Identifying Fallacies about Climate Change

EES 2110

Introduction to Climate Change

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Class #23: Friday, March 03 2023

The Scientific Consensus on Climate Change

What is the Scientific Consensus?

- Is it important whether most scientists agree or not?
- What if some scientists disagree?
- Do most scientists agree?
  - Careful reviews of scientific literature find 95% of scientists publishing about climate change believe planet is warming because of human activity.

Dissident Scientists

Stanley Prusiner

- 1980s: *Prion* theory: infectious diseases can spread by proteins with no genetic material
- 1997 Nobel Prize
  - Many biologists thought this was a scandal
  - He was right.
    - *Prions* cause Mad Cow Disease and many other deadly diseases

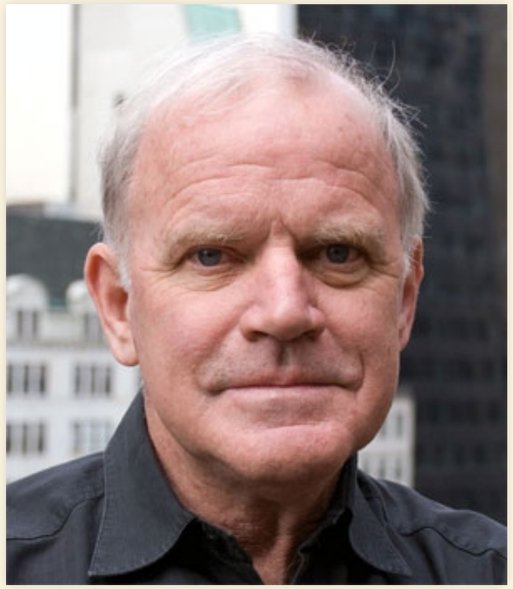
Boris Belousov

- 1950: Discovered a bizarre chemical reaction that oscillated rhythmically, like a clock.
- Journals refused to publish his work.
- 1961–1964, Anatoly Zhabotinsky learned about Belousov's reaction, investigated it, and published in a biology journal.
- Belousov-Zhabotinsky reaction is very important in studying biological and chaotic systems.

Dissident Scientists

Peter Duesberg

- Famous biology professor
- Member National Academy of Science
- Major discovery of cancer-causing virus
- Claims that HIV virus does not cause AIDS



Kary Mullis

- Nobel Prize in medicine/biology
- Invented PCR for analyzing DNA
- Endorses Duesberg’s theory of AIDS

Meaning of Consensus

- Does scientific consensus mean we can be 100% certain that people are warming the planet?
- What about the future impacts of climate change?

What Gets in the Way of Policy?

What Gets in the Way of Policy?

- Politicians don’t understand science?
- Public doesn’t understand science?
- Scientists don’t understand politics?

Issues for Policy

- What do scientists agree on?
- Should policy focus on limits to CO_2 or ΔT?
- Should policy wait for better scientific certainty?
- Uncertainty:
  - How much warming is “dangerous”?
  - How much CO_2 would produce dangerous warming?
  - Are there tipping points?
  - If so, where are they?
- Addressing uncertainty:
  - Precautionary principle
    - *Better safe than sorry*
  - No regrets policy
    - *Worth doing even if global warming turns out to be not so bad.*

1979 Report

Carbon Dioxide and Climate: A Scientific Assessment

The conclusions of this brief but intense investigation may be comforting to scientists but disturbing to policymakers. If carbon dioxide continues to increase, the study group finds no reason to doubt that climate changes will result and no reason to believe that these changes will be negligible. … A wait-and-see policy may mean waiting until it is too late.

