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"How It All Ends"
(original script—final version)

*AUTHOR'S NOTE: This is the original script, but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution*," please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck! (wonderingmind42@gmail.com, 25OCT2007)*

Here's something I bet you haven't thought of. . .

You know that whole shouting match about global warming?

[Foil {*wearing Viking-type hat*}: Yeah! And I'm sick of it! {*Explosion with smoke—BOOM*!}]

What's with the hat and smoke?

[Foil (aside): I'll be playing devil's advocate. Lay off—it's the best I could do for horns and brimstone.]

Okay. I know it seems like such a noisy mess that it's easy to tune out. But here's a thought for you: while we debate whether humans can really change the climate or not, we are at the same time running the experiment. The kicker is, no matter what the outcome of the experiment, we're in the test tube! So it seems clear that we'd better get to the bottom of the controversy as quick as possible.

[Foil: But how do you know which side to believe?]

Well, what if I told you I've got a way to look at it where you don't need to **believe** anyone, but can still decide **with confidence** what we should do?

[Foil: What're you smokin'? That sound impossible.]

Yeah, I thought so too, so I put it out there in a video, and after being critiqued by thousands of people, I think I've now got a conclusion that is pretty much undeniable.

[Foil: We'll see about that. FLASH]

[0:55]

So here's the reasoning in a nutshell. If you want more detail, watch for the index at the end of the video:

[At board, with "You can never be 100% certain, so EVERY CHOICE CARRIES A RISK. Activists warn: Upheaval and destruction. Skeptics warn: severe economic harm."]

First off, no one's perfect. So any choice you make brings with it a risk if your choice turns out to be a mistake. Given that, which risk would you rather take: listen to the activists and take big action now, risking the possible harm to the economy that the skeptics warn us about, or listen to the skeptics and don't take big action

now, risking the possible destruction and upheaval that the activists warn us about. Bottom line is, which is the more acceptable risk: the risk of taking action, or the risk of not taking action?

[Foil: Um, geez—when you put it that way. . .{*starts to take horns off}*]

Hey, don't just accept what I say! I'm just some guy. Think it through for yourself!

[Foil: Okay, okay. {*Puts hat back on.}* Wait a minute—global warming isn't caused by humans in the first place—I've seen lots of evidence for that. So you're presenting a false choice!]

Are you infallible?

[Foil: No.]

Could you be wrong?

[Foil: Yes.]

So the question "which is the more acceptable risk" still applies doesn't it?

[Foil: {*acidly}* Fine. But it's still a loaded question.]

Well, take a look at where the question came from, and see if you agree that it's a valid one.

[1:00]

If you need to make a decision when things are unclear—like we do with global warming—it's useful to look at the different **possibilities** for the future.

The first possibility is whether human-caused global warming is real or not. We'll put F for the future where it turned out to be false, and T for true.

The other possibility is what action we end up taking. Let's make column A action, and column B no action.

So that gives us a grid that sketches out four basic possibilities for our future.

What might each of these futures look like?

First is the future where we did take action, and global warming turned out not to be real after all. Let's take the most pessimistic view and say there's significant harm to the economy, with no positive benefits.

What about this box? We didn't take action, and we didn't need to. Everybody celebrates: the skeptics because they were right, and the activists because it wasn't the end of the world after all.

How about this box? We took action, and it was a good thing, too, because here the doomsayers were right. We've still got the economic costs, but everyone's okay with that, because we saved our cookies.

Now how about this box? The doomsayers were right, but we listened to the skeptics, and didn't act. If we took a pessimistic view up here, let's do the same thing down here. Well, you've heard this story before: disasters—environmental, political, social, public health, **and** economic—on a global scale.

Obviously, this is grossly simplified. The smiley faces should give that away. But we **can** say the future will fall roughly into one of these four boxes.

Most of the shouting match is about trying to predict which row the future will fall into, which we can't know for certain until we get there.

What we **can** know, because we control it, is which **column** the future will **not** fall into. Because by taking action or not, we are choosing a column, and that **eliminates** the risk in the other column.

It's a bit like buying a lottery ticket—we choose ticket A or ticket B with its risk, and wait to see what the laws of physics dish out as our result.

One way or the other, we're taking a risk: so which risk is more acceptable,

the risk of taking action, or the risk of not taking action?

[Foil: Hey. . . that sounds good, but the logic is bogus. Wouldn't that grid argue for action on any possible threat? No matter how costly the action, or how ridiculous the threat, like Giant Mutant Space Hamsters? Because according to that it's better to go broke making giant rodent traps than to even risk the possibility of becoming Hamster Chow, right? So that grid is useless. FLASH!]

Yeah, I totally agree with you.

[Foil: What??]

The grid by itself isn't a silver bullet. But what it does do is it allows us to make a decision using **uncertain** knowledge by changing the question from "Are humans affecting the climate?" to the **real** question "What's the wisest thing to do, given the uncertainties and the risks?" Really, it's just basic risk management. So to get around your hamster argument, we need to get a sense of how likely each row is.

[Foil: Why can't we just wait until the science is finished, and then we'll **know** what to do?]

Well for one thing, that doesn't avoid risk, because that's the same as just choosing column B, which is where we sit right now. And for another thing, science is never **finished**—we're still studying the law of gravity for Pete's sake! As a science teacher, I can tell you that science—that most precise and geeky of all human endeavors—is surprisingly never certain! Every single scientific statement carries with it some sort of estimate of how big the uncertainty is. Which is part of why there will almost always be some disagreement on any scientific question.

[Foil: But where does that leave us, if anything any scientist says is accompanied by a sort of "but I could be wrong"?]

The trick is to not look at what individual scientists are saying, but instead look at what the professional organizations are saying. The more prestigious they are, the more weight you can give to their statements, because they've got huge reputations to uphold, and don't want to ever say something that later makes them look foolish.

Probably the two most well-respected of these in the world are NAS [hold up whiteboard reading "the U.S. National Academy of Sciences"], and AAAS [hold up whiteboard reading "the American Association for the Advancement of Science"]. These are not advocacy groups, but both recently issued unprecedented statements calling for big action now on global warming. This isn't a bunch of hippies. These are the nerdiest people on the planet.

[Foil: So trust the eggheads, huh? Basically you're saying "If NAS and AAAS said so, who the heck are **you** to argue?"]

No. Well, sorta. I mean, who else are you going to believe on a scientific issue? But remember, you still don't **have** to **believe** them. You're just using the fact that two such stodgy institutions staked their reputations on this, to get a sense that this row must be way more likely than this row, pushing this line up.

Even companies such as these *[pull off sheet on board to reveal the words "USCAP agrees that the world must preserve the possibility of stabilizing the climate at a level that would avert the most dangerous impacts of climate change" with list of companies beneath*] are calling for emissions caps—on their own industries!—pushing the line up even further. Now the conclusion is clear, since we've got solid reasons to believe on our own that this is a much more threatening risk than this—

not only in potential damage, but in likelihood as well.

[Foil: Okay, I can see that. But if the statements from those groups are such a slam dunk, then why do we still hear so much debate?]

Well, there is a handful of dissenting scientists—like there always is—and a media that knows that controversy sells. But I found a couple polls that suggest it's the lack of **absolute** certainty that's holding people back, which is a little odd to me. We buy car insurance without being **certain** that we'll get into an accident, because we want make sure that if it does happen, we don't end up broke.

And during WWII, just the **possibility** that Hitler might be developing an atomic bomb was enough of a threat to justify all-out action. If you were a voter back then and it was public knowledge, would you have insisted that **every** scientist interviewed thought such a bomb was possible before supporting the Manhattan Project? Would you have held out until **you** understood the physics? No. So why are Joe Schmoes like you and me **still** debating the finer points of climate science instead of talking about risk management?

[Foil: Well, there's a gajillion causes out there already screaming for my attention and money. "Save the Planet" and stuff.]

Look, it's not the planet that I care about. It'll do fine on its own. What I care about is saving our bacon. And I understand how overwhelming it is when you hear cries about {*places placards on the table, while speaking increasingly quickly}*

save the whales, or the rainforests, or the children,
or air pollution, water pollution, light pollution,
toxic waste, nuclear waste, government waste, corporate waste,
Peak Oil, Snake Oil,
flag burning, wire-tapping, gay marrying, immigrating,
ANWR, Anbar,
gun rights, human rights, water rights, right to life, abortion rights.

Whew! Where do you start?

Well, let me suggest a way to prioritize. All of these [*sweep off desk with a CRASH*] will be peanuts, if the worst of this [place placard reading "global warming"] comes to pass.

[Foil: Oooo, way to go, Mr. Smarty-Pants. {*points to floor*} You just managed to tick off pretty much everybody. How come your pet crusade trumps everyone else's?]

Because on the outside chance that the **worst** of global warming **does** happen {*place placards reading "floods, droughts, hurricanes, wildfires, dustbowls, famine, epidemics, refugees, wars, economic collapse" while talking*}, we'll be so busy dealing with the fallout that most all other human concerns may seem like rearranging deck chairs on the Titanic. I mean who's really going to care if some protester wants to burn the flag on the courthouse lawn when the whole city's flooded?

[Foil: But why the hysteria? What's the big deal about a degree or two?]

Yeah. Turns out it's not the warming that gets ya. It's the way that such a quick change throws a monkey wrench in the whole system. That's why global "warming" is a misleading name, and global "climate change" is only a little better. Really, what we're talking about is "global climate destabilization." And it gets worse. Because just in the last 5 years we've learned that this may happen very **abruptly**, like within the span of a decade. It may turn out to be like pushing a light

switch: small pushes in the past have created only small results, until you hit an unexpected tipping point.

[Foil: Man, we're totally hosed. We're going back to the Dark Ages, aren't we?]

Disturbing, isn't it? Actually, there's a lot of reason to believe we can fix this—maybe even without reducing our standard of living. If we're quick about it.

[Foil: But what difference can I make? I'm just one guy. . . with a stupid hat.]

What you do is—spread the word! Because the only way we really get into column A. . . is by policy changes. And those only happen when enough people demand it. So you forward this video to others. If they forward it to ten others, and so on, in just 4 steps, that's over ten thousand people that may have their opinions influenced. That's power. Use it.

This is likely to be the greatest threat that humanity has ever faced. Think that's overblown? Maybe. But can you be so certain that you're willing to bet everything? Because we only get to run this experiment once.

Hopefully this idea of risk management will end the debate. How the world ends up? Well, that depends in part on you. And what you do next.

We have greatness within us—innovative, giving, determined. It's time for the best in us to come out.

——end——

"How It All Ends: Index"
(original script—final version)

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Viewing Sequence on Board:

Nature of Science
Risk Management
Why There Is Still Debate
The Manpollo Project
Mechanics of GCC
Scare Tactics
The Solution
God's Will
Get What You Want (Skeptics #1)
I Hope I'm Wrong (Skeptics #2)
No Holds Barred (Skeptics #3)
Your Mission

This video is titled "How It All Ends: Index" and is a guide to a sort of "Expansion Pack" of videos backing up the arguments contained in the video "How It All Ends."

[BOARD, LIST] Okay, so here's the plan. If you feel sort of middling about this issue, and have a specific question, you can choose which video to watch from the "a la carte" menu that I'll give you in a minute. If you feel like I do and want to do whatever you can to make policy changes on climate change happen, then you'll probably want to watch them all. I know that seems like a big time commitment, but if there's ever a time in your life to be thorough and thoughtful, it is now, with this issue. It is worth taking those few hours of your life to watch a few videos. Because we need as many information warriors out there as we can get—I'll give you your specific assignment in this video ["Your Mission"].

If you're a skeptic you'll be looking for holes, so you'll want to watch all in this

sequence too, except this one. Don't watch that one cuz it'll give away our game plan. Crud! We can edit that out, right? [Beat.]

If you're a skeptic, you'll be looking for holes, so you'll want to watch all in this sequence too, except for this one. That one probably wouldn't be worth your time.

In fact, skeptics, you'll probably want to watch them all twice, because you don't want to end up making an assertion that someone else answers simply with "He already covered that." That would just be embarrassing. And be warned: if you try dismiss my my hours of complex and thorough argumentation with a "That's just typical liberal scaremongering" without specifically addressing my points, you'll have to forgive the rest of us if we interpret that as a concession, that you **can't** refute the argument, so you won't even try. In fact, I made these three just for you! You're welcome!

[DESK] A little background: in the Spring of 2007, I presented the basic decision grid about climate change in a video titled "The Most Terrifying Video You'll Ever See." Within a month, it had garnered over a million hits on various websites, and at least 5,000 comments, most of them critical. Turns out, my "silver bullet" argument had a hole big enough to drive a Hummer through, caused by an assumption I didn't realize I had. (Isn't that just way with assumptions?) As a result, I posted three more videos, titled "Patching Holes #1-3," answering those criticisms. Problem is, no one found those videos to watch them.

Throughout that whole debate, I tracked the comments and discussions in various places, continuing reading until it had been a long time since I'd read a new argument or criticism that I hadn't seen before. So as a result, I am extremely familiar with the objections to my argument, and have come back, loaded for bear. Hence the hours and hours of expansion pack videos.

So skeptics, I'm throwing down with you right now: I'm quite confident there is not a single reasonable criticism of my argument which I have not already anticipated and refuted in the expansion pack videos. How's that for a challenge? Actually, as I was editing the videos, I did find one assertion I made that I realized had a hole in it. So I brought attention to it with a subtitle. It's just another free service I provide to you, the viewer. Can you find it?

And for those of you already sympathetic to the cause: if you see that the skeptics do find a hole, how about you take on the patching of it? Last go 'round a couple people had my back, but the comments were overwhelmingly negative, and it pretty much felt like me against the Internet. How about some warm fuzzies, too, people? Cuz I gotta tell you. I've been working non-stop on this freakin' project for 4 months, and it's time I got some sleep and got back to my family. So I'm passing the torch on to you. Run with it.

For instance, if someone wants to make a better index than I'm about to give you, say one that goes down to the scale of which part of a video, please do. Post it as a response. Take this stuff, fix it up, pimp my argument. I've got no ownership of these ideas. I'm just trying to plant a seed here. Or a virus, more properly, but that's not nearly as pleasant an image, is it?

In fact you, yes you right there, have my explicit permission to take this material and do anything you want with it in any form. Copy it, rip it, do a mash-up, turn it into a PowerPoint (take out the dirty parts first), turn it into a musical and go on tour, even remake it, claim it as your own work and get paid for it! I don't care. Just get it out

there! I can't be the only champion for this reasoning. We've all got to be champions for it. Because that's what it will take to change the culture, which is what it will take to change policies, which is what it will take to eliminate the possibility of that lower righthand corner.

I know I really drone on in a couple of the videos. Well, more than a couple. Okay all. Look—I didn't have time to make them short and eloquent. So you get long and punishing. Sorry 'bout that, Chief. Anyway, all the ideas are there. Please look past the poor production values, the sleep-deprived slurred speech, the Red Bull–fueled stutters, and the repetition, the redundancy, the saying the same thing over and over, when I just keep repeating myself, flogging a dead horse again and—

Throughout these videos, I use the terms "global warming" and "global climate change" interchangeably, though really they mean different things, as well as "human-caused" and "anthropogenic" which mean the exact same thing.

I've deferred answering most of the technical objections dealing with the science of global climate change, cuz they're already covered most excellently on [placard] Grist.com's "How to Talk to a Climate Skeptic." So check there for the answers to any technical objections you don't see me cover. No need to reinvent the wheel.

At its heart, this is a deadly serious issue. But, in an effort to not take myself too seriously, and to try to bring a little levity to an often angry debate, I'm going to wear a different silly hat for each video. [rapid collage]

[BOARD, LIST] Be aware: if you make a la carte choices, things may be just a little confusing, because a lot of this is intertwined. So if something doesn't make sense, go upstream in the flow to get the context.

Most of these videos have multiple parts, due to the time limit on some video hosting services. For instance, this bruiser comes in 7 individually wrapped packages [point to "Risk Management"]. I've tried to make sure each part points to the next one. But if you get lost, just go back to my wonderingmind42 account, and you should find everything there.

[DESK] I finally realized why I get frustrated with people in discussions when they keep bringing up technical little objections to the science of global climate change, or when they get abrasive about how none of the proposed solutions is ever going to work. Here's my objection to all the nit-picking: who the heck are **you or I** to judge either the fitness of the science, or the fitness of the policy solutions? I'm no climate scientist. And I'm no policy maker. It's foolish for me to try to act like either of those. That's why we hire the professionals in both those fields.

What you and I **are** qualified to do is to set the agenda, delegate, and then supervise. We are the boss, and we hire the experts to do the technical stuff for us. What we should be doing is taking what the scientists tell us about the natural world, decide what level of resources to devote to the problem, and then delegate to the policy makers to come up with the best proposed solutions. Then they check it off with us by giving us the executive summary, we make the final decision, and give the green light. Why the heck are we micromanaging this? We're only hurting ourselves by trying to do the jobs of the experts that we've hired. Let's start acting like the executives of public policy that we should be: listen to our best when they give us an assessment, and then delegate to our best in coming up with solutions, supervising all the while to ensure our interests are well-served. Let's stop being the pointy-haired boss in this whole thing.

Let's face it: the issue is complex, and our lives are busy. And so here we sit in column B, waiting to see what the future holds. I find that terrifying.

Remember when everybody tore into the FBI because it had all the information it needed to stop the September 11th attacks at the time, but it didn't connect the dots? The dots that were so easy for us to connect in hindsight? I keep thinking about that. Why don't we see if the dots connect now? Instead of doing it in hindsight. Don't we deserve that much?

I know watching these videos is going to be a slog (think about how I felt making them!), but this may be the single most important issue in your life. You may not believe that now, but given the unequivocal statements made by the best scientists on the planet, you can't just dismiss the possibility. Isn't it worth a little more time to figure that out?

This is the most credible, most clear and pressing threat on a global scale in the history of humanity, with the sole exception of being on the brink of global nuclear war during the Cuban Missile crisis. But this time, you—as an individual citizen—not only know about it, but you play a necessary part. You can help prevent it. If there's ever a time in your life, in our history, to be thorough and deliberate, conscientious and unselfish, determined and extraordinary, wouldn't it be right now? At this moment?

So. What do you do next?

It's time for the best in us to come out.

[On screen: for the a la carte menu listing which expansion pack video to watch for which objection or question, see "How It All Ends: Menu"]

——end——

"How It All Ends: Menu"
(original script—final version)

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(Cross-references in parentheses.)

"Nature of Science"

Topics

What "peer-reviewed" means, and why it's so important. ("Risk Management")

Telling the difference between causation and correlation.

Objections Answered

"Why should we trust the scientists?"

"Why don't we just go with the facts? Just look at the evidence."

"Why should we listen to scientists now, if they've been wrong before?"

"Scientists can't even predict the weather, so why should we listen to them about something even bigger, like the climate?" ("Scare Tactics")

"There is no consensus amongst scientists on global warming."

"Climate models are just models, just **predictions** about the future. So they're just conjecture, and therefore useless." ("Risk Management")

"Risk Management"

Topics

How do you go about making a decision when faced with uncertainty?

How do you decide you who believe, and who not to?

What tricks can we learn from Casinos and insurance companies?

What "peer-reviewed" means, and why it's so important. ("Nature of Science")

Details from the AAAS and NAS statements. ("Get What You Want")

Details from the industries calling for mandatory emissions caps on themselves—the US Carbon Action Partnership or USCAP. ("Get What You Want")

How the warnings of "harm to the economy" are a Jedi Mind trick.

Objections Answered

"That grid is just Pascal's Wager."

"There is little argument on the existence of global warming, but there's still a lot on its causes." ("Mechanics of GCC")

"What about the Copenhagen Consensus, the Leipzig Declaration, the Oregon Petition?"

"Stop telling me what to think"

"That grid is so grossly oversimplified that it's useless." ("The Manpollo Project")

"I noticed you dropped the global depression that was in the upper left box in the original grid in 'The Most Terrifying Video.' Couldn't take the heat, huh, so you had to bias the grid your way?" ("Get What You Want")

"You underplayed the negative consequences in the upper left." ("Get What You Want")

"You overplayed the negative consequences in the lower right."

"Well, we can't just surrender control of our future to a bunch of eggheads who we don't know and never elected."

"But that's just a PREDICTION. That doesn't mean it's really going to happen." ("Nature of Science")

"That's just argument from authority!"

"There are at least 3 documentaries on YouTube alone disproving AGW."

"If action on climate change is such a good deal, how come businesses aren't doing it yet?"

"I think we'll innovate ourselves out of any problem."

"Whatever negative economic consequences show up in the upper left, should show up in the lower left, too, so if we choose action, we're doomed to economic harm."

"The upper right corner is the only box that looks attractive. That's why we should choose column B."

"I'd rather not take action on an uncertain threat, so that we can face any real threats that **do** materialize down the road with the wealth that an unfettered economy would bring us." ("Get What You Want")

"The statements from AAAS and NAS shouldn't be taken as any big deal, because the scientists are biased. Their grant money depends on them crying wolf." ("No Holds Barred")

"The grid is useless without actual numbers assigned to the probabilities." ("The Manpollo Project")

"One hundred years of data is not enough to know thousands of years of the past climate."

"The IPCC is just a UN hack. They have no credibility."

"Why Is There Still Debate?"

Topics

A little bit of the psychology and sociology of why we're still talking about this in the face of very clear and explicit scientific agreement.

Why scare tactics can sometimes be a good thing.

Smackdown: "An Inconvenient Truth" vs. "The Great Global Warming Swindle."

Why we'd be better off if Gay Sex were the cause of global climate change. ("Scare Tactics")

Objections Answered

"But I've heard the opposite of all that you say about climate change, so doesn't that prove it's still being debated?"

"Mechanics of GCC"

Topics

The basics: greenhouse effect vs. global warming vs. global climate change.

Some of the swindles of GGWS.

Objections Answered

"CO_2 is an insignificant greenhouse gas compared to methane and water vapor."

"There is little argument on the existence of global warming, but there's still a lot on its causes." ("Risk Management")

"If we take action and climate change doesn't happen, how will we know whether it was ever true in the first place?"

"How arrogant to think that we can change the globe. We're too small to have any effect." ("Scare Tactics")

"The water vapor from HFC cars would just replace the CO_2 as a GHG"

"Humans are not causing global warming." ("Scare Tactics")

"Climate changes all the time." ("Scare Tactics")

"We're coming out of a cold cycle, so this is natural." ("Scare Tactics")

"Scare Tactics"

Topics

The big threat: abrupt climate change.

The military's assessment of abrupt climate change as a threat to national security.

Why this is probably the only issue that matters, save one (which I'll leave as an exercise for the viewer).

Why I like clear cuts and nuclear power now.

Why we'd be better off if Gay Sex were the cause of global climate change. ("Why There Is Still Debate")

Objections Answered

"The picture you paint is unlikely to happen. How could it be so bad?"

"What's the explanation for the disaster scenarios on the Red Bull cans? How do we get 'epidemics' and 'wars' from **climate change**?"

