PUBLIC UNDERSTANDING OF SCIENCE:

KEY INSIGHTS AND ACTIONS FOR DIVISION 15 MEMBERS

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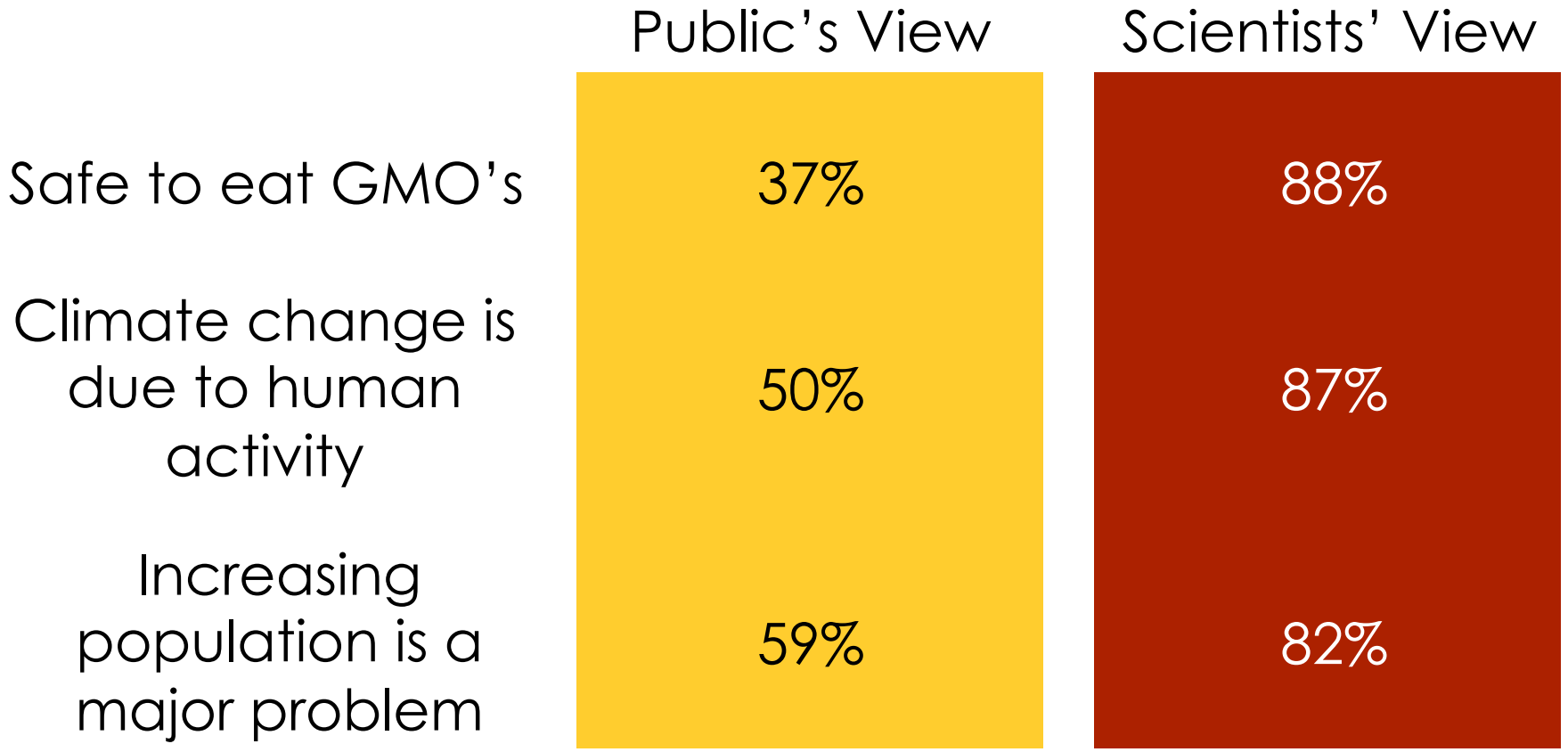
MOTIVATED CHANGE RESEARCH LAB

THE VALUE & LIMITATIONS OF SCIENTIFIC KNOWLEDGE

Democratic societies depend on citizens to make informed decisions about scientific issues, for the good of their health and well-being, their communities, nation, and planet

- Issues include: vaccinations, climate change, fracking, stem cell research, GMOs, etc.
- Challenging to evaluating scientific claims and understand the premises of science
- Disconnect between scientists' opinions and the general public

PEW RESEARCH CENTER



SCIENCE COMMUNICATION

- "Balanced" reporting may result in public confusion when issues have been fairly well resolved - e.g., human causes of climate change
- For example, disproportionate visibility has been given to "science denialists"
- Exploiting uncertainty in science leads to manufactured doubt

GLOBAL WARMING
THE DEBATE

SCIENTIFIC EVIDENCE

Are scientists convinced?

YES 97% of climate scientists think global warming is significantly due to human activity

NO 3% of climate scientists do not think global warming is significantly due to human activity

Surveys have found that over 97% of actively publishing climate scientists are convinced humans are significantly changing global temperatures (Doran 2009). Not only is there a vast difference in the number of convinced versus unconvinced scientists, there is also a considerable gap in expertise between the two groups (Anderegg 2010).

There's a consensus of scientists
because there's a consensus of evidence

MEDIA COVERAGE

Does reporting reflect the consensus?

YES 28% of news coverage depicts human contribution to warming as significant

NO 72% of news coverage includes a skeptic viewpoint or denies man-made warming

Because of the institutionalized journalistic norm of balanced reporting, United States television news coverage has perpetrated an informational bias by significantly diverging from the consensus view in climate science that humans contribute to global warming (Boykoff 2008).

Media coverage misrepresents scientific
understanding of man-made global warming

PUBLIC PERCEPTION

Are the public convinced?

YES 26% of people believe global warming is happening and humans are causing it

NO 74% of people are not convinced or deny humans are causing global warming

A recent poll by the BBC / Populus suggests that since the 'climategate' coverage in the media there has been an increase in the amount of people sceptical about man-made global warming. However, the scientific consensus has not changed over this period (BBC News).

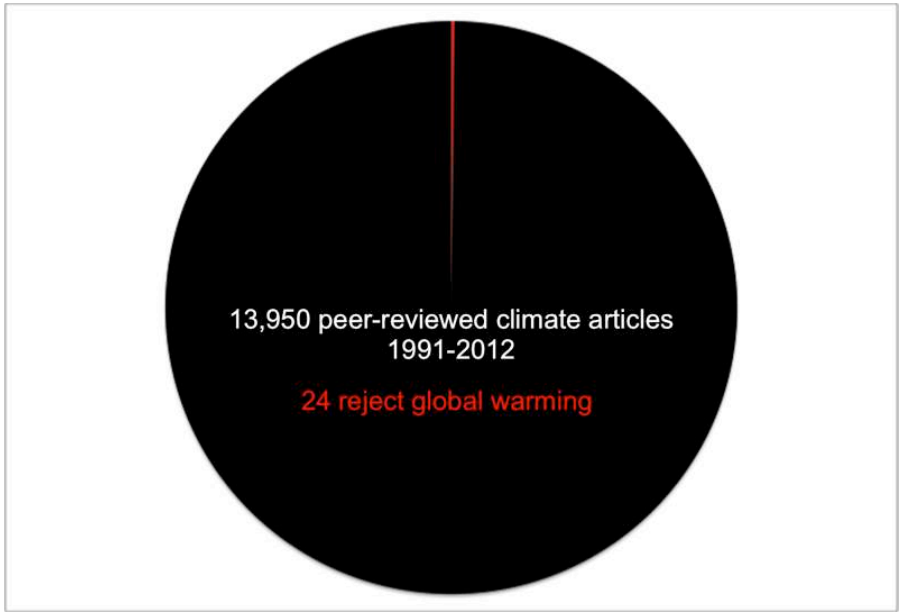
Media coverage of global warming is not 'balanced'
and is affecting public opinion throughout the world

Renegade Conservatory Guy

Motioniab

WHAT CONTROVERSY?

