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KNOWLEDGE

Why We Never Think Alone

STEVEN SLOMAN

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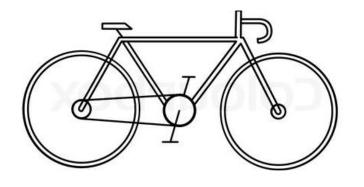
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What You Think You Know



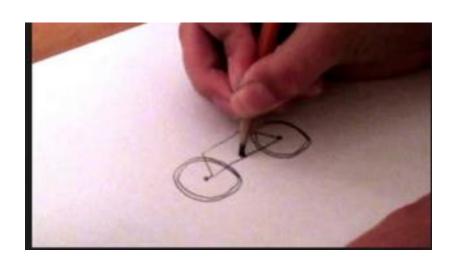
What You Actually Know

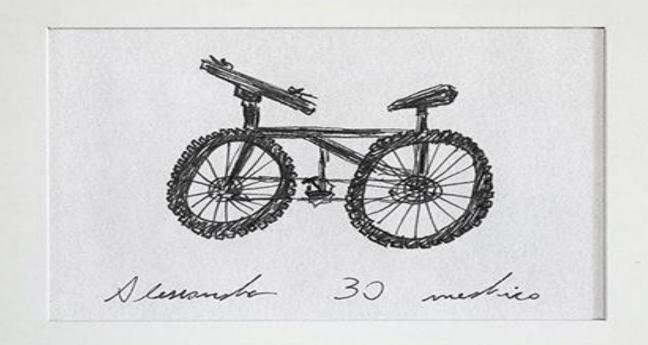




The Artist and the Bicycle



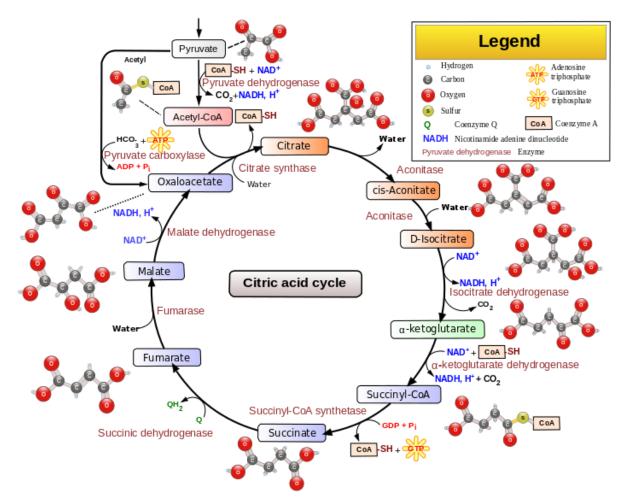






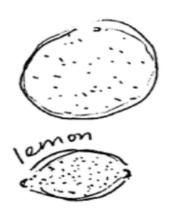
Krebs Cycle

The sequence of reactions by which most living cells generate energy during the process of aerobic respiration.



After a Couple of Years

citric acid cycle something is broken down



"The opinions that are held with passion are always those for which no good ground exists."

-- Bertrand Russell, Sceptical Essays.

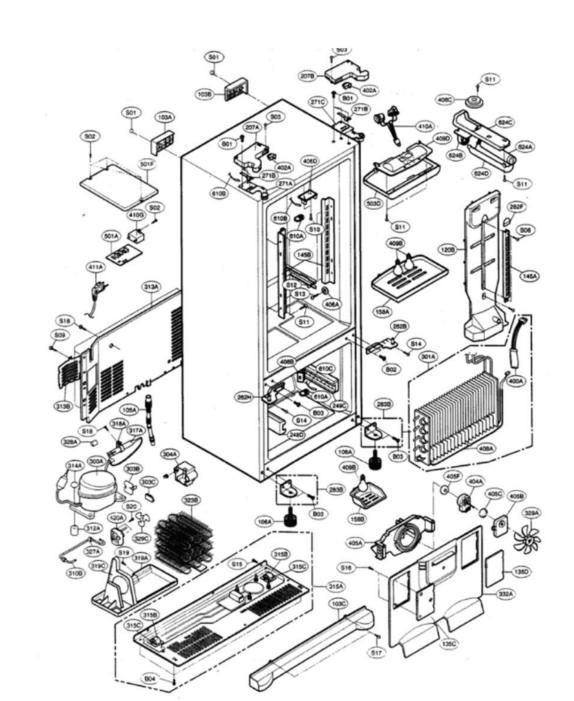
The Knowledge Illusion and Policy

- National flat tax
- Cap and trade
- Unilateral sanctions on Iran
- Raising the retirement age for social security
- Single-payer health care system
- Merit-based pay for teachers

