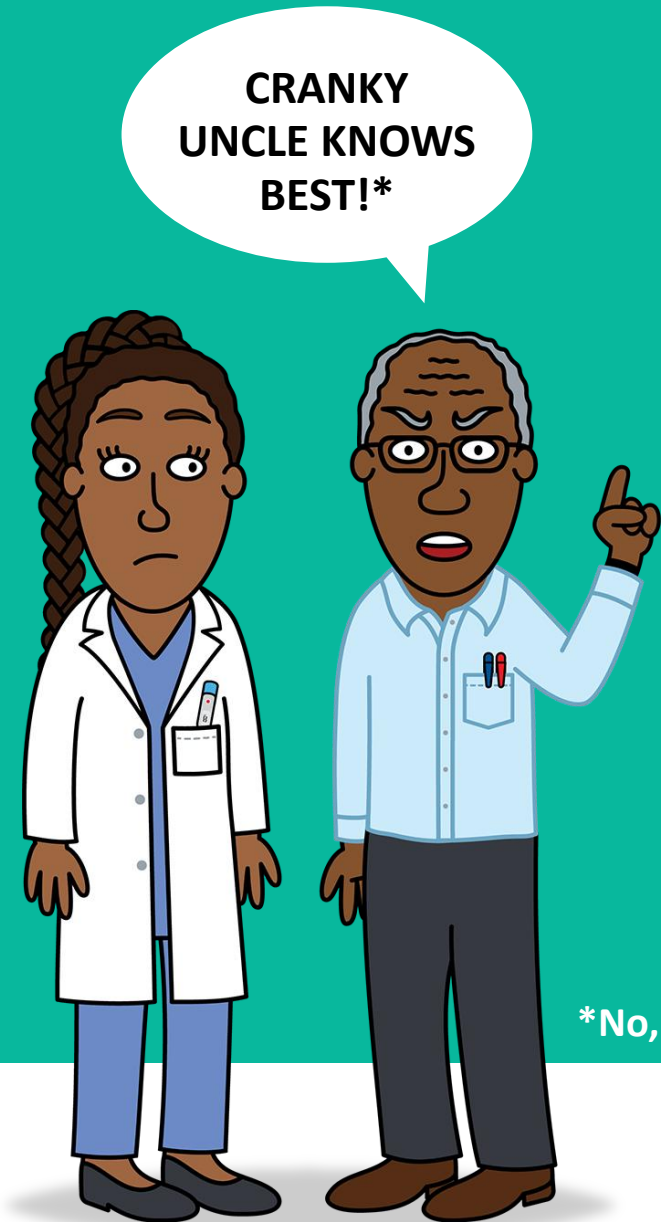
Translations complete:

1. Albanian
2. Danish
3. Dutch
4. Finnish
5. French
6. German
7. Italian
8. Macedonian
9. Portuguese
10. Romanian
11. Spanish
12. Swedish
13. Turkish