National Research Council, *Carbon Dioxide and Climate: A Scientific Assessment* (Nat'l. Academy Press, 1979)

Fallacies about Climate Change

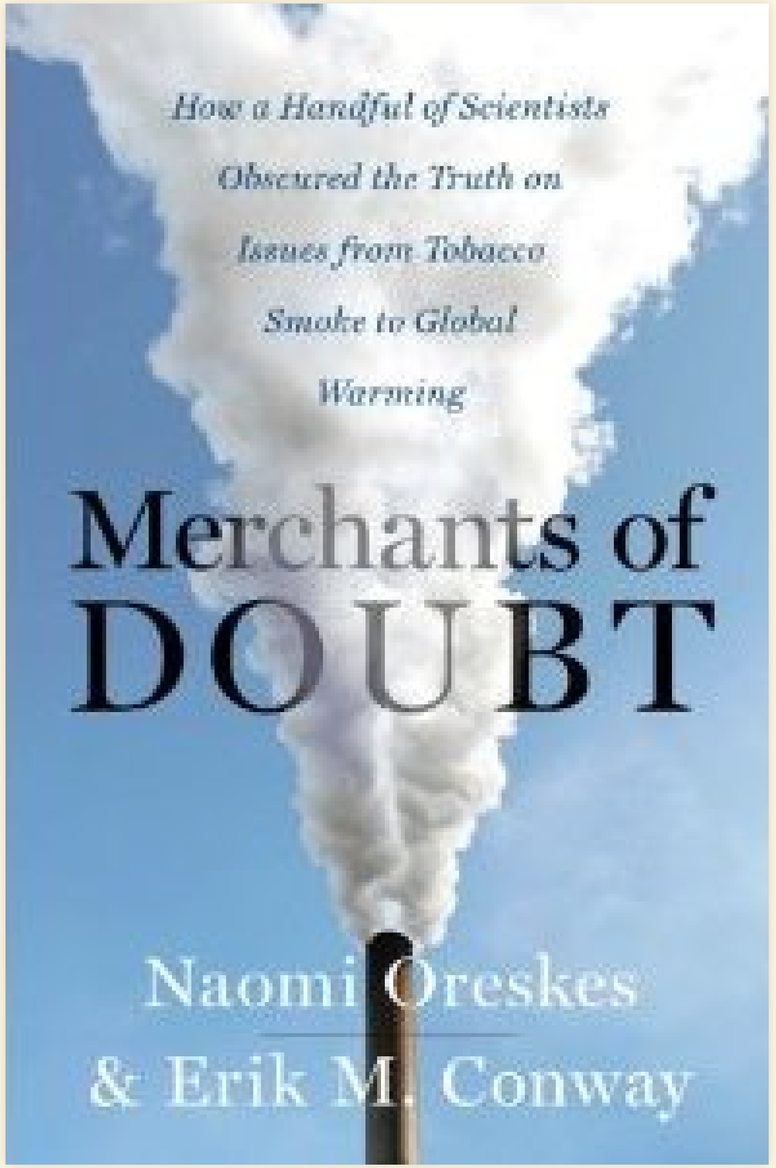
Science vs. Values

- Science can tell us:
  - Is the earth warming?
  - Why is the earth warming?
  - How might warming affect us in the future?
- Science can’t tell us:
  - Is climate change good or bad?
  - What should we do about climate change?
- Rather than debate the values (what should we do?), some people reject the facts (what is happening?).

Everyone is entitled to his own opinion,
but not his own facts.
— Daniel Patrick Moynihan