It's Not Our Fault



How is the ball held?
What kind of ink works? How does it flow?
How are colors generated?
How is pressure exerted?
How are the materials manufactured?
What determines demand and pricing?



How much do you know?

1 Gigabyte

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KNOWLEDGE ILLUSION

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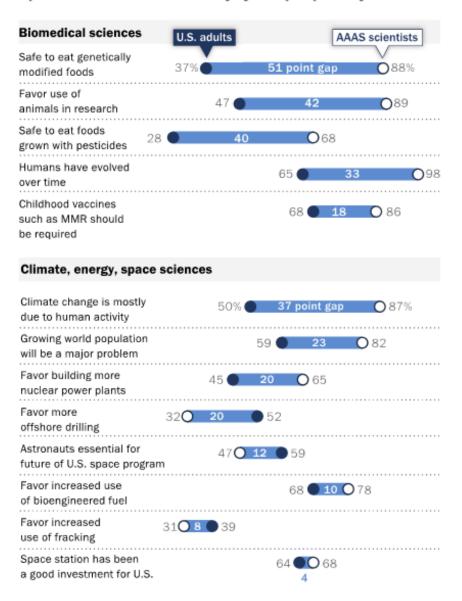
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Opinion Differences Between Public and Scientists

% of U.S. adults and AAAS scientists saying each of the following



Survey of U.S. adults August 15-25, 2014. AAAS scientists survey Sept. 11-0ct. 13, 2014. Other responses and those saying don't know or giving no answer are not shown.

PEW RESEARCH CENTER

Deficit Model

Over 80 percent of Americans support:

- 1. labeling of GMO foods "produced with genetic engineering"
- 2. "mandatory labels on foods containing DNA"

Knowledge Overconfidence and Counter-Consensus Views About Science

General Approach

- Objective Knowledge
- Subjective Knowledge
- Extremity of Counter-Consensus Views

Objective Knowledge

- 15 true-false questions; 5 question genetics sub-scale
- Adapted from the National Science Foundation's Science and Engineering Indicators survey, and the U.S. Environmental and Biotechnology Study
- sum of a participant's T-F answers

True or False? The oxygen we breathe comes from plants.								
Definitely false	Probably false	Maybe false	Not sure	Maybe true	Probably true	Definitely true		
True or False? Antibiotics kill viruses as well as bacteria.								
Definitely false	Probably false	Maybe false	Not sure	Maybe true	Probably true	Definitely true		
True or False? All insects have eight legs.								
Definitely false	Probably false	Maybe false	Not sure	Maybe true	Probably true	Definitely true		

Subjective Knowledge

Next, we will ask you to rate **your understanding of genetically modified foods** on a seven-point scale. To ensure you understand the scale, this section explains what three (of the seven) levels of understanding mean, using the example of how a crossbow works. Please read each description to get a sense of how to use the scale. As you will see, a 7 implies detailed and deep knowledge, a 1 implies very little knowledge, and a 4 is in the middle.