- What is portrayed as controversial is only controversial among citizens, politicians, and lay people
- Climate change, the age of earth, and natural selection are non-controversial among experts
- This graph shows the consensus
- A recent study claims many of the studies rejecting global warming are flawed



EROSION OF TRUST IN EXPERTISE

- There is abundant information available online
- Presentation online can be difficult to assess for validity, accuracy, and bias
- How do individuals decide what knowledge to accept as valid?
  - What authorities and expertise do individuals trust? (And how does social identity influence this process?)
  - More likely to believe science articles posted by friends on Facebook than from expert sources

SCIENTIFIC LITERACY CRISIS?

We DO need improved science education.

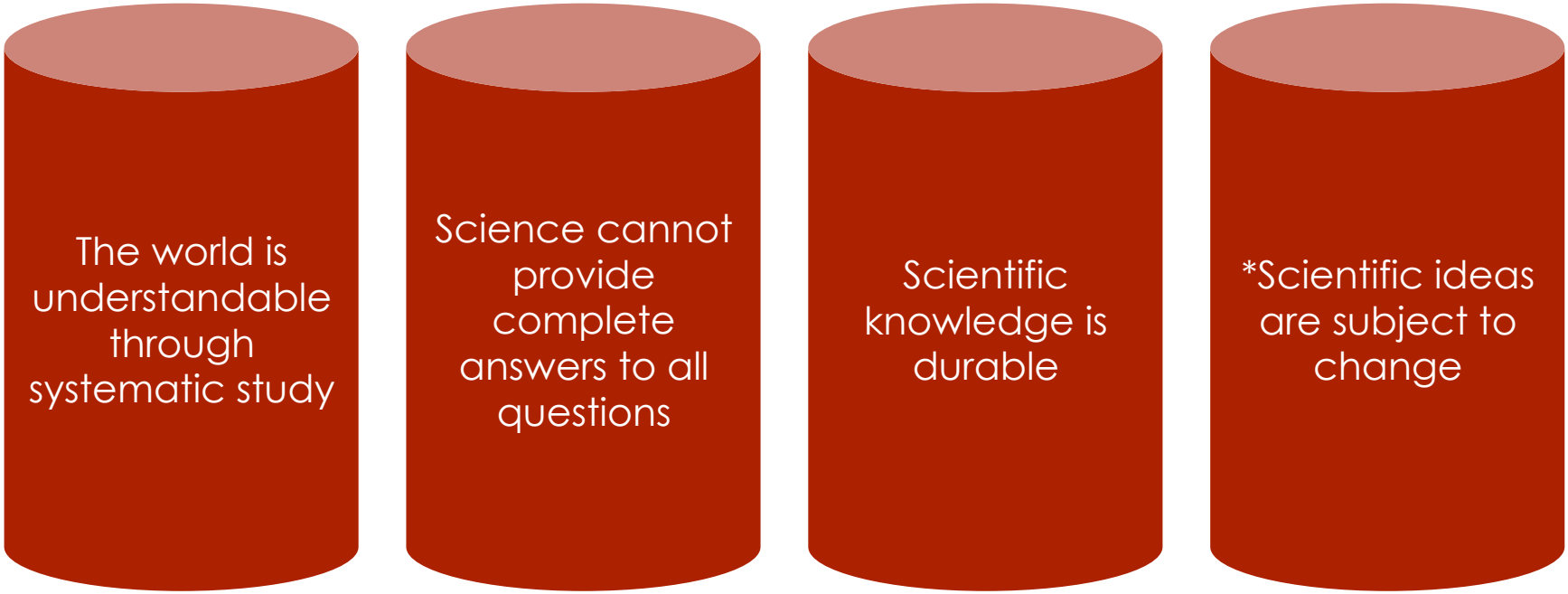
But knowledge is not enough – and many topics are complex and difficult to understand

Scientific literacy is more than knowledge of science content

- Includes understanding of the nature of science
- Origins, production, and validation of scientific knowledge
- Limitations of science

WHAT IS SCIENCE AND HOW IS IT CONDUCTED?

Four beliefs scientists share (AAAS):



*Individuals often confuse tentativeness for uncertainty

EPISTEMIC COGNITION AND CONTROVERSIAL ISSUES

Critical when individuals must:

- Decide what counts as evidence
- Resolve competing knowledge claims
- Evaluate information critically
- Integrate multiple sources of information
- Incorporate new knowledge

CHANGE ON CONTROVERSIAL ISSUES

Requires: "Hat Trick" of Change

Three types of change that are linked and difficult to achieve for controversial topics:

- Conceptual change
  - Overcoming misconceptions
- Attitudinal and emotional change
  - Shifting in valence of attitudes and emotions
- Epistemic conceptual change
  - Changing one's thinking about the nature of knowledge or nature of science

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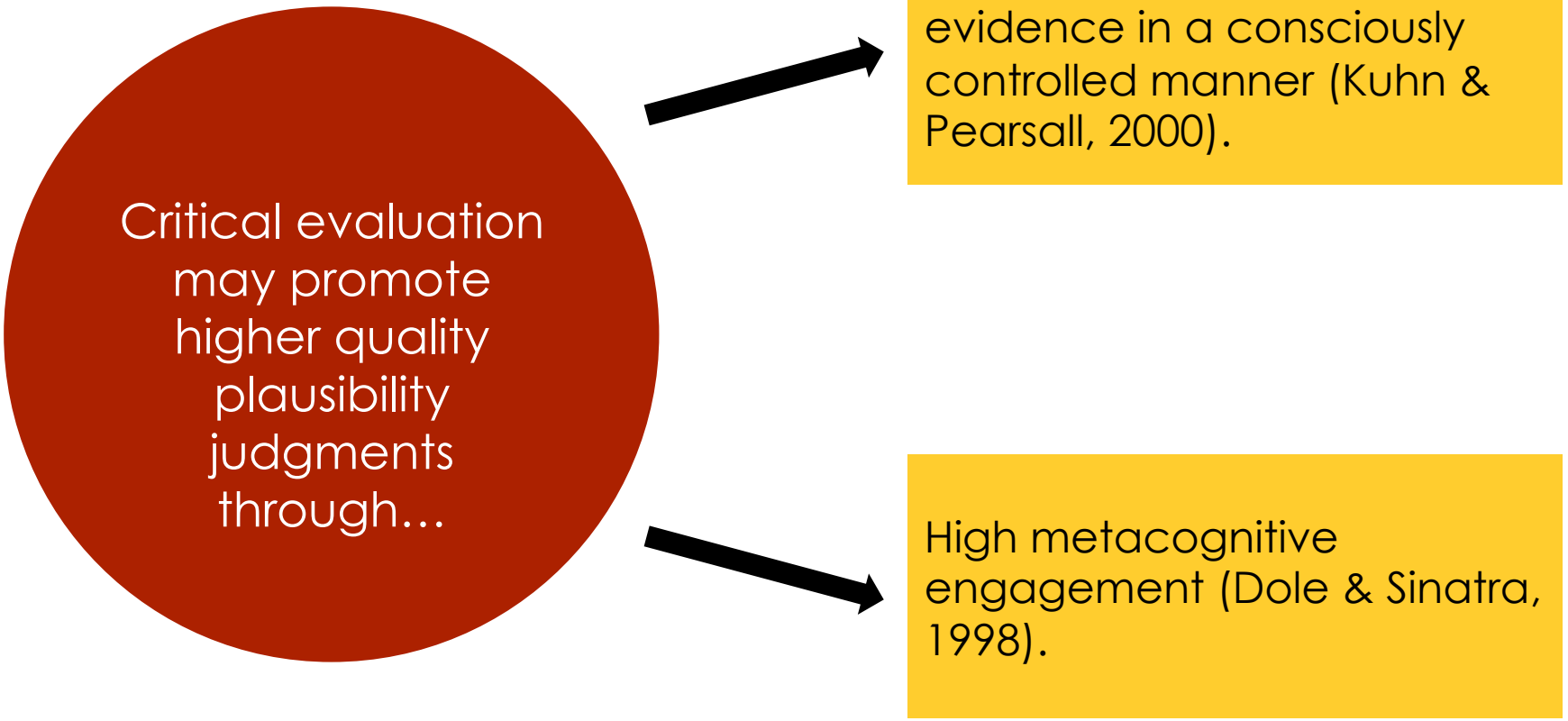
Non-controversial topics require conceptual change, but not AC & ECC.