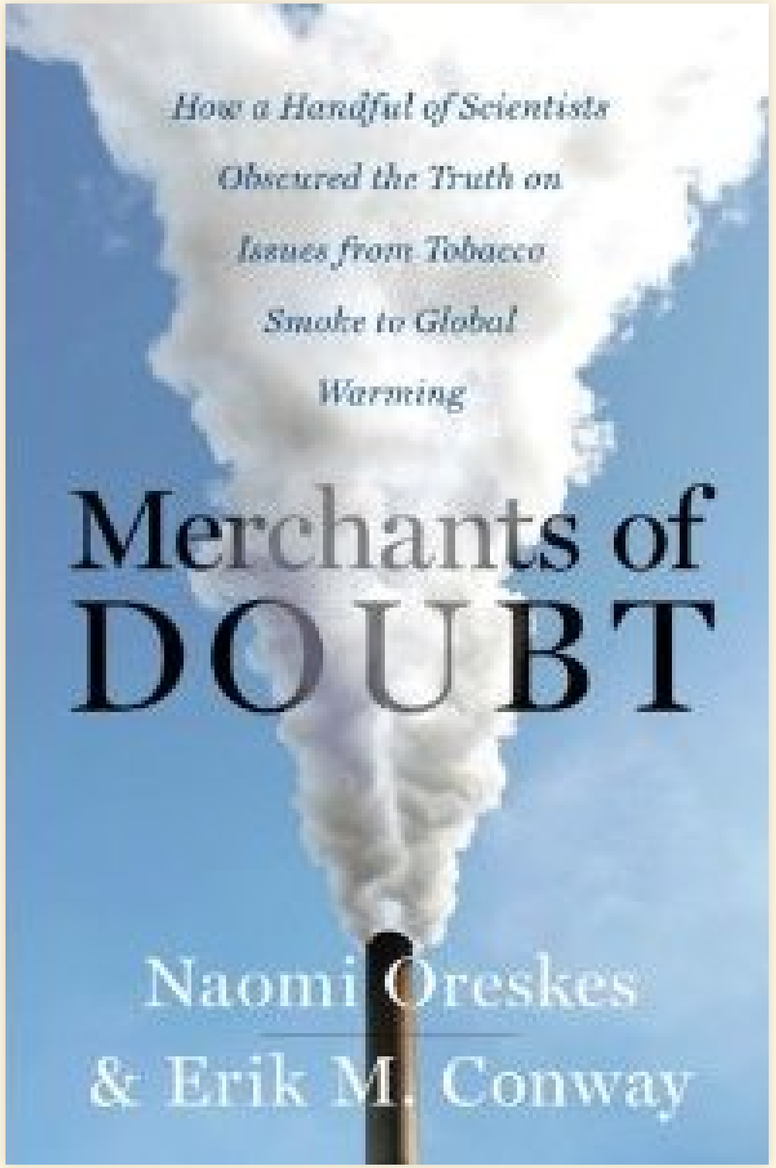
Merchants of Doubt

- A number of prominent physicists and chemists took money from big companies to sow doubt about science showing that …
  - smoking causes cancer
  - burning coal causes “acid rain”
  - chlorofluorocarbon chemicals were destroying the stratospheric ozone layer
  - burning fossil fuels causes global warming
- The same scientists kept appearing in these different propadanda campaigns