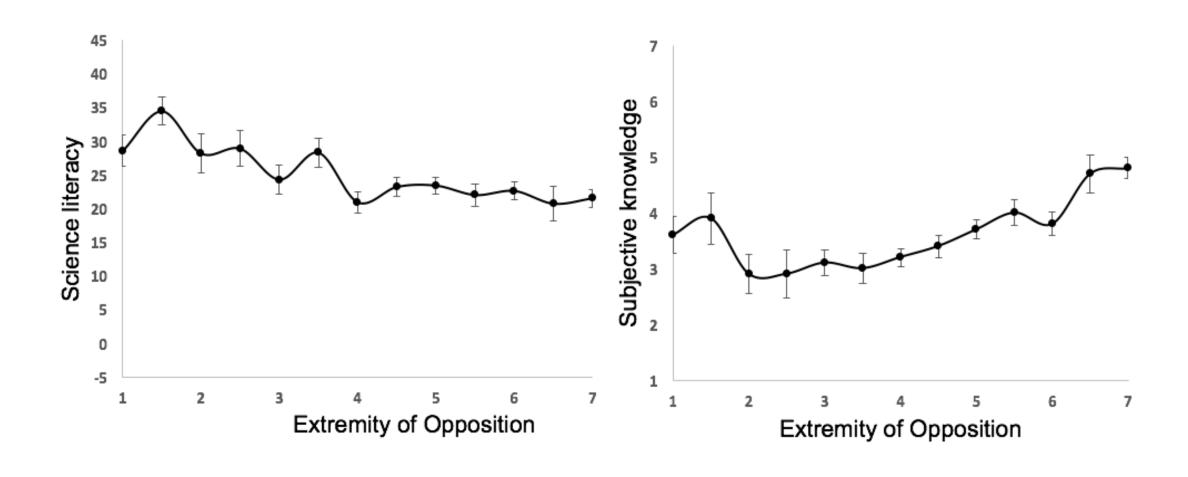
Level 7 knowledge: A person with level 7 knowledge of crossbows can tell you all about their parts and how they work together. This person could tell you that a crossbow has a stiff, flexible piece of metal as a bow with a wire or strong line; that the bow is permanently mounted on a block of wood or metal; and that the wire is pulled back by something that gives a mechanical advantage—either a lever, a small block and tackle, or a crank wound around a spool that pulls a wire attached to the bow wire. The bow wire is held back by a pin connected to a trigger, and an arrow is set in front of it. The pin is directly connected to the trigger so that when you pull on the trigger, it causes the pin to pivot around a point such that the end moves downwards and releases the bow wire. When the pin releases the string, the bow very quickly un-flexes, rapidly imparting the energy stored in the flexed bow to the arrow.

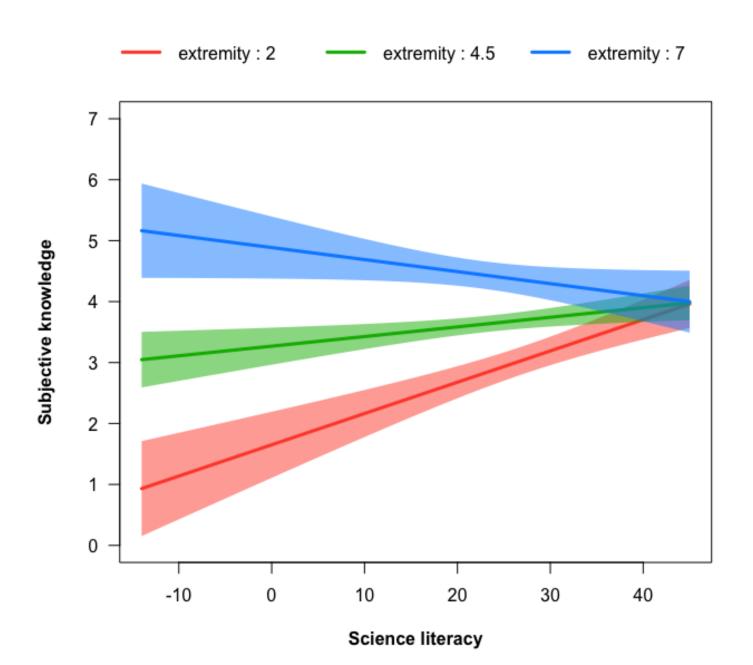
Level 4 knowledge: A person with level 4 knowledge might know that the crossbow is a fixed bow and arrow arrangement; that it gets more power than a normal bow and arrow because it allows you to pull the string back extra hard and then trap it there, rather than hold it; and that it is then released by a trigger.