NEGATIVE ATTITUDES AND CONTROVERSIAL ISSUES

Heddy, Danielson, Sinatra, & Graham (2017)

- Misconceptions about GMO's are associated with negative attitudes about GMO's
- Using a refutation text to overcome misconceptions resulted in a reduction of negative emotions
- Reduction in misconceptions and negative emotions associated with a shift in attitudinal valence

LOMBARDI ET AL. (2013) REAPPRAISING THE PLAUSIBILITY JUDGMENT



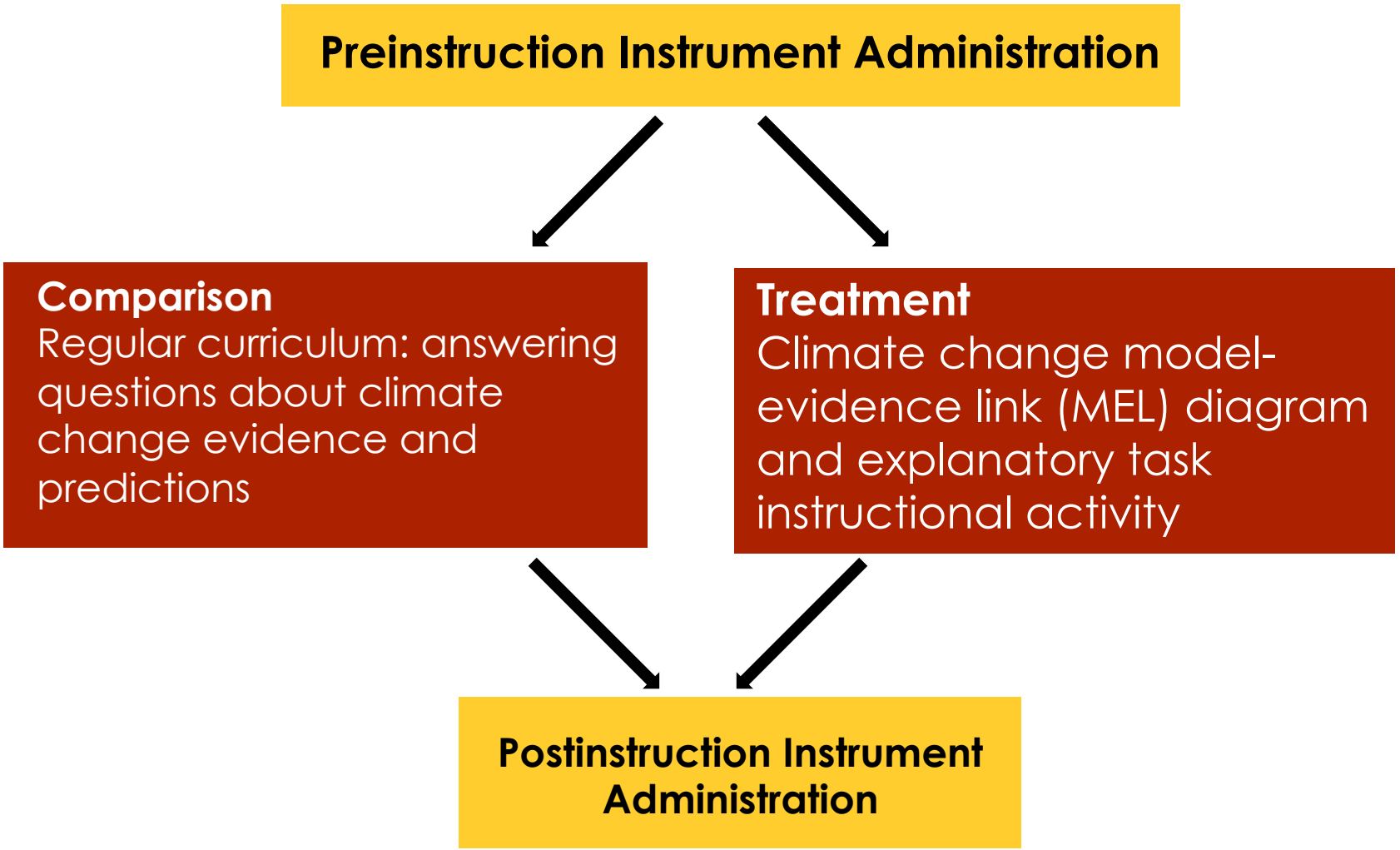
PARTICIPANTS

Middle school (grade 7) earth science students

(*N* = 169)

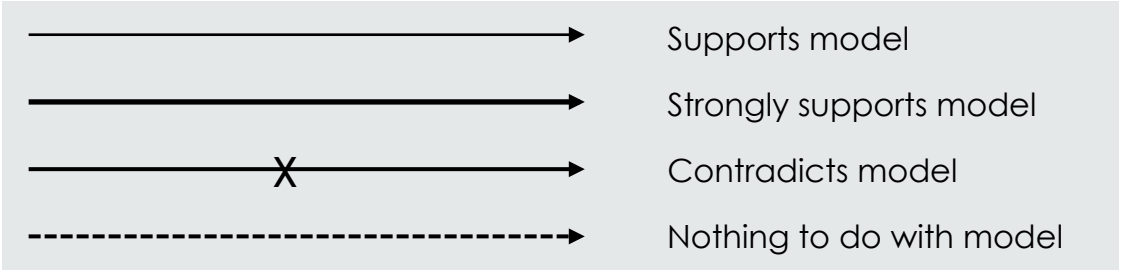
- 64% Hispanic, 52% male, & 47% eligible for free or reduced-cost lunch
- 7 classes critical evaluation (treatment)
- 7 classes regular curriculum (comparison)
- Both classes taught by regular teachers

DESIGN


Preinstruction Instrument Administration
Comparison
Regular curriculum: answering questions about climate change evidence and predictions
Treatment
Climate change model-evidence link (MEL) diagram and explanatory task instructional activity
Postinstruction Instrument Administration

MODEL-EVIDENCE LINK (MEL) DIAGRAM*

Directions: draw two arrows from each evidence box. One to each model. You will draw a total of 8 arrows.



Evidence #1

Model A

Evidence #3

Evidence #2

Model B

Evidence #4

Based on Chinn & Buckland, 2011

PERCEPTIONS OF MODEL PLAUSIBILITY & CORRECTNESS

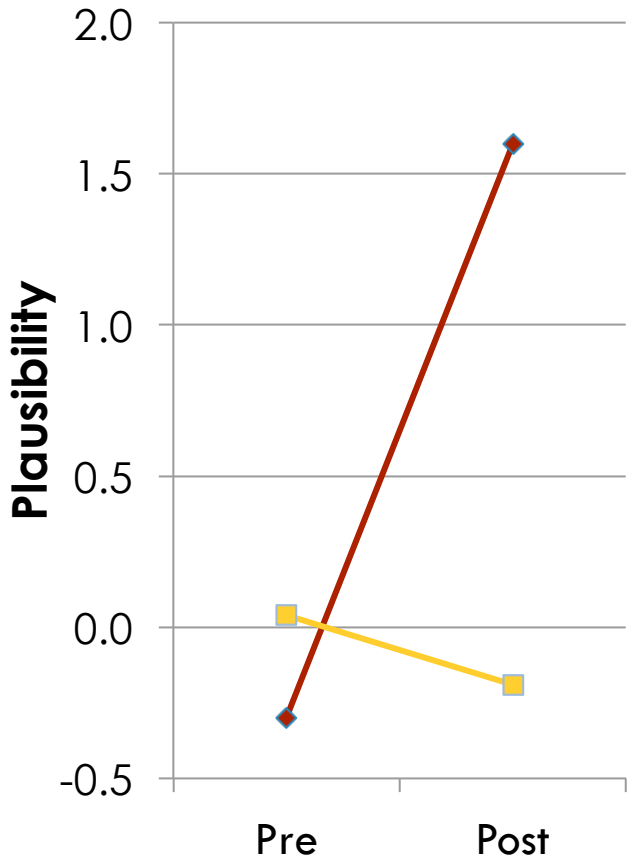
Circle the plausibility of each model. [Make two circles. One for each model.]