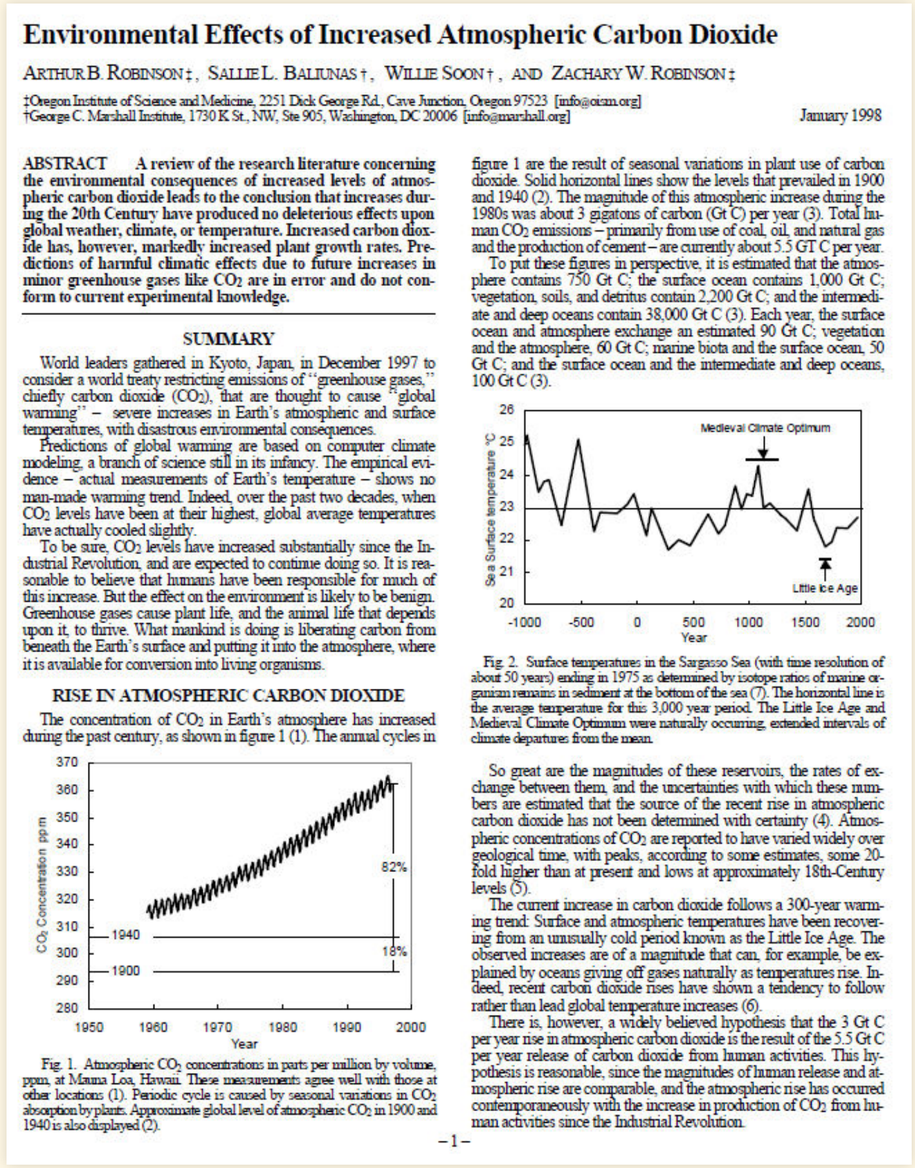
Merchants of Doubt

- In the 1980s, scientists working for big oil companies, like Shell and Exxon, concluded that burning fossil fuels would cause dangerous global warming
  - The companies shut down the research
  - Then they spent millions of dollars attacking climate science
    - Exxon offered scientists $10,000 to write articles criticizing scientific reports about climate change



Oregon Institute of Science and Medicine

- Sounds fancy.
  - It's one room in a farmhouse at the end of a road in rural Oregon.
  - In 1998: 2 people: Arthur B. Robinson and his 21-year-old son
- Circulated a document printed on glossy paper, typeset to look like an article from *Proceedings of the National Academy of Sciences*
  - Claimed to prove that CO_2 does not affect the climate
- Arthur Robinson also says that nuclear radiation is good for you
  - And he has collected over 14,000 vials of human urine that he claims will extend his life and let him overthrow the "medical-industrial-government complex."



Environmental Effects of Increased Atmospheric Carbon Dioxide

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January 1998

ABSTRACT **A review of the research literature concerning the environmental consequences of increased levels of atmospheric carbon dioxide leads to the conclusion that increases during the 20th Century have produced no deleterious effects upon global weather, climate, or temperature. Increased carbon dioxide has, however, markedly increased plant growth rates. Predictions of harmful climatic effects due to future increases in minor greenhouse gases like CO_2 are in error and do not conform to current experimental knowledge.**

SUMMARY

World leaders gathered in Kyoto, Japan, in December 1997 to consider a world treaty restricting emissions of "greenhouse gases," chiefly carbon dioxide (CO_2), that are thought to cause "global warming" – severe increases in Earth's atmospheric and surface temperatures, with disastrous environmental consequences.