# Cranky Uncle Vaccine

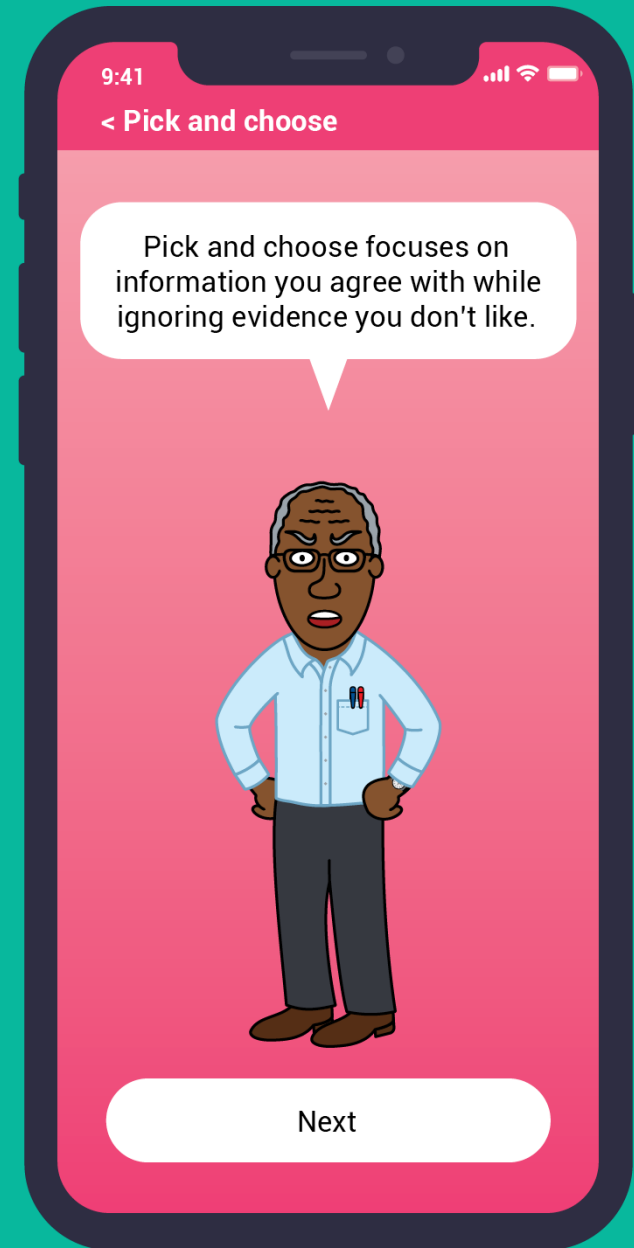
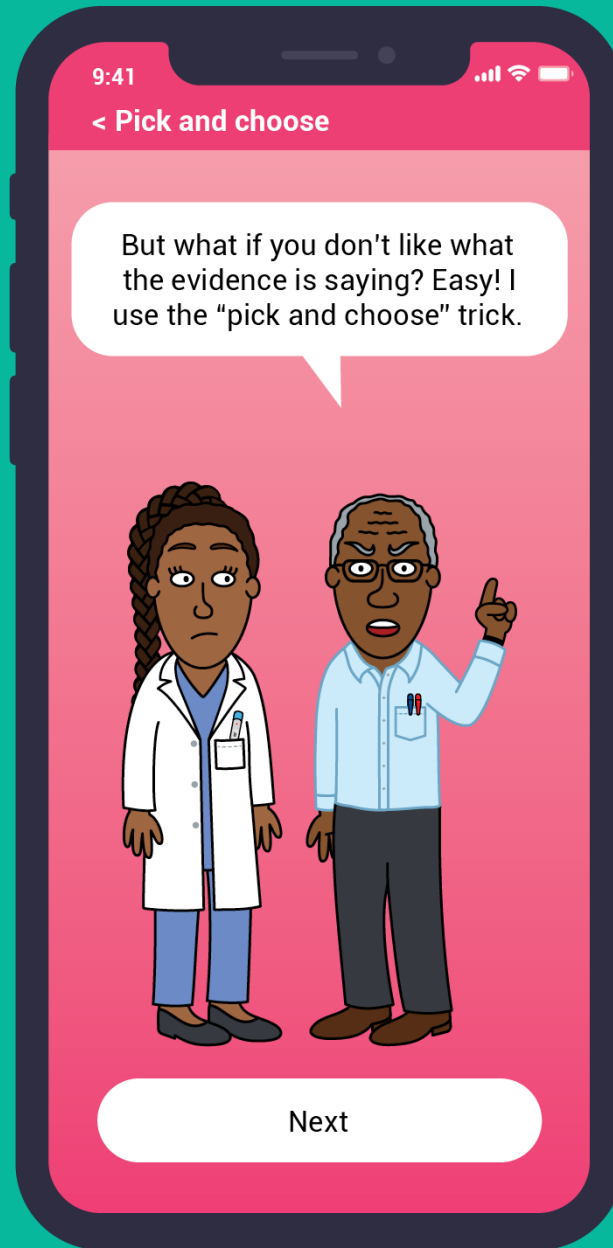
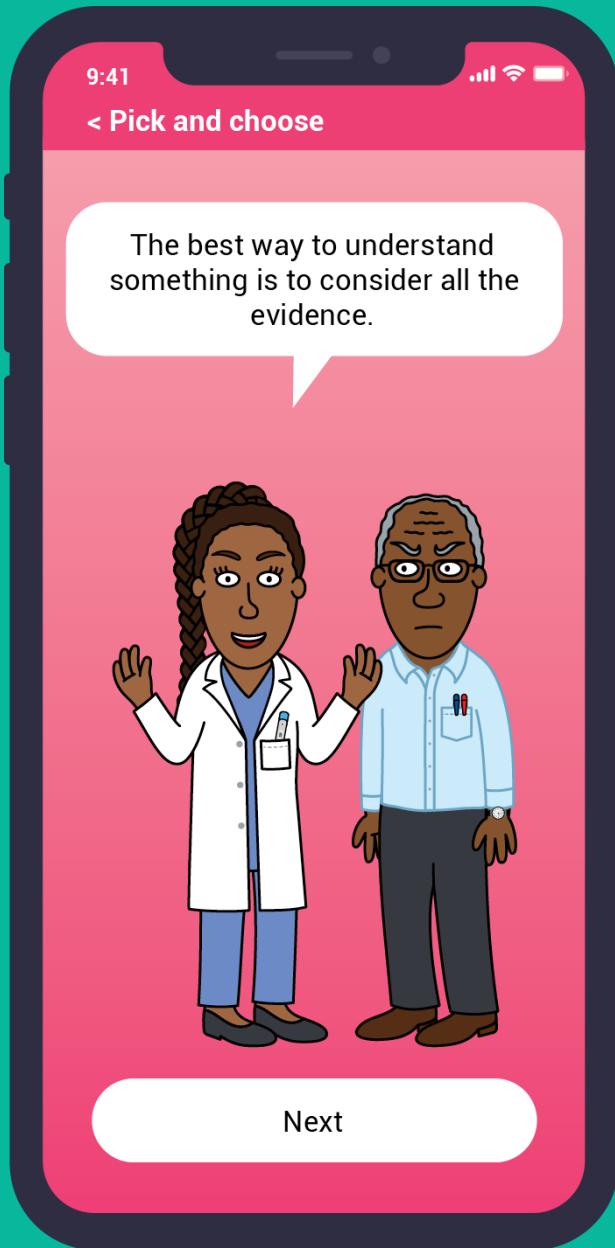
A free digital game that teaches you how to spot misinformation tricks that you might see on social media or hear from a friend or family member (*especially a cranky uncle*).