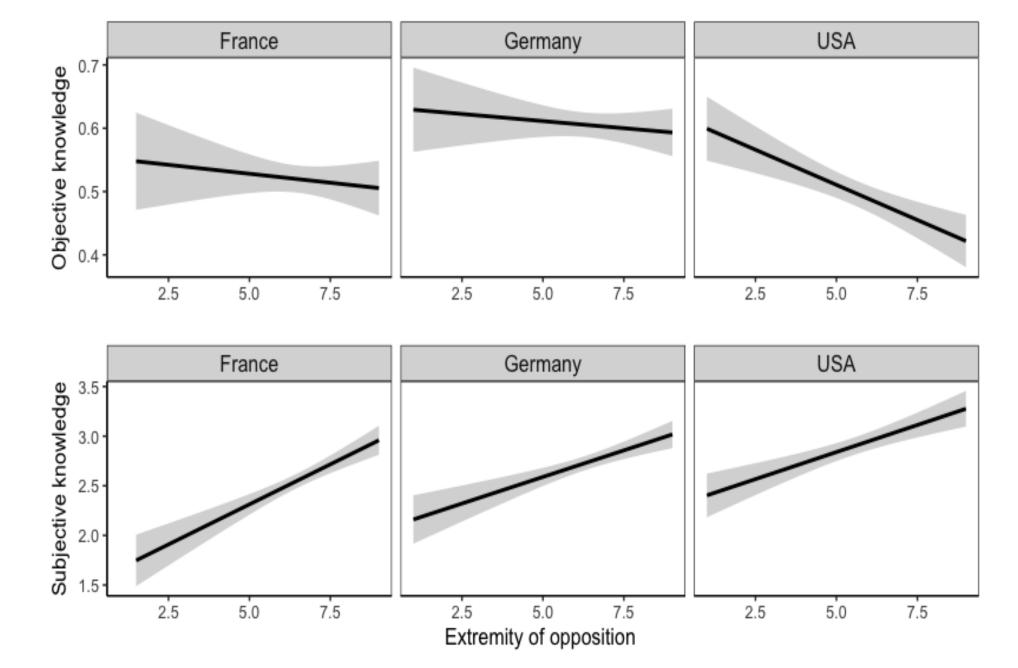
Level 1 knowledge: A person with level 1 knowledge might know what a crossbow looks like and what it does (shoots arrows).

Using the scale you just learned about, how would you rate your understanding of genetically modified foods?						
Vague understanding =						Thorough understanding =
1	2	3	4	5	6	7
0	0	\circ	\circ	\circ	0	0

