Debunking common climate change myths

JOHN COOK
Explaining climate change science & rebutting global warming misinformation

Scientific skepticism is healthy. Scientists should always challenge themselves to improve their understanding. Yet this isn’t what happens with climate change denial. Skeptics vigorously criticise any evidence that supports man-made global warming and yet embrace any argument, op-ed, blog or study that purports to refute global warming. This website gets skeptical about global warming skepticism. Do their arguments have any scientific basis? What does the peer reviewed scientific literature say?

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Posted on 14 September 2014 by John Hartz

SkS Highlights
Based on the evidence, 97% of climate scientists have concluded that humans are causing global warming.

Climate myth...

There is no consensus
The Petition Project features over 31,000 scientists signing the petition stating "There is no convincing scientific evidence that human release of carbon dioxide will, in the foreseeable future, cause catastrophic heating of the Earth's atmosphere ...". (Petition Project)

Science achieves a consensus when scientists stop arguing. When a question is first asked – like ‘what would happen if we put a load more CO2 in the atmosphere?’ – there may be many hypotheses about cause and effect. Over time, those hypotheses are experimentally tested, then refined and replaced by more solid hypotheses. This is how science advances.
Anatomy of an effective debunking

Bringing all the different threads together, an effective debunking requires:

- **Core facts**—a refutation should emphasise the facts, not the myth. Present only key facts to avoid an Overkill Backfire Effect;
- **Explicit warnings**—before any mention of a myth, test or visual cues should warn that the upcoming information is false;
- **Alternative explanation**—any gaps left by the debunking need to be filled. This may be achieved by providing an alternative causal explanation for why the myth is wrong and, optionally, why the misinformers promoted the myth in the first place;
- **Graphics**—core facts should be displayed graphically if possible.

The following example debunks the myth that there is no scientific consensus about man-made (global) warming, because 31,000 scientists signed a petition stating there is no evidence that human activity can disrupt climate.

97 out of 100 climate experts agree humans are causing global warming.

Several independent surveys find 97% of climate scientists who are actively publishing peer-reviewed climate research agree that humans are causing global warming.

On top of this overwhelming consensus, the National Academies of Science from all over the world also endorse the consensus view of human caused global warming, as expressed by the Intergovernmental Panel on Climate Change (IPCC).

However, movements that deny a scientific consensus have always sought to cast doubt on the fact that a consensus exists. One technique is the use of fake experts, citing scientists who have little to no expertise in the particular field of science.

For example, the OSIM Petition Project claims 31,000 scientists disagree with the scientific consensus on global warming.

However, around 99.9% of the scientists listed in the Petition Project are not climate scientists. The petition is open to anyone with a Bachelor of Science or higher and includes medical doctors, mechanical engineers and computer scientists.
Making Sense of Climate Science Denial

Climate change is real, so why the controversy and debate? Learn to make sense of the science and to respond to climate change denial.

About this Course

In public discussions, climate change is a highly controversial topic. However, in the scientific community, there is little controversy. With 97% of climate scientists agreeing on human-caused climate change, the debate comes down to understanding this science so you can make informed decisions and share that understanding with others.
## Global warming is happening

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[http://sks.to/fmf](http://sks.to/fmf)
The psychology of misinformation
The golden rule of debunking

Fight Sticky Myths...

...With Stickier Facts
S.U.C.C.E.S.

- Simple
- Unexpected
- Credible
- Concrete
- Emotional
- Story
Educational opportunity

One of the most powerful and engaging ways to explain science is by explaining how science can get distorted.
Test scores

- Misconception based learning
- Traditional learning

Mean score:
- Pretest
- Posttest
- Delayed posttest

McCuin et al. 2014
Scientific consensus

97% of climate scientists agree on global warming
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.
The point of modern propaganda isn't only to misinform or push an agenda. It is to exhaust your critical thinking, to annihilate truth.
INOCULATION THEORY

Warning of threat + Counter-arguments
Warning Before Misinformation

... several independent investigations have concluded that the “Petition Project” is extremely misleading. For instance, many of the signatures on the petition are fake (for example, past signatories have included the long deceased Charles Darwin, members of the Spice Girls, and fictional characters from Star Wars). Also, although 31,000 may seem like a large number, it actually represents less than 0.3% of all US science graduates (a tiny fraction). Further, nearly all of the legitimate signers have no expertise in climate science at all.
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Facts vs Misinformation

van der Linden et al. (2017)
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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.

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 spokespersons 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.
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Response to Misinformation

- "Fake experts" technique
- Misinformation

Change in Perceived Consensus (%)
3 ELEMENTS TO AN EFFECTIVE DEBUNKING

FACT
Replace the myth with a more compelling and memorable fact

MYTH/MISCONCEPTION
Warn people before mentioning the myth so they’re cognitively on guard

FALLACY
Explain the technique used by the myth to distort the fact.

- F: Fake Experts
- L: Logical Fallacies
- I: Impossible Expectations
- C: Cherry Picking
- C: Conspiracy Theories
5 CHARACTERISTICS OF SCIENCE DENIAL

F - Fake Experts
L - Logical Fallacies
I - Impossible Expectations
C - Cherry Picking
C - Conspiracy Theories

Magnified Minority
Red Herring
Misrepresentation
Jumping to Conclusions
False Dichotomy
Putting theory into practice
“We’ve actually been in a hiatus since the late 1990s.”
SCOTT PRUITT

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

“It’s a snowball... It’s very, very cold out.”
JAMES INHOFE

“...the primary control knob is the ocean waters...”
RICK PERRY
MYTH “31,000 dissenting scientists prove there’s no expert agreement on human-caused global warming.”

PREMISE #1
A large proportion of scientists dissent against human-caused global warming.

PREMISE #2
Scientists are experts on climate change.

CONCLUSION
There is no expert agreement on human-caused global warming.
MYTH
“31,000 dissenting scientists prove there’s no expert agreement on human-caused global warming.”

PREMISE #1
A large proportion of scientists dissent against human-caused global warming.

PREMISE #2
Scientists are experts on climate change.

CONCLUSION
There is no expert agreement on human-caused global warming.

MAGNIFIED MINORITY
31,000 is only 0.3% of over 10 million people with science degrees in USA.

FAKE EXPERTS
99.9% of the 31,000 signatories are not climate scientists.
5 CHARACTERISTICS OF SCIENCE DENIAL

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John Cook

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Web: http://www.skepticalscience.com
Podcast: http://evidencesquared.com
MOOC http://sks.to/denial101x
“It’s a snowball... It’s very, very cold out.”

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

MARCO RUBIO
Humans have died naturally in the past...

...so this death must be natural!
Since 1998, our climate has absorbed 4 Hiroshima bombs worth of heat every second.
“We’ve actually been in a hiatus since the late 1990s.”

SCOTT PRUITT
How "Skeptics" View Global Warming

Global Surface Temperature Change (°C)

skepticalscience.com
Human fingerprints on climate change

- Cooling upper atmosphere
- Shrinking upper atmosphere
- Less heat escaping to space
- Less oxygen in the air
- Winter warming faster than summer
- More fossil fuel carbon in the air
- Nights warming faster than days
- More heat returning to Earth
- More fossil fuel carbon in trees
- Pattern of ocean warming
- More fossil fuel carbon in coral
- More fossil fuel carbon in ocean
“...the primary control knob is the ocean waters...”

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