"What's wrong with a degree or two? How is that like flipping a light switch?"

"We can't even predict the weather tomorrow, so why are we making predictions about 20 years from now?" ("Nature of Science")

"Climate has always changed, so why are we suddenly the bad guys?" ("Mechanics of GCC")

"It's the sun, stupid. Or cosmic rays."

"I've heard predictions of temperature **drops**. How does that come from global **warming**?"

"Why get all wound up about the climate changing? Who's to say what the right climate is?"

"Birds and bees build nests and homes out of raw materials in their environment,

just like we do. How is this different? If there were no beavers, there wouldn't be any beaver dams disrupting the natural course of a river—is that good or bad or just the way it is?"

"The climate has done fine before without us!"

"But it's been warm in the past. Where's the evidence that that's bad?"

"Why should we [that is, America] change? It won't make a difference unless China and India are stopped."

"But CO_2 lags temperature in the ice core data, so those silly scientists have got it backward!"

"Humans are too small to have an effect on the climate." ("Mechanics of GCC")

"You're indulging in irresponsible scare mongering."

"The Solution"

Topics

How to do more than "just pass it on."

Understanding the technical and policy solutions.

Applying the test of future regrets.

How **are** we supposed to fix this without going back to the Dark Ages?

How you might be able to be a part of history. Probably won't get any monuments, but it'll make a great story for the grandkids.

Objections Answered

"So exactly what is this "action" you've been whining about? Specifics, please."

"So what do we do about it? What do I do about it?"

"Biodiesel is bad because it displaces food crops!"

"Wind turbines kill birds, you know!"

"If man has changed the climate, then what is it SUPPOSED to be now? Until we have a clue what the norm is, how do we know how much we need to adjust what we're doing?" ("The Manpollo Project")

"What if taking action makes it worse? Or we overshoot and cause an ice age?" ("The Manpollo Project")

"Leave the government out of this. The free market can handle the problem."

"How much action is enough? Exactly what needs to get done?"

"I'm too busy to deal with climate change. And the problem is too big."

"Get What You Want" (Skeptics #1)

Topics

How taking action on climate change is actually a better bet for getting skeptics what they want: economic and political liberty.

If your objections to the argument "Sure there's uncertainty, but why not take action, just in case?" is along the lines of "We need to protect the economy" or "I don't want the government getting more control of my life."

If you want to see me put an economist and a scientist in a jar and shake it to see them fight. Not really. But sorta.

Why you shouldn't confuse Al Gore with global climate change.

Why I put “Global Depression” in the upper left box in my original “The Most Terrifying Video You’ll Ever See,” but dropped it in “How It All Ends” (“Risk Management”)

Even more details from the USCAP statement. (“Risk Management”)

Objections Answered

“You’re an alarmist.” (“No Holds Barred”)

“What’s **your** motivation, Mr. Do-Gooder?”

“My personal economy, for better or worse, ends at my property line.”

“You underplayed the negative economic consequences in the upper left.” (“Risk Management”)

“I’d rather not take action on an uncertain threat, so that we can face any real threats that **do** materialize down the road with the wealth that an unfettered economy would bring us.” (“Risk Management”)

“Science isn’t so hot. Remember when the eggheads were all certain in the 1970’s that the globe was going into an ice age that never materialized? They’re always screaming some Chicken Little story. So why should we listen now?”

“Global warming is a ploy for the elites to grow the government and take away our freedoms.”

“I Hope I’m Wrong” (Skeptics #2)

Topics

The details of how I’ve tried to be conscientious and unbiased in my analysis.

Why being terrified of climate change has actually mellowed me out in some aspects.

If you want to see a picture of me without my shirt on. (Don’t worry, there’s a warning just before the image, so you can skip that part.)

For the story of a very unexpected and violent explosion in my classroom.

Why I’d be okay with us taking big action on climate change, but turning out to be wrong about it, even if it results in economic harm.

Objections Answered

“You’re clearly biased, so why should I listen to anything you have to say?”

“No Holds Barred” (Skeptics #3)

The final stand in the debate with hard-line skeptics. You might want to watch this video if:

. . . You feel like you’re not getting anywhere in your argument with warmers.

. . . You’re tired of being told you’re the problem.

. . . You want to call me an alarmist. (“Get What You Want”)

. . . You’ve ever been called a conspiracy theorist about this.

. . . You want to hear me get sassy.

. . . You claim that the AAAS and NAS statements aren’t credible because “the scientists are biased. Their grant money depends on them crying wolf.” (“Risk Management”)

. . . You subscribe to Michael Crichton’s hypothesis that the threat of global climate change is mostly a conspiracy by scientists.

. . . You think that "The truth is that reasonable people of good will can look at the same evidence and come to opposite conclusions, including scientists."

. . . Your objection has any mention of asteroids.

. . . You think everything that the government touches turns to crap, so we should just let the free market solve the problem. ("The Solution")

. . . You think we should pick column B because it contains the only box that seems attractive.

. . . You wonder why I would think the website "How To Talk To a Climate Skeptic" is actually a better resource for skeptics than for warmers.

. . . You think there's no way anyone could ever show you that you actually like government.

. . . Your objection to action is along the lines of "But people need to trust that the money spent to stop climate change will be spent effectively and honestly."

. . . You think that I'm delusional and cannot—even in principle—be convinced that AGW is bunk.

. . . You think choosing column A dooms us to economic harm, regardless of the truth of global warming. ("The Manpollo Project")

. . . You think global warming is a ploy for the elites to grow the government and take away your freedoms. ("Get What You Want")

"God's Will"

If it seems like global climate change is just God's Will, and therefore out of our control, or that taking action to combat it would be contrary to God's Will.

"The Manpollo Project"

Topics

If the grid in "How It All Ends" was the height of simplicity, and "Risk Management" was the next step up in complexity, this is the final installment of complexity. There's no "for simplicity's sake" here.

Objections Answered

"Your grid is oversimplified." ("Risk Management")

"What about the intermediates between no action and all-out action?"

"What if climate change is happening, but we're not the ones doing it?"

"What if climate change is happening, **and** we're the ones doing it, but our actions don't stop it? Or they make it worse?" ("The Solution")

"The consequences in each box themselves aren't certain—there should be a range of possible consequences in each box, not just a worst-case scenario."

"Don't we need more columns and rows to account for all of those possibilities?"

"The grid is useless without actual numbers." ("Risk Management")

"You biased the grid by putting **only** economic consequences in the upper left, but economic **plus** a bunch more in the lower right."

"Choosing column A dooms us to economic harm, regardless of the truth of global warming." ("No Holds Barred")

——end——

"How It All Ends: Nature of Science"
(original script—final version)

*AUTHOR'S NOTE: This is the original script, but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution*," please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck! (wonderingmind42@gmail.com, 25OCT2007)*

This video is called "Nature of Science" and is part of the expansion pack accompanying the orginial video "How It All Ends."

This video will explore the nature of science a bit, looking at how it is unavoidably tentative and uncertain. The purpose is that we can then do a better job of putting into context the things we hear about the science of global climate change.

Let's start out with my assumptions. If we're talking about the meaning of life, then science can be informative, but is just one tool of many equally valid ones, like faith, love, and direct experience. But when we're talking about trying to predict and manipulate the physical world, I think that science is our best bet. It's certainly got by far the best success rate. As Carl Sagan observed, if you want to know when the next eclipse of the Sun will be, you might try magicians or mystics, but you'll do much better with scientists. If you want to save your child from polio, you can pray or you can inoculate.

One more thing before we dive in: scientific thinking and critical thinking in my mind are essentially the same thing. So as I talk about how science goes about figuring out what to believe, underneath it all I am at the same time suggesting how we as individuals—as citizens—should go about deliberating issues.

It's a well-established psychological phenomenon—and, in fact, is simply human—to start out with your beliefs, and then go looking for evidence to support them. The problem is, we tend to forget or simply not hear evidence that contradicts our beliefs. I mean, who wants to be shown that they're wrong? Formally, that phenomenon is called "confirmation bias." The devilish result is that if you're not diligently aware of it, you could be served up a plate of equally balanced evidence, and come out convinced that yours is the viewpoint that was better supported by the evidence, because you gave greater weight to the evidence that agreed with what you already believed, and discounted—or simply didn't hear—what contradicted it. So confirmation bias can serve to actually reinforce misconceptions in the face of evidence. That's why it's critical to be vigilant about it in your own thinking, and why you'll hear me refer to it again and again.

In science (and in criticial thinking—like we should all be trying to do in the whole

climate change debate), it's the opposite. Instead of starting with beliefs and then looking for evidence, you start by looking at whatever the evidence is, and then use that to **form** beliefs. I think that's pretty much what a chemistry professor of mine once meant when he was teaching us about climate change. He said "Get informed, and let it change you." That's sort of the nutshell of how a good scientist might go about advocating for something: he doesn't tell you what to believe. He just reminds you: start with the evidence, and move to belief, instead of the other way around.

"That's exactly what I've been saying!" I can hear the shouting in my head right now, from some online commentors who've latched on to my previous videos about climate change. "Why don't we just go with the facts!??"

Hey, sounds good to me. Simple, right? Just go with the facts? The sticky part is determining what exactly are the facts. Here's an example. I'll give a series of increasingly complex statements, and you think about at what point we can no longer simply **agree** it's a fact, and instead have to do some interpreting.

[Behind burning candle] I have a candle in front of me. Fact. The candle is burning. Fact. I'm sitting in a chair. Here you might ask for more evidence before we pronounce it fact, because you can't see it, so how about if I showed you? Okay, with a little checking—fact.

The problem is, I'm not really sitting in the chair, because I'm not actually in contact. What's really happening is my outer electrons are repelling the outer electrons of the chair strongly enough to make me hover imperceptively above it, like magnets that can push on each other without touching [DEMO]. Okay, so I'm tricky. "Don't be such a dork," you say. "Some things are just obvious." Well [eat candle], one of my favorite quotes on the matter is from Buckminster Fuller. In fact, students have to walk underneath it to get into my room. He wrote "Everything you learned in school as 'obvious' becomes less and less obvious as you begin to study the universe." [Open mouth with "Ahhh."]

This becomes a central point. Because, while we may all agree that—for all intents and purposes—I am sitting in this chair, when we shout at each other about whether the globe is warming or not, it turns out both claims are subject to the same question: how are we to decide whether something is a fact or not? It's not always as clear cut as we'd like.

This may seem like splitting hairs, but it becomes kind of important if you have a question about a complex system or a really important issue, like: gee, is that asteroid going to hit the Earth or barely miss? Is this case of bird flu a human-to-human transmission or not? Is the globe warming or not? Are we the ones doing it or not?

"Sophistry!" you cry. "We can just look at the evidence." Well, problem is, evidence still needs to be interpreted, which can be done poorly or skillfully. You see webbed foot tracks in the hall, come across a shimmery green feather, and hear a quacking sound. You conclude there must have been a mallard duck who recently passed by. It's obvious. But is it possible it's actually a kind of duck **you've** never seen before, and had you been better trained as an ornithologist, you would have known that the green was slightly the wrong hue for a mallard, and the tracks a little too big? Interpreting evidence well takes skill, training, and experience.

You wouldn't propose lowering prescription drug costs by hiring my high school chemistry students instead of people with Ph.D.s to research the drugs, would you? They both look at the same printouts from the same machines: who's interpretation of the evidence are you going to trust? "Well then, let me do it myself," you say. Um—go for it. But then don't be expecting me to accept your drugs, which is the case with climate change, since it's **global,** which means you're not the only one affected by your decision. I'll stick with the professionals,

thanks.

Here's an example I often give my students. I tell them that we're going to get creamed in Friday night's football game, because—have they heard?—the opposing side's offensive line has an average weight of just over 300 pounds! That usually worries them, until I tell them that the linemen weigh 110, 103, 98, 97, and 1120 pounds. That leads to a discussion of the difference between the "mean" average and the "median" average, and gets them to question their faith a little bit in the reality so obviously implied by such simple numbers as "the average." If something as simple as the average can be so tricky, how come we're okay with Joe Schmoes like you and me doing armchair analysis of climate science—one of the most complex topics in human history—instead of leaving it up to the scientists?

Why does evidence need expertise to interpret it? Because things are almost always way more complicated than they seem.

I once cornered a Yale University particle physicist at a wedding reception, cuz even though I teach physics and chemistry, I've always got some questions myself, and no one around to answer them. Anyway, I asked him how big an electron really is. I'd been wanting to know for a while, so I was determined to get a solid answer. An hour and several diagram-covered napkins later, I finally got him to grudgingly assent to a single sentence answer that we'd negotiated like it was a UN treaty. The deeper you go, or the bigger the system (like climate), the less accessible the "evidence" is to easy interpretation. (Fair warning: if you're an expert in some field of the physical sciences, you'll probably want to avoid me at parties. . .)

Yeah, but not everything is as complex as the climate, you say. You're right, some things are simpler, like 1+1=2. Here's Bertrand Russell and Alfred North Whitehead's proof of that outlandish mathematical statement.

This is part of why all science is inherently uncertain, and tentative. Because the world is tremendously complex. So how do we get **any** answers? Well, you delve as far into the complexity as you need to for your purposes, or as far as you can get with your measuring instruments, and then you make an explicit estimate of how close you think you probably got to the "true value," acknowledging that you'll never get there.

The goal, of course, is to make that uncertainty as small as possible. There's a couple basic ways of doing that.

The first is to be very careful about what biases—or preconceived notions—the scientist brings to the table. The scientist Konrad Lorenz summed up that duty when he wrote: "It is a good morning exercise for a research scientist to discard a pet hypothesis every day before breakfast." Why? Because if you aren't aware of your preconceived notions, then you are susceptible to the trap of confirmation bias—starting with belief, and then looking for evidence, rather than the other way around.

This can be insidious, because you don't realize you're doing it, and as a result, you become more confident of your conclusions than the evidence really merits.

The author Douglas Adams put it perfectly when he observed that "assumptions are the things you don't realize you have." That's what the candle thing was about.

Here's a couple more examples. You'll probably be on your guard now, but see if you can do more than just avoid being tricked. See if you can identify the assumptions **you** hold that allow me to mislead you.

[In front of board with 1+1=10 on it.] If I asked you to make some simple observations, you might say I'm sitting in a chair in front of a whiteboard, which has an incorrect equation on it, and my toy is missing a green ring. Well, we've already established that I'm not really sitting

on my chair—I'm hovering imperceptibly above it. And what if I told you that's not a whiteboard—it's a showerboard from Home Depot? Or that I'm not missing a green piece, but a blue one [switch and reveal]. Or that this is "base two" math, and you approached it with the wrong assumption—that it was standard "base 10"—so that YOU were the one who was wrong, even as you pointed your finger at me? And I bet you thought this was a fancy hat. Well really, it's folded newspaper. In each case, you make an unconscious assumption, which leads you from "the evidence," to a totally incorrect conclusion. Not because you're dumb, but because you didn't have the appropriate training or experience to be qualified to interpret the evidence.

So in scientific or critical thinking, you take great pains to identify the assumptions you don't realize you have, so that you can account for them, and not wind up with a wrong conclusion when you interpret the evidence.

Okay, okay, you're saying. Let me try another one. I'm ready this time. This time you'll need a pencil or pen, and a piece of paper. Hit the pause button while you go get one.

What I'm going to do is flash an image on the screen for just an instant. Your job is to reproduce it as accurately as you can on your paper. I'll just flash it for an instant, and it's not fair using the pause button. Ready? Here we go. [Flash "Paris in the the Spring."]

Okay, now press the pause button again, and do your drawing. When you're done drawing, play the video again.

[Playing with some toy.]

Okay, have you reproduced faithfully what you saw? Here it is again. See how you did. [reveal]

If you got it right, that means you're thinking more like a scientist, trying to be deliberately conscious of your assumptions. Well done. Most people write "Paris in the Spring," when it quite clearly says "Paris in the the Spring." Why? Because the human brain is amazing. When it doesn't have the opportunity to fully examine something (a picture, a sound, a social interaction, a political problem), it fills in the blanks using past experience.

That's great, and really really useful, but the problem arises when we don't realize we're doing it, because it can cause mistakes. When I get disheartened with all of the really confident and totally incorrect stuff I hear from most people who are skeptical about climate change, I have to remind myself that their brains are just doing what they are supposed to: filling in gaps in a really complicated picture, using past experience. For instance, I often hear: "How arrogant to think that humans can change the planet—we're so small." Now that you're more aware of how bias and preconceived notions influence conlusions, can you identify the past experience coming into play there? It's probably that throughout human history, the weather and climate have always been acting on us, and never the other way around. So I guess it's not surprising that people feel that way.

But it is disheartening, because I wish they would be a little bit more humble. To acknowledge that—hey—you might be wrong. Think of it this way: the only way to ever improve, is to admit that you might be wrong. Not one of us is infallible. That means that each of us—you and me included—is right now carrying around some beliefs that are mistaken. If we don't acknowledge that we may have some, then we'll never have a chance to get rid of them—to trade them in for more correct or more useful beliefs. That means you'll never improve, and will die no more correct than you are right now. I don't know about you, but the idea that I am right now as good as I will ever be is oppressive to me—as well as being flat out

ridiculous. I mean, what are the chances that you know everything right now?

That's one reason why I got frustrated during the online debate about my original video "The Most Terrifying Video You'll Ever See." When I reworked my argument in response to some holes that people had poked in it, a couple people essentially said "So why should we listen to you now, since you admit you were wrong before?" and sat back smugly, convinced they'd won the debate. To them, I **lost** credibility because I changed my argument in response to the critiques. That's just crazy talk! In science and reasoning, admitting you're wrong makes you **more** reliable, because in the future, people can trust that if you're wrong, you'll change. If you never admit you're wrong, you lose credibility, because your claims of being right simply become unbelievable. **No one** is right all the time.

[At board] In fact, I would argue that it not only increases your credibility with others, but it increases your happiness to admit you're wrong. Here's what I mean. Let's say you choose to belong to the group of people who never admit they're wrong. In that group, there are two subgroups: those who actually never ever make a mistake, and those who sometimes make a mistake. If you're always right, then hey presto—life is good. But if you are one of these people, bad things happen, cuz sometimes you're going to be wrong, but not admit it. You get into nasty fights, you lose credibility with people, and you never learn anything new.

Now let's say you choose to belong to the group of people who will admit to themselves and others when they're wrong. Again, two subgroups: those who never make a mistake, and those who sometimes do. Again, being actually infallible is all giggles and joy. Here, when people admit it when they make a mistake, they can take that opportunity to fix it: they learn new things, they have less nasty conflicts, and people not only like them better, but respect their opinion more.

Wouldn't you say there are probably precious few of these people in all of human history? What are the chances you or I are one of them? Since we're almost certainly in one of these groups, don't you think this is the better bet than this?

[Back at desk.] So how does this work in science? First, as I mentioned, scientists acknowledge that neither they nor their instruments are perfect, and so they always include an estimate of the error or uncertainty in any scientific statement. Second, scientists take great pains to identify and isolate their assumptions, trying to identify and eliminate errors that they may be making. Third—and this is terribly important—they put their work out there and ask for criticism, so that weak points can be identified and strengthened, and the uncertainty reduced. That's why it's so important to ask if the statement you're hearing about climate change has been "peer-reviewed." That's the official process that science goes through to sift the solid, credible ideas from the sloppy science. Although it doesn't always work, it is a bruising, messy, drawn-out process designed to only let the best, most robust ideas float to the top. If something has been peer-reviewed, generally that means that it's methods are up to snuff, and the scientific community thinks its worth looking at. It's getting close to "the best answer that science can give us."

Keep in mind, it doesn't always work. Sometimes a peer-reviewed scientific article is shown to have significant problems. Guess what happens then? The peer-reviewed journal that published the research admits it, and sometimes even formally retracts the article, apologizing in the process! Why? To **increase** their credibility!

Peer-review is the process science uses to get closer and closer to the truth, but it is critical to remember in this whole climate debate: science never claims to actually gets there.

That's the surprising thing: science—that most precise and anal of all human endeavors—is also the one to never claim to know the truth. Isn't it ironic? Don't you think?

Another dynamic of science that's worth noting is that of establishing when one thing causes another, and when the two things are just correlated. Here's what I mean. If you look at this chart, it is clear that as the number of pirates in the world has decreased, the average global temperature has increased. There's the evidence, and no one disputes it. So, what's the interpretation? That the lack of pirates causes global warming? That pirates combat global warming, and therefore we should start some pirate schools ASAP? This is an example of correlation, two things whose trends track each other. But science is careful to not yet say that one causes the other.

For a serious example, it turns out that left-handed women contract breast cancer at a higher rate than right-handed women. So does left-handedness cause cancer? How does science go about answering that question? Well, it's complicated, but this much is useful for us lay people to know: if two things are correlated, but scientists can't find a way to feasibly explain the **mechanism** by which one influences the other, then they are not considered cause and effect. That doesn't mean science says "They aren't cause and effect." It means science says "We don't have any reason to believe they are cause and effect," but they are always open to future ideas and evidence.

Sometimes you hear the criticism: "Scientists can't even predict the weather, so why should we listen to them about something even bigger, like the climate?" That's a little bit like saying: mathematicians can't even predict how this coin flip will turn out, so why should we listen to their predictions of how a million coin flips will turn out? Climate is about averages and overall trends, which are easier to predict than a particular occurrence. Also, the predictions are getting better and better over time. Remember: science never claims to have the exactly correct answer—that's just a misconception—and an inappropriate demand—by the public and the media. But the self-critical nature of science means that it tends improve (which, incidentally, is why it's so disturbing that the predictions of climate change have gotten more dire as time has gone on). But it never is done.

Sometimes you hear the criticism "There is no consensus among scientists about human-caused climate change." News flash! There's no consensus among scientists about anything! The inherent uncertainty of science means there will almost always be dissent on any scientific issue.

Pick the most well-known, well-established scientific law you can think of. The Law of Gravity, right? Guess what? There's no consensus on it! We've got a satellite up there right now, Gravity Probe B, testing our current understanding of gravity. And you know what it's looking for? I'll give you a hint: remember the phenomenon of "confirmation bias?" Scientists are really careful to avoid that, so the probe isn't so much looking for evidence to **confirm** our theory. It's looking for evidence to contradict it! We're actively trying to **disprove** perhaps the most widely accepted and beloved of all scientific theories. Why? Because we love it so much, we want to make it stronger. Looking really hard and conscientiously for **contradictory** evidence and **failing** to find it does more to increase our confidence than looking for supporting evidence and finding it.

Science is never certain. You know that classic Mentos and Diet Coke reaction? [show video] You want to know the scientific explanation for it? Here it is: no one knows!!! There's lots of conjecture—it's quite the hot topic in the chemistry education community. So you can

find **explanations**, but the uncertainties associated with them are going to be very large. Why have we not studied it further to reduce the uncertainties? Because it's not worth it. But the more important the issue is, the more research goes into it, the smaller the uncertainties become. But if you're waiting for there to be no dissent at all, then you'll wait forever, no matter what the scientific issue.