\*No, no he doesn't!



# Fact-based + Logic-based inoculation




# Quiz questions (practise critical thinking)

9:41

Name That Fallacy!

My favourite movie is perfect if you focus on the good scenes and ignore the bad parts.



False cause

Pick and choose


Evil intent

Misrepresentation

9:41

Name That Fallacy!

I heard someone went vegetarian and got really sick. Vegetarianism is unhealthy!



Impossible expectations

Personal stories


Natural is best

False cause

9:41

Name That Fallacy!

You drive a car so you can't complain about pollution!

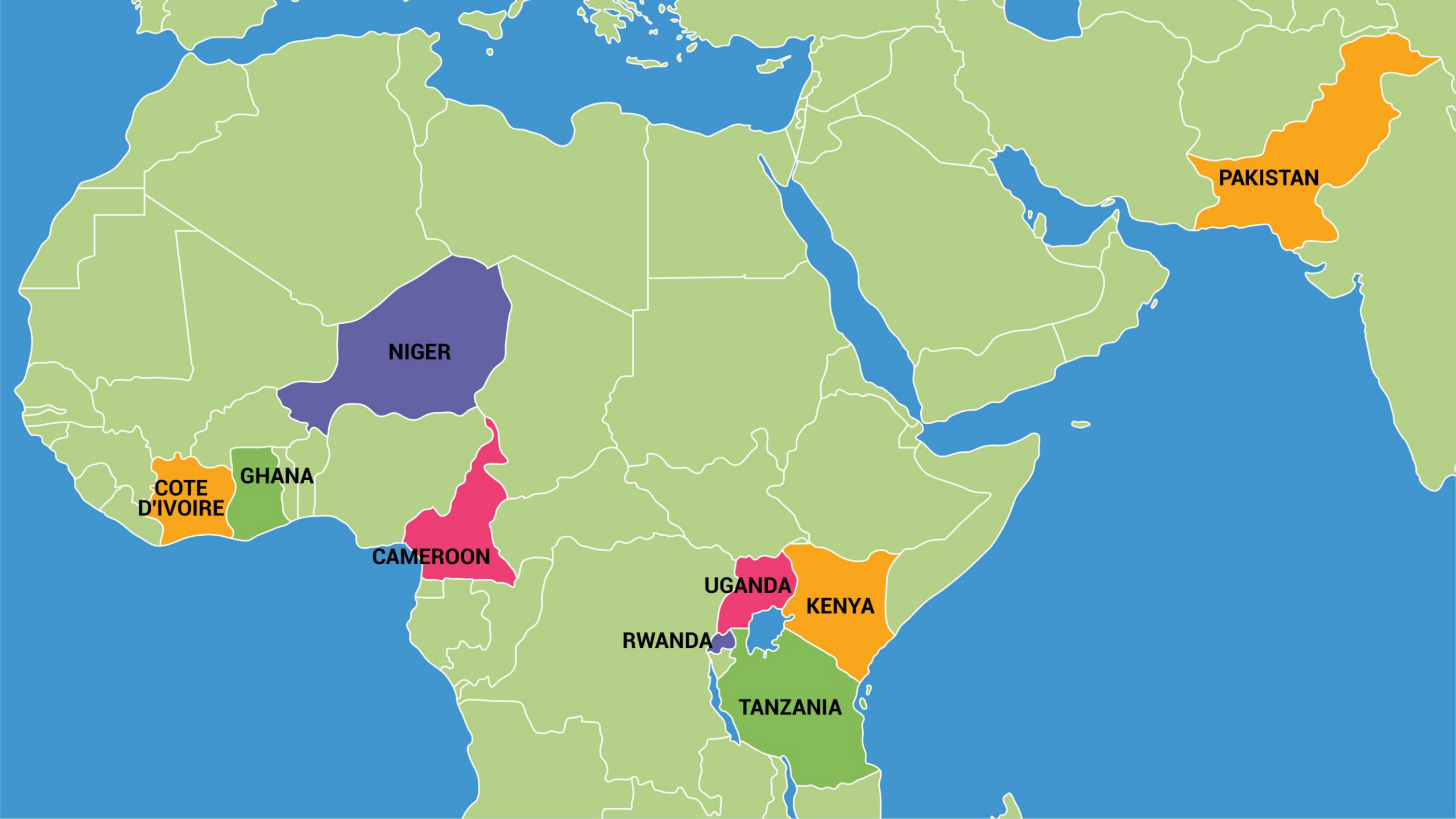


Impossible expectations

False cause

Personal attack

Personal stories



**NIGER**

**COTE  
D'IVOIRE**

**GHANA**

**CAMEROON**

**RWANDA**

**UGANDA**

**KENYA**

**TANZANIA**

**PAKISTAN**



# Kenya co-design workshop July 2022







How true do you think the following statements are?

## Agreement with fact

Vaccines are among the most thoroughly tested medical products available.