Predictions of global warming are based on computer climate modeling, a branch of science still in its infancy. The empirical evidence – actual measurements of Earth's temperature – shows no man-made warming trend. Indeed, over the past two decades, when CO_2 levels have been at their highest, global average temperatures have actually cooled slightly.

To be sure, CO_2 levels have increased substantially since the Industrial Revolution, and are expected to continue doing so. It is reasonable to believe that humans have been responsible for much of this increase. But the effect on the environment is likely to be benign. Greenhouse gases cause plant life, and the animal life that depends upon it, to thrive. What mankind is doing is liberating carbon from beneath the Earth's surface and putting it into the atmosphere, where it is available for conversion into living organisms.

RISE IN ATMOSPHERIC CARBON DIOXIDE

The concentration of CO_2 in Earth's atmosphere has increased during the past century, as shown in figure 1 (1). The annual cycles in figure 1 are the result of seasonal variations in plant use of carbon dioxide. Solid horizontal lines show the levels that prevailed in 1900 and 1940 (2). The magnitude of this atmospheric increase during the 1980s was about 3 gigatons of carbon (Gt C) per year (3). Total human CO_2 emissions – primarily from use of coal, oil, and natural gas and the production of cement – are currently about 5.5 GT C per year.

To put these figures in perspective, it is estimated that the atmosphere contains 750 Gt C; the surface ocean contains 1,000 Gt C; vegetation, soils, and detritus contain 2,200 Gt C; and the intermediate and deep oceans contain 38,000 Gt C (3). Each year, the surface ocean and atmosphere exchange an estimated 90 Gt C; vegetation and the atmosphere, 60 Gt C; marine biota and the surface ocean, 50 Gt C; and the surface ocean and the intermediate and deep oceans, 100 Gt C (3).

Fig. 1. Atmospheric CO_2 concentrations in parts per million by volume, ppm, at Mauna Loa, Hawaii. These measurements agree well with those at other locations (1). Periodic cycle is caused by seasonal variations in CO_2 absorption by plants. Approximate global level of atmospheric CO_2 in 1900 and 1940 is also displayed (2).

Fig. 2. Surface temperatures in the Sargasso Sea (with time resolution of about 50 years) ending in 1975 as determined by isotope ratios of marine organism remains in sediment at the bottom of the sea (7). The horizontal line is the average temperature for this 3,000 year period. The Little Ice Age and Medieval Climate Optimum were naturally occurring, extended intervals of climate departures from the mean.

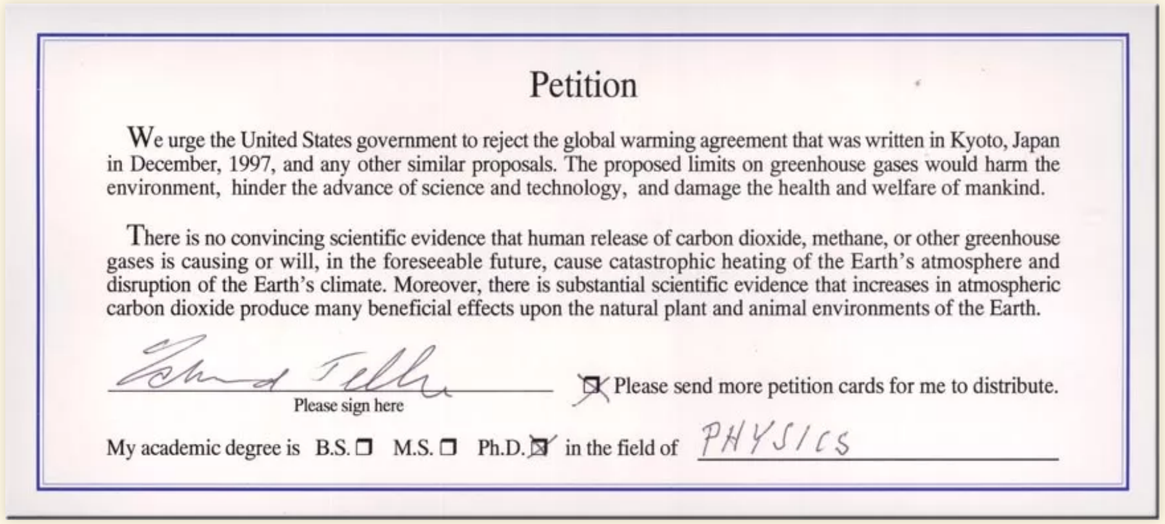
So great are the magnitudes of these reservoirs, the rates of exchange between them, and the uncertainties with which these numbers are estimated that the source of the recent rise in atmospheric carbon dioxide has not been determined with certainty (4). Atmospheric concentrations of CO_2 are reported to have varied widely over geological time, with peaks, according to some estimates, some 20-fold higher than at present and lows at approximately 18th-Century levels (5).