	Greatly implausible (or even impossible)									Highly Plausible
Model A	1	2	3	4	5	6	7	8	9	10
Model B	1	2	3	4	5	6	7	8	9	10

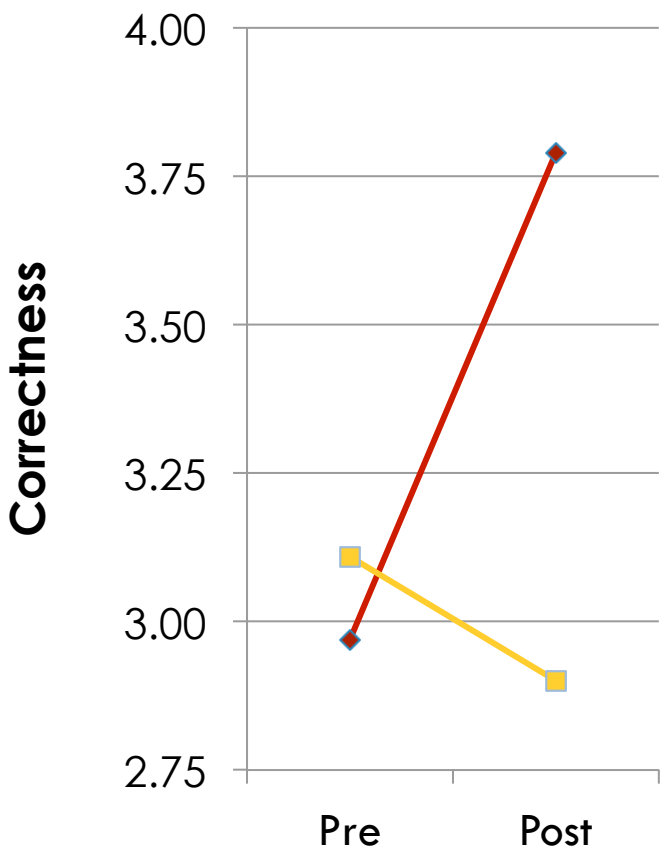
Circle the model which you think is correct. [Only circle one choice below.]

Very certain that Model A is correct	Somewhat certain that Model A is correct	Uncertain if Model A or B is correct	Somewhat certain that Model B is correct	Very certain that Model B is correct