- True
- Partly true
- Partly false
- False

## Agreement with fallacy

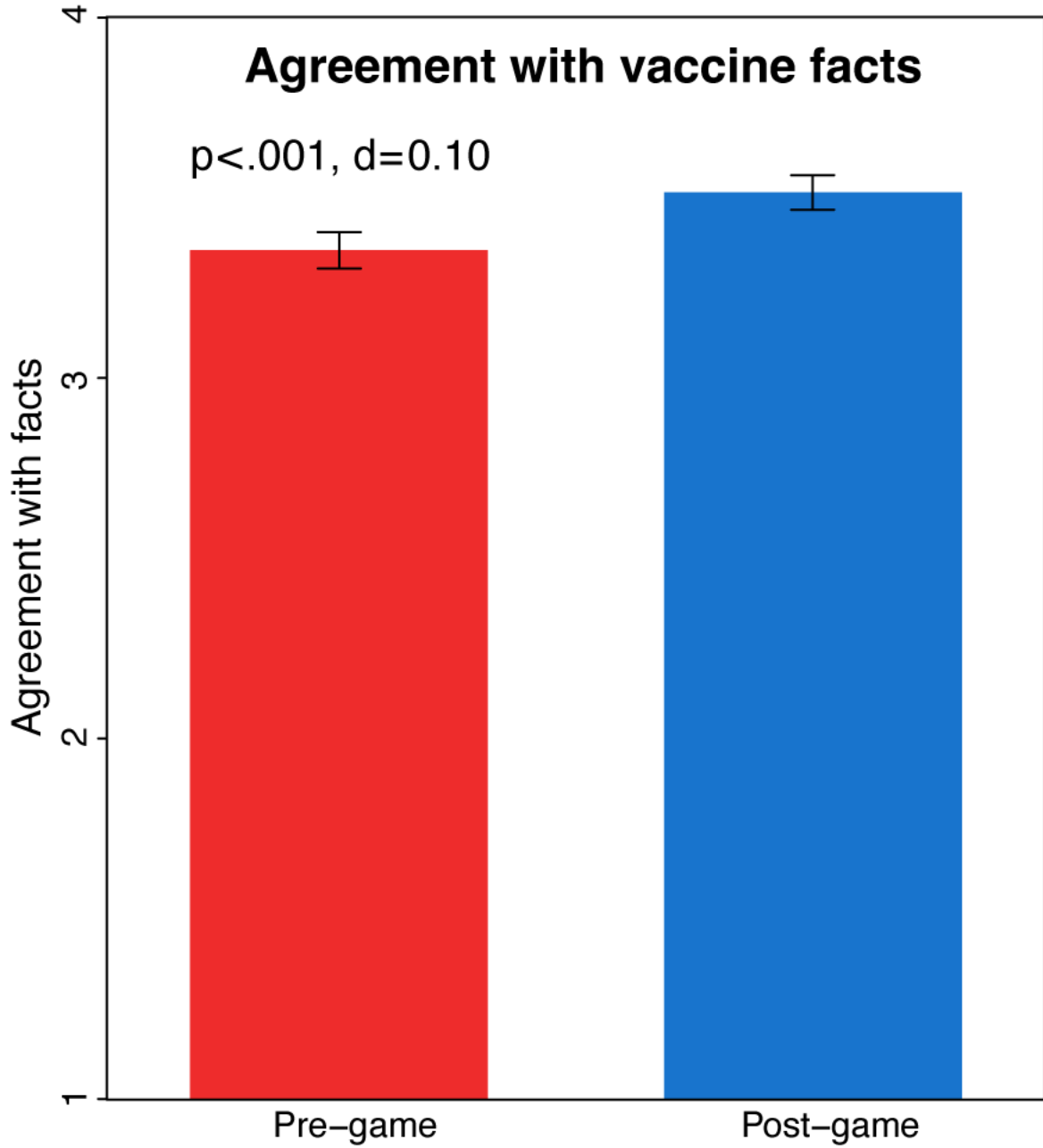
Someone got sick after a vaccine so the vaccine must be to blame.