It's sort of like with this whole climate debate, it's easy to find websites giving all sorts of reasons to believe what I already believe. But that doesn't increase my confidence. I want my argument to be rock solid, so I go looking for websites that **contradict** what I believe. And when I can't find much that's credible, **that** increases my confidence in my views. It's like testing to see if something is watertight. You look for the **leaks**, and if you can't find any, then your confidence increases. It feels great to have everyone tell you you're right, but it's a deceptive, complacent game. The way to really get confident is to go poking at the other side, saying "what's your response to this? How would you contradict this?" which I've done quite a bit with my grid argument about global climate change, which is why there are so many bloody minutes of me talking on video as a result: the experience left me bruised and battered, but it left my argument that much stronger. In fact, as I film this, an early version of "How It All Ends" leaked onto Digg.com a couple days ago, and I am heartened the every single criticism I read there already is countered in my video scripts. It didn't get that way by me talking to people who agree with me. In fact I handed my scripts to one of the best critical thinkers I know and said: "Please find the holes in this argument." That's why science is the most self-critical endeavor in the history of humanity—it knows that that is the most effective way to get better.

How about this objection: "Climate models are just models, just **predictions** about the future, which we can't test until the future actually happens. We don't know what's really going to happen. So they're just conjecture, and therefore useless." My response is—ever ridden on a modern airliner? Cuz they're all designed on the computer, modeled on the computer, tested in the computer model, then physical models, and finally computer models again, which is where the pilots learn to fly them. When the Boeing 777 was first flown, all the technicians, managers, and you can bet test pilots, were extremely confident that it would fly. Why? Because we've learned how to make good computer models, by tweaking them until their output matches what we see in the physical world.

Climate models on the computer, for instance, are calibrated with the observed climate of the past. If we feed a model the conditions in 1950 and it churns out predictions for the period 1950 to 2000 that closely match what actually happened, then that gives us confidence in the predictions it makes when we put in the conditions for 2000 and ask it about 2030.

It's been proposed that the greatest knowledge is to know that you do not know. So when you hear pronouncements about how global climate change is bunk, or that we're not the ones doing it, keep that in mind. Now that you understand a bit about the uncertain and tentative nature of science, ask yourself: how credible are pronouncements about a scientific issue, when they're made with such certainty?

Along those lines, I was struck by how many people in the comments to my "Most Terrifying Video" made absolute statements of truth about the world. A ton of people flat out said "Humans are not causing global warming." Other comments I got included:

"Humans are too small to have an effect on the climate."

“Global warming is a ploy for the elites to grow the government and take away your freedoms.”

“It is true that the climate is changing, but there’s a lot of debate about whether we’re the ones causing it.”

“Taking action may make things worse.”

“Climate changes all the time.”

“We’re coming out of a cold cycle, so this is natural.”

“100 years of data is not enough to know 1000s of years of the past climate.”

“Personally, I don’t think global warming is as definitely man-caused as popular media make it out to be.”

“Personally, I think?!!??”

We’re talking the most complex science in the history of humankind. Chaos theory was discovered studying weather systems. “Personally, I think?!!??” Who the heck are **you** say what the physical truth is?

But then, I admit, I fell into a similar mistake of being absolute, claiming in that video that “the only choice” is column A. Who the heck **are we** to think we’ve got a lock on truth? Have you ever been completely sure of something, and then turned out to be wrong? Shouldn’t that temper our confidence the next time we feel that way? It should give you pause when the trained person is **less** certain of themselves than the **untrained** person. I was certainly humbled by the unexpected explosion in my classroom that I describe in the video “I Hope I’m Wrong.” I guess the bottom line lesson is here that we will probably do better for ourselves and for the whole with some humility.

Look, I don’t have the answers. And neither, probably, do you. But we, as a people, as a species, can probably come up with something that’s decent. Will it be right? Will it work? We can’t know for sure. Will it be better than nothing? Probably.

I forget where I read it—maybe it was even a bumper sticker LOL—but I recently came across a line that I think pretty well sums up the lesson in humility that scientific thinking teaches us. And I suspect it may help us make some headway in this whole discussion of what to do about climate change. It’s just this:

“Don’t believe everything you think.”

——end——

"How It All Ends: Risk Management"
(original script—final version)

*AUTHOR'S NOTE: This is the original script, but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution*," please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck! (wonderingmind42@gmail.com, 25OCT2007)*

This video is titled "Risk Management" and is part of the expansion pack accompanying the original video "How It All Ends."

The purpose of this video is to further explore the question of "How do you go about making a decision when faced with uncertainty," and to expand on the grid about global climate change presented in the video "How It All Ends."

First, a couple warnings to the viewer. Ronald Reagan said it well in 1985 when he told college students: "Your generation is subject to more information than any generation in history. Let me suggest one thing, don't let me get away with it. Check me out, but check everybody else out too. Don't just take it for granted because you read it someplace. Check it out."

When I first posted the decision grid about climate change in "The Most Terrifying Video You'll Ever See" in Spring of 2007 I got accused of telling people what to believe. "I'm not telling you what to believe," I replied. "Well you're telling me what to think," some said. "I'm not telling you what to think, I'm telling you how to think," I said. "Well don't tell me how to think," they said. "Crikey!" I said. "What am I allowed to tell you? Why are you watching this? For entertainment? You've got plenty of that elsewhere. [Mentos backwards]"

So here's what I am doing: I'm suggesting how to go about making decisions **for yourself** in this very complicated issue that has really high stakes, but some uncertainty. But don't just accept what I say because it sounds reasonable and you like my face. Think it through for yourself. Sort it out with others. Check my sources.

[AT THE BOARD] I got accused of being manipulative too, by oversimplifying. So here's my official disclaimer. Just because it's written down or even published somewhere doesn't make it true. Check it out for yourself. But at the same time, be very careful, because just because you disagree with something or don't like it doesn't mean it's wrong.

For instance, when I make this claim [Write 1+1=10 on the board], you may think "What a dope he is!" But it turns I'm correct, as I explained in the video "How It All Ends: Nature of Science." If you think it's wrong, it's because you unconsciously brought the wrong

assumptions to it. So be very careful of doing exactly that as you hear different things in the climate change debate.

[DESK]

So the question before us is, what do you do when

1- You can't figure out the right choice, but

2- You have to choose.

The answer is: you do the best you can with what you have. As I explained in the video "How It All Ends: Nature of Science," we cannot have certainty on climate change, so we're just going to have to tolerate some ambiguity. It is incredibly unlikely that we will get the answer exactly right, and spend the exact right amount of money and resources to get the exact effects we want.

That means no matter how careful we are, we are either going to overspend or underspend. And let's be big boys and girls about this: that means we can either err on the side of overspending, in which case we "waste money" but get done what we want to get done, or we can err on the side of underspending, in which case we don't waste any money, but less gets done than we wanted.

Anyone who says that's a false choice and that we can spend exactly the right amount of money to get done exactly what needs to get done is either lying to you, or just dumb. Sorry—no need to be mean. They're either being disingenuous, or they haven't fully thought things through yet.

So, the formal process of doing the best with what you have is called "risk management," and it's a great tool that's used all the time by industries and governments.

What risk management does is relieve you of the necessity of knowing things **for certain** before making a decision. That's the really powerful part: you don't need to know the truth, in order to still be confident that you're making the choice that will most likely bring you what you want. And that's a big relief, because it means you and I don't need to sort out all the arguments about climate science.

We can leave that to the people who actually know what they're doing. Like I said before: during WWII, would you have insisted on personally resolving all common sense contradictions of atomic physics—like the ideas that matter and energy are the same thing—before agreeing that the Manhattan Project was a good use of resources? No.

You and I are not qualified to evaluate the science, so we shouldn't get too cocky about trying. This is why objections like "100 years of data is not enough to know thousands of years of the past climate" always curl my toes. Who the heck are **you** to say that? Have you studied the various competing statistical models for integrating proxy data into supersets? Can you even tell which parts of that sentence are valid and which parts I just made up?

Or are you applying that "common sense" that, as we saw in the video "Nature of Science," is so woefully ill-equipped for evaluating complex scientific evidence?

There's a reason it takes a long time and a lot of coffee to get the letters "P," "h," and "D" behind your name in the sciences. What you and I **are** qualified to do, is basic risk management. Which is good, because that gives us the oversight of the whole process. That hopefully answers the objection "Well, we can't just surrender control of our future to a bunch of eggheads who we don't know and never elected."

They do the science, and then we weigh the risks and costs, and—as a society—decide what to do. So by trusting scientists to do science, we are in no way abdicating control of our

lives to the scientists or the government. We retain that. (That is, if you vote.)

Okay, so how do we go about doing this risk management? Turns out it's a whole field of study, but we can simplify it a bit for our purposes, and take a page from the playbook of casinos and insurance companies. Both of those stake their existence on potentially huge costs associated with unpredictable events. So how do they manage to stay in business, and in fact, turn a healthy profit? Well, it pretty much boils down to something called "Expected value." It's worth taking a look at.

[AT BOARD] Let's take a simple example and say you're playing a game where you buy a ticket, and that ticket has some likelihood of paying off. We need to distinguish here between two different ideas. The first is the probability that the ticket will pay off. That's expressed as a number between 0 and 1. 0 means it cannot payoff, 1 means it will definitely pay off, 0.5 means it has a 50% or 1-in-2 chance of paying off.

The second number is the consequence, or what happens if the ticket pays off—what you win in this case. Every ticket has a probability, and a consequence that go with it.

So let's say the game is such that 1 ticket costs $1, has a probability of 0.5 (or a 1-in-2 chance of winning), and the consequence is the house gives you $2 (that's the payoff if your ticket wins). Now, we can't say what will happen with a given ticket, whether it will payoff or not, but we can track what happens over a large number of plays. To make it easier to understand, let's say the winning happens at even intervals.

cost	1	1	1	1	1	1	1	1	1	1	1	1	1
consq.	0	2	0	2	0	2	0	2	0	2	0	2	0

Over 12 plays, your total cost is 12 x $1 or $12, and your total winnings are 6 x $2, or $12. You broke even.

The expected value is a way to predict at the beginning whether you'll break even or not, by looking at what one ticket—on average—is worth. You won $12 over 12 tickets, so your tickets—on average—brought in $1 each, even though no single ticket did that. That's the expected value of the ticket, one dollar, and you can calculate it before ever playing the game in a very simple way.

To get the expected value of an action (in this case, buying a ticket), you just multiply the action's probability by its consequence. Here, 0.5 x $2 = $1. So at the very start, knowing the odds and the payoffs, you can compare the cost of a ticket ($1) to that ticket's expected value ($1) and see that over time, you can expect to about break even.

What if the odds change? Let's say the probability of the event (a ticket winning) goes to 1-in-4, and the consequence stays the same. Now the expected value of a single ticket is 0.25 x $2 = $0.5, while the cost remains at a dollar. Now you know you can expect to lose money.

Does that mean you **will** lose money? No. You **may** come out ahead. But you can **expect** not to. If you're there for a good time and can spare the cash, go for it, have fun. But if you're betting with your retirement, that game wouldn't be a very wise choice.

[BACK AT DESK] Before we apply this to the climate change grid, I want to be clear on something. Some critics of my older video kept shouting "But that's just a PREDICTION" (all caps), as if that means it's pure conjecture. Predictions are not statements that something WILL happen, but that something might happen, and the better the prediction, the more robust the work that went into it, the more likely it will turn out to be true.

For instance, if I'm betting on a roll of a pair of dice with all payoffs being equal, I'm going to bet on the seven, because my study of past dice rolls predicts that a seven is the most likely outcome. But betting on a seven doesn't require that I believe it **will** happen. It just means that based on my study, it's my best bet, it's expected value is the highest of my choices.

And before you go crying "but the expected value is a flawed mechanism—what about the St. Petersburg Paradox?" I'll just make the point that if it's good enough to turn a profit for casinos and insurance companies, it's good enough for our purposes here.

So to use this device of expected value for our grid about action on climate change, we need to get some sense of the probability of the two rows, and the consequence of the scenarios in each box. But with "the Google" here to serve up statements supporting pretty much any conclusion we want, how do we sift through all the noise to come up with a confident assessment of probabilities and consequences?

The problem is, you can read Michael Crichton's State of Fear, and then Fred Pearce's With Speed and Violence: Why Scientists Fear Tipping Points in Climate Change. You can look up the "Leipzig Declaration" and then the "Scientists' Warning to Humanity." And at the end of the day you'll still be left with the question "But they all contradict each other, so who's right?"

I know it sounds like I'm making the point that it's futile to do any research, but I'm not. I'm trying to make the point that if you want to get anywhere, you can't just read stuff. You've got to do things differently: to examine the source, to look at credentials and possible bias, to take a step back and ask not "Who should I believe," but instead "What is the process I will use to decide what to go on?"

I'd suggest you do it by assigning weight to different statements based on the credibility of the source. As a science teacher, I've spent a lot of my time thinking about how you evaluate claims and assign credibility to sources. That doesn't answer the question "What should I believe," but it does provide an answer to the question: "Given the uncertainty, what is probably the most useful statement to move forward with?" Which, really, is the fundamental question you're faced with at the heart of most matters.

As a disclaimer, I'll point out that these are just general guidelines—any source could be wrong, and as a colleague of mine is fond of saying: "Even a blind squirrel finds a nut occasionally." So this is a tool to use **just as a starting point**.

[AT THE BOARD] I would place sources on a spectrum running from less reliable to more reliable, based on two factors. One is: how much does the source know about what they are doing? Are they trained? Are they speaking about their expertise? Are they conscientious? In other words, how likely are they to arrive at a correct conclusion?

The other factor is: how likely are they to spin that conclusion? Do they have an agenda of some sort? What's the likelihood that they are biased in some way that will affect what they choose to tell me, and what they don't?

Using those, I'd say at the very bottom of our spectrum lies the individual lay person—who doesn't necessarily have expertise, and may very well have an agenda. That's not to say there's nothing to be learned from individuals, though. They can be useful for new ways to see things, or directions to go. It's just that you don't want to rely on their information any more than is necessary. Like Reagan said—check out what they say for yourself.

I would give more weight to the individual professional who is speaking about their area

of expertise, because they may have an agenda, but at least they know what they're doing. I might give still more weight to think tanks and advocacy groups—like the Cato Institute or Greenpeace. They've still got an agenda, but they've got greater resources than just a single person, and so can be more thorough.

For example, I found an interesting figure about atmospheric carbon dioxide I wanted to use in this project. So before throwing it into the video script, I looked at who provided it, and saw that it was someone with a Ph.D. after his name (better than nothing), from the Environmental Defense Fund (not as credible as I'd like—their agenda is right there in their name). So what do I do? I go look it up somewhere else! Because I'm looking for the truth, not just support for my beliefs.

Now this one, I'm not sure where to put—floating somewhere around the middle, I guess—petitions and other self-selecting statements, like the Oregon Petition or the Economists' Statement on Climate Change. They may very well know what they're doing (you should check to see of the signers have expertise in the area), but the big problem is the signers are self-selected—by definition, there are no dissenters on there, so their spin factor can be fairly high.

They really are susceptible to the trap of confirmation bias I described in the video "Nature of Science," though they can be pretty credible as well. For example, the Oregon Petition was a project of a small think tank of six employees in rural Oregon, while the Economists' Statement on Climate Change had 6 Nobel Laureates sign it, so I wouldn't give equal weight to the two, even though they both fall into this category. Again, it depends a lot on who the signers are.

Somewhere in here I'd put university research programs. They're generally more credible than think tanks, because they're a couple of funding steps removed from vested interests.

Now we're getting into the pretty credible stuff: peer-reviewed scientific articles. As I noted in the video "Nature of Science," this is getting close to "the best that science can offer," because it's gone through a bruising process of critique by experts in the field, and only gets published if the journal in question feels it's up to snuff.

Now, some journals are higher quality than others, and their publications can be weighted more—there are a ton out there, but anything from the journals "Science," "Nature," "The Proceedings of the National Academy of Science," or "Physical Review Letters" is going to be literally the best you can get in science—they generally don't publish an article unless they believe that it marks a significant breakthrough in its field.

I just recently discovered a danger in this rule of thumb about trusting peer-reviewed stuff, that you should be aware of if you're going to be analyzing sources. Usually when someone gives me a reference to back up what they're saying, my first question is "Is it peer reviewed?" And generally the stuff that's skeptical of human-caused global climate change hasn't been published in a peer-reviewed journal, because it didn't fit the expectations of rigor that most peer-reviewed journals maintain.

But I recently learned there is now a small journal named "Energy & Environment," which I've read most scientists don't take seriously, but which does have its own peer review process. The upshot is—and the editors admit it—it's an outlet for climate skeptics to get their stuff published, so that others in the political and popular debate can then cite "peer reviewed" scientific studies that show global warming isn't such a big deal after all.

I find that scary. It seems like an abuse of trust, cuz scientists know which journals are more reputable than other, and so they know how much weight to give to the publications of different journals, but the public doesn't—to us, if it's "peer-reviewed," then it must be solid stuff. That used to be true. Thankfully, it still is for the most part.

Here we get to the two types of sources that I think carry the most weight, and I don't think I'd rank one over the other in general. Here you'd put statements from an organization that contradict its normal bias. For instance, if the local timber lobby said "We've got to thin out this forest for its own health" you wouldn't be that convinced, but if the Sierra Club made the same statement, you'd sit up and take notice. The reasons must be really compelling if the Sierra Club is going to contradict their normal message.

Finally, there are professional organizations. That is, organizations that exist not to advance a particular agenda, but to simply serve the communication and training needs of a particular profession, like the American Medical Association, the American Institute of Architects, etc.

Not only are they made up of people who know what they're doing, but for the association to actually come out with a statement generally requires that most of the members agree with it, so there's going to be a bruising and very thorough process to make sure it's not some whim or a flimsy statement that may later embarrass the organization.

It's important to note that I just totally made up this credibility spectrum. This is just what I do when I'm deciding how much weight to put in statements I read, and I'm suggesting it here as a tool to use in our discussions. If you have a better tool or some insight that refines this, please share it with me. And, while I'm quite confident of the two ends, the middle can get pretty mixed up.

For instance, you may find a book published by a think tank, but it was written by a professional individual, and so shouldn't necessarily be given more weight than any other book. You really have to think about what biases might be present in any given example. Remember: this is just a starting point.

Now, armed with our credibility spectrum, we can explore the grid more.

PROBABILITIES

[DESK]

Let's start by trying to get a sense of the probability of human-caused global climate change being true. Before we look at direct statements about it, I'll share a rule of thumb that may be useful to you, if you have the inclination. Look at what scientists are saying to each other when the media isn't interviewing them. I regularly read some scientific and lay scientific literature, and I'll tell you, for a number of years now, the tenor about climate change has been not at all controversial.

Generally when it's mentioned, it assumes the reader is on board with the idea that humans are causing the climate to change. The hot debate is on what exactly that will look like, and how fast it will happen. That should tell you something.

In the video "How It All Ends" I shared that the two most well-respected scientific organizations on the planet—AAAS and NAS—recently called for significant and immediate action on climate change. They fall into that topmost area on our spectrum of credibility, so it's worth looking at exactly what they said.

The American Association for the Advancement of Science, or AAAS, has 144,000 members, has been around since before the Civil War, and is the publisher of the journal

"Science"—the gold standard for peer-reviewed journals. In December of 2006, it approved an unprecedented statement calling for action on climate change. Next time you hear someone matter-of-factly say global warming is bunk, remember these next couple paragraphs, and who wrote them:

[On board: Google "AAAS statement climate change"]

The AAAS statement, starts out:

[ON SCREEN] "The scientific evidence is clear: global climate change caused by human activities is occurring now, and it is a growing threat to society. Accumulating data from across the globe reveal a wide array of effects: rapidly melting glaciers, destabilization of major ice sheets, increases in extreme weather, rising sea level, shifts in species ranges, and more. The pace of change and the evidence of harm have increased markedly over the last five years. The time to control greenhouse gas emissions is now."

[DESK] Remember—this isn't Al Gore talking. This is the AAAS.

[ON SCREEN] The statement continues on to say: "As expected, intensification of droughts, heat waves, floods, wildfires, and severe storms is occurring, with a mounting toll on vulnerable ecosystems and societies. These events are early warning signs of even more devastating damage to come, some of which will be irreversible. Delaying action to address climate change will increase the environmental and societal consequences as well as the costs. The longer we wait to tackle climate change, the harder and more expensive the task will be."

[DESK] Doesn't this make you little nervous? This isn't from your local "save the stream" organization. These are the guys who know what they're doing better than anyone else in the world.

And the statement ends with an uncharacteristic call for action.

[ON SCREEN] "It is time to muster the political will for concerted action. Stronger leadership at all levels is needed. The time is now. We must rise to the challenge. We owe this to future generations."

[DESK] This isn't Greenpeace. These are some of the stodgiest, most well-trained, intelligent people on the planet. They're not infallible, but if you're not going to listen to what they have to say about a scientific issue, then who are going to listen to? It's not a rhetorical question. Who would you listen to?

Maybe the National Academy of Science. NAS, which is pretty much the other crown jewel of scientific societies, has 2,100 members (1 of every 10 members has won a Nobel Prize), and has been around since 1863.

The NAS statement of June, 2005 wasn't just from the NAS. [Google "joint academies climate change"] It was a joint statement made along with the national academies of the other major industrialized countries (the G8), and included China, India and Brazil as well.

[ON SCREEN] The NAS statement said: "The scientific understanding of climate change is now sufficiently clear to justify nations taking prompt action," and it called on world leaders to "Acknowledge that the threat of climate change is clear and increasing," and to "Recognize that delayed action will increase the risk of adverse environmental effects and will likely incur a greater cost."

[DESK] There you have the two most well-respected scientific organizations on the planet (along with the national science academies of pretty much every other major industrialized nation) both saying: the globe is warming, we're the ones doing it, it's going to be bad, and we'd better do something about it quick. That is huge. This isn't just a couple, or

a dozen, or a hundred scientists talking.

That doesn't mean every member agrees with the statements, but if AAAS and NAS say something about a topic in science, that is the closest we are ever going to get to a statement of "What science knows." They **are** the Science Establishment (capital letters). If that's not good enough for you to change your mind, then I gotta tell you—nothing from science ever will be. Cuz it just doesn't get any stronger than that.

It's worth noting here that both the AAAS and the NAS statements **explicitly** endorsed the findings of the IPCC (Intergovernmental Panel on Climate Change). I mention this because a lot of skeptics simply dismiss the IPCC as a political hack, implying that its findings are incompetent and biased. Well, maybe now that won't be so easy, given the endorsement of the top two scientific bodies in the world.

AAAS coming out and saying that climate change is a real problem that needs to be dealt with fast is a lot like when the AMA came out and said that smoking was bad for you. You could still find doctors that disagreed, but the issue was pretty much as close to settled as it could ever be. The only way it could get any more settled would be if the tobacco companies themselves admitted it. Which they finally did, long after it was obvious to everybody that they'd been financing a misinformation campaign.

