Slide 1

Scientific Reasoning

Slide 2

FIGURE 6. Climate Change Factions by Party Affiliation

Legend: Believer | Sympathizer | Skeptic

	Believer	Sympathizer	Skeptic
All Americans	46	25	26
Democrat	65	20	13
Independent	44	26	26
Republican	22	28	46
Tea Party	23	23	53
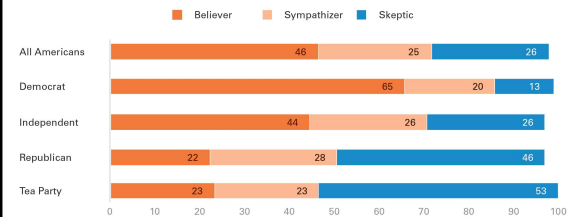
Source: PRRI/AAR, Religion, Values, and Climate Change Survey, November 2014

Slide 3

Public trust in science by political ideology

Moderate — Conservative — Liberal

TRUST IN SCIENCE (Unadjusted means)

NOTE: Figure shows three-year moving averages for each group, which smooth the patterns over time.
SOURCE: American Sociological Association

DESERET NEWS GRAPHIC

Slide 4

Motivated Reasoning

Slide 5

aps ASSOCIATION FOR PSYCHOLOGICAL SCIENCE
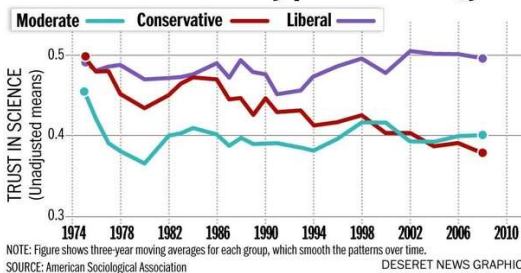
Motivated Rejection of Science

Stephan Lewandowsky[1,2,3] and Klaus Oberauer[4]
[1]School of Experimental Psychology, University of Bristol; [2]Cabot Institute, University of Bristol;
[3]School of Psychology, University of Western Australia; and [4]Department of Psychology, University of Zurich

Abstract
Some scientifically well-established results—such as the fact that emission of greenhouse gases produces global warming—are rejected by sizable proportions of the population in the United States and other countries. Rejection of scientific findings is mostly driven by motivated cognition: People tend to reject findings that threaten their core beliefs or worldview. At present, rejection of scientific findings by the U.S. public is more prevalent on the political right than the left. Yet the cognitive mechanisms driving rejection of science, such as the superficial processing of evidence toward the desired interpretation, are found regardless of political orientation. General education and scientific literacy do not mitigate rejection of science but, rather, increase the polarization of opinions along partisan lines. In contrast, specific knowledge about the mechanisms underlying a scientific result—such as human-made climate change—can increase the acceptance of that result.

Slide 6

The Cognition Underlying the Rejection of Science

- Heuristic thinking
- System 1 processing of evidence consistent with my world view
- Critical, System 2 processing of evidence that opposes my world view

9/10/2020

Slide 7

	Rash got better	Rash got worse
Users of new skin cream	223	75
Non-users of new skin cream	107	21

Results

223/(223 + 75) = 75%
107/(107+21) = 84%

7

Slide 8

Results

	Increase in crime	Decrease in crime
Cities that banned guns	223	75
Cities that did *not* ban guns	107	21

8

Slide 9

a

Users of new skin cream	Results Rash got better	Rash got worse	Results Rash got worse	Rash got better
Users of new skin cream	223	75	223	75
Non-users of new skin cream	107	21	107	21

b

Cities that banned guns	Results Increase in crime	Decrease in crime	Results Decrease in crime	Increase in crime
Cities that banned guns	223	75	223	75
Cities that did *not* ban guns	107	21	107	21

Numeracy affects judgment

Political views affect judgment

Fig. 1. Synthetic data used as stimuli in an experiment by Kahan, Peters, Dawson, and Slovic (2013). See text for details.

9

Slide 10

Science & Politics

- Both liberals and conservatives engage in motivated reasoning
- Current science topics threaten conservative world view more than liberals
- But when liberals are threatened, they also distrust science
- For a-political science, no partisan difference
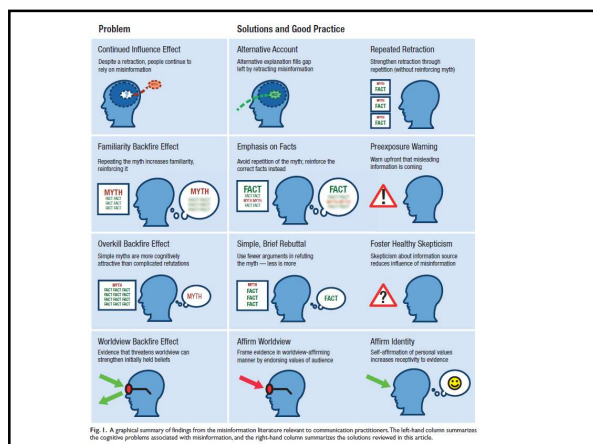
10