The current increase in carbon dioxide follows a 300-year warming trend: Surface and atmospheric temperatures have been recovering from an unusually cold period known as the Little Ice Age. The observed increases are of a magnitude that can, for example, be explained by oceans giving off gases naturally as temperatures rise. Indeed, recent carbon dioxide rises have shown a tendency to follow rather than lead global temperature increases (6).

There is, however, a widely believed hypothesis that the 3 Gt C per year rise in atmospheric carbon dioxide is the result of the 5.5 Gt C per year release of carbon dioxide from human activities. This hypothesis is reasonable, since the magnitudes of human release and atmospheric rise are comparable, and the atmospheric rise has occurred contemporaneously with the increase in production of CO_2 from human activities since the Industrial Revolution.

Oregon Petition

- Asked readers to sign a petition saying that greenhouse gases do not affect the climate.
- They claim that 31,487 scientists have signed the petition
  - No attempt to verify identities or credentials
  - Signatories include:
    - Characters from Star Wars
    - Characters from the TV show M*A*S*H
    - Michael J. Fox and Ginger Spice
  - Credentials included over 1,000 veterinarians
    - Almost none had any expertise in climate science.
- Several members of Congress cited the petition



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.

Edward Teller
Please sign here

☒ Please send more petition cards for me to distribute.

My academic degree is B.S. ☐ M.S. ☐ Ph.D. ☒ in the field of PHYSICS

Recognizing Fallacies

Categories of Fallacies: FLICC

- People who reject climate science mostly use five categories of fallacies:
  - **F**ake experts
  - **L**ogical fallacies
  - **I**mpossible expectations
  - **C**herry picking
  - **C**onspiracy theories