CHANGES IN PERCEPTIONS OF MODEL PLAUSIBILITY AND CORRECTNESS

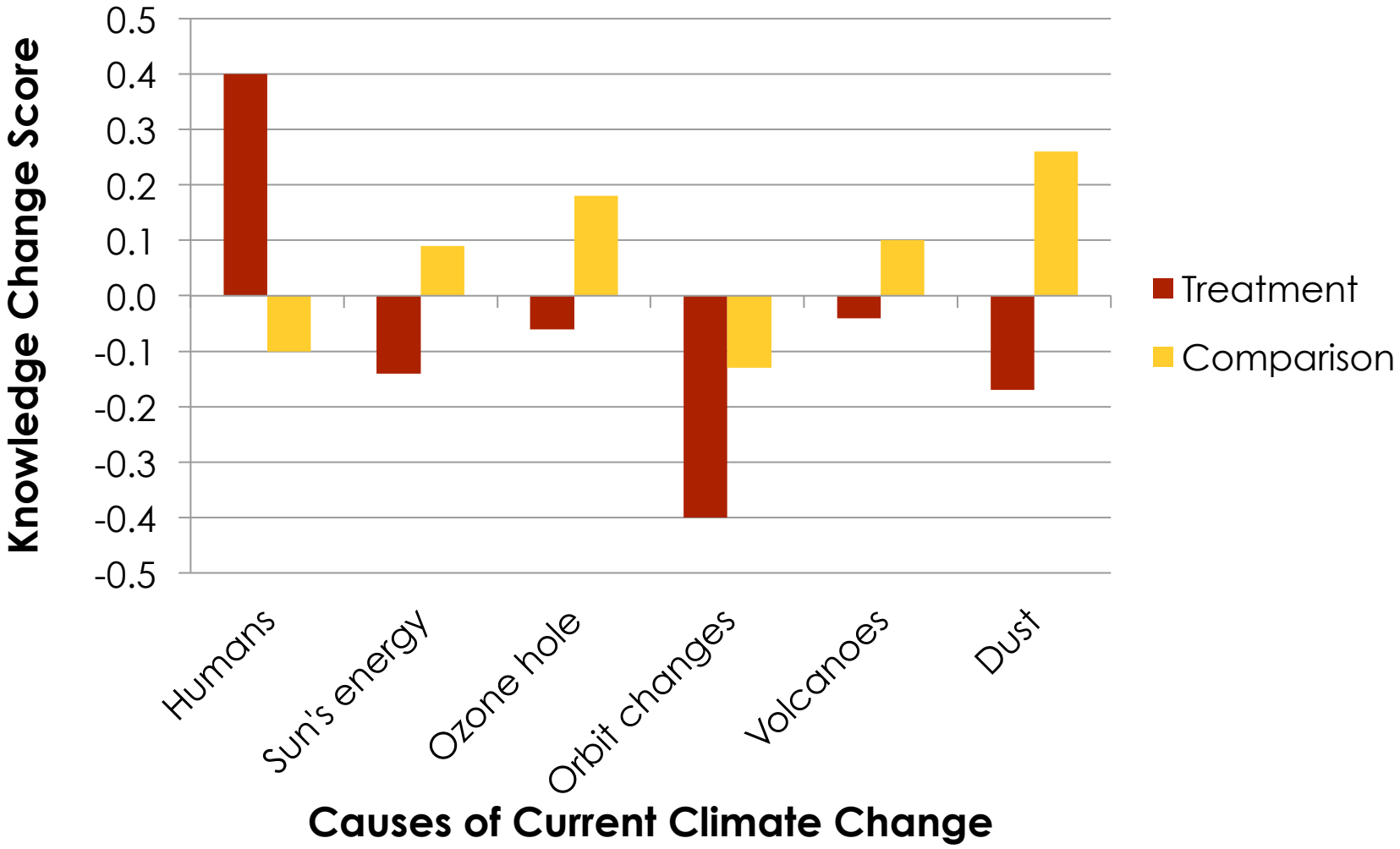


$\eta^2 = .073$

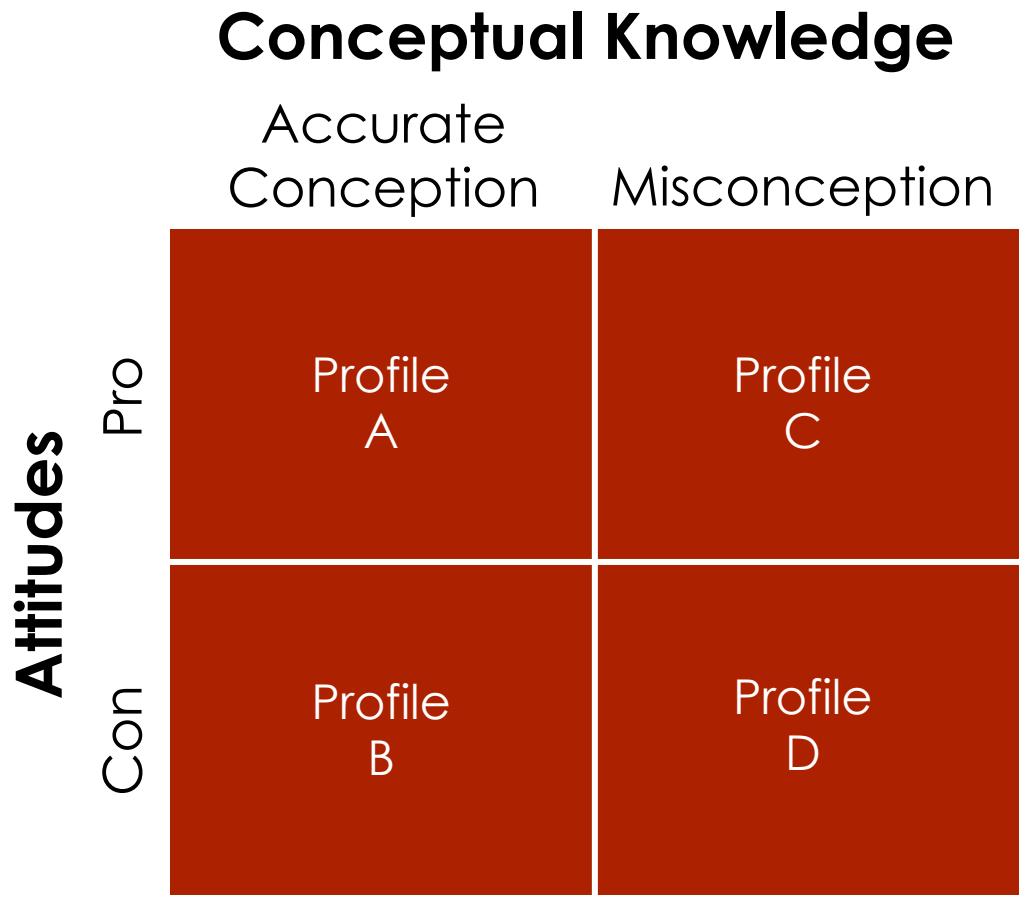


$\eta^2 = .15$

EVIDENCE OF CONCEPTUAL CHANGE



RELATIONSHIP BETWEEN ATTITUDES AND CONCEPTUAL KNOWLEDGE



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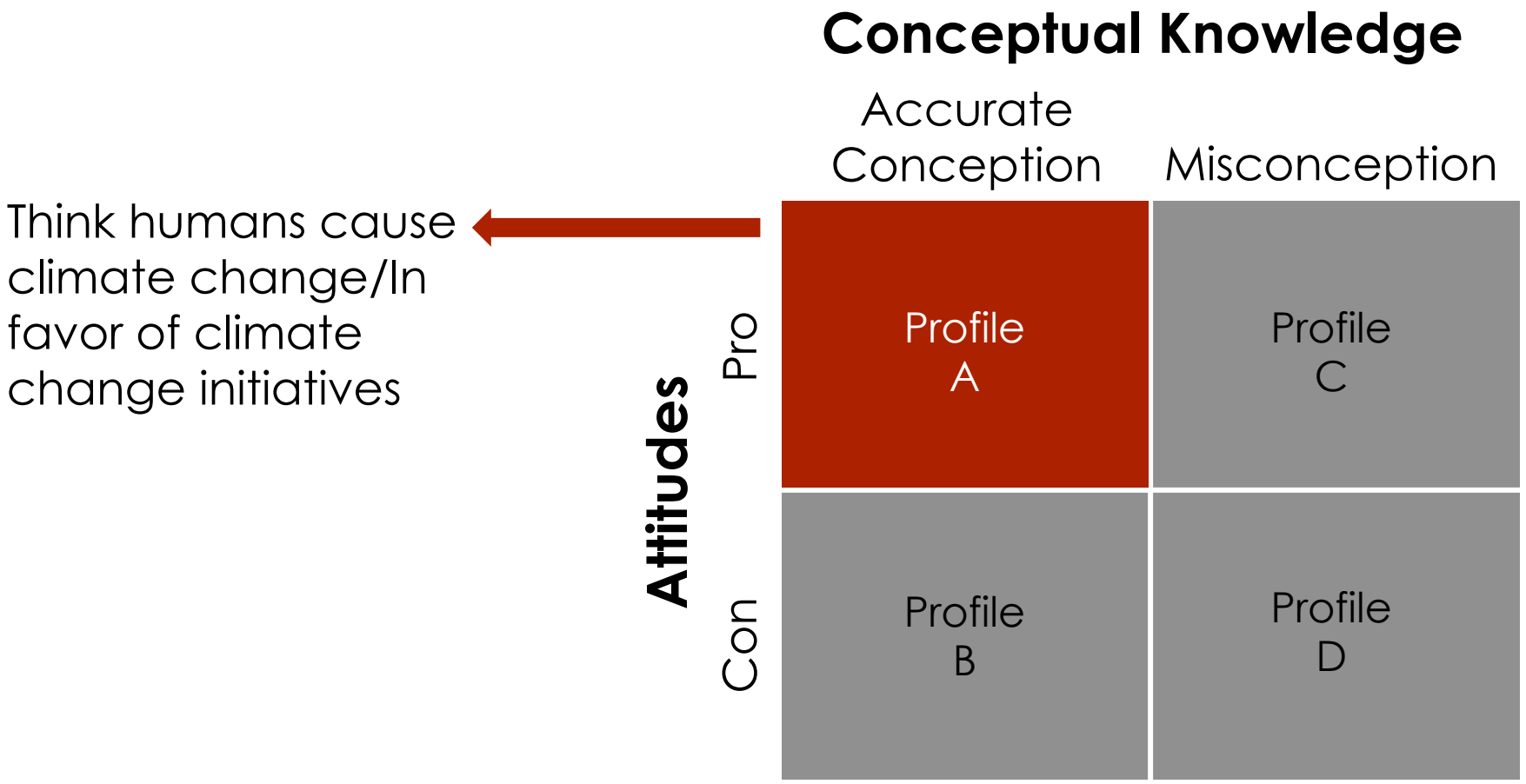

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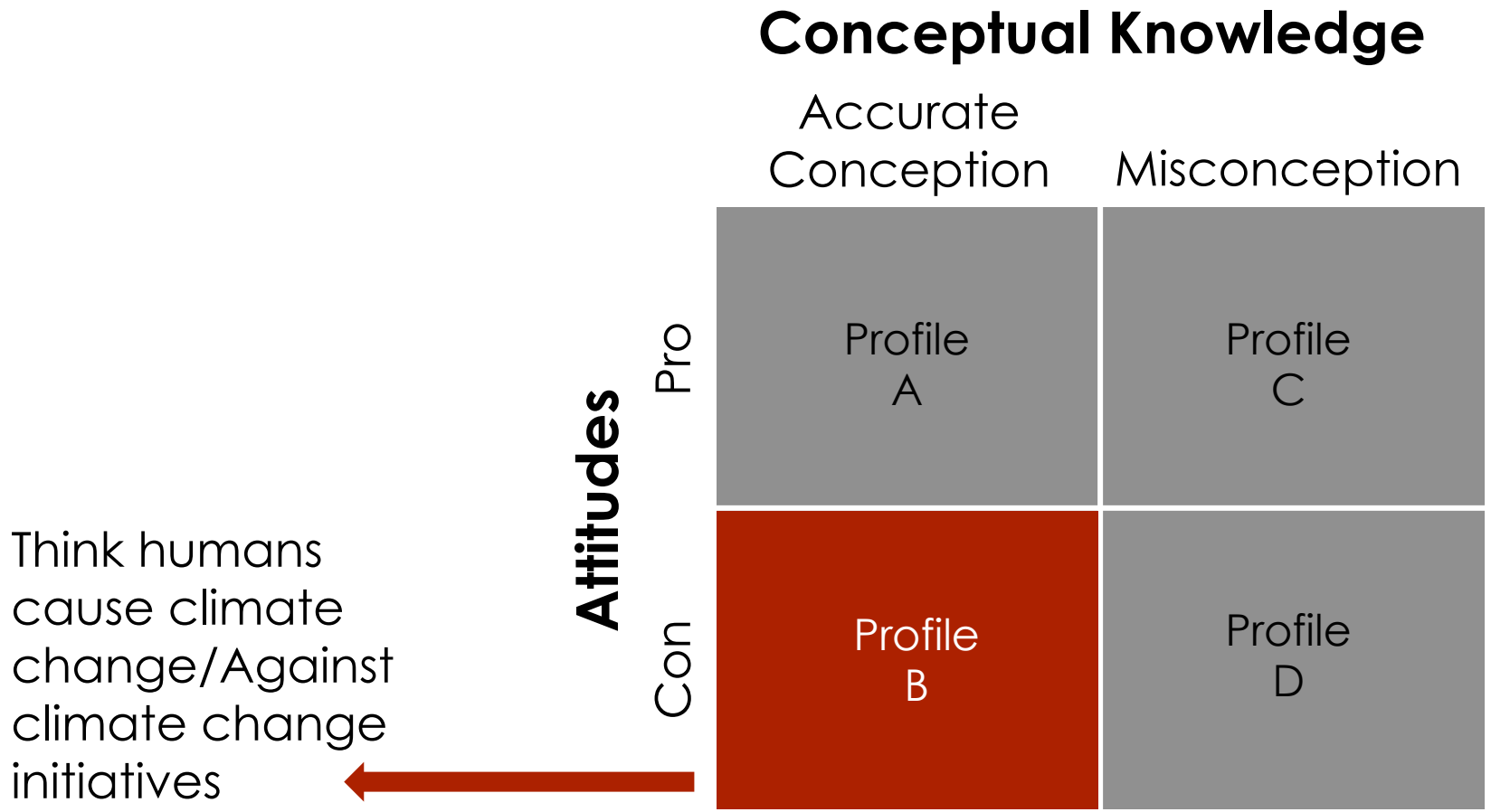