Slide 11

Rational Denial

- Rational strategy to achieve political ends
- Goals = accuracy, but also profit, identity etc.
- Backfire effects – doubt source of evidence if it conflicts with worldview
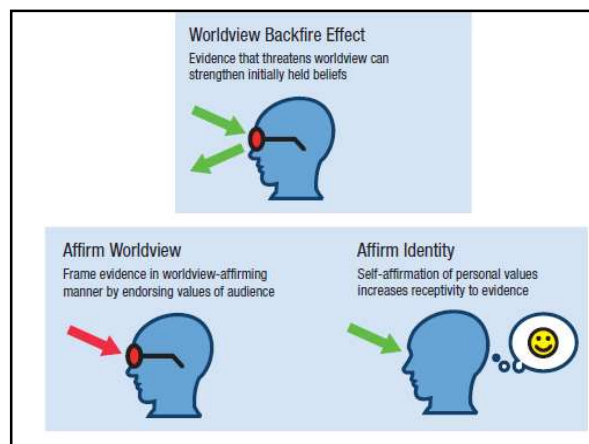
11

Slide 12

Communicating contested science

- Framing: carbon tax vs. carbon offset
- Narratives
- Explaining the mechanism
- Affirm worldview, affirm identity

12

2

Slide 13

Problem	Solutions and Good Practice	
Continued Influence Effect Despite a retraction, people continue to rely on misinformation	**Alternative Account** Alternative explanation fills gap left by retracting misinformation	**Repeated Retraction** Strengthen retraction through repetition (without reinforcing myth)
Familiarity Backfire Effect Repeating the myth increases familiarity, reinforcing it	**Emphasis on Facts** Avoid repetition of the myth; reinforce the correct facts instead	**Preexposure Warning** Warn upfront that misleading information is coming
Overkill Backfire Effect Simple myths are more cognitively attractive than complicated refutations	**Simple, Brief Rebuttal** Use fewer arguments in refuting the myth — less is more	**Foster Healthy Skepticism** Skepticism about information source reduces influence of misinformation
Worldview Backfire Effect Evidence that threatens worldview can strengthen initially held beliefs	**Affirm Worldview** Frame evidence in worldview-affirming manner by endorsing values of audience	**Affirm Identity** Self-affirmation of personal values increases receptivity to evidence

Fig. 1. A graphical summary of findings from the misinformation literature relevant to communication practitioners. The left-hand column summarizes the cognitive problems associated with misinformation, and the right-hand column summarizes the solutions reviewed in this article.

13

Slide 14

Worldview Backfire Effect
Evidence that threatens worldview can strengthen initially held beliefs

Affirm Worldview
Frame evidence in worldview-affirming manner by endorsing values of audience

Affirm Identity
Self-affirmation of personal values increases receptivity to evidence

14

Slide 15

The polarizing impact of science literacy and numeracy on perceived climate change risks

Dan M. Kahan[1]*, Ellen Peters[2], Maggie Wittlin[3], Paul Slovic[4], Lisa Larrimore Ouellette[3], Donald Braman[5] and Gregory Mandel[6]

15

Slide 16

How to foster understanding of climate change

- Science education!
- But heuristics?
- Higher numeracy → more System 2
- Prediction:
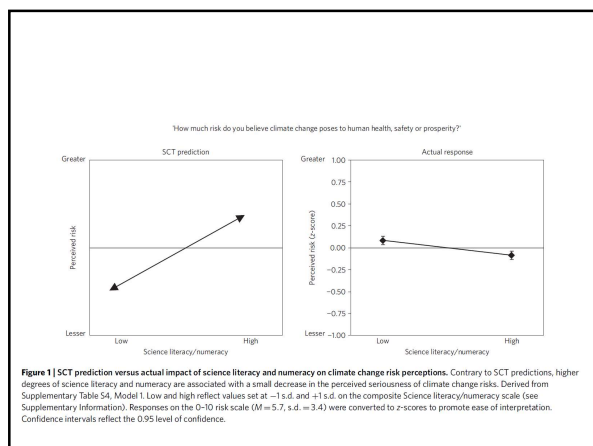
scientific literacy → belief in climate change

16

Slide 17

Numeracy

Item		% correct
EVENROLL.	Imagine that we roll a fair, six-sided die 1,000 times. (That would mean that we roll one die from a pair of dice.) Out of 1,000 rolls, how many times do you think the die would come up as an even number?	58%
PCTTOFREQUENCY1.	In the BIG BUCKS LOTTERY, the chances of winning a $10.00 prize are 1%. What is your best guess about how many people would win a $10.00 prize if 1,000 people each buy a single ticket from BIG BUCKS?	60%
FREQUENCYTOPCT1.	In the ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What percent of tickets of ACME PUBLISHING SWEEPSTAKES win a car?	28%
COMPFREQUENCY.	Which of the following numbers represents the biggest risk of getting a disease?	86%
COMPPCT.	Which of the following numbers represents the biggest risk of getting a disease?	88%
DOUBLEPCT.	If Person A's risk of getting a disease is 1% in ten years, and Person B's risk is double that of A's, what is B's risk?	64%
DOUBLEFREQUENCY.	If Person A's chance of getting a disease is 1 in 100 in ten years, and person B's risk is double that of A, what is B's risk?	21%
PCTTOFREQUENCY2.	If the chance of getting a disease is 10%, how many people would be expected to get the disease:	