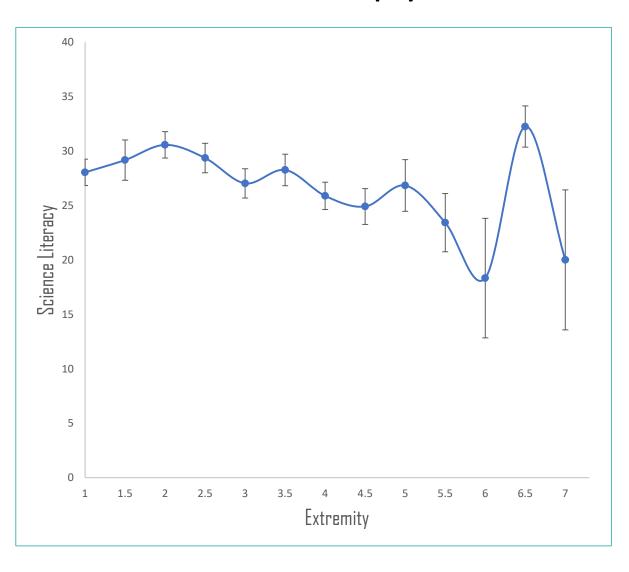
Genetically Modified Foods

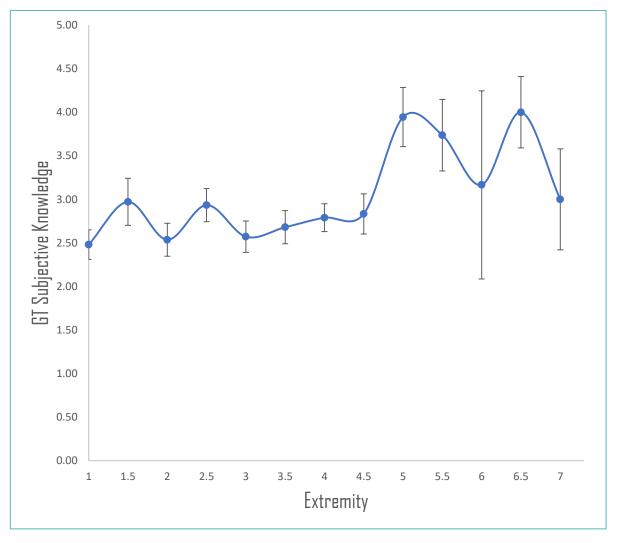






Gene Therapy: Same Pattern

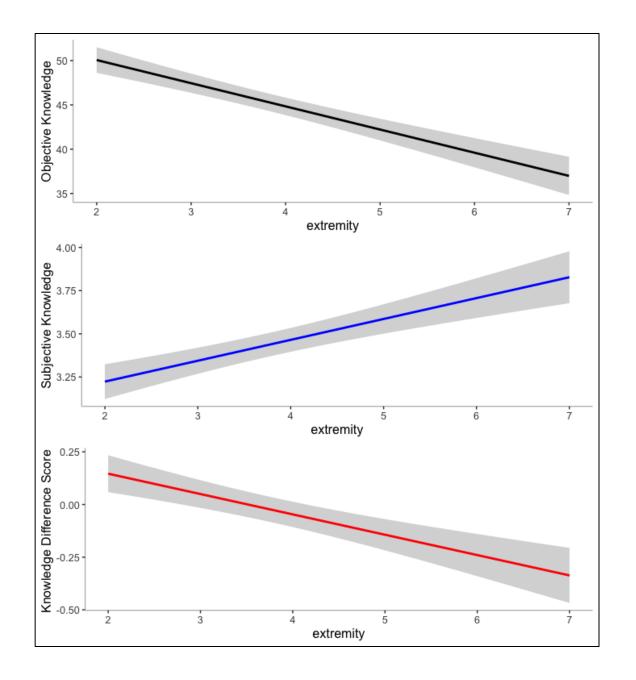




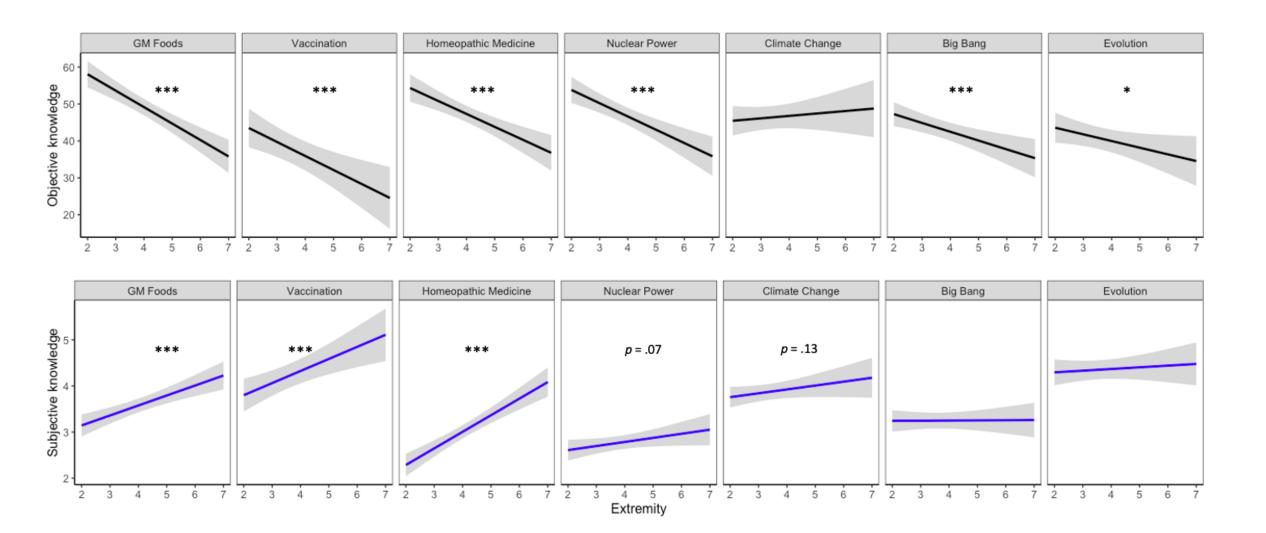
Issues and Statements of Consensus

Issue	lssue Consensus		
Climate Change	Most of the warming of the Earth's average global temperature over the second half of the 20th century has been caused by human activities.	(Anderegg et al., 2010; IPCC, 2014)	
Genetically Modified Foods	Consuming foods with ingredients derived from genetically modified crops is no riskier than consuming foods modified by conventional plant improvement techniques.	(AAAS, 2012; Economidis et al., 2010)	
Nuclear Power	Nuclear power is necessary and should be expanded.		
Vaccinations are safe, beneficial, and have zero link to autism.		(Destefano et al., 2013; Funk & Rainie, 2015; Gust et al., 2008)	
Homeopathic Medicine There is no reliable evidence that homeopath medicine is an effective treatment for any health conditions.		(NHMRC, 2015; NIH, 2020)	
The universe began approximately 14 billion years ago in a hot and dense state, and has expanded and cooled since then.		(Guth et al., 2017)	
Evolution Humans and other living things have evolved over time.		(AAAS, 2006; Pew Research, 2015)	