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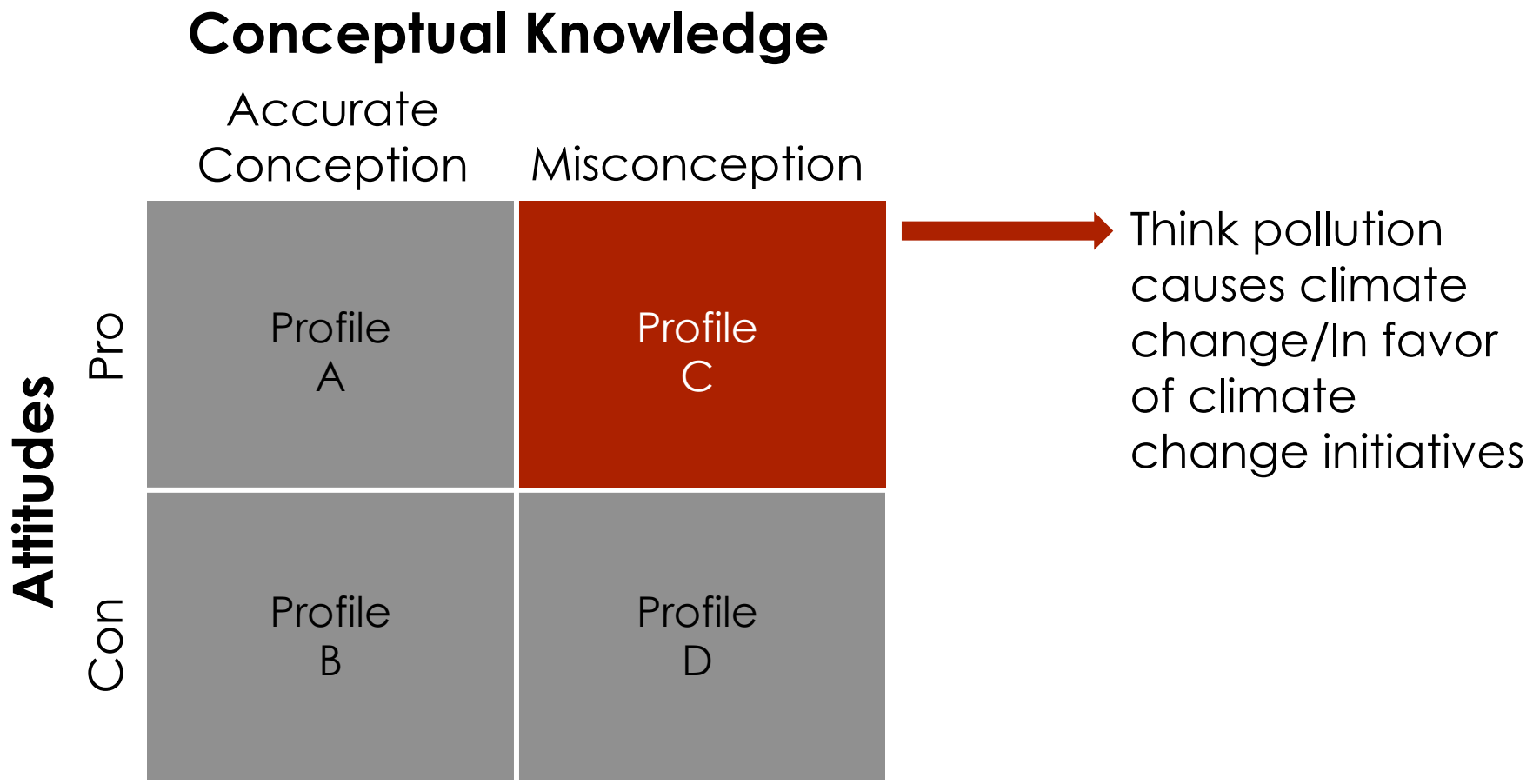