17

Slide 18

Scientific Literacy

	% correct
The center of the Earth is very hot [true/false].	86%
All radioactivity is man-made [true/false].	84%
Lasers work by focusing sound waves [true/false].	68%
Electrons are smaller than atoms [true/false].	62%
Does the Earth go around the Sun, or does the Sun go around the Earth?	72%
How long does it take for the Earth to go around the Sun? [one day, one month, one year]	45%
It is the father's gene that decides whether the baby is a boy or a girl [true/false].	69%
Antibiotics kill viruses as well as bacteria [true/false].	68%

18

'How much risk do you believe climate change poses to human health, safety or prosperity?'

Figure 1 | SCT prediction versus actual impact of science literacy and numeracy on climate change risk perceptions. Contrary to SCT predictions, higher degrees of science literacy and numeracy are associated with a small decrease in the perceived seriousness of climate change risks. Derived from Supplementary Table S4, Model 1. Low and high reflect values set at −1 s.d. and +1 s.d. on the composite Science literacy/numeracy scale (see Supplementary Information). Responses on the 0–10 risk scale ($M = 5.7$, s.d. $= 3.4$) were converted to z-scores to promote ease of interpretation. Confidence intervals reflect the 0.95 level of confidence.

19

2 Theories

- Science Comprehension Theory
  - Perceived risk of climate change is based on understanding the science
  - Solution is science education
- Cultural Cognition Theory
  - Form scientific beliefs that fit with one's identity group
  - Motivated to hold beliefs that fit world view

20

2 World Views

- hierarchical, individualistic world-view
  - Decisions by authority
  - Skeptical of environmental risks
  - Value commerce and industry

- egalitarian, communitarian world-view
  - Collective attention to individual need
  - Morally suspicious of commerce and industry
  - Alert to social inequality
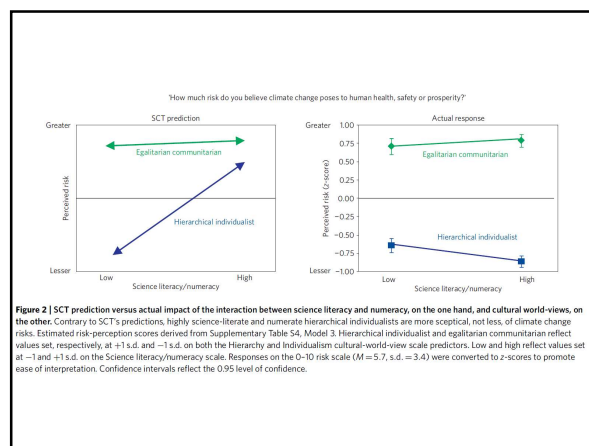
21

Individualism-Communitarianism (Individualism)

IINTRSTS.	The government interferes far too much in our everyday lives.
CHARM.	Sometimes government needs to make laws that keep people from hurting themselves.
IPROTECT.	It's not the government's business to try to protect people from themselves.
IPRIVACY.	The government should stop telling people how to live their lives.
CPROTECT.	The government should do more to advance society's goals, even if that means limiting the freedom and choices of individuals.
CLIMCHOI.	Government should put limits on the choices individuals can make so they don't get in the way of what's good for society.

22

Hierarchy-Egalitarianism (Hierarchy)

HEQUAL.	We have gone too far in pushing equal rights in this country.
EWEALTH.	Our society would be better off if the distribution of wealth was more equal.
ERADEQ.	We need to dramatically reduce inequalities between the rich and the poor, whites and people of color, and men and women.
EDISCRIM.	Discrimination against minorities is still a very serious problem in our society.
HREVDIS2.	It seems like blacks, women, homosexuals and other groups don't want equal rights, they want special rights just for them.
HFEMININ.	Society as a whole has become too soft and feminine.

23

'How much risk do you believe climate change poses to human health, safety or prosperity?'

Figure 2 | SCT prediction versus actual impact of the interaction between science literacy and numeracy, on the one hand, and cultural world-views, on the other. Contrary to SCT's predictions, highly science-literate and numerate hierarchical individualists are more sceptical, not less, of climate change risks. Estimated risk-perception scores derived from Supplementary Table S4, Model 3. Hierarchical individualist and egalitarian communitarian reflect values set, respectively, at +1 s.d. and −1 s.d. on both the Hierarchy and Individualism cultural-world-view scale predictors. Low and high reflect values set at −1 and +1 s.d. on the Science literacy/numeracy scale. Responses on the 0–10 risk scale ($M = 5.7$, s.d. $= 3.4$) were converted to z-scores to promote ease of interpretation. Confidence intervals reflect the 0.95 level of confidence.

24

Fig. S2. Impact of the interaction between science literacy and numeracy, on the one hand, and cultural worldviews, on the other, for climate-change and nuclear-power risk perceptions. $N = 1540$. Derived from

25