Overall Results



Results by Issue



Incentive Compatible Confidence Measure



IMPORTANT INSTRUCTIONS AND BONUS OPPORTUNITY - please read carefully









In the next part of the survey we will ask you to answer 30+ true-false scientific questions. Mixed in among them are 5 questions on the science surrounding \${e://Field/issue.text} specifically. These questions were developed using factual information from top scientists at organizations such as:

- -NASA
- -The Organisation for Economic Co-operation and Development (OECD)
- -The National Science Foundation (NSF)
- -The National Institutes of Health (NIH)
- -The Environmental Protection Agency (EPA)

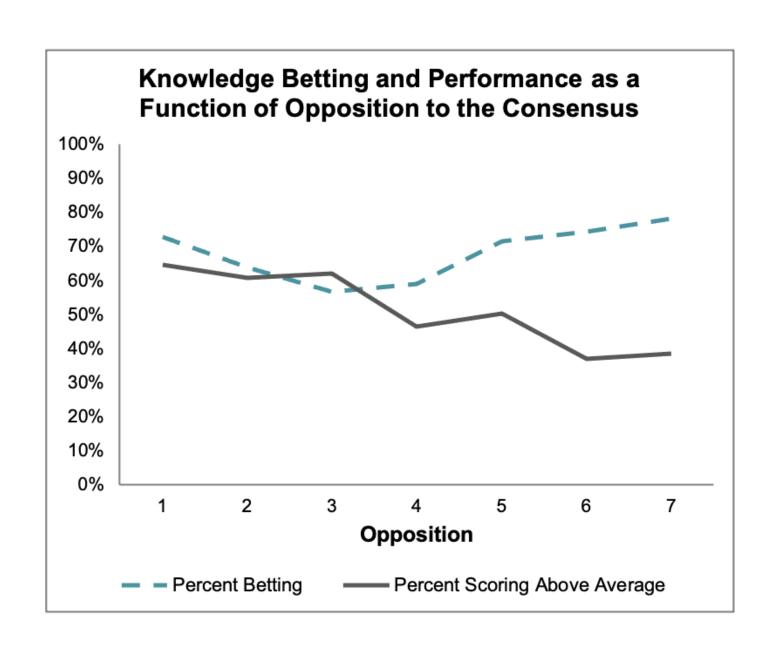
We would like to give you the opportunity to bet on your understanding of \${e://Field/issue.text}, as defined by the agreed-upon knowledge of these scientists.

If you decide to bet, you will receive a \$.50 bonus if you score better than the average on these five questions. If you do not choose to take the bet, we will give you a one-time bonus of \$.25.

Would you like to bet?

No. I would **not** like to bet

Yes, I would like to bet



Covid Vaccine Study

COVID-19 is an illness caused by a coronavirus called SARS-CoV-2 that can spread from person to person.