- True
- Partly true
- Partly false
- False



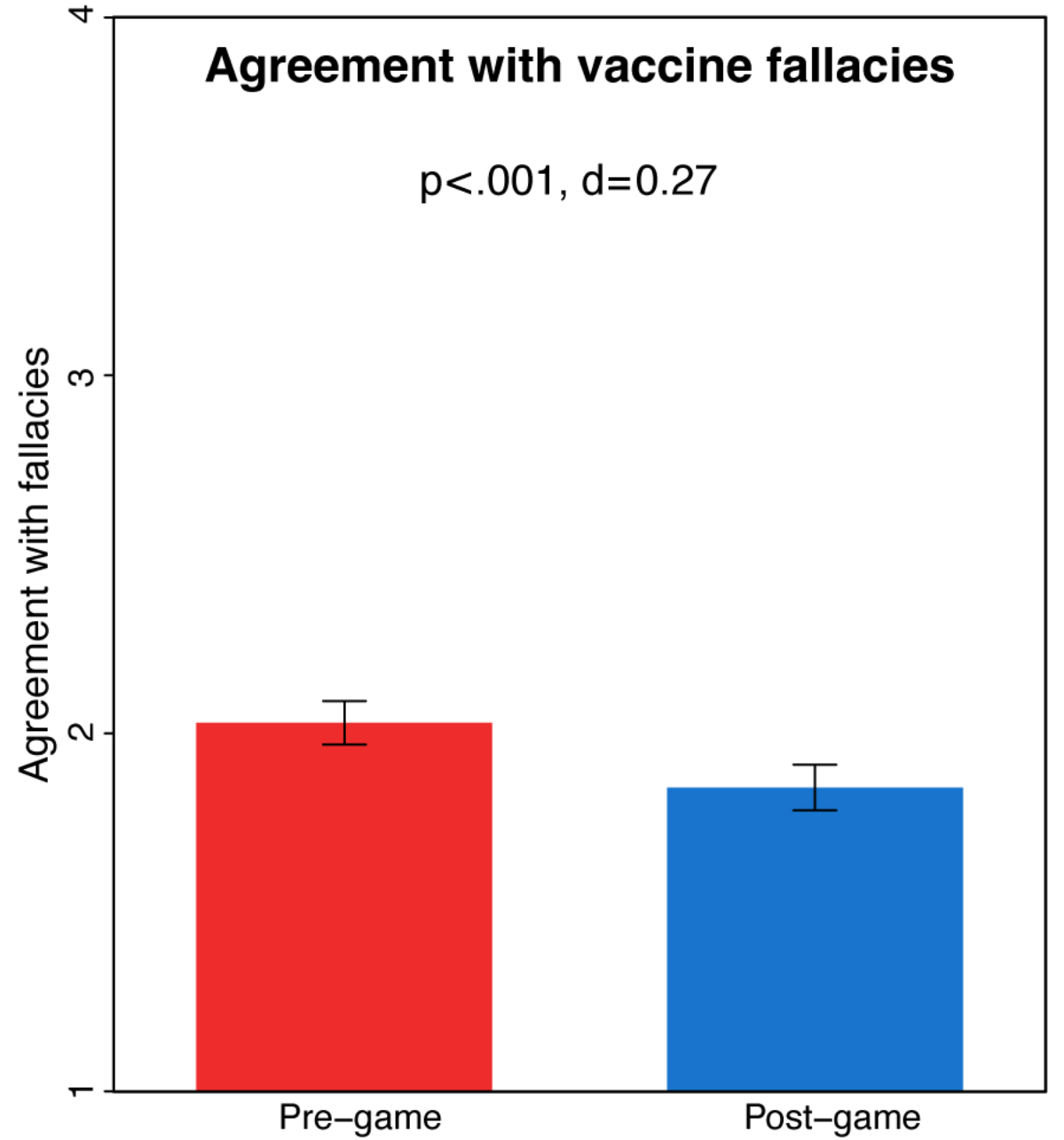
### Agreement with vaccine facts

$p < .001$ ,  $d = 0.10$



### Agreement with vaccine fallacies

$p < .001$ ,  $d = 0.27$



## General vaccine attitude

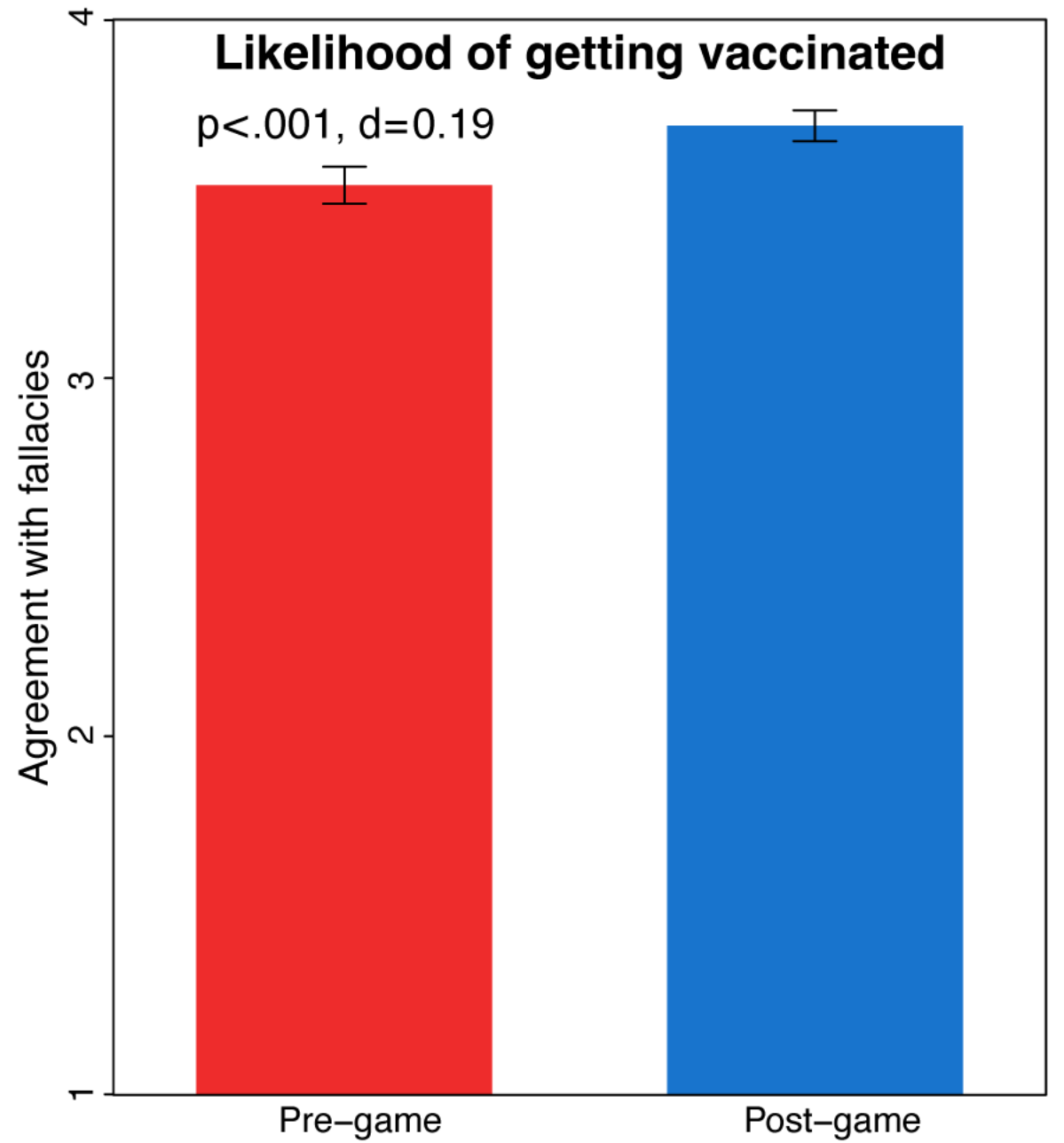
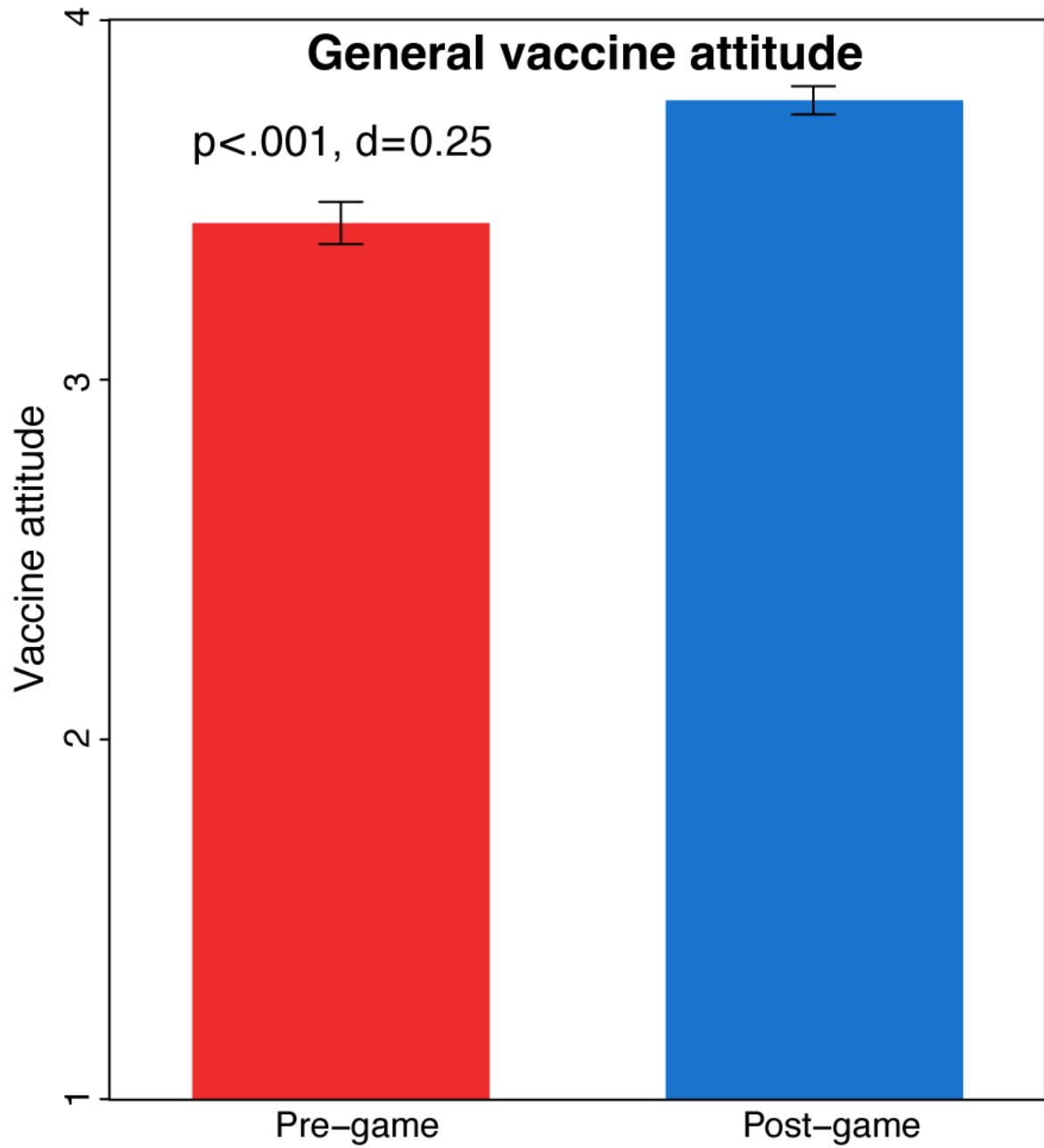
Thinking about vaccination in general, would you say you are personally...

- 😊 Strongly for vaccination
- 😊 Somewhat for vaccination
- 😞 Somewhat against vaccination
- 😞 Strongly against vaccination

## Vaccine intent

How likely are you to get recommended vaccinations for yourself or your children, if applicable?

- 😊 Very likely
- 😊 Somewhat likely
- 😞 Somewhat unlikely
- 😞 Very unlikely





# Pakistan Cranky Uncle characters





THE UNIVERSITY OF  
MELBOURNE

# Thank you

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Email: [jocook@unimelb.edu.au](mailto:jocook@unimelb.edu.au)

Web: <https://crankyuncle.com>