Well, it turns out, we can take that analogy even further. Because remember the other category at the top of our credibility spectrum—organizations making statements that contradict their normal stance? In the video "How It All Ends," I briefly shared—okay, I flashed it on the board for a little over one second—a tiny bit of the statement from the [SMALL BOARD] US Carbon Action Partnership (USCAP), which includes Shell, BP, ConocoPhillips, Ford, Chrysler, GM, GE, PGE, Dupont, and Dow Chemical. These guys are calling for mandatory requirements on carbon emissions—on themselves!

And get this: last year, none other than Exxon CEO Rex Tillerson himself said about climate change: "The potential risks to society could prove to be significant, so despite the areas of uncertainties that do exist, it is prudent to develop and implement strategies that address the potential risks." [Google "Rex Tillerson prudent"]

He may not sound totally gung-ho, but given that Exxon has long been the poster child of corporate climate change denial, that's pretty much like the tobacco companies finally saying that yes, it may be that cigarettes can harm you. Plus, for the first time last year, Exxon didn't donate to the Competitive Enterprise Institute, a think tank that has been at the forefront of the climate change issue.

In the past, when I've cited the AAAS and NAS statements, I've sometimes heard the criticism that those citations are just "argument from authority," and are therefore useless. Talk about grasping at straws. The criticism can be valid in a formal logic structure—like in mathematics. But if we're talking knowledge about the physical world, of course authority matters.

"Honey, remember your doctor warned that if you didn't cut down on the salt, you'll have another heart attack." "Don't just argue from authority. Explain to me the details of cellular metabolism and osmosis, or I eat as many chips as I darn well please."

And ask yourself this: does the Earth go around the sun, or does the sun go around the Earth? No one even seriously questions that anymore, right? Try this sometime. Stand and point to the sun in the sky. A few hours later, stand in the same spot, facing the same direction, and do it again. Is your arm pointing in the same direction as it was before? No! Clearly, the sun is the thing that moved, and clearly, the Earth is too large to have gone

anywhere, and is right where you left it.

If your senses—and your common sense—are so easily fooled, then how do you decide what to believe about the natural world? Well, why do you so firmly believe that the Earth orbits the sun, despite all evidence and common sense to the contrary? You believe it because: smart people told you so. And you trust them, when it's their area of expertise, and enough of them agree. Of course authority matters. That doesn't mean it's infallible—just ask Galileo. But it's certainly a better bet than armchair analysis.

So who is providing the rebuttal to AAAS, NAS, and USCAP? I'll share a handful of names, and if you keep your eyes open, I guarantee you'll recognize them in the future, cuz they come up again and again. [SMALL BOARD] Lindzen, Landsea, Singer, McIntyre, McKitrick—they're almost all professional individuals. Remember—there are a lot of people out there to cherry pick from.

Maybe this is the origin of the objection I sometimes hear: "It is true that the climate is changing, but there's a lot of debate about whether we're the ones causing it." Hopefully you see now from the AAAS and NAS statements that no—there really isn't debate about the cause of climate change. At least not in the scientific community, who really are the only people actually qualified to debate the evidence.

And these scientists who are climate skeptics? You'll hear them complain again and again that they've been marginalized because they spoke out against the orthodoxy. No. They've been marginalized because they no longer have any credibility with the other scientists. No one will even debate them, because they've gotten so far out there. Incidentally, that'll be a claim you hear, too—"The chickens won't even debate me, because they know I'm right."

So you will see quotes from guys with scientific-sounding titles after their name, giving reasons that human-caused climate change is bunk. They **can** be found. The Google is a wonderful thing. But just because someone on the web can provide quote after quote doesn't make the case convincing. Volume doesn't count for much when you're down here on the spectrum. The only category **less** credible than the one these guys are all in is some random jerk on YouTube. Wait.

[Beat]

Speaking of us jerks on YouTube—[we jerks? we jerk? !!!]—speaking of YouTube, I've had a bunch of people send me links to at least 3 separate documentaries on YouTube "proving" human-caused global warming to be false. Now, if someone sends you such references, you can either look up the criticism of those movies (being sure to evaluate the credibility of those providing the criticisms), or you can save time and short-circuit the whole debate by simply asking the person who sent you the links: "What is your explanation for why these filmmakers would be more correct about the science than AAAS and NAS?" If they fall back on "Well, the scientists have a vested interest in people listening to them, cuz it keeps the grant money coming, so they're biased," try applying that standard to the filmmakers—filmmakers vs. scientists for Pete's sake! Is it really reasonable to think that scientists' paychecks are **more** vulnerable to the public's tastes than filmmakers'?

[BOARD, GRID] Make up your own mind, but like I said in "How It All Ends," it sure seems to me that the reasons are overwhelming to believe that this row has a much greater probability than this one, pushing this line up.

CONSEQUENCES

[DESK] Now remember, we're trying to get a sense of which column is our best bet by using the tool of expected value, which has two components: probability—which is what we've just been establishing—and consequence.

With the consequence, it'll be a little confusing here, because in my earlier example about expected value, the consequence was a payoff from the bank, and therefore a positive thing, that we wanted to maximize.

Here, the consequence is going to be the negative impacts of our actions, which we want to minimize. So once we get our expected value, we'll want to pick the column with the **lower** expected value, because it will give a sense of the pain and suffering we can expect from choosing that column.

Another complexity is going to be that—unlike with our gaming example—we don't know what the consequences in a box will be. That in itself has lots of uncertainties. In fact, in a long back-and-forth with one skeptic as I was trying to find a credible source for the possible consequences here, he finally got exasperated and said "Economic models are even less reliable than climate models!" Which I thought was kind of funny, cuz skeptics are usually all over climate models like a bad rash.

[BOARD, GRID] So when you hear skeptics warning that we shouldn't take action because it might hurt the economy, ask yourself—or ask them, if you're feeling up to it—where's the acknowledgement of uncertainty here, that is the hallmark of the careful, methodical scientist down here?

[DESK, different angles] A: "Anthropogenic global warming is uncertain, and might [have the word "might" flash in real time on the screen] not be true, so we shouldn't take action yet."

B: "Why not take action, just in case? Better safe than sorry."

A: "Because it would [flash "would'] hurt the economy."

Did you catch the Jedi Mind Trick?

Maybe this hypocrisy of implying certainty for their side while attacking the uncertainty of the other side will count for something when you evaluate these arguments for yourself in the future. After all, where's the wisdom in ignoring the warnings from the more reliable model of climate change, in favor of heeding the warnings of the **weaker** model of economics?

[BOARD, GRID] Anyway, to simplify our expected value estimation, let's neglect putting in the proper range of consequences in each box, and instead just take the feasible worst-case scenario, because that's what we really care about, right? "What's the worst that could happen?" That gives us a single value for a consequence that we can then multiply by the probability of the row to get the column's expected value.

Let's start with the upper left box, where we took action, but didn't need to, because human-caused climate change turned out to not be true after all. This is the consequence that the skeptics warn us about. When I first did this grid in "The Most Terrifying Video," I put in worldwide depression up there. But get this—I just pulled that out of my hat—I totally made it up! Because I was trying to show extremes.

But people got hung up on it, so this time I decided to try to get some reliable sources instead of just blowing smoke. I did a bunch of searching, because I wanted to find some really credible stuff, maybe a professional association of economists, like AAAS and NAS, but from the other side of the debate.

I wasn't finding much that wasn't on the bottom of the credibility spectrum, so I

challenged climate skeptics to find good sources predicting dire economic consequences for me. I put the challenge in the comments to my "Most Terrifying Video"—I was even deliberately brash, trying to provoke response. It felt kind of naughty.

I had a long back-and-forth with a quite thoughtful, educated guy who referred to his first long response as "The Thinking Man's Objection to AGW," a description I found a little odd. I emailed the big conservative think tanks: Cato, CEI, AEI, Heritage. I asked for help in some climate skeptic discussion groups. I even emailed Prof. Ross McKitrick himself—one of the most prestigious skeptics, who is a professor **of economics** at the University of Guelph in Canada. I figured if he didn't know, nobody did. And he sent me several documents.

The reason I went to such great lengths was I was want to avoid the confirmation bias described in my video "Nature of Science" by trying to find evidence to **disprove** my views. I hope you'll agree that I did a conscientious job looking.

Well, if you're skeptic, don't get your hopes up, cuz **with all that**, I couldn't find any credible economic disaster scenarios—that is, from sources above conservative think tanks or professional individuals on the credibility spectrum. To be honest, I didn't even try to find anything from those sources, because I knew I wouldn't put much stock in it. Maybe economic disaster scenarios resulting from unnecessary action on climate change doesn't even exist above the individual lay person, which would really say something, wouldn't it?

Anyway, the most dire stuff I could find that was credible entailed a reduction in GDP growth, with a maximum estimate of 3%. Keep in mind, that's not a reduction in GDP—that's a reduction in GDP growth, meaning it's not growing as fast as it otherwise would have. There's a ton more econometric numbers in there, but I couldn't find any sort of concrete description of the fallout of that, like a depression.

And that 3% was the outside prediction—most credible sources put it closer to 1.5-2%. Certainly no mention of a depression, even in just the U.S. If you'd like to look at the documents Prof. McKitrick sent me, I've made them available online—perhaps they're more dire than I could make out. I put them on GoogleDocs and I'll provide the URLs at the end of this video.

Sorry for the formatting disaster—I received them as pdf's, which GoogleDocs doesn't accept, so I did what I could to make them available. I'm sure there are plenty of you out there smarter than me. Let me know what you figure out.

[BOARD, GRID] So, no depression up here. Just some wasted economic resources that could have gone for something else, but no global depression giving rise to the next Hitler or nuclear war. Let's not trivialize the economic costs—I've been laid off before because of a recession. It sucks. But compared to what's in the lower right corner—well, we'll get to that.

[DESK] The other source a bunch of people pointed me to was a project called the Copenhagen Consensus, headed by economist Bjorn Lomborg, author of The Skeptical Environmentalist. It was an interesting project where 8 economists, 4 of them Nobel Prize winners, got together and asked "Faced with all the world's problems, if we had 50 billion dollars over the next four years to spend to do good in this world, where should we spend it?"

They ended up putting climate change on the bottom of their list, for some interesting reasons, which I won't debate here for two reasons. First, it doesn't help us with our grid, because it doesn't answer the question "What is the feasible worst-case scenario for harm if we take action on climate change and it turned out to be unnecessary or ineffective?"

And the second reason is, because if you Google "economists' statement climate change," [on board] you'll see that Lomborg's self-selected group of top economists (including

4 Nobel Laureates) is countered by another self-selected group of top economists (including 6 Nobel Laureates), which conclude, amongst other things, that [ON SCREEN: "ECONOMISTS' STATEMENT ON CLIMATE CHANGE" — Feb. 13, 1997] ". . .there are many potential policies to reduce greenhouse-gas emissions for which the total benefits outweigh the total costs. For the United States in particular, sound economic analysis shows that there are policy options that would slow climate change without harming American living standards, and these measures may in fact improve U.S. productivity in the longer run."

They say action would actually be **good** for the economy, which is an argument I've heard a lot of individuals make. Things like "energy efficiency saves money," "early pioneers in an industry make the big money," and so on, which is food for thought, but doesn't help us with our expected value calculation.

Now, I know I said let's not take into account the range of possible consequences in a box so that we're just looking for disaster scenarios, but I found something interesting along the lines of action having positive rather than negative effect on the economy that I thought was interesting. USCAP, that group that includes all those heavyweight companies like Shell and Ford, says some surprising things in their document. Most notably:

[ON BOARD] "In our view, the climate change challenge, like other challenges our country has confronted in the past, will create more economic **opportunities** than **risks** for the U.S. economy," including (my paraphrasing)

- creating new markets
- increased U.S. competitiveness
- reduced reliance on energy from foreign sources
- increased energy security
- improved balance of trade
- world leadership for the U.S."

[DESK] These guys make this box sound like a party! What a deal—reduce the chance of a global catastrophe, and get paid to do it! Sign me up!

But wait, if it's such a good deal—if you can cut emissions and not pay a cost—then how come not all businesses are doing it yet?

Look, change is hard—for all of us—okay? There's a reason that the phrase "business as usual" is used to refer to not being innovative or seeking to improve. It's way easier that way. Plus, that question sort of assumes that businesses are all-knowing, doesn't it? That if businesses aren't doing things a better way now, then that must be because a better way doesn't exist? That it never takes time, or pressure, to come up with better ways to do things? That necessity **isn't** the mother of invention, but just a distant cousin? Sometimes, a prod is helpful.

In 2002, BP committed to cutting its own CO_2 emissions by 10 percent over ten years, to get good publicity. At the time they calculated that they could do it at no net dollar cost, and would get great publicity. Well now, they say it's going to end up saving them $650 million through energy efficiency! That's cool! And it shows that the dire warnings of the economic doomsayers are really starting to look pretty flimsy.

Along those lines here's another thing I turned up that I want to share here as you are making your own evaluation of the predictions of economic doom and gloom that the hard-line skeptics seem to so often resort to. [SMALL BOARD] Google "Backgrounder #1229," and you'll get the Heritage Foundation's commentary on a 1998 DOE report about the economic impacts of the Kyoto Protocol. (The DOE report was actually one of the documents Prof.

McKitrick sent me.)

The Heritage Foundation's article is subtitled "More Bad News for Americans," and their lead economic consequence, the biggest, scariest impact that they chose to highlight to warn the reader of the "Devastating Economic Consequences" was: if we followed the Kyoto Protocol, by the year 2010 a gallon of gasoline could cost as much as $1.91. I had to laugh. I mean, to be fair, there's lots of other numbers in there. But that's the scariest thing that they could dredge out of the report, and they repeated it three more times! Given that they're always calling the people who advocate action on climate change "Chicken Littles," you just gotta appreciate the irony.

What wasn't a laughing matter, however, was how deviously manipulative the article was. It was supposedly about the DOE's report, but woven in with the mild quotes from the DOE report were quotes from "a nationally recognized econometric firm," which were the ones predicting dire consequences. The carefully crafted message that the casual reader takes away is that the heavyweight DOE report predicted harsh economic consequences from the Kyoto Protocol, something that simply wasn't true if you looked at the actual report. I take the time to relate this to you in order to underscore the importance of evaluating your sources. That Heritage stuff was downright slimy.

[BOARD, GRID] Yet another rosy economic view of the upper left box by a heavyweight economist is the Stern report of the British government, which says this will cost 1% (pointing at upper right box) of GDP, but this would cost 20% (pointing at lower right box).

So try as I might, I just couldn't find a credible economic disaster scenario for this box. That doesn't mean it doesn't exist—maybe you'll find one and send it to me. But I think you'll at least agree that I tried to be conscientious in looking.

But really, I didn't need to do all that looking, and you didn't need to do all that listening, because here's a point that makes the severity of the economic costs up here moot anyway. Think of it this way if you'd like: the main idea of those who warn that the negative consequences up here are worse than the negative consequences down here, is that government spending and regulation would be bad for the economy. For the moment, let's simply accept that thesis. Now, imagine the scenario here: we take action on a nebulous threat, but we have the time to do our best to ease the restrictions into place in a planned and thoughtful manner, to minimize the chance of disrupting the economy, skeptics have time to protest, the usual mess of capitalist democracy in action.

Now, imagine the scenario down here. We chose to not take action on climate change, and it ended up happening, despite what anyone's opinion was. A world full of natural disasters. Will we just sit there and take it? No. If we're getting battered and bruised, we're going to do something about it, quickly. And in a panic. Extreme things, maybe even draconian things, because our coastal cities are flooding.

So if planned, controlled action up here is bad for the economy, how much worse for the economy will panicked, harsh action down here be? An economy which has already been battered by disaster after disaster in a destabilized climate and has fewer natural resources like croplands and predictable growing seasons.

Up here you've got negative economic consequences, and anything that flows from it. Down here, you've got all of that—every bit of disaster scenario that the individual lay blogger wants to conjecture—plus a bunch of bonus features. So no matter what feasible worst-case economic scenario we grant up here, it is included and made worse down here.

So, we've made a very conscientious effort to find credible worst-case economic

scenarios that spell disaster up here, and haven't come up with much.

Let's now look at that other big negative consequence on the board, where we chose to not take action—or we debated too long (same thing)—and human-caused climate change turned out to be true. Here our feasible worst-case scenario gives us political, social, environmental, public health, **and** economic catastrophes on a global scale.

Sea levels rise 20, 30 feet, entire coastal countries disappear, hundreds of millions of refugees displaced, pushing in on each other, causing widespread warfare over scarce resources and ancient hatreds, entire forests die and burn, massive floods alternate with killer droughts, the breadbaskets of the U.S. and Russia turn to dustbowls, leading to catastrophic famines, dreadful epidemics spread like wildfire, storms like Katrina and Mitch are the norm, plus all the economic harm from up here, exacerbated by haste and natural disaster.

We're talking a world straight out of science fiction, a world that makes Al Gore look like a sissy Pollyanna with no guts who sugar-coated the bad news. If the statements from the experts aren't enough for you in deciding which column is the better choice, just bring your common sense to bear.

Which situation sounds like it would do more damage to the economy: government spending and regulation up here, or a world halfway to Mad Max's Thunderdome down here?

Watch the video "How It All Ends: Scare Tactics" if you want details for where that picture comes from.

So, let's recap, and then we can apply the expected value calculation.

First, to establish the probabilities of these two rows, we looked at a bunch of sources.

[BOARD, credibility spectrum with sources on sides] These sources essentially say that human-caused climate change is most likely true and serious. These sources say that human-caused climate change is either not true, or true but not serious. Looking at where all of these sources fall in terms of our assessment of their credibility, it seems pretty much irrefutable [BOARD, GRID] that this row is much more probable than this row, which we can represent by moving this line up.

Then, in terms of consequences, we decided to not worry so much about the range of possibilities, and simply accept the feasible worst-case scenario for each. Up here, we've got reduced GDP growth, and all that ripples out from that.

Down here, we've got what seems to be almost a Mad Max world. We've stacked up Lomborg's 4 Nobel Laureates vs. "The Economists' Statement on Climate Change's" 6 and called it a wash, as well as showing that any negative economic consequences up here are not only included, but also made worse down here. And we've deferred looking at the details behind the physical consequences here to the video "How It All Ends: Scare Tactics."

Now for the hard part—we need to come up with some actual numbers for probabilities and consequences in order to then do our expected value calculation. Except, lucky for us, we don't. Because we've just hit a special case in expected value. We've established that both the consequence and the probability of this are greater than this.

And if you go back to our original gaming example, you'll see that in such cases we don't even need actual numbers in order to know which expected value will turn out larger. Play with it, and you'll see that no matter what the exact numbers are, if both the probability and the consequence of this box is greater than those of this box, the expected value of this column will turn out to be larger than this column.

Remember, in this application, the expected value we're talking about is a bad thing, because it represents our suffering. So we would definitely be betting against the odds, and against our own rational self-interest to pick this column, because it's expected value of suffering is greater than this column—probably much greater. Remember, this is how casinos and insurance companies do business. They've got it figured out. Why should we ignore such a successful tool when betting on the future of the planet—I mean us?

Now, I want to be completely intellectually honest with you, because stuff like that Heritage Foundation article I mentioned earlier just really ticks me off, and I don't want to even be accused of bowing to their level. So, to avoid being like them, I want to tell you that for the sake of accessibility, I did a little sleight of hand with the expected value "calculation."

I don't see how it could change the conclusion, but then, I'm only human and I could be wrong. And you shouldn't believe anything I say anyway, but check it out for yourself. Here's the deal: really, the expected value of a column should be the sum of the expected value of both boxes in that column, and we only looked at the worst-case scenarios in each column. If that simplification doesn't do it for you, and you want the greater complexity, then go watch the video "How It All Ends: The Manpollo Project."

[DESK] You may be thinking to yourself "Did he just take 30 minutes to tell me 'Better safe than sorry?'" Pretty much. Only it's a bit more well founded, cuz "Better safe than sorry" applies to building a defense system against Giant Mutant Space Hamsters, just in case some attack, and as I hope you've seen, this risk management is robust enough to not be slain by that criticism, because we established the credibility of the threat.

Also, I've heard the criticism that this is the precautionary principle, which is supposedly self-contradictory (at least according to Michael Crichton and Wikipedia, both well-credentialed philosophers). Regardless of the validity of the precautionary principle, this ain't it, because this isn't formulated with the criterion of scientific consensus, but just likelihood of outcome.

If you think it's self-contradictory and invalid, go tell the casinos that there's no way they're going to make any money if they keep giving stuff away all day. I'm sure they'll appreciate your keen insight.

Before we wrap up this brief [bullsh*t!] exploration of risk management, there are a few loose ends to tie up, most of them objections that I've heard about these arguments.

Objection: "I think we'll innovate ourselves out of any problem. We always have in the past. I mean, we're still here—right, Mr. Gloomy?" My response is: you don't base your decision to buy car insurance on optimism, but on a realistic assessment of the worst case scenario. We pay to insure our cars, our homes, our health, without knowing for certain that anything bad is going to happen. Why is it suddenly different here?

As for putting faith in science to get us out of any jams in the future, umm. . . that's pretty much what the scientists are trying to do right now, but no one's listening. They're saying "knock off with carbon emissions, cuz it's probably going to totally hose us." I think the only reason we're still talking about this is that NAS and AAAS don't have a huge advertising budget to get the word out.

And the exuberant faith that our innovation will magically do whatever we need it to quickly becomes ridiculous. The late Julian Simon, a well-respected economist—and, I've

read, Bjorn Lomborg's inspiration for writing The Skeptical Environmentalist—actually wrote "the quantity of copper that will ever be available to us is not finite."

Wait, if something's not finite, doesn't that mean it's infinite? Is he saying there's an infinite amount of copper available for us? Is he still reading those alchemy books? Do you think, on a scientific issue, it's wise to listen to people so clearly ignorant of science?

As for the idea that we shouldn't get all worked up because—hey—we've always managed to avoid global catastrophe in the past, that just reminds me too much about what a good friend of mine in high school used to say. He'd do careless, stupid, things, and when I chided that he should be more careful, he'd say, "I haven't died yet. So I'm not going to."

It was a joke. It was funny. He's dead now, from driving drunk. That's not funny. That's deadly serious. Is that really the way we want to decide on public policy that influences everybody on the planet? "We haven't hosed ourselves yet, so we're not going to."

Objection: "That grid is just Pascal's Wager, which has more holes than Swiss cheese. You can't put lipstick on that pig." No, but can I put the pig and cheese on rye? Nah, it looks like Pascal's Wager because they are both basic decision grids. What sunk his was the infinite payoffs, and assumptions without evidence. This one has finite payoffs, and assumptions **based on** evidence.

Objection: "Whatever negative economic consequences show up here (pointing at grid) would show up here too, since they're a function of our action, not of what the physical world ends up doing. So if we choose action, we're doomed to economic harm."