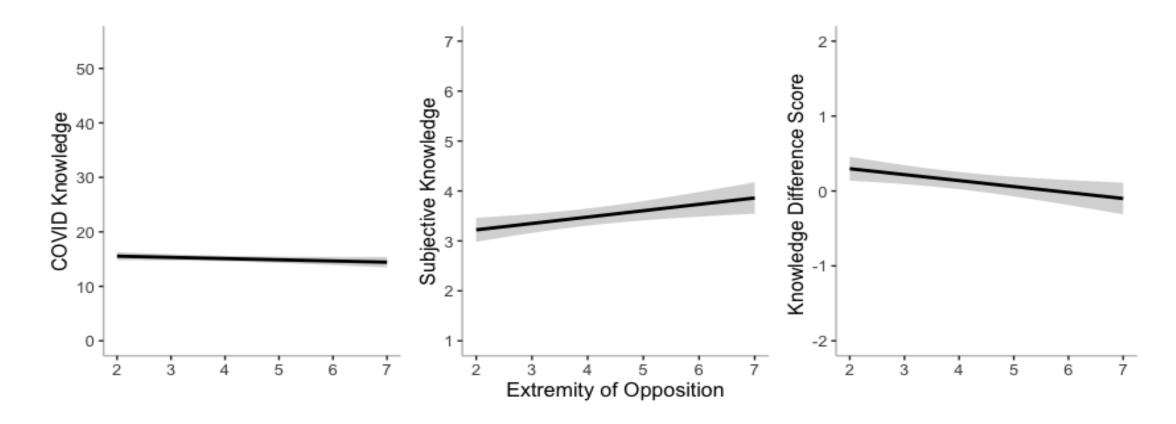
If a COVID-19 vaccine were available to you today, would you get the vaccine? Please indicate your answer on the 7-point scale below.

		Lean slightly		Lean slightly		
Definitely get		toward getting		against getting	Probably not	Definitely not
the vaccine	Probably get it	it	Neutral	it	get it	get the vaccine
\circ	\circ	\circ	\circ	\circ	\circ	\circ

Covid Knowledge Items

- COVID-19 is a kind of bacteria.
- People younger than 65 cannot contract COVID-19.
- There is currently no publicly-available COVID-19 vaccine.
- There are many different types of Coronavirus.
- COVID-19 may be transmitted through houseflies.
- COVID-19 is a variant of the Flu.
- COVID-19 is transmitted mainly via small respiratory droplets through sneezing, coughing, or when people interact in close proximity.

Results



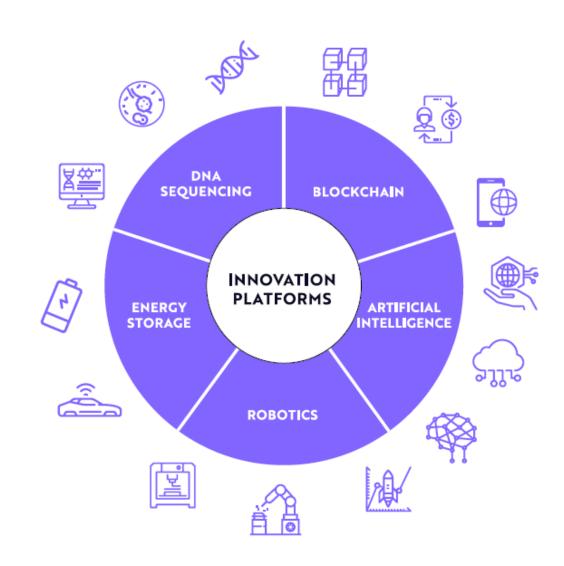
Other Covid Behaviors

- Independent Team
- Data collected via Facebook ads and a student subject pool
- Preventive behaviors (e.g. social distancing)
- Policy Attitudes (e.g. mask mandate)
- Covid Knowledge (20 items)
- Subjective Knowledge (2 measures)

Results

- Preventive behaviors and anti-consensus policy attitudes:
 - Decrease with decreases in objective knowledge
 - Decrease with increases in subjective knowledge (both direct and compared to scientists)
- Effects hold up with inclusion of political ideology control.

Disruptive Technology



Conspiracy Theories



Five Lessons

Intellectual humility is unnatural but important

Diffidence Calibration Overconfidence

For better discourse explain don't advocate

Our views are not our own. Beware of echo chambers.

Ask more "stupid" questions

Sometimes overconfidence is good. Take chances and learn from mistakes.

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