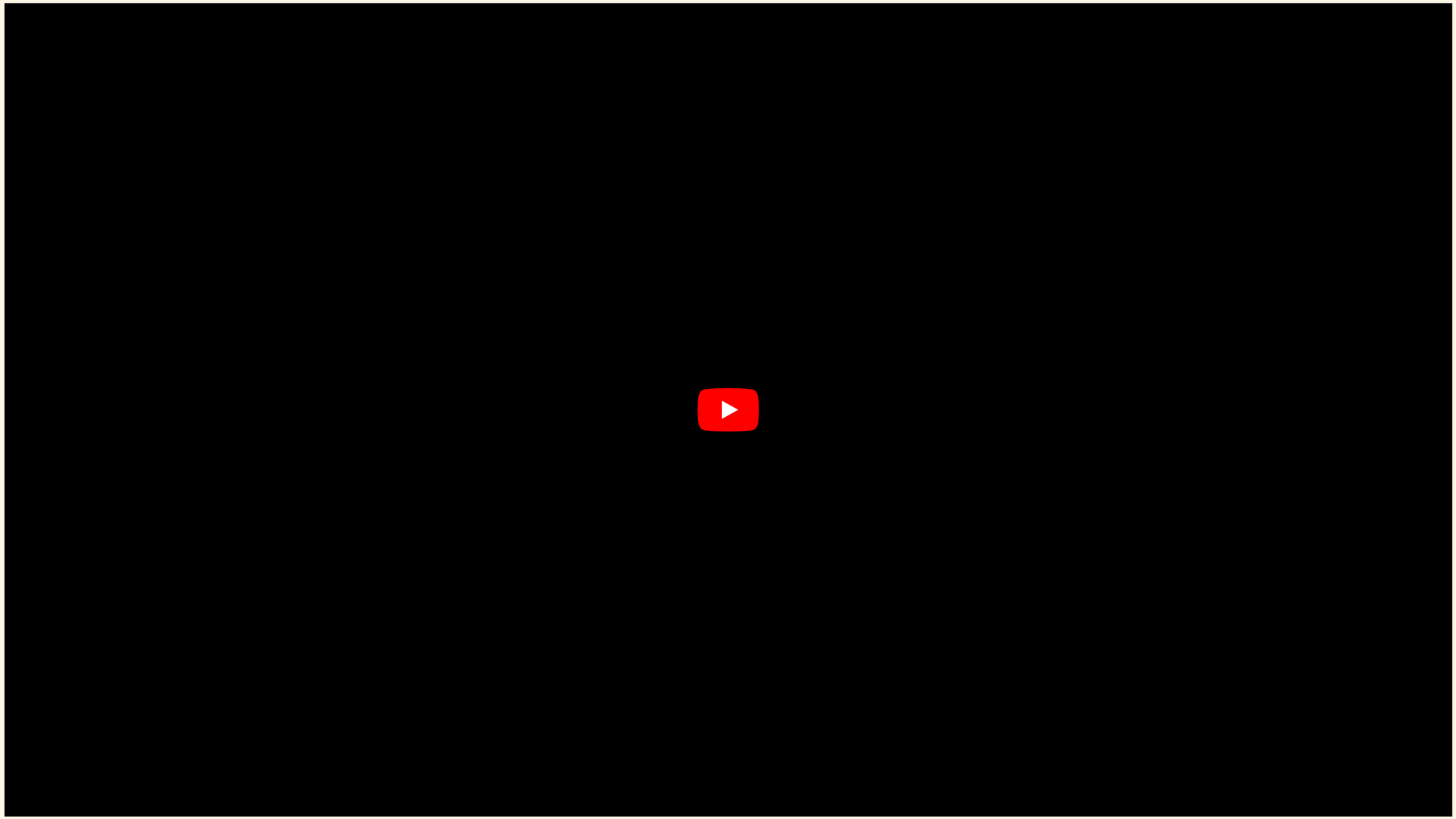
Innoculation Theory

- Based on psychological research
- Similar to vaccination against disease
- Presenting a weakened form of misinformation helps people recognize and resist propaganda
- Two elements:
  - Warn people about misinformation
  - Explain how the misinformation is wrong
- Facts vs. Logic
  - Facts can help you refute a single fallacy
  - Understanding the logic of fallacies helps you refute entire categories of misinformation

Example: Fake Experts Fallacies

In an experiment when participants are taught to see the Fake Expert fallacy in a tobacco ad, they were much less likely to be fooled by climate misinformation that used the Fake Expert fallacy.

Example: Cherry-Picking Fallacy



Discussion

- Form groups of 3–4
- Discuss misinformation you have heard about climate science.
- How did you respond?

Preparation for Monday

Preparation for Monday

- Download and install the “Cranky Uncle” Game
  - iPhone: https://sks.to/crankyiphone
  - Android: https://sks.to/crankyandroid
  - Browser: https://app.crankyuncle.info
- These links and the group sign-in code for this class are posted on Brightspace