My response: remember, the negative economic consequences of the left column are just the worst-case possibilities—they are not guaranteed to happen. So choosing action does NOT doom us to economic harm, or even economic costs. That's just the **worst-case** possibility. Watch the video "How It All Ends: Get What You Want" to see how it's actually quite likely that column A would be a net benefit to the economy.

Anyway, if you think adding the worst-case economic scenario to the bottom left corner would change the expected value of column A compared to column B, that's a pretty complicated calculation. Actually, it's a pretty simple calculation, but coming up with the numbers to put into is very complicated. If you want to do that, then go watch the video "How It All Ends: The Manpollo Project."

Objection: "The upper right corner is the only box that looks attractive. So I choose column B." My response: hey, that's fine if you're playing the tables at Vegas—I think that's called being risk-seeking rather than risk-averse. But you're not playing at the tables with your own money. You're playing with the globe which the rest of us have to live on.

That's not called risk-seeking or risk-averse. That's just called being a selfish prick ["jerk"]. Go watch the video "How It All Ends: No Holds Barred" to see why that's such an embarrassingly ridiculous stance to take.

Objection: "We should be saving up for real threats, like the asteroid Apophis hitting us in 2036. If we've squandered our money on the climate change boondoggle, we'll be too economically crippled to do anything about it." Okay, that's just bizarre. And I heard it several times.

You're going to believe scientists when they talk space rocks, but not when they talk climate science? And if you do believe the space rock scientists, then you haven't even been paying attention, cuz that asteroid has been taken off the danger list. If that's your reason for not worrying about climate change, I'm afraid you've got bigger problems.

Objection: "It's not that simple. What about the intermediates between no action and

all-out action? What if climate change is happening, but we're not the ones doing it? What if climate change is happening, **and** we're the ones doing it, but our actions don't stop it? Or they make it worse? You need more column and rows."

My response: Okay. Let's talk about that. Take a swing through "How It All Ends: Why There Is Still Debate," and then I'll meet you at "How It All Ends: The Manpollo Project," where we'll get radical and totally blow this grid up.

For the rest of you, when you look at the statements from AAAS and NAS saying that climate change is a real threat, and at the statements from so many industry and economic sources saying that taking action will probably help—rather than hurt—the economy, doesn't it start to seem kind of ridiculous that we're still talking about this? Let's get going. Forward the video to others. Talk about it to friends and family. Git 'er done.

http://docs.google.com/Doc?id=dw69vk2_1grchjj
http://docs.google.com/Doc?id=dw69vk2_3f9z7hv
http://docs.google.com/Doc?id=dw69vk2_5fzs8wb
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——end——

"How It All Ends: Why There Is Still Debate"
(original script—final version)

*AUTHOR'S NOTE: This is the original script, but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution*," please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck! (wonderingmind42@gmail.com, 25OCT2007)*

This video is called "Why There Is Still Debate" and is part of the expansion pack providing further detail to the arguments contained in the video How It All Ends.

This video will explore the question of why there is still popular debate on the topic of global climate change, in spite of overwhelming agreement in the scientific realm.

I've sometimes heard the objection: "But I've heard the opposite of all that you say about climate change, so doesn't that prove it's still being debated?" Sure. I guess by definition if you see differing opinions, then it's still being debated. In the media. In the popular press. In the blogosphere. But not in the scientific realm.

As you may have seen in the video "Risk Management," the unprecedented statements from AAAS and NAS—probably the two most well-respected scientific organizations on the planet—make it clear that the best that science has to offer tells us that: 1) the globe is warming, 2) we're the ones doing it, 3) it's going to be bad, and 4) we'd better do something about it quick.

If these statements as well as the others examined in that video make for such a slam dunk, then why do we (in the US, at least) still hear so much debate?

I think there are probably a lot of reasons for that.

First off, I found some surveys that indicate it's the lack of absolute certainty that's holding most people back. If that's the case for you, I think that if you watch the "Nature of Science" video, you'll see that waiting for certainty from science is a losing proposition, and if you watch the "Risk Management" video, you'll see that we can still make good decisions without knowing for certain what's going on with climate change.

This hesitation on the public's part allows organizations and companies which stand to be inconvenienced or economically harmed—in the short run—to delay action by playing up the uncertainty of the science. The basic way it works is this: every statement in science is accompanied by an explicit acknowledgement of uncertainty.

Good scientists will be very explicit about the uncertainty. Vested interests—like trade organizations, think tanks, some governments, and individual companies—then emphasize this uncertainty. The media has a couple of reasons to include and amplify this uncertainty. The first is, they know that controversy sells. And the second is, they don't want to be accused of bias, so they go out of their way to present "the other side." Unfortunately, this creates the illusion that the two sides actually carry equal weight in the scientific community, which you've seen, they don't.

The Union of Concerned Scientists—which **is** an advocacy organization, but is rigorous enough that they are often consulted by the government—observed that "public opinion can be easily manipulated because science is complex, people tend to not notice where their information comes from, and because the effects of global warming are just beginning to become visible."

This is starting to change. Exxon—sort of the poster child for this dynamic of propagating public doubt about climate change—just recently made some stunning public shifts. In a January 2007 Wall Street Journal article, when Exxon's vice president for public affairs Kenneth Cohen was speaking about greenhouse gas emissions and their effect on global temperatures, he was quoted as saying: "society knows enough now—that the risk is serious and action should be taken." And in 2006, Exxon, after funding them for years, stopped funding the Competitive Enterprise Institute, a think tank that ran ads just last year saying that carbon dioxide is helpful, rather than a problem.

So there is indeed deliberate manipulation of public perception in order to serve the interests of stakeholders. On some level, I suppose you can't fault them. After all, they are just playing the game we've got, since the whole purpose of a publicly-traded corporation is to "increase value for shareholders," not "do the greatest good for the greatest number."

Although some of them, you can fault. It's worth including here a story that I also share in the video "No Holds Barred," just in case you don't manage to slog through that one, because it's significant, and really helped galvanize me to action.

On either side of this bitter debate, you hear accusations that the other side is in somebody's pocket. From the skeptics you'll hear "It's just a liberal plot to get control of our lives," and it's not uncommon for a warmer to imply that anyone who argues hard for the skeptical side must be a corporate shill. I figured that the idea of vested interests hiring people to surf the net and argue for the skeptical side wasn't too outlandish, but I also thought it sounded a little too sinister to probably be true.

Well, a couple months ago, I was reading a back-and-forth discussion about Grist.com's "How to Talk to A Climate Skeptic," [Google the exact phrase "We're all seekers for truth here" WITH THE QUOTE MARKS] and there was one guy really taking the lead for the skeptical view, talking quite reasonably how there's a lot to be said for both sides, and the science on the issue is divided, which is why people are divided, etc. He was saying stuff like "The truth is that reasonable people of good will can look at the same evidence and come to opposite conclusions, including scientists. This is what makes the climate change debate so interesting. It is one of the greatest scientific debates in history." Seemed like a very reasonable, nice guy who just happened to hold a different opinion than mine.

Imagine my surprise and horror when someone outed this guy as a consultant hired by the electric power industry! And as soon as that was revealed, the guy immediately disappeared, though he had been countering most every point up to then! It was really creepy! Especially when I looked back on the stuff that he had written that I had excused before as being simply uninformed, but really, was deliberately manipulative, and downright intellectually dishonest. "This is what makes the climate debate so interesting. . ." It's not 'interesting' you jerk—it's potentially life or death for real people if the worst case scenarios actually come to pass! We're not **sure** it'll happen, but that's what the rest of us are sincerely trying to avoid. And you find it an 'interesting' discussion. It's hard to convey how angry that makes me, to see someone so careless about their impact on other people's lives.

I felt so violated! I share this with you here because you should know that there are indeed selfish, dishonest people out there who will try to manipulate you for their own benefit, regardless of any harm to you. Given that I actually ran across a guy doing this leads me to conclude that it's not that outlandish to assign a good amount of the remaining public debate about the issue to a campaign by vested interests to take the inherent uncertainty of all science and cloud the public's perception of this issue.

That said, being human, we have a number of psychological factors which make us quite susceptible to that kind of manipulation [of "the inherent uncertainty of all science and cloud[ing] the public's perception of this issue"].

One is simply fear of change. If what AAAS and NAS say is true, then it sure sounds like we may be in for some really big lifestyle changes. So it's natural to just tune it out. If global climate change is really as much of a big, ugly beast as science says it might be, that really threatens the status quo, which people assume would throw millions of people's lives into turmoil and change. So they resist the conclusion because they're afraid of it, not because they understand it.

I know personally, when I talk to people about climate change, I'm always very anxious of being criticized and dismissed for "using scare tactics," which for some reason is a fatal criticism—once someone slaps that label on you, your credibility is destroyed and no one will listen to you unless they **already** believe what you have to say.

But can't you imagine a possible situation in which perhaps you aren't scared enough for your own good? Couldn't "scare tactics" be a positive thing then? I read a totally engrossing newpaper column a year or so ago titled "If Only Gay Sex Caused Global Warming," by Daniel Gilbert. He's a psychologist, and his basic point was that the human brain is conditioned to respond to threats that are immediate, quick, visible, and personal. I call it the Saber-Tooth Tiger Reflex. I'm not sure if I just made that up. ". . . [W]e accept gradual changes that we would reject if they happened abruptly," he wrote. "If climate change had been visited on us by a brutal dictator or an evil empire, the war on warming would be this nation's top priority. . . . When terrorists attack, we respond with crushing force and firm resolve, just as our ancestors would have. Global warming is a deadly threat precisely because it fails to trip the brain's alarm, leaving us soundly asleep in a burning bed. It remains to be seen if we can learn to rise to new occasions."

And there's the hitch. Our way of dealing with problems—being reactive to

them—has worked out okay for us as a species so far. When we've really blown it somewhere, we could just move on to new ground. But now, with six billion people and techonology that changes the whole bloody planet, there's nowhere to run to. Nowhere to hide.

Which creates another psychological stumbling block. If a situation is too big to comprehend, or too threatening, then our screen just goes blank. Who among us has not stuck our head in the sand, and ignored a terribly pressing problem, subconsciously hoping it will just go away, and dreading the time of reckoning when it must be faced, knowing all along the situation will only be the worse for our inattention, but still not rousing ourselves to action?

And then there's the dynamic of confirmation bias which I detailed in the video "Nature of Science," where we pay more attention to the evidence which supports what we already believe, and less attention to the evidence which contradicts it. This explains what was a very puzzling discovery for me. I came across a poll about public attitudes towards global climate change. And it showed there was a significant split across party lines in terms of the percentage of people who believed that humans are causing the globe to warm up.

Now, you probably don't find it surprising that more Democrats than Republicans believe in global warming, and ordinarily I wouldn't either. But I'd been steeping myself in this question of how do you go about deciding what to believe about what's going on with the physical world, and this split along political party lines about a physical reality just sort of blew me away. Why the heck should political belief influence one's assessment of what is physical reality? I just got this ridiculous picture in my head of a Democrat and a Republican standing and looking out the same window—the Democrat saying "Gee, it's pouring rain out there," and the Republican saying "No, it's a sunny blue day." And of course the Greenie saying "Hey—let me see!"

So how does confirmation bias explain that split? It's fair to say that Republicans have a greater distaste for government than Democrats, and if climate change is really being caused by humans, that strongly implies the need for more government action. A Republican would rather not see this happen, and so confirmation bias ends up making more of the "global warming is a hoax" evidence stick, and less of the "global warming is a problem" evidence stick. Along these lines of conirmation bias, I can't tell you how many times a skeptic has posted a comment along the lines of "Here are three movies on YouTube you MUST see. They all prove how global warming is a hoax."

It's true that films like "The Great Global Warming Swindle" and "An Inconvenient Truth" are exactly these sorts of evidence that can strongly feed confirmation bias. And you can bet that the fans of each movie have a pretty strong political profile, despite the significant difference in how the two movies have stood up to analysis by credible sources. That's probably because we're not in the habit of going out of our way to see if we're wrong. Really, who likes being shown to be wrong?

If you're a fan of "An Inconvenient Truth," how much research have you done into the critiques of the movie? How about if you're in the "Great Global Warming Swindle" camp? Have you looked up some of the really embarrassing goofs the filmmakers made, like filling in the blanks on some of the scientific graphs? Oops. Do some open-minded googling there, and you may be stunned. Whichever movie you're a fan of, you

owe it to yourself: if you can only find weak critiques that are easily dismissed, that increases your esteem for your favorite movie. And if you find there are a bunch of fatal flaws, then thank goodness you found out now rather than later, and can dump that stinker as fast as possible.

It's just natural when you go about collecting evidence and arguing again and again to become really convinced yourself, and lose the ability to see that perhaps you could be wrong; perhaps someone else does make a valid point. I know it's happened to me as I've steeped myself in the evidence and arguments in writing these videos. More than once I caught myself thinking "My God—how could anyone not be convinced??" So it is a difficult but very worthy skill to step back and clear the board, saying to yourself: "Okay, I'll pretend I haven't formed an opinion yet. Let's see how the arguments stack up against each other." I try to aspire to it, though I'm not always successful.

In fact, as hard as I try to form watertight conclusions, I still hope I'm wrong. Which is an idea so important, it's got its own video: "I Hope I'm Wrong."

——end——

"How It All Ends: Manpollo Project"
(original script—final version)

*AUTHOR'S NOTE: This is the original script, but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution*," please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck! (wonderingmind42@gmail.com, 25OCT2007)*

[DESK] This video is called "The Manpollo Project" and is part of the expansion pack accompanying the original video "How It All Ends."

This video is to address the concerns of all those who feel that I've oversimplified something inappropriately in my risk management approach to climate change represented by the grid in the video "How It Alls Ends," and that that oversimplification can't be ignored, because it would qualitatively change the outcome of our analysis.

Generally, I get accused of being either incompetent or manipulative by simplifying. So here, we'll answer that. So if you think I oversimplified inappropriately, here we'll make sure we don't do that, by taking the full complexity head on, and not shirking a single detail. So buckle your seatbelt.

Regarding the grid, I've often heard objections such as: "It's not that simple. What about the intermediates between no action and all-out action? What if climate change is happening, but we're not the ones doing it? What if climate change is happening, **and** we're the ones doing it, but our actions don't stop it? Or they make it worse? Don't we need more columns and rows to account for all of those possibilities?"

Okay, those are all valid, but before we explore them, I'll point out that if you first watch the videos "The Mechanics of Climate Change," "Scare Tactics," and "The Solution" you'll probably see how unfeasible those last three scenarios are—that is, how clear it is that we are the ones doing it, and that action would be only beneficial—and you might no longer be concerned with the need to include them as rows before using the grid to draw a conclusion about what to do.

Also independent of whether the science I explained in those three videos allays your concerns, the video "Risk Management" points out that the top scientific organizations in the world have publicly and explicitly said: yes, the globe is warming, yes, humans are the ones doing it, and yes, our actions will have an effect, but we'd bettter get on it quick. So the short answer to the objections is: who are you and I to

argue with the top scientists about the science?

But, some of you still don't trust the objectivity or competence of those scientific authorities, so we'll take on all those "what if's" head on, and include them in our pathetically oversimplified grid. Here we go.

[At BOARD, big GRID] Holy sh*t, it exploded!

Across the top we've got five columns representing five different degrees of action, from all-out to status quo. Down the side, GCC stands for global climate change, A stands for anthropogenic, or "caused by humans." T and F are for AGCC ending up being true or false, and we've got the effects of our actions on the climate—positive, negative, and no action.

So we've got scenarios that range from:

GCC false, but our actions negatively affect the climate
GCC false, climate not affected
GCC false, climate positively affected
GCC true, but not A, and actions cannot affect climate
GCC true, but not A, can be negatively affected
GCC true, but not A, can be positively affected
GCC true, A, can not be affected
GCC true, A, actions negatively affect climate
GCC true, A, and our actions positively affect climate

Into each of these 45 boxes we put our different economic, environmental, social, political, and public health scenarios. If you recall our "expected value" discussion from the video "Risk Management," you might think we would then assign to each box a number to represent the consequence if that scenario happened—in this case, the cost to us. Not just the economic cost, but some sort of quantified measurement of the various forms of suffering or benefit.

[DESK] But if you remember in that video, I pointed out how each box actually contains a range of possible consequences, and that to simplify our expected value calculation, we purposefully neglected to take into account that range, and instead just took the feasible worst-case scenario. This led a number of people who looked at the simplified grid to claim that column B was the better bet, because they forgot that was just a simplification, and therefore they assumed that choosing column A doomed us to economic harm, no matter how the truth of global climate change played out.

But, now that we're unpacking that simplification, it's clear from what I shared in the videos "Risk Management" and "Get What You Want," choosing column A only brings with it the POSSIBILITY of economic harm, not the certainty. As you saw in those videos, long and conscientious searching on my part turned up exactly zero economic doomsday scenarios from credible sources. All the economic doomsday stories turn out to be simple conjecture from people at the very bottom of our credibility spectrum. And in fact, a number of quite credible sources, including industry leaders in the US Climate Action Partnership, assert that column A quite likely leads to economic

growth. So, that should get us over our economic phobias surrounding column A and the boogeyman of government action.

[BOARD, BIG GRID] So if we're sincerely trying to not oversimplify here, what we need to do gets a little complicated. Fortunately for us, the tool of expected value is scalable, and can be applied recursively. So we'll go into each box, look at the full range of possible consequences—say in here from global depression all the way to wild economic boom—assign numerical values to each of those possible consequences.

To stay backwardly compatible with our previous oversimplification, let's still represent consequences that cause suffering as positive numbers—the greater the magnitude, the greater the suffering or impact—and let's set zero as neutral—no deviation from the norm. Counterintuitively, that gives us negative numbers for good consequences, like an economy boosted by innovation, but we can handle that. That's why we're here, instead of stopping at the oversimplified four-boxer.

So next, we'll multiply each of the possible consequences in a box by the individual probability of that consequence happening, to give us an expected value for each possible consequence. Then we'll sum up all those expected values of the different possible consequences in just that box to get the expected value of that box as a whole.

That will give us a single number we can then use as the consequence of that box (of course you'll recognize that it's really the expected value of the box itself). This replaces the assumed worst-case scenario we used before, which had confused some people into thinking that choosing column A doomed us to economic harm. So we've taken care of that problem.

Then we'll calculate the expected value for the whole column, by multiplying the consequences of each box (again, really the calculated expected value of each box) by its probability, taken from the row, and sum up those nine products to get the expected value of the column. You'll recognize that's the exact same process of taking the sum of a series of products that we did in each box, illustrating the very slick recursive nature of the expected value.

Then we'll move over and do that same process for each column, and the next, and so on. That will eventually give us an expected value assigned to each level of potential action, and we finally get the satisfaction of simply looking at five numbers and asking: which one is the closest to negative infinity? Because that will tell how how much suffering we can expect if we choose that column.

Recall that to stay consistent with our original four-boxer grid-for-the-masses, zero is neutral, positive numbers are suffering, and negative numbers are actually benefits, so the greatest benefit comes from the number that is farthest to the left on a number line. And remember, there are no guarantees, because there were probabilities of probabilities layered in here. But expected value is a well-proven tool, used by businesses all the time, and it's the best we've got here. Okay, let's get started. [Fake a start.]

Oh, and you'll recognize, of course that the probabilities of all of our rows are going to need to sum to exactly 1, if we're trying to be thorough and not neglect any scenarios. That one of course represents the fact that we a have 100% chance of something being true. So the absolute probabilities we distribute across these columns

will also handily function as relative probabilities, as in “How much more likely is this row than this one?” [Fake a start.]

Oh, and one more thing. You know how we did that process for the whole range of possible economic consequences for a single box? We’ll need to do an identical process for each of the other factors besides economic, because there are probably things beside economic numbers that we might want to factor into our happiness, don’t you think?

But for our first time through, I’d suggest we limit the factors to economic, environmental, social, political, and public health scenarios, since those will be the easiest to quantify, and probably have the greatest bearing on our standard of living. At the end, if we have a close tie between two columns, then we can go back in and add some other factors to refine our answer.

So, let’s get going with assigning those numbers, because if we break each range of possibilities for each factor in a box into a reasonable 5 cases, that gives us five cases times five factors, times 45 boxes, or a little over 1100 numbers we’ve got to agree on to quantify consequences, and an equal number of probabilities to assign. You might want to go get an energy drink, cuz this may take a while. Ready?

Juuuuust kiddin’! There’s no way I’m qualified to quantify all that! And neither, probably, are you. I mean, look at us—we’re interacting through homemade videos and derisive comments, for Pete’s Sake!

If this is to be done—really done, and not “oversimplified”—why on Earth would we be satisfied with a hack job or armchair analysis?

[DESK] This analysis is how a business who knew their business would do it—like a casino, or an insurance company. Except they wouldn’t be listening to you and me and our opinions of what they should do, because I suspect it’s actually even way **more** complex than what I just described.

What they would do is hire really smart people with Ph.D.s, tell them to eliminate their biases as much as possible, and turn them loose on the problem. So, if making a profit is important enough for a company to hire the best to do their expected value calculations, how come we’re not doing that in this case, for global climate change, which might have slightly more at stake than one business’s profit?

So if you’re serious about getting to the truth of the matter, and not just taking potshots to buy some time and preserve your opinion, then let’s hire the best and brightest we’ve got, and have them work with the greatest urgency on this. I’m serious—let’s draft the best scientists, political economists, historians, and analysts on the planet to bring their greatest effort to bear, to work round the clock on what our best scientists say may be the greatest challenge we’ve ever faced. I’m talking a project on the scale of the Manhattan project and the Apollo project put together. We could even call it the Manpollo Project if you like, and we would give it the greatest national urgency and resources.

Because you and I may not be qualified to do this grid, but as citizens, what we ARE qualified to do—and in fact are **responsible** for doing—is deciding how much resources to put into calculating the answer. Isn’t that what government is FOR—to bring to bear our collective time, expertise, and resources to accomplish what you and I cannot individually? You wouldn’t remove your own appendix. You wouldn’t try your

own law case. We let the experts do the details—which you and I are not qualified to do—and we retain our supervisory role, examining the executive summary before signing off on a course of action.

In fact, there's a silver bullet! Both sides of the debate will agree that we should have such a Manpollo, project, and here's why: because each side thinks the project will get us closer to the truth, and dispel the untruths that the other side has spun. So we all want this, because everyone thinks they're right, and would love further ammunition to prove the other side wrong. Wouldn't that be worth the cost?

Because a Manhattan Project is not going to cause a global depression. An Apollo Project is not going to going to bankrupt the US, or lead to government control of your life. So what's to lose? If we have a Manpollo project and it finds that human-caused climate change turns out to be bunk, then hey—okay, we diverted some government jobs from one sector to another. Isn't reducing the uncertainty about this at least worth that cost?

Let's not kid ourselves any more. You can ask about solar activity, or natural cycles, or proxy data, but the climate is way too complex for you or me to do armchair evaluation of this stuff in the face of so much peer-reviewed science. Let's get the big boys (and girls) on it. Don't we deserve that?