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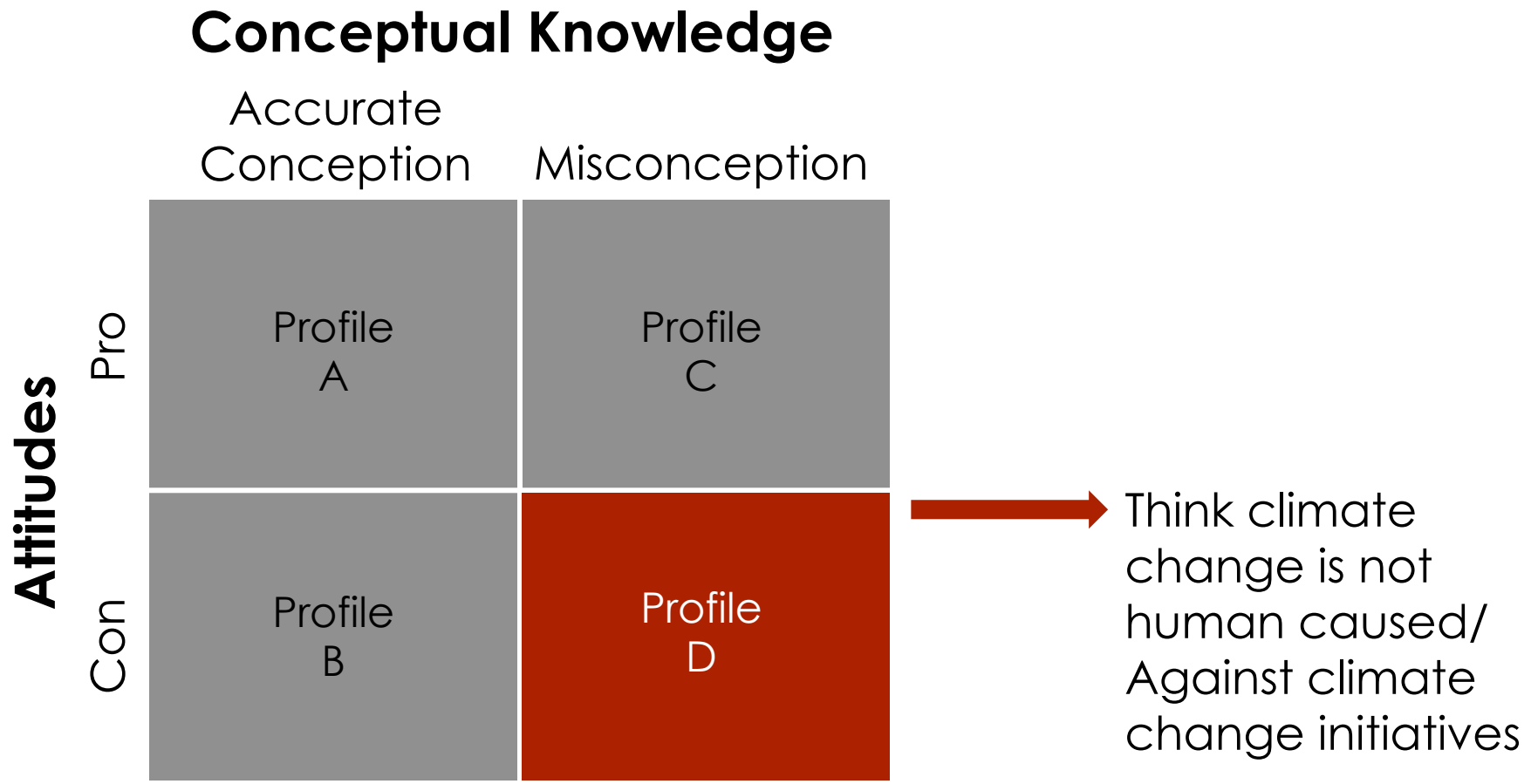
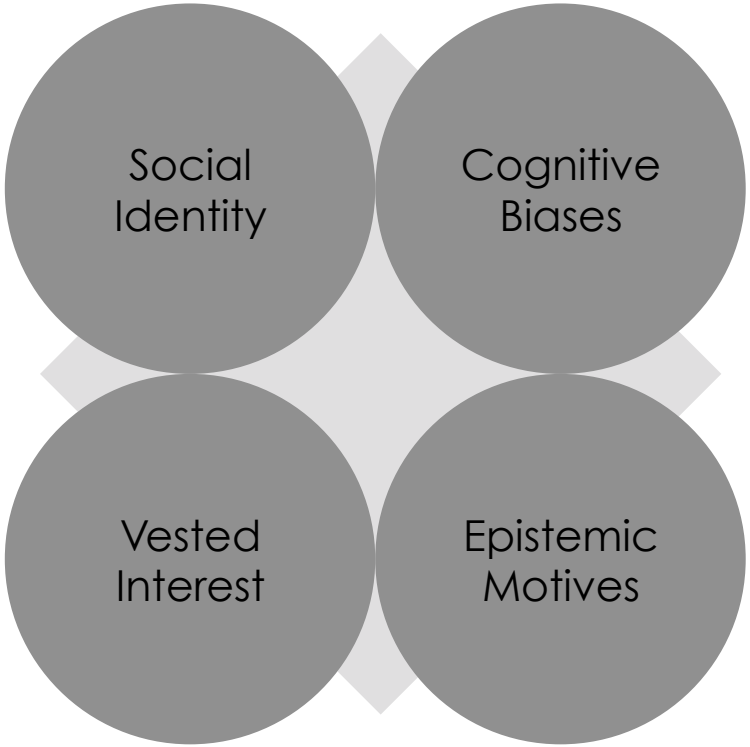
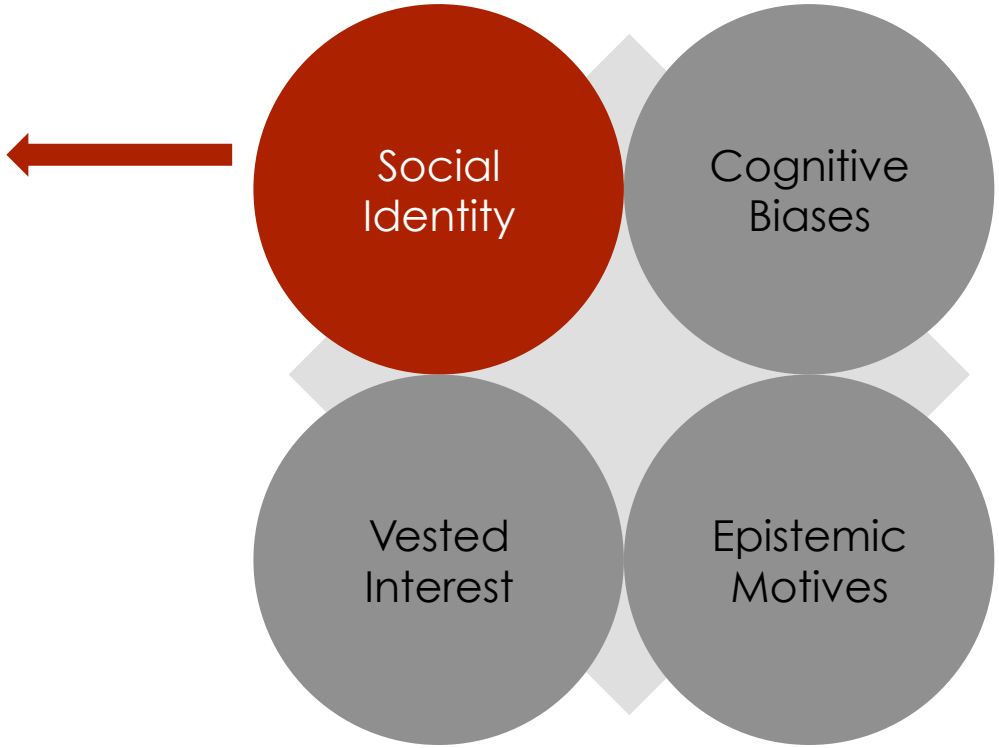


MOTIVATIONS THAT INFLUENCE REASONING (SINATRA, KIENHUES, & HOFER, 2014)



MOTIVATIONS THAT INFLUENCE REASONING (SINATRA, KIENHUES, & HOFER, 2014)

I'm a Conservative and Conservatives Reject Climate Change



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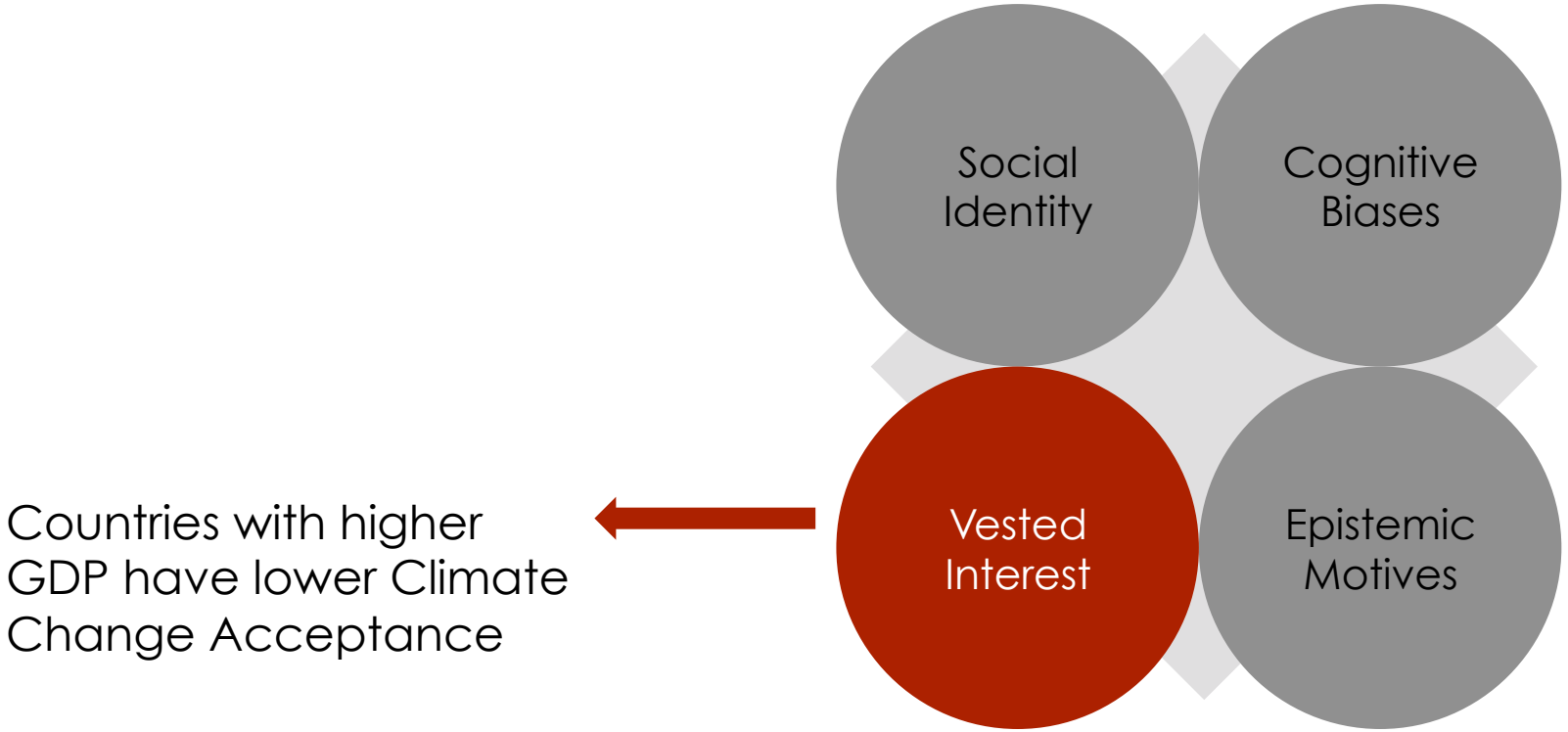