I am not talking about forming another commission to "study the problem further." We've been doing that for 20 years, and the statements from AAAS, NAS, and USCAP that I shared in the video "Risk Management" make it clear that that time is past. And you can't resort to "Well, that argument could be made about those Giant Mutant Space Hamsters—we'd better have a Hampollo Project to study it, because the possibility can't be dismissed." Climate change has a little more peer-reviewed science behind it than the hamsters.

In fact, faced with the statements from those organizations, if someone still argued that the idea of anthropogenic climate change can be dismissed out of hand, so that it's not even worth studying our options with a Manpollo Project, at this point people might start to view them a bit like Saddam Hussein's Minister of Information—the guy who denied the existence of the bombs falling around him.

A Manpollo Project's mission would be to study the science, study the political economy, study the history, to not only come up with the whole range of possible scenarios, but to actually quantify each one. To come up with numbers for consequences—both positive and negative—and for probabilities, so that an expected value could be calculated that would end this tumultuous, ineffective political bedlam that surrounds the issue, which really should be decided by analysis, and not political rhetoric. The project would have to be well-respected enough by all that the public would place such confidence in it that we would all agree ahead of time to follow its recommendations, even if we didn't like them. We would all feel confident that the answer recommended was the one most likely to get us what we want, regardless of our individual political opinions.

Because the physical world—which, in the end, is what this all is about—isn't influenced by our opinions. It is only our actions which have impact. And currently, our actions are firmly in column B. If that's going to remain the case, don't you want to

know—with as much confidence as you can—that that is the best place to be? Wouldn't you rather be assured by a huge team of highly competent and unbiased experts, rather than going on your own armchair evaluation of what you've read or heard?

In WWII, if Germany's threat threat to the world justified the Manhattan Project, why wouldn't global climate change's threat to the world justify a similar effort now? Just because it doesn't have a mustache? Look, Hitler himself was undeniably real, but him developing the atomic bomb—which I understand is the threat we were reacting to with the Manhattan Project—was just a possibility. **No** one—no scientist or policy maker—knew for **sure** that such a bomb was possible. The scientific issue was **uncertain**. Yet we took action, in spite of that uncertainty, because the risks of not taking action seemed far greater. Just the possibility that Hitler might get the bomb was enough to justify all-out action. Why not here? Paying for a Manpollo Project is not going to be the end of the world as we know it. But not paying for one, might be.

Let's get to it.

——end——

"How It All Ends: Mechanics of Global Climate Change"
(original outline—final version)

*AUTHOR'S NOTE: This is the original outline (no script exists—the video was done from the outline), but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution*," please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck!*
(wonderingmind42@gmail.com, 25OCT2007)

I) Intro
   a) To understand debate, helps to know the basics of how GW works.
   b) I'm gonna simplify a lot. You can always do some Googling to get the more detailed stuff. Check out Grist's "How to Talk to a Climate Skeptic."
   c) Don't believe what I say—research it for yourself, but be very careful.
      i) To not stop the first time you find evidence for what you want to believe—look for refutations to that.
      ii) Use the credibility spectrum from "Risk Management" to evaluate sources.

II) Greenhouse Effect
   a) Lottsa GHG.
   b) Good thing!

III) Global Warming
   a) Change GHG => equilibrium changes.
   b) This has lots of effects, hence "GCC"
      i) See video "Scare Tactics."
   c) Many GHG. Often hear objections:
      i) "Methane is more powerful."
      ii) "Water is more plentiful."
      iii) CO_2 is only the fifth most plentiful gas at .04% (there's more argon!) (wow—that number has changed since I started teaching science!)
      iv) So why the fuss about CO_2?
         (I) It's such a tiny amount.
         (II) It's good for plants.

(III) Greenhouse effect is good.

(IV) Ever heard of too much of a good thing?

v) Cuz that's the one we're seriously monkeying with. How?

IV) The Carbon Cycle

a) Let's take a quick look at the big picture, then go back and fill in.

b) Trees—cool trick (CO_2 => C and O_2).

c) Get buried and rearranged to fossil fuels (Lego T-Rex to hotrod).

i) Coal from plants, oil from ocean plankton.

d) Burn it (O_2) to release energy and CO_2. Back where it started!

e) Time scale is the killer.

i) What's collected over 300,000,000 years.

ii) Releasing in about 200 years.

iii) That's what all the fuss is about.

V) A Closer Look—Rates

a) Rates

i) We'll talk Gt of carbon .

(I) (When we say "carbon" in the air, we mean the C in CO_2.)

(II) Billions of tons.

ii) Tons of stuff going on. Rates of movement—Gt per year.

(I) Numbers from NASA—won't add up cuzza rounding .

(II) Main ones to look at are:

(a) Oceans (in: 92, out: 90).

(b) Terrestrial biosphere (plants) (in: 121, out: 120).

(c) Sedimentation (in: 0.2).

(d) Anthropogenic sources (fossil fuels:6, deforestation:1, total:7).

(e) Volcanoes (negligible at 0.15).

(III) If you got swindled by GGWS, let's correct some of what they said:

(a) Oceans give off way more than people. True, but net effect is a "carbon sink" at 2 Gt/yr.

(b) Plant and animals give off 150. My numbers say 120, but that's close. Again, net effect is almost nothing.

(c) Volcanoes give off more than humans.

(d) First two are deliberate manipulations, and the last a simple lie.

(e) Don't believe me! Simple Google complete discredits that movie and filmmaker.

(IV) Where's the A-CO_2 go?

(a) 2 into oceans.

(b) 3 remain in atmosphere.

(c) 2 into unknown "sink," which could be a problem.

(V) Ways to get a sense of the scale.
(a) Time (300 million yrs vs 200 yrs).
(b) Rate (0.2 Gt/yr sedimentation vs 7 Gt/yr human emissions).
(c) and . . .

b) Amounts
i) 750 in atmosphere.
ii) 40,000 in ocean.
iii) 300 in oil (hard figure to come by—from UNEP graphic).
iv) 3000 in coal.
v) So is human 3 Gt/yr significant? Adds .4% to atmo per year. Why is that a concern?

c) Changes
i) CO_2 levels in atmo. Atmo is .04% CO_2 (less than 400 ppm).
(I) Been fairly stable for last several thousand years, all parts in balance.
(II) Vostok graph.
(a) On large time scale, quite variable.
(b) Note CO_2 never been above 300 ppm (that's our .03% in atmo) in 160,000 years.
(III) Keeling graph. When I first learned, it was 350. Today it's ~380.
(IV) These are the now famous graphs. Watch AIT for more. Like Gore or not, the science has been vetted (Google it and evaluate your sources on the credibility spectrum).

VI) Misconceptions and Objections
a) Who are you and I to judge?
i) Are you a climatologist? Am I?
ii) Would you stake your future on my sole advice, even if I were?
iii) Defer to the professionals and supervise them.
iv) But as long as we're talking, we can use this picture to see why some objections can be dismissed easily.

b) "Isn't this still controversial?"
i) Not at all. Science has been essentially certain for a while that:
(I) GHG are increasing due to human activity.
(II) GHG trap radiation and act to warm the Earth.
(III) So really, the burden is on the skeptics to explain: how could we increase CO_2 emissions and NOT have an effect?

c) "That graph (Vostok) is all over the place, so it's natural variation, not human-caused." "Climate changes all the time." "We're coming out of a cold cycle, so this is natural."
i) Climate is complex, with many factors that can act as "forcings" from time to time (sun, orbital wobble, mainly).

ii) This time WE are the forcing, by short-circuiting the carbon cycle.

iii) No model or finding can explain the observed warming expect AGW.

d) "If we take action and climate change doesn't happen, how will we know whether it was ever true in the first place?"

i) What we know is summed up in models, which make testable predictions.

ii) Bad news: according to models, it's too late to avoid change. We're now talking about mitigating how bad it will be.

iii) So, if we act and things turn out dandy, with NO change, we'll know our models were wrong, and the skeptics can say "I told you so."

e) "How arrogant to think that we can change the globe. We're too small to have any effect."

i) Tell that to a virus. Or a mosquito in your bedroom.

ii) Keeling graph—hard scientific data: we are significantly altering the composition of our atmosphere.

iii) Too small? It's enough. Over 99% atmo is N_2 & O_2 neither of which is a GHG. A little GHG goes a long way.

(I) Remember that the next time someone makes a misleading claim about how little CO_2 humans contribute to the atmo.

f) "The water vapor from HFC cars would just replace the CO_2 as GHG."

i) No, cuz it would come from atmo in first place. Where's the CO_2 from?

VII) More Bad News

a) Ocean may stop absorbing—may be masking the effect.

b) Missing sink may stop absorbing—may be masking the effect.

c) Now that you understand the basic mechanics, you're set up to understand where the real gloom and doom scenarios come from. Watch the next video "Scare Tactics" for that cheery picture. But then don't forget to finish up with "The Solution."

——end——

"How It All Ends: Scare Tactics"
(original script—final version)

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This video is titled "Scare Tactics" and is part of the expansion pack accompanying the main video "How It All Ends."

GONNA BE BAD

[With flashlight] Ever wonder where the horror stories of global climate change come from? In this video, boys and girls, we'll see why the boogeyman is real, and not just a make-believe story your friends tell you to scare you. Bwuaah-haa-haa (cough, cough)

[Desk] When I first posted a version of the climate change decision grid in the Spring of 2007, a lot of the complaints I heard were along the lines that I had biased the grid by underplaying the negative consequences in the upper left box, and overplaying the negative consequences in the lower righthand box. In the video "How It All Ends: Risk Management," I justified the consequences placed in the upper left box. Here, we'll take a closer look at the lower right box. As you'll recall, that's the feasible worst-case scenario where we didn't take action, but human-caused global climate change turned out to be true after all.

I was accused a lot of scare mongering. Which got me to thinking: is that always a bad thing? Can you imagine a scenario where maybe you're not scared enough for your own good? I'm a science teacher, so I'm in a position of being able to understand a bit of where the pronouncements of "impending doom" come from. Now, most in the scientific world are very careful to NOT pronounce impending doom, not just because they don't want to be accused of scaremongering, but because scientists have a trained hesitancy about being too confident. So the perception of doomsaying usually is created by the media's **reporting** on what the scientists actually say.

As you'll recall from the video "How It All Ends: The Nature of Science," **all** science is **explicitly** uncertain, but that uncertainty is often dropped from the story when

the media gets ahold of it. This is where the public has gotten its perception of "Why should we listen to the scientists this time, when they're always predicting doom, and it never comes?" It's because when the scientist says "I found an interesting preliminary result: it may be possible that average global temperatures might be falling. This merits further study," the media—which is all about telling stories—runs with that and proclaims "Scientists warn of impending ice age! Glaciers may cover Florida!"

Which is why you personally, are at a huge advantage, having seen parts of the statements from AAAS and NAS that I shared in "Risk Management," because you've had the opportunity to bypass the media and see for yourself what the scientists are saying. And, after viewing "Nature of Science," you now have a better appreciation of how tentative science really is. So now you grasp how really remarkable those statements from AAAS and NAS are in their boldness. Science in its very nature is tentative, yet the two organizations that pretty much **are** the Science Establishment felt compelled to announce to the world: the globe is warming, we're the ones doing it, it's going to be bad, and we should do something about it quick. If you feel a little nervous because the normally sober fuddy-duddies seem decidedly alarmed—that's probably a healthy reaction.

I should make this clear: the nasty details of catastrophic climate change I described in previous videos are the **worst-case** scenarios, so we don't think at this point that they are <u>likely</u> to happen. But—as time goes on and our understanding gets better—they appear to be increasingly feasible. Eric Rignot, a NASA scientist who has measured a doubling in ice loss from Greenland over the past decade, recently said: "We see things today that five years ago would have seemed completely impossible, extravagant, exaggerated." [National Geographic, June 2007]. Martin Parry, co-chair of the Intergovernmental Panel on Climate Change (IPCC), told reporters this month, "We are all used to talking about these impacts coming in the lifetimes of our children and grandchildren. Now we know that it's us." [Washington Post, September 29, 2007]. Now remember, as a professional individuals, they're near the bottom of our credibility spectrum that we described in the video "Risk Management." But still, the sentiments give you pause.

Just today a student said to me "I'm tired of the predictions painting a worse and worse picture. I just want them to come out and say—oh, we were wrong. Everything's going to be fine." I told him he can get just such a pleasant bedtime story—just go the websites of the conservative think tanks like the Heritage Foundation, the Competitive Enterprise Institute, the Cato Institute, the American Enterprise Institute, the Hoover Institute. Cato actually published the book <u>Climate of Fear: Why We Shouldn't Worry About Global Warming</u>, and CEI ran TV ads last year with the tagline "Carbon dioxide. They call it pollution. We call it life."

But then, of course, he'd be obliged to compare them on the credibility spectrum with AAAS, NAS, USCAP, and Exxon. And then he'd probably get depressed again. But despair not! We <u>can</u> do something about this, which is what the video "How It All Ends: The Solution" is about. So be sure to not click away until you've seen that one. In the meantime, let's employ some "scare tactics," and take a look at where the boogeyman stories come from, to get a sense whether raising the alarm about abrupt climate change is closer to the story of Chicken Little or of Paul Revere. You gotta

admit, they were both alarmists.

PENTAGON

In the video “Risk Management” I detailed how AAAS, NAS, and USCAP—as well as the national science academies of most of the rest of the world—have publicly called for action on climate change. But I didn’t a mention another stunning warning about climate change from a source high up on our credibility spectrum: a 2003 Pentagon study titled “An Abrupt Climate Change Scenario and Its Implications for United States National Security: Imagining the Unthinkable.” Commissioned by the Pentagon’s most respected big thinker, co-written by a former Shell Oil analyst, and reported on by Fortune magazine; it’s hardly the Sierra Club newsletter. You should definitely check it out yourself [Google “Pentagon climate change”]. It is an accessible yet terrifying read, full of war and chaos, as our military planners sketched out a worst-case, but plausible scenario:

“As famine, disease, and weather-related disasters strike due to the abrupt climate change, many countries’ needs will exceed their carrying capacity. This will create a sense of desperation, which is likely to lead to offensive aggression in order to reclaim balance.”

It cautions that, while the scenario it explores is not likely, “[i]t is quite plausible that within a decade the evidence of an imminent abrupt climate shift may become clear and reliable. . . The [sic] report explores how such an abrupt climate change scenario could potentially de-stabilize the geo-political environment, leading to skirmishes, battles, and even war due to resource constraints. . . . Disruption and conflict will be endemic features of life.” Ewww, that last line is icky. In so many ways.

“Recent research. . . suggests that there is a possibility that this [currently observed] gradual global warming could lead to a relatively abrupt slowing of the ocean’s thermohaline conveyor, which could lead to harsher winter weather conditions, sharply reduced soil moisture, and more intense winds in certain regions that currently provide a significant fraction of the world’s food production. With inadequate preparation, the result could be a significant drop in the human carrying capacity of the Earth’s environment.”

Did you catch that? You may have nodded off for a second cuz these guys are even more verbose than I am, but that was essentially government-speak for “We’re all gonna die!!!!” Not quite, but roll the phrase “significant drop in the human carrying capacity of the Earth’s environment” around in your head a few times, and see how warm and fuzzy it makes you feel.

The report’s bottom line warning to the nation’s military planners is: “because of the potentially dire consequences, the risk of abrupt climate change, although uncertain and quite possibly small, should be elevated beyond a scientific debate to a U.S. national security concern.”

If you go and you read this report about a national security concern, you’ll notice that the only mention it makes of terrorism—is as a consequence of abrupt climate change.

PEARCE

Pretty scary stuff. It makes a little more sense now when the author Fred Pearce relates his experience in researching his book With Speed and Violence: Why Scientists Fear Tipping Points in Climate Change. Remember, on our credibility spectrum, as a professional individual he falls near the bottom, and so we won't take his personal **analysis** about the climate at face value. However, we certainly have no reason to question his personal **experience**. In the introduction he writes:

"Some environmental stories don't add up. I'm an environmental journalist, and sometime the harder you look at a new scare story, the less scary it looks. The science is flaky, or someone has recklessly extrapolated from a small local event to create a global catastrophe. . . . But climate change is different. I have been on this beat for eighteen years now. The more I learn, the more I go and see for myself, and the more I question scientists, the more scared I get. . . Don't take my word for it. Often in environmental science it is the young, idealistic researchers who become the impassioned advocates. Here I find it is the people who have been in the field the longest—the researchers with the best reputations for doing good science, and the professors with the best CVs and longest lists of published papers—who are the most fearful, often talking in the most dramatic language."

ABRUPT CLIMATE CHANGE

So let's take a look at some of the specific mechanics that have got top brass and top scientists both so nervous.

The details of all these worst-case scenarios are very complex, which is why in both the "Risk Management" and the "Nature of Science" videos I suggested leaving the interpretation of the evidence to the experts, and we stick to performing our supervisory duties by taking what the scientists say and deciding the course of action that seems to have the best expected value. But, now that you've watched "How It All Ends: Mechanics of Climate Change," you are in a position of understanding a bit where some of the more outlandish-sounding predictions come from. So we'll explore those here.

I think you'll be disappointed to find that they are far more reasonable than you would hope. Because the picture ain't pretty. As always, you shouldn't take what I say at face value. Do some research for yourself, and remember to evaluate your sources. A lot of what I'll share here can be found in a book called Abrupt Climate Change: Inevitable Surprises, published by NAS, which—as a professional organization—is at the top of our credibility spectrum. You can actually read the whole book online if you google around a little.

In discussions about this with skeptics, I often feel frustrated with their insistence on immediate and certain consequences before they would acknowledge the need to do anything. Sometimes I find myself thinking "What do I have to do—say that global climate change is going to come to your house—personally—and eat your lunch!??" So here's where we see why it's not so outlandish that yes—global climate change may indeed eat your lunch.

The reason why this message may seem so different from what you've been used to hearing about climate change is that, just in the last few years, an entirely new

topic in climate change has emerged. That is the idea of **abrupt** climate change. We used to think that the climate of the past changed gradually, and twenty years ago, when climate models first started suggesting that we could change the climate, all the discussion was about it happening in hundreds to thousands of years. But as the science improved (the data collection, computer modeling, and understanding of complex systems), the predicted time scale for the change just got shorter and shorter.

This is where most of the scary stuff comes from. And unfortunately, it's not simply conjecture. Just in the last 5 or 10 years, we've come to see that the typical behavior for the climate seems to not be to change gradually, as we'd previously thought, but to hang in one state for a while, and then suddenly lurch to a new state, in a very short period of time, usually prompted by some sort of poke—some change in the conditions. And now the best, most recent science is suggesting that we may face the threat of the climate changing very abruptly—that means within decades. Perhaps even a single decade.

This general trend in the science of climate change—this trend of ever increasing severity of the predictions—is in itself frightening. Because in general, what science tells you today is more reliable than what it told you yesterday. In science, changing your mind is a good thing, because it means your understanding is getting better, closer to the physical truth. So it's bad news for us that as time has gone on and the picture about climate change has gotten clearer, it has also gotten more grim. One more reason to be nervous.

So we no longer see the climate as something gradually shifting over millennia, but as something lurching from one extreme to the other, usually prompted by some sort of outside factor. Wally Broecker, the Columbia University climate researcher whose work is the foundation of carbon cycle science, summed it up vividly, saying: "We are getting a picture of the climate as an angry beast. And we are poking it with a stick." This is one of the most authoritative climate dudes on the planet. Yikes.

ABRUPT=COMPLEX SYSTEM

In order to understand how something as huge as the global climate can change in a geological eyeblink, we need to first understand the nature of complex systems, sometimes known as non-linear dynamical systems, or in the popular parlance, "chaotic" systems.

I've pointed out elsewhere that "global warming" is not a great name for the phenomenon, not only because some places get colder, but because the change in temperature may not be the main thing we'll notice. It's how the rapid change in temperature destabilizes the climate, affecting precipitation (droughts and floods), wind events (storms, hurricanes and tornadoes), and ecosystems (forest fires, agriculture, and permafrost) that will really matter to us.

So how can such a small change so destabilize the global climate? Because the climate is a complex or "chaotic" system. So it's worthwhile to look briefly at some of the features that define a complex system.

<u>Unpredictability of specifics</u>

One main feature is that the behavior of the system is extremely difficult to

predict—hence the term chaos. General trends are easier to tease out than specific behaviors—sort of like it's easier to say that about 50% of coin tosses will be heads, but you can't predict the outcome of a single toss. It's also why we can talk about probabilities of what the climate may do in 20 years, but we have trouble predicting whether it's going to rain Tuesday or not.

Extreme sensitivity

Another distinguishing characteristic is what's called "extreme sensitivity to initial conditions." What that means is that tiny little differences can cascade into vastly different outcomes. Popularly known as "the butterfly effect," it's not just fanciful, but is easy to observe. Imagine two dried leaves floating on the surface of a swift river. One of them ends up hung up on a rock 10 yards downstream, while the other one finds its way to the ocean, even though they were placed side by side.

One objection you'll often hear when talking about climate change is "how arrogant to think we can affect the planet. It's only common sense that we're too small to have an effect." Tell that to a virus, or a mosquito in your bedroom when you're trying to go to sleep. In a complex system—like the climate—very small differences can have huge effects. If you watched the video "Nature of Science," you'll know that common sense is easily fooled, and is no way to make a decision about a complex topic.

Here's a slightly geeky example, but if you stick with me, it can be a pretty cool realization. Here's a graph made by a fairly simple calculation, but the calculation is run again and again. It's designed to do a basic population simulation of rabbits or wombats or javelinas or whatever, and it turns out to behave like a complex system. (Note that the population is not in whole numbers—you can take the vertical axis to be in millions if it makes you more comfortable.) Across the bottom we have "generations," each one representing one turn of the crank on our simple calculation. You can see that the population goes up and down in a way that looks random, or chaotic. You couldn't be expected to look at this and predict what the population of the next generation will be. Maybe you can describe some patterns, like it goes up, then down, but anything more specific soon fails.

But here's where the really wild part of complex systems shows up. In this graph, the initial population differs from the one in this graph by just .0000002%. As you compare the population fluctuations between the two cases, you see that they track along nicely—identical as far as we can tell—which is what you would expect. But then, after 50 generations—BAM! The profiles diverge wildly, and we suddenly have two very different outcomes. Two completely different outcomes from initial conditions that were only as different as 5,000,000 is from 5,000,001! That's crazy! That's wild! That's chaotic!

So next time you hear someone say "Oh, but we're too small to make any difference to something as big as the global climate," you just whip out your graphing calculator and show them this. Or. . . maybe not.

Feedback

The reason that complex systems behave with such extreme sensitivity is due to another hallmark of a complex system: feedback. This is where you have some

process with an input and an output, say, like a microphone hooked up to a speaker. Here the input is the sound that goes into the microphone. The system transforms the input—in this case, amplifying it—and the speaker give the output—LOUD SOUND. In the population simulation we just talked about, the input is the number of live rabbits going into a breeding season, and the output is the number of live rabbits surviving at the end, and the system is all the things affecting bunny survival.

Feedback is when the output of the system is then used as the input for the next go-around—it is "fed back" into the system. As you've probably experienced, the results [DEMO feedback] can be painful sometimes.

The reason feedback leads to the extreme sensitivity we mentioned a minute ago, is because the process—breeding rabbits or an amp, or whatever—in one "turn of the crank" takes small differences and makes them slightly larger. These result are then "fed back" into the system for another go round, which makes the differences still larger, which are then made larger, which are then made larger, and you can see how you can quickly get a result which seems way out proportion to the original input.

"But that's not feasible. That implies it would go forever, and run away!" Eventually, other factors kick in to stop the change, just like the speaker doesn't continue to get louder forever. It bumps up against some limits [DEMO], so that the sound does level off, though that doesn't mean it's comfortable for us. [DEMO]

This is why—with global climate change—it's not the temperature increase that really has scientists worried. Who wouldn't like to be just a little warmer on a chilly day? The problem is that even a small change in temperature can get amplified by feedback mechanisms, so that we end up with a huge change further down the line—not necessarily in temperature, but in some other characteristic of the climate. Maybe in rainfall patterns, or storm frequency, or growing season.

<u>Forcings and Tipping Points</u>

The changes in the conditions which trigger such abrupt shifts in the climate are called "forcings." In the case of our speaker demo, the forcing would be the small amount of ambient noise which gets the whole feedback cycle started.

In the past, the likely forcings which caused abrupt climate change were things like changes in the output of the sun, or the periodic wobble in the Earth's axis, or a large random event—say, the breakup of a single ice dam releasing a huge lake all at once. The conditions at which a small tweak in the conditions causes a huge change is called a "threshold," or in the popular press, a "tipping point."

In the video "How It All Ends" I offered the analogy of flipping a light switch—small pushes result in small movements, until a tipping point is reached, when the same small movement that had done not much of anything suddenly results in a big change. Sort of leaning a canoe gradually over, until it suddenly tips. Or here [speaker DEMO], moving the mic a quarter of an inch at a time does nothing. A little movement, little to no change. The same little movement, still little to no change. But at some unexpected time, the same little movement which had unnoticeable effects before. . . . [screech] This is the part of complex systems that I think is really fascinating. Or really terrifying if I happen to be in the test tube.

It is the likely presence of tipping points in our climate which makes the game of

climate change so dicey, or perhaps we should say Russian Roulette-y. The nerve-wracking part is, we've recently learned enough to have very strong suspicions that the Earth's climate has tipping points, but because of the unpredictable nature of chaotic systems, we can't know where they are! We can say that the farther and faster things change, the more likely we are to cross one. But tipping points really can only be identified from the other side. [Oops—guess I shoulda stopped there.] This is where that picture of the climate as "an angry beast" is coming from.

In fact, recent research seems to be showing that in the measurable past, there have only been two periods of climate stability, one of which humans grew up in. You might think "Ha! Change is inevitable! See, I told you it was a natural cycle!" Sure, on a geologic time scale it's inevitable, like tens of thousands of years. But we have excellent evidence that CO_2 is a forcing which may trigger another abrupt climate change sooner than it would have otherwise happened. So yes, it's inevitable that the climate will change, probably drastically. But we seem to be making the difference between whether it happens 20,000 years from now, or in 2020. That's the difference between it happening to you, and it happening to your great-great-great-great-great-great—well, you get the point. Plus, dying is inevitable, too. But you still dodge the bus, don't you?

So how do we know it's NOT just a freaky coincidence that the climate is changing observably at the same time we are putting observably more greenhouse gases into the air. How do we know it's not natural, caused by the sun, or cosmic rays and clouds, or the Earth's wobble? The simple answer is: no peer-reviewed study or model or graph has been able to reproduce the observed warming of the last 20 years **without** also including the "forcing" of anthropogenic—human-caused—carbon dioxide emissions. Go look it up yourself. There is no scientific explanation (that is, done by scientists, rather than armchair commentators) of what we observe now in the physical world that does **not** incorporate human "forcings." When you hear that old saw about "It's the sun, stupid," go do some looking, and you'll see that hypothesis is a contender for much of the 20th century data, but falls apart for the last 20 years. Plus, no one contends that the sun does **not** affect the climate. It is certainly one of the factors. But the picture seems to have become clear that it can't explain the warming by itself. But then, what do I know—I'm not a scientist, and this stuff is really hard to understand. If you want competent analysis of a complex scientific issue, go ask the trained professionals who know how to properly interpret data. I think they've probably got a few of those over at AAAS or NAS. Maybe they've published something on the topic. Oh, that's right. . .

The Pentagon Report I mentioned earlier specifically warns of such abrupt climate change:

"The research suggests that once temperature rises above some threshold, adverse weather conditions could develop relatively abruptly, with persistent changes in the atmospheric circulation causing drops in some regions of 5-10 degrees Fahrenheit in a single decade."

<u>Drops</u> of 5-10 degrees?? In a single decade?? From global <u>warming</u>? Remember, That's why global "climate change" is a better phrase. Better still climate

destabilization, or climate chaos, or how about just global climate ["cl*st*rf*ck" is beeped out.]

So what exactly is the threshold temperature at which it all hits the fan? We don't know. We can't know, until we've hit it, cuz tipping points can only be identified from the other side. Nervous yet?

We know it's possible, because it's happened before.

12,000 years ago, long before SUVs, the globe warmed 9 degrees Fahrenheit in—guess how long. You got it—a decade!

"That's what I've been saying!" some skeptics have told me. "The climate has always been changing. So why are **we** suddenly the bad guys?" Wait, that story is comforting to you? That because the climate has gone totally cattywompus in the past, therefore it can't be **us** doing it now? What about the fact that it can lurch so far, so suddenly? Nine degrees in 10 years? Don't you find that just little disturbing? And anyway, isn't that reasoning sort of like socking your sister in the arm, and when she complains to mom, saying "You know, that arm has really been a problem for her in the past, huh? So clearly I'm not involved."

Well I'm sorry to break it to you, but here's the bad news: remember that idea of a "forcing?" In the past it was a change in solar activity or a wobble in the Earth's orbit that provided the poke that sent the climate spinning off into a new state. Well this time, we are the forcing. We are the poke which threatens to send the climate lurching to a new state.

How can we—puny little us—do such a big thing? Well, remember, with a complex system, the poke—the "forcing"—doesn't have to be big to have huge effects. It just needs to be in a ticklish spot to set off feedback mechanisms which then amplify the change, setting off more feedback mechanisms, and so on. And in this case, we are providing the forcing by digging up 300 million years worth of buried carbon in the form of oil and coal, and putting it into the air in the space of a couple hundred years.

This is why we should be talking more about "climate sensitivity" than "amount of warming." And as far as I can tell, this is a indeed a shift that's happening in the climate science community. I think it also is why the newer research seems to be making the IPCC's predictions seem too conservative—perhaps way too conservative. Because newer research is showing that there are a number of possibly very significant climate feedback mechanisms which weren't incorporated into the IPCC's climate models. So it looks like history may end up judging the IPCC's predictions as being way off base—but off base in the direction of too mild! That's not good news.

One last feature of complex systems that seems a little contradictory is that of lag time. On the one hand you hear talk about abrupt change, but on the other hand, there can be significant lag time between cause and effect, simply because the system is so large, with so many interactions, that chains of cause-and-effect take a while to play out. What that means is you've got to look way ahead if you want to anticipate changes. This doesn't contradict the characteristic of abrupt change, and in fact, can make a nasty combination.

As an analogy, a large ship is very easy to oversteer if you don't know what you're doing. Here's why. You want to turn left, so you spin the wheel left a little bit.

The ship doesn't seem to turn—because it's got a lot of momentum that's hard to change—so you turn the wheel more. Still going straight, so you crank the wheel harder. Now, finally, the ship starts to turn a little bit, but this is the turning that results from you spinning the wheel the very first time, four spins ago. So now, when you stop spinning the wheel in response to the ship turning, there's still a bunch of your spins "stacked up" that are going to be affecting the ship over the next few minutes. So you end up turning very sharply to the left—in a sense **abruptly** once it happens, though there was a long lag time after you first turned the wheel. And it's the long lag time that allows you to stack up inputs, contributing to the magnitude of the abrupt change that eventually happens. With the ship, you panic and turn hard to the right, making the same mistake the other direction, but worse, and off you go in a wild zig-zag over the next few minutes, communicating to all salty hands that it's a landlubber at the helm.

You know those big supertankers? The biggest ships on the planet? I haven't talked to a pilot firsthand, but I've read they need to start their turns MILES AHEAD. As a physics teacher, I have a keen sense of inertia, and that picture sounds reasonable to me. So in a sense, our climate, with it's complex interactions, lag time, and huge amounts of matter and energy, is like a huge ship, and we're turning the wheel with our greenhouse gas emissions. The problem is, we're NOT looking miles ahead. My fear is we won't look up until it's obvious to the most casual observer that we're in trouble, and at that point, it may very well be too late to avert the shipwreck. Even if we can, it will take Herculean effort, because it takes a huge effort to make the same turn in a short amount of time that smaller efforts made earlier could have accomplished.

CLIMATE FEEDBACK MECHANISMS

So now we get to the meat of the boogeyman [ewww], where we can get a sense of why there are such drastic predictions resulting from a little bit of projected warming. What it basically comes down to is potential feedback mechanisms in the climate. We'll take a brief look at a few just to get a flavor. There's tons of info out there on this stuff if you want more.

[BOARD] Shiny white ice sheets reflect sunlight. When warming happens and you lose a little ice, then less sunlight is reflected, and more is absorbed by the underlying rock or water. This increases the temperature, which melts more ice, reflecting less sunlight, and so on.

[BOARD] Near the surface of the ocean, the phytoplankton—just like land plants—use photosynthesis to split CO_2 from the air, keeping the carbon to build themselves, and spitting out the oxygen for us to breathe. We like them. They are good to us. They are actually responsible for about half of the globe's photosynthesis, and to live they require the nutrients that are carried by cold ocean water upwelling from the depths. If the surface of the ocean warms up a little bit, that increases the thermal stratification in the ocean, leading to less upwelling of that cold, nutrient-rich water, which leads to less phytoplankton growing. Less phytoplankton means less CO_2 is removed from the air, which traps more of the sun's energy, warming the air and the ocean more, causing less upwelling, less phytoplankton, more CO_2, and so on.

[BOARD] At the bottom of the ocean is trapped a huge amount of methane—a more powerful greenhouse gas than CO_2—in the form of hydrates: kind of frozen

together with water. Increase the water temp, and that melts the methane hydrate, which migrates to the atmosphere, where it does its greenhouse gas thing, warming the air, warming the ocean, melting more methane hydrates, and so on.

[BOARD] Warmer temperatures allow permafrost to thaw, which releases methane stored there, increasing temperatures, melting more permafrost, and so on.

[BOARD] Warmer temperatures allow frozen peat bogs to melt, allowing the peat to go back to the rotting it was doing before being frozen. Rotting peat releases both CO_2 and methane, leading to higher temps, melting more peat bogs, and so on.

[BOARD] Carbon from the atmosphere ends up in the surface water of the ocean (both as dissolved CO_2, and as part of the bodies of the plankton). The famous "ocean conveyor belt"— which not only keeps Europe nicely warm (Northern Europe is the same latitude as Siberia, but considerably more temperate)—carries the surface water down to the bottom of the ocean in the North Atlantic, effectively sequestering or "locking away" the carbon. Warmer temperatures melt more ice on land, increasing the flow of freshwater into the North Atlantic, slowing down the conveyor belt. If the ocean conveyor slows, carbon is sequestered more slowly, allowing more to build up in the atmosphere, increasing temperature, melting more ice, leading to more freshwater flowing into the North Atlantic, slowing the conveyor, and so on. This is part of why you'll hear about Greenland—not just because it's melting ice would raise sea levels, but because it's perfectly positioned to seriously bollix up the ocean conveyer.

[DESK] Forests can give rise to the same feedback mechanism as the phytoplankton do. As the climate changes, a forest may find itself in a climate that stresses it out, increasing disease, allowing more insect attacks, and eventually you can have a significant part of the forest die—or perhaps the whole thing in extreme cases. So it stops taking as much CO_2 out of the atmosphere, allowing temps to rise, leading to more dead trees, and so on. But it gets worse, because if you have an entire forest standing dead, it's just a matter of time before a lightning strike sets off a massive wildfire, releasing back into the atmosphere all the carbon that used to make up the trees. So not only does the forest stop taking carbon **out** of the air, it can actually emit carbon back **into** the air that was handily sequestered.

If feedback mechanisms don't have you scared enough yet for your own good, there's also the concept of maskings. These are dynamics which keep the warming smaller less than it otherwise would be. That's a good thing, in the short run. But the problem is, if the masking gets "used up" or stops working, then the effects of global warming will accelerate faster than expected. These maskings have been compared to coiled springs—they take up some of the shock now, but if used too much, when they let go, we get a nasty backlash.

[BOARD] Such maskings include the "global dimming" provided by aerosols—those are tiny little particles of stuff that our activities have put into the air—air pollution, sort of. Except in this role, they could be considered a positive thing by buying us some time. Essentially, they act to reflect some of the sun's energy back out into space before it makes it to the ground, keeping us cooler. Kinda like atmospheric sunscreen. The irony is, as we pollute less in terms of traditional air pollution, the global dimming will probably decrease, allowing more sunlight in, increasing the warming. So the aerosols are probably "masking" some of the warming we're causing currently, but could

spring on us in the future.

[BOARD] Another masking effect comes from what are called carbon "sinks," like the ocean, or forests. You may recall from the video "Mechanics of Climate Change" that we emit about 7 billion tons of carbon every year, but only about 3 billion tons of it hangs around in the atmosphere long enough to have a greenhouse effect. Two billion tons goes into the ocean as dissolved gas and bodies of little beasties. So the ocean acts as a sink, masking the warming that would otherwise be caused by those 2 billion tons of our yearly carbon emissions hanging out in the air, doing their greenhouse thang.

One problem is, in addition to its role in feedback cycles I mentioned a minute ago, the ocean probably has a finite capacity for absorbing carbon, but we don't know what it is. It may be that one day, it sort of—well—stops absorbing. That would really suck. Because that would almost double the amount of our yearly carbon emissions that would accumulate in the air—from 3 billion tons to 5 billion tons—without us even emitting an ounce more. So suddenly we discover we need to cut our emissions even faster and more drastically than we thought. It might be like having the goalposts moved when we already thought we were giving it our all. Such is the curse of maskings. Friendly in the short run, but with a serious backlash if you abuse them.

And do you remember how we can't account for that last 2 billion tons of our yearly carbon emissions? There must be a sink somewhere taking that stuff in, but since we have no idea even what it is, we can't have any idea of how resilient it is, or how easily it could stop absorbing that carbon, leaving our full 7 billion tons a year to accumulate, instead of our current 3.

[DESK] So maybe now you see why there seems to be an increasing sentiment in the climate science community that—since the IPCC didn't include a number of the feedback mechanisms now being studied—its predictions of climate change—often dismissed by skeptics as overblown and alarmist—are probably too optimistic.

DOOMSDAY SCENARIOS

It's worth giving just a brief explanation for each of the specific doomsday scenarios that I mentioned in the video "Risk Management."

Seas rising 20, 30 feet. This is due not just to the runoff from melting ice sheets and glaciers. A lot of it can be accounted for by the simple thermal expansion of seawater. Generally, when anything gets hot, it expands, and takes up more room. This is actually what accounts for most of the observed rise in sea levels so far. So you get a double-whammy: more water (from ice on land), and expanding the water that is already there.

Entire forests die and burn. I already mentioned how a changing climate can stress out the trees leading to increased disease and infestations. But here's another way to look at it: but basically, as things warm up, regional climates will migrate, and the forests of northern California may find themselves in a Southern California climate. They don't like that climate. That's why they stuck to Northern California. So you can have entire forests die just as effectively as if you'd picked it up and plunked it down in the wrong spot on earth. These dead forests dry, and as soon as lightning strikes, you get the next catastrophe.

Widespread wildfires clear the land of the dead forests, but the forest doesn't come back like it used to after fires, because all the seeds on the ground are for a different climate. I don't have a reference for this one, so maybe I'm just making this part up. Someone let me know.

Massive floods alternate with killer droughts. This is a kind of funky one, because climate change can mean the same annual rainfall, which sounds like no big deal. Here again, relying on common sense can really do you disservice. Because if the rainfall is distributed differently, it can have a profound effect on our lives. For instance, here in the Pacific Northwest of the U.S., instead of getting our precipitation drizzled fairly evenly throughout the winter, we might get it mostly dumped in a month or two. Since it would be warmer, more of the precipitation than usual would be rain and less would be snow, not only causing large amounts of flooding when it fell, but reducing the accumulated snowpack. So when spring and summer roll around, there would be very little snowpack to feed the watersheds, and we end up with consistent droughts. Not only that, but a huge fraction of our electricity comes from hydropower—a carbon free source. So we would import more electricity from the coal-fired power plants elsewhere, which would increase carbon emissions. Hey—another feedback cycle! All despite the fact that on paper, the total annual rainfall stays the same as before.

The breadbaskets in the U.S. and Russia turn to dustbowls, leading to widespread famine. This was mentioned in the Pentagon report, due mainly to more arid soils, harsher winter conditions, and stronger winds.

Dreadful epidemics rage like wildfire. Milder winter conditions—wait, didn't I just say harsher winter conditions? I can't have it both ways, can I? Yes I can. Because what's the name of the game? Global climate **change**—it's all about the disruption caused when things like ecosystems and economies are set up for the regional climates they have now, and then abruptly find themselves in a different climate. Anyway, milder winter conditions (in some areas), fail to cause the die-offs of insect larvae that usually occur, so you get markedly increased insect populations, spreading over wider territories, carrying disease for people, animals, and crops. If you combine that with a public health care system already stressed by dealing with refugees from coastal areas, and the water treatment systems of major metropolitan areas being breached by rising seawater (remember how you-know-what always flows downhill? What happens when the bottom of the hill is raised up?), you can see where epidemics become feasible results of climate change.

Have you heard of colony collapse disorder? About 25% of the commercial honey bee hives in the U.S. have suddenly and mysteriously died. Global climate change can't be blamed yet, but environmental stresses are thought to play a significant factor, perhaps by allowing more favorable conditions for parasites or fungi while at the same time lowering the bees' immunity. This is the type of sudden, triggered, large-scale problem that sudden change in climate might bring about. If you think we're just talking about honey, you should be aware that commercial hives are responsible for the pollination of something like one third of U.S. crop species. If you're worried about "protecting the economy from harsh government regulation," think about the economic impact of losing the commercial production of a third of the US crop species. "Protect

the economy" indeed.

Storms like Katrina can become the norm. The debate is already active about how much to attribute recent changes in hurricanes seasons to climate change. But no climate scientist debates that it is plausible in the future.

And none of this sounds good for the economy, does it?

OBJECTIONS

Still, you'll often hear objections like:

"Why get all wound up about the climate changing? Who's to say what the right climate is?"

"Birds and bees build nests and homes out of raw materials in their environment, just like we do. How is this different? If there were no beavers, there wouldn't be any beaver dams disrupting the natural course of a river—is that good or bad or just the way it is?"

"The climate has done fine before without us!"

"But it's been warm in the past. Where's the evidence that that's bad? Sometimes I feel kinda chilly."

My response to all these come down to: the climate is tremendously complex. Like I said a minute ago, it's more accurate to think of "global warming" as "global climate change," and even more descriptive to think of it as "global climate destabilization." I've even heard it described as "global climate chaos." Maybe that image is a little less comforting than "global warming." Who's to say a light tap on the chest is a bad thing? It's not. Unless you're balancing on top of a post. The issue is not the temperature; the issue is the stability of the climate. Every human settlement is set up for the regional climate it has now. How does spinning the wheel and swapping climate at random with another settlement sound to you? We've got a number of examples of ancient civilizations that disappeared suddenly, and abrupt climate change is one of the main suspects: the Anasazi, the Mayans, the Nabataeans.

There is no "right" climate. And there's nothing morally wrong with a changing climate. The problem comes simply from the effects that a changing climate has on our standard of living. The problem is, we're pretty much set up to deal with it like it is now. Here, it seems the greatest criterion for a "good" climate is predictability. Consistency. So that we don't plant our crops and have them die. We also don't tend to like extreme weather events, like storms, floods, and droughts. What the best science is now showing us is that a little change in the temp can radically change climate, making it both unpredictable, and violent. That's the problem. So it's really not about saving the planet. It's about saving ourselves and our standard of living.

CHINA

One objection I hear a lot is: "Why should we [that is, America] change? China is a bigger emitter, and India's right up there. Taking action would just hamstring us economically, and wouldn't solve anything unless China and India are addressed."

Yes, we should do everything we can to help and prompt China and India reduce their emissions—perhaps by developing the new energy technologies, and selling it to them at a profit! But aside from that, it doesn't at all invalidate action on our part.

Here's why.

In a global system, bottom line, it's the total emissions that matter. And when you're playing a game that has a tipping point, where the movement from here to here is not big deal, but the same sized movement from here to here… [DEMO], there's no way to assign who emitted that little bit that put us just over. Because you could point the finger at anybody and say: if you had emitted just this little bit less, then the total wouldn't have crossed that tipping point, and we wouldn't be hosed.

And you'd be totally correct to say that. You do recognize, of course, that they'll be saying the same thing to you. And they'll be equally correct. Everyone's disappointed at the guy who missed what would have been the winning shot at the end of the basketball game, but the truth is, if that other guy hadn't missed that lay-up in the second quarter, the game would have been won as well. And with carbon emissions, it's all going on simultaneously, so it's even more ridiculous to pick a scapegoat. So, no more of this "But what about China?" nonsense. It's not even about the morality of "chipping in" or "doing our part" or "doing the right thing." It's about doing what's in our self-interest. It's about doing whatever we can to avoid crossing a hidden tipping point which might totally hose all of us. Plus with 5% of the world's population, the US emits 25% of its greenhouse gases, so we really shouldn't be stirring up the hunt for a scapegoat anyway.

CO_2 LAGS

Speaking of the past, now is a good time to address a common objection from those who want to believe that humans aren't changing the climate, so they go looking for evidence, and stop as soon as they find something that sounds like it supports their view. I'm not making fun of that—I just point it out as an example of how you actually get farther from the truth about the physical world—rather than closer to it—when you start from belief and look for evidence, rather than the other way around. Be sure to watch the video "Nature of Science" for ways to guard against this phenomenon of "confirmation bias."

The objection is this: "In the ice core data of past climate changes, increases in atmospheric CO_2 concentration actually happen 500 years <u>after</u> the temperature starts to go up. Those silly scientists have got it backwards! That's proof that CO_2 doesn't cause warming—it's the other way around!"

This is exactly why I suggest we leave the analysis of the evidence to the scientists, who know what they're doing. Here's the misinterpretation the skeptics are making about that data.