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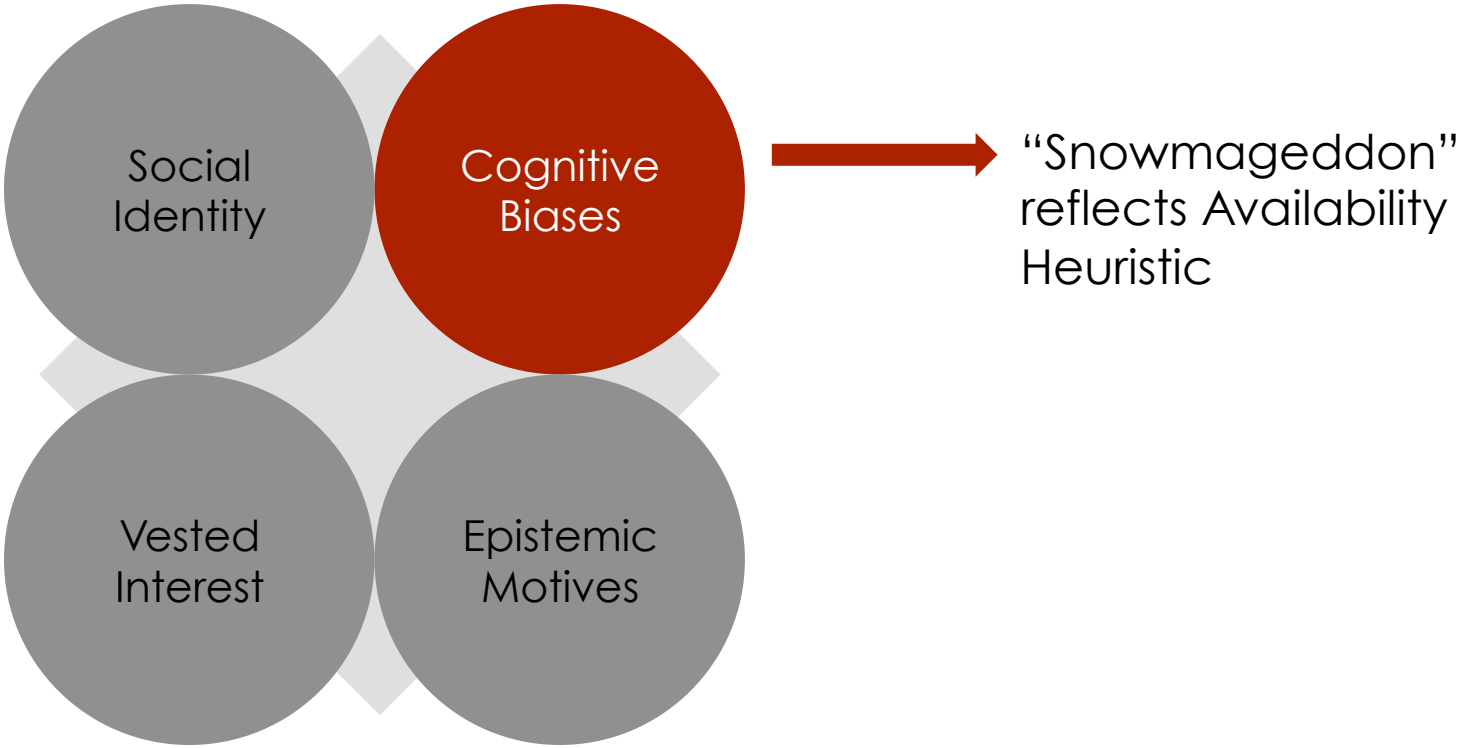

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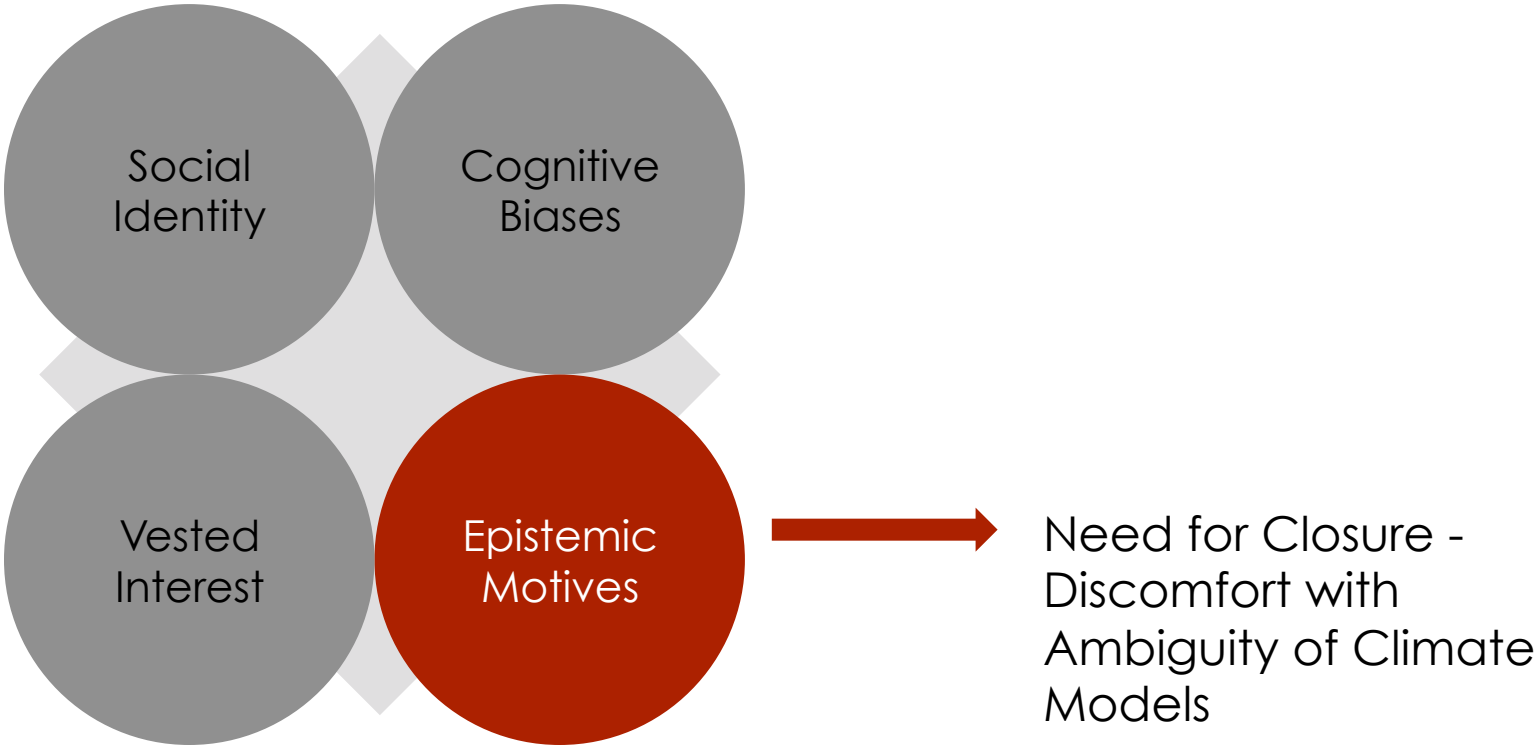

IMPLICATIONS FOR EDUCATORS

- Teach scientific processes to develop epistemic competence.
- Teach for deeper understanding.
- Promote epistemic cognition.
- Use instructional scaffolds.

IMPLICATIONS FOR POLICY

- Fund educational research on thinking.
- Support standards that emphasize how to think, over what to think.
- Support the development of more malleable psychological skills and dispositions.
- Push back on the current trend of ignoring factual basis of claims.
- Demand more rigorous teacher preparation standards.

IMPLICATIONS FOR DIVISION 15 MEMBERS

- Communicate your research to the general public.
- Support education policy that supports teaching of science.
- Become active in scientific organizations (APA and others).
- Become (or remain) involved in teacher education.
- Support and recruit students to become APA members.

AMERICAN PSYCHOLOGICAL ASSOCIATION

Questions?

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