They are correct that the ice core record generally shows the CO_2 concentrations lagging the temperature by several hundred years. The explanation is, <u>the CO_2 wasn't the forcing of **those** changes in climate</u>. Some other forcing that we've talked about started those periods of warming—like the sun, or the Earth's orbital wobble. First off, logically that doesn't prove that CO_2 can't or isn't acting as the forcing this time. It's the same as saying "My car has stopped many times before, but it's never been for lack of gas. Therefore I must not be out of gas," even though your gas gauge reads low.

And the second hole in that objection is scary in itself. You see, the warmer a liquid is, the less gas will stay dissolved in it. That's why a glass of tap water left out

overnight will have bubbles on the sides in the morning—when the water warms up to room temperature, it can't hold all the air that had been dissolved in it when it was cold, so some of the air comes out as a gas, and sticks to the side.

Well, CO_2, along with all other atmospheric gases, dissolves into the ocean. When something warms the ocean up a little bit—the sun, the Earth's orbit, whatever—what happens to the amount of gas that gets to stay dissolved in the water? It gets less, which means some of that dissolved CO_2 is now released into the atmosphere. And what does more CO_2 in the atmosphere do? It traps more of the sun's heat. Does this remind you of anything? Like, a feedback cycle?

The extra trapped heat warms the ocean more, releasing more CO_2, which warms the globe and the ocean more, releasing more CO_2, which warms the globe more, and so on. So CO_2 did not trigger the periods of warming we observe in the ice record, but through this feedback loop, it probably turned out to be the dominant factor in the eventual magnitude of the changes. So, far from dismissing CO_2 as a problem, this objection actually emphasizes the power of a little CO_2.

And speaking of emphasizing, I want to use this misconception to emphasize that none of us should get too cocky about our ability to understand climate science—perhaps the most complex topic of study in all human history. Think back to the video "The Nature of Science" if you've watched that already. Do you remember how easily fooled your common sense was? There's a reason that it takes a long time to get a Ph.D in these fields. As citizens, it is our role to essentially supervise those who are working for the greater good on our payroll, but we hired professionals for a reason. It's because the world is complex, and they aren't as easily wrong as we are. For instance, remember this feedback demo? What would you expect would happen if—once the feedback loop is activated—I move the mic closer? Louder, right, since there's less room for the energy to dissipate, so the output and therefore the input has higher amplitude? [DEMO—it shuts off.] Wild huh? Totally unexpected. Guess why it does that? I don't know. But I'm gonna have my Physics class play with it and see what they can figure out. But I recommend not trying this experiment at home with your own planet.

DIRE TIMES AHEAD?

The Pentagon report I mentioned earlier cautions: "With at least eight abrupt climate change events documented in the geological record, it seems that the questions to ask are: *When will this happen? What will the impacts be? And, how can we best prepare for it?* Rather than: *Will this really happen?"*

In his introduction to <u>With Speed and Violence</u>, author Fred Pearce quotes a climate scientist who said to him quietly: "If we are right, there are really dire times ahead." If you'll recall, my whole point of this video project is not to convince you to **believe** such predictions, but simply to ask the question: why risk it? Where is the value in ignoring such warnings from so many smart, experienced, credible people in the field?

Ten years ago, before I learned the details of global climate change, I lumped it in with all the other environmental causes. But once I learned the specific mechanics, evidence, and scope of the issue, things changed. Dramatically. I distinctly remember

that afternoon, and the dreadful, dawning sense of "Oh, my God," as the sheer scope and reach of the threat unfolded and fell together. I'd studied quite a bit of physics and chemistry by that point, and in that one afternoon, in that one chemistry lecture by that one professor, the puzzle pieces fell together with a crashing sense of awe. It transformed me.

As I said earlier, I live in the Pacific Northwest, and I love hiking in old-growth forests. I'm a literal tree-hugger. I dig touching this huge, living thing and imagining how it was there, in that exact same spot, already old, when the Declaration of Independence was signed, or when the pilgrims landed, or even before horses came to the continent. It's just freaking amazing.

But now, when I see clear cuts, I think "Sweet! Carbon sequestration! Let's get more trees planted, so we can cut them down too!" When a charity asks for money, I ask back "What will it do to reduce carbon emissions?" I'm even a booster for nuclear power now—the most reckless, irresponsible, short-sighted boondoggle ever—but it's carbon free! I know I sound like a zealot, but this is entirely a pragmatic thing for me.

It reminds me of an account I read recently by a Washington insider. He was speaking about how the sentiment on Capitol Hill about global climate change was slowly changing, as lawmakers one by one each have their own individual "Holy shit" moment.

But there are so many problems, and only finite resources of time and money. Why start with climate change?

I had a professor of chemistry, oceanography, and atmospheric sciences—smart guy!—who put it this way: Paper or plastic? Doesn't matter. Save the whales? Doesn't matter! Toxic waste? Save social security? Pro-life or pro-choice? Doesn't matter! If the worst of the potential consequences of global climate change come to pass, it will so dominate us as a species that every other conceivable issue will pale in comparison.

<u>That</u> is why climate change is not "just another" environmental issue. This is not about whether you love mother Earth or care for the whales or enjoy the idea of old growth forests or the value of wild lands. This is the height of pragmatism. This is about preserving our standard of living in the face of potentially drastic changes that we ourselves have caused.

Just why is climate change such a dominant issue? Look out your window. Climate is everywhere, everywhen. In the past, when we mucked someplace up, we could always move "to greener pastures." But when it's global, there's nowhere to run to. Nowhere to hide.

Part of what makes this all terrifying is not just the possibility of abrupt climate change, but how it's a complete mismatch for our threat-survival system. Psychologist Daniel Gilbert wrote an excellent column in 2006 titled "If Only Gay Sex Caused Global Warming," where his basic point was, we evolved (if you believe in that) to react to what is immediately threatening—call it the Saber Tooth Tiger reflex—and that's worked great for us so far as a species. But now we find that we are threatened by something that instead is abstract and in the future. And we're just not wired to watch out for stuff like that. I guess that's why we're sitting in column B of our grid—"little to no significant action"—which is a frightening place to be when you realize the what the stakes are,

and that the odds seem to be heavily in favor of human-caused global climate change turning out to be true rather than false. I don't know about you, but that gets me really agitated.

It's sort of like changing lanes on the highway to miss an unexpected obstruction in your lane. If you're vigilant and on your game, you see it far enough ahead that you can signal, look in your mirror, check your blind spot, and smoothly change lanes to avoid it. But if you're careless or distracted, so that you don't see it until you're almost on top of it, all you can do is yank the wheel and hope no one is in the lane next to you.

And that's the problem. As a species, we're pretty much ADD. As a group, we're not looking down the road; we're just trying to get through the next couple of minutes.

And to me, that's the most terrifying part of all this. We're confident that we get out of any pickle we need to, because our brilliant innovations, improvisations, and reactions have always fit the bill before. Maybe that's why the alarm bells haven't gone off. Our unconscious bias has been formed by our past success, so we can't imagine failing so spectacularly. But this time, it seems it will probably take something new for us to succeed: we will have to overcome our basic human nature of being reactive, instead of proactive. That's a heck of a challenge.

Years ago I learned a lesson about looking ahead that has stuck with me, and I'd like to share it here. I grew up on a farm—a nursery, technically. My dad grew ornamental plants in the ground, and sometimes it was my job to mow the grassy roads in between the planting beds. You'd want to get as close to the plants as possible, without hitting them, to minimize the amount of hoeing you'd have to do by hand later. The problem was, the plants were both delicate, and expensive. So you'd have to really concentrate. Especially cuz you were driving a medium-sized tractor fairly fast and the big mower hanging off the back would swing out the opposite way when you turned.

So if I was trying to nestle right into the row of plants to my right, I'd have to be extremely careful of turning the wheel to the left, cuz that would swing the mower to the right, towards the plants. So of course what happens is by shying away from turning to the left, you'd have a bias for drifting right, which would require turning the wheel to the left to correct, but you wouldn't want to do that cuz it would swing the mower towards the plants, so you'd hesitate, drifting farther to the right, requiring a bigger turn left which you'd want to do even less.

The upshot was, if you weren't totally on top of it, making tiny little corrections immediately, anticipating what was coming up ahead, you would quickly find yourself in a nasty feedback spiral and before you knew it you'd mowed down a couple hundred dollars worth of plants.

I learned my lesson fast. Thankfully, all it cost was some money.

Let's not require such a lesson for ourselves when the cost might be our climate, our standard of living, our future.

It's going to take a lot of us giving our best effort to be as thoughtful, self-critical, methodical, and generous as we ever will be in our lives. But I think we can do it. We've never encountered a problem like this before, where the lag time is large, the tipping points hidden, and the outcome global. This time, the problem is like none other, so the solution must be like none other.

It's time for the best in us to come out.

——end——

"How It All Ends: The Solution"
(original script—final version)

*AUTHOR'S NOTE: This is the original script, but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution*," please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck! (wonderingmind42@gmail.com, 25OCT2007)*

This video is titled "The Solution" and is part of the expansion pack accompanying the original video "How It All Ends."

[BOARD, OUTLINE] In this video I'll share three different categories of solutions for combating anthropogenic global climate change. First, technical solutions: what, physically, will address climate change. Second, policy solutions: what do we as a society do to implement the technical solutions. And finally, personal solutions: what do you—the viewer—do differently tomorrow than you did today?

You may have already watched "The Mechanics of Global Climate Change" and "Scare Tactics," in which case, you probably see that the technical solution is screamingly simple. If the problem is that we are emitting too much CO_2, then the solution is: stop doing that! If you have a headache from banging your head against the wall, the simplest solution is to stop banging your head.

I hope it's clear what the answer is to these objections that I often hear: "If man has changed the climate, then what is it SUPPOSED to be now? What's the right climate? Until we have a clue what the norm is, how do we know how much we need to adjust what we're doing? What if taking actions makes it worse? Or we overshoot and cause an ice age?"

It's not like there's a giant thermostat hidden somewhere whose dial we get to turn, if we could only decide what setting it's supposed to be at. We're not talking climate engineering—no giant space mirrors. This is a common objection, so I want to be clear: "taking action" on climate change means stopping the disturbance we are currently causing. It means stopping rocking the boat.

A slightly less charitable but certainly more vivid analogy would be: stop thrashing like a monkey at the controls of a nuclear power plant! That's the action we're talking about—stopping the thrashing. Now, we're not "the bad guy" for being the

thrashing monkey. We didn't realize we were in a control room. We were just doing our thing. We're only now starting to see that there are some buttons and levers that maybe we've been bumping.

So now that we know better, the wise thing to do is to get a bit more cautious and little less careless in our dancing around. To realize that there may be consequences we hadn't thought of, and won't like, if we continue doing things the way we have. It's gonna take some will power, because you've gotta admit, continuing doing things like we always have is certainly the most convenient thing in the short run. Which is maybe part of why there's still so much resistance despite the very clear statements from the very qualified AAAS and NAS.

Because the hitch is: we really like doing the things that emit all that CO_2—at least in the industrialized countries, it's the carbon-emitting activities that largely make our lives so darn comfortable. And by activities, I don't just mean going muddin' on the weekend in your lifted pickup. I essentially mean the modern lifestyle, because a huge chunk of our electricity comes from burning fossil fuels, which—as you'll recall—is the exact opposite of the process that put that carbon in the ground in the first place over the last 300 million years.

[BOARD, OUTLINE] So on a conceptual level, the technical solution is simple: stop moving so much bloody carbon from the ground into the air. But, as you might expect, the implementation involves some complexity, which comes from several factors.

The first is the simply huge energy requirements created by our large population using current technology to maintain such a high standard of living.

The second is: oil and coal (made mostly of carbon) are a <u>very easy</u> source of energy. It's pretty much just lying around, chock full of energy. We just dig it up, and—since the huge amounts of energy are stored in a very stable form—we can safely haul it to wherever you need the energy.

Once we're there, to extract the energy, we let the carbon combine with oxygen from the atmosphere, releasing heat—that is, we burn it—and we use the heat to do something useful for us, like spin a turbine, or push a piston. At the end of that we're left with the waste product of the reaction—CO_2. But it's not poisonous, and it's never been a problem, so we just vent it into the air, and let it drift away. In fact the Competitive Enterprise Institute helpfully ran ads just last year reminding us that CO_2 is necessary for all plant life. "Carbon Dioxide," went the tag line. "They call it pollution. We call it life." So we dump the waste product into the air, and it feeds the plants. No big deal.

Well, it didn't used to be a big deal. But we've been doing this so much, that the waste bin we've been using—the atmosphere—is starting to "fill up." See this bag? It's a five pound sack of coal—almost pure carbon, dug up from the ground where it's been stored for some hundreds of millions of years. What's the significance of the 5 pound sack? This is the amount of carbon that you put in the air with every gallon of gasoline you burn. If you're in a Hummer, that'll get you maybe 12 miles, and if you're in a Prius, that'll get you 4 times as far. Of course, the Hummer will totally stomp the Prius flat in the shopping mall parking lot, but we're not talking about that.

So the problem is not that we're running out of this stuff. We will in a little bit, but

not yet. The problem is that the waste basket is starting to back up. Not in the sense that we can't fit any more CO_2 in, but in the sense that it's now making a difference in the way the atmosphere—and therefore the weather patterns—behaves.

[BOARD, OUTLINE] So, although the technical solution is simple—reduce carbon emissions—the challenge is how do we do that without reducing the activities that we like so much?

There are three basic strategies in our category of technical solutions: get the energy from a process that doesn't put CO_2 into the atmosphere, reduce energy demand, and do things that actually take carbon back out of the atmosphere.

First, lets look at changing where we get our energy. We currently get almost all of our energy from fossil fuels—coal, oil, and natural gas. That's where the whole problem is, because each of those is made mostly of carbon. So the first strategy is to find different sources for our energy. This is what's meant when you hear the term "renewable energies" or "alternative energies." Basically, those both refer to anything that's not a fossil fuel, because we want to get our energy from non-carbon-based sources. Get it from your sun, or your wind, or uranium. [Snicker] This can be fun and exciting stuff—cars that "run on water," cool stuff like that!

Hydroelectric power—zero carbon emissions. Wind farms—zero carbon. Nuclear power—zero carbon. (There's the little problem of what to do with the waste, but that now <u>pales</u> in comparison to the problem of global climate destabilization.) Electric cars—neck snapping acceleration (so I've read) and zero carbon if the electricity comes from renewables. These are mature technologies. They just need a leg up.

We can use biodiesel and ethanol, both of which come from plants we grow. Use them in their own production, and they're zero carbon! Think of them as stored solar energy. Really, the energy is from the same source as fossil fuels, just fresher. They're composed of carbon taken from the air and stitched together with energy from the sun. They still turn back into CO_2 when you burn them, so technically they emit CO_2. But the carbon they emit was already in the air a couple of years before, whereas the carbon that fossil fuels emit was last in the air hundreds of millions of years ago. So yes, biodiesel and ethanol emit carbon when you burn them, but just a year before that, they took that exact same amount of carbon <u>out</u> of the air, so the net carbon emissions of biodiesel and ethanol are zero. It's a really slick trick.

Hydrogen fuel cells are a totally cool technology that's just getting started. The core part is often just a membrane. Put hydrogen from your tank on one side of the membrane, and oxygen from the air on the other side, and presto—the thing produces electricity with no moving parts! And guess what the waste product is? What might you get when you combine hydrogen—H—with oxygen—O. H_2O! Water! So when you run your hydrogen fuel cell car, not only is there no noise, but the only thing coming out your tailpipe is water! It's actually more pure than what comes out your tap! You could drink it! Just pipe it right through the window into your cupholder! Don't try that with your gasoline car.

Of course there are drawbacks to each those energy sources. That's why they're called "alternatives" instead of "perfects." But before someone tries to kill your buzz about the cool stuff ahead—like pointing out that wind turbines kill birds, and biodiesel

isn't really carbon-neutral because we still use fossil fuels in its production—remember that we're quickly seeing that the alternative to renewable energies—that is, business as usual, moving carbon from underground into the atmosphere—is likely to have a much, much worse downside than all of these "renewable energies" combined. So delaying action because the alternatives aren't perfect, is just a case of not thinking things through.

[BOARD, OUTLINE] Now as we look at the second strategy in our technical solutions, remember, the problem is too much CO_2, and the basic solution is to reduce and eventually stop the process of moving carbon in large amounts from the ground to the air.

"Great. Back to the Dark Ages," you say.

Actually, no. That's only if you're not creative. We just need to change our thinking. For the last 15 years, this next point from Hal Harvey has stuck in my mind, because it changed how I think about problems:

[SCREEN] "More than a decade ago, Amory Lovins and John Holdren and a few others asked this question in the energy field: what do people want? [Their] response was that people do not want barrels of oil or kilowatt-hours of electricity or cubic meters of gas; instead they want heat, light, drivepower, mobility. That simple insight more than doubled the number of potential solutions to the energy crisis by allowing for demand-side answers. That insight, borne of a simple question, created an energy revolution." [Hal Harvey, May 22, 1992 Commencement Address, Energy Resources Group, UC Berkeley.]

[BOARD, OUTLINE] So the second technical strategy is to reduce carbon emissions by reducing energy demand. There are huge gains to be made quite easily here: compact fluorescent light bulbs, better fuel efficiency standards for cars and trucks, weatherizing buildings, Energy Star appliances. These are all on the shelf right now.

Oh, we'll have to work at it, but a lot of it has the potential to end up paying for itself through the savings in energy purchased! Basically, it's just being smarter—more efficient—with the energy we use.

For example, you probably didn't realize that for every dollar's worth of electricity you buy for your light bulb, you immediately throw out 80 cents, because it turns directly into heat, instead of light. If you think government taxes are bad, this heat tax is even worse, because it's 80%, and no one even provides any services with it.

You just throw that money, literally, out the window. In fact if you're not in a cold climate, it's worse than just throwing it out the window. You'd do well to just throw it out the window. That would be smarter than what you're doing right now. Because when the heat from that 80% "tax" you pay on your light bulbs doesn't go out the window, it stays in your house and warms it up. So if it's a nice day out, you then turn on your AC, spending even more money. All because you were using what William McDonough calls "fairly efficient heaters which happen to give off some light." In terms of the thermodynamics, using one of these is like walking into your dark kitchen at night and turning on your electric burners to see by. These things are ridiculous!

So, thinking like Hal Harvey, can we get the same function, without throwing away all that energy? You bet! Compact fluorescent bulbs are more expensive to buy,

but end up saving you money by using less electricity for the same light, and they're getting better all the time.

How about that old saw: drive less. Or get a car with a higher gas mileage. If your manhood can't stand small cars, drive a biodiesel. A cool trick—the mileage doesn't really matter since it's close to carbon neutral. In fact, if you plant some grass on the roof and bury the clippings, you could be carbon negative! You don't even have to stop your weekend muddin'—just do it in a diesel truck! I told my students they should buy me a diesel Hummer 3, and by running biodiesel in it, I'd be better for climate change than the math teacher's Prius. Since then I've learned Hummers don't come in diesels. And no one's started a collection yet. But a guy can dream!

There's tons of innovations going on right now in all sorts of products to bring you the same functionality, but at greatly improved energy efficiency. It's pretty slick—save the planet while saving money.

[BOARD, OUTLINE] The third basic technical strategy for reducing the concentration of CO_2 in the atmosphere really has nothing to do with emissions. It is simply to actively pull carbon out of the air, and put it somewhere else. This is often called carbon sequestration [on board]—just like when a jury in a high profile trial gets sequestered—put away. Except the carbon doesn't get a book deal afterwards.

When my students see for themselves that the problem is too much CO_2 in the atmosphere—"I see-oh-too much CO_2" as one student put it—invariably they start asking if there is something we can put into the air to neutralize it somehow. They want things that we can do to get the CO_2 out of the air. Well there's no way to neutralize it as such, but there are some ideas about complicated systems that you can attach to your coal-fired power plant, to try to capture the CO_2 coming out and inject it back underground somehow. Perhaps those will be part of the solution.

But I tell my students that we already have a mature technology that will capture CO_2 from the air and turn it into a solid form, which we can then dispose of. This device is already available, and it's remarkably durable and low-maintenance, almost to the point of being self-repairing in a limited sense. In fact one of the most ingenious parts of it is it's also pretty close to being self-assembling, so once you have the basic kit, you can just do a simple installation and go away, while it does the rest! Because of this, it starts out small so it's easy to transport, and as it captures the CO_2, it stores it on-site in handy packages that are then easy to haul away.

You'd think these would be really expensive, but amazingly, they're so cheap that if one does break, you don't even try to fix it, you just install a new one. You don't have to hook them up to the electrical grid—they're solar powered, so you can even put them in remote places. Their emissions are benign, even helpful. (Maybe the CEI could do an ad about that.) And, they're not an eyesore! In fact, many people actually like to look at them and hang around in their shade. And the waste that they produce—the solid form of the carbon—actually can be useful as a building material.

Have you guessed what the device is? A tree. And all you need to get one of your own is this little packet of instructions on how to make one out of air and water, stitched together by solar energy. Install it in the ground, and it almost immediately starts to assemble itself, pulling CO_2 out of the air, stripping off the carbon to reassemble into wood, leaves, and fruit, and spitting out the waste oxygen for us to

breathe. A pretty cool trick, and these will definitely be part of the solution.

[BOARD, OUTLINE] Those are just some of the technical solutions. But how do we make those happen? That's where policies come in. Because the problem is so big, the only way we can make **enough** happen on a **large** enough scale **soon** enough is by **national** policies.

Some policies are pretty straightforward, like providing significant funding for research into renewable energy technologies , and tax breaks for using such technologies. This is necessary as a government policy because renewables cannot compete economically yet with fossil fuels, because all of our infrastructure is set up for fossil fuels. So we need an institutional push to help renewable energy sources mature enough that they can compete with the relatively and easy and available fossil fuels. That is exactly why we have governments, to fill in where the free market can't accomplish what needs to happen. The free market won't make renewables competitive until the fossil fuels become scarce, which looks like it probably won't happen until well after the climate undergoes some irreversible (at least on our time scale) changes.

Other obvious policies include higher fuel efficiency standards for vehicles, and subsidies for creating the infrastructure for the manufacture, distribution, and storage of hydrogen and biofuels.

A policy called cap-and-trade is already in place in much of the rest of the world, and although its implementation certainly has some wrinkles to be worked out, it's pretty clever. Done well, it can accomplish the goal of making sure that total emissions (which—after all—is the bottom line we care about) remain below a specified level, yet individual emitters are allowed flexibility to make changes and adapt. It also links financial economy with carbon emissions, so that companies who do better at reducing their emissions are financially rewarded at the expense of companies that do poorly. I'm no economist, but it sure seems to harness some of the best dynamics of markets in order to accomplish a greater good that no single company—or the market itself—could ever afford to pursue on its own.

But again, as with the science, there are people way more qualified than you or me to figure out what would be the most effective policies to accomplish our objective of reducing carbon emissions as quickly as possible.

[BOARD, OUTLINE] So what do you personally do about this? Well, that depends on several things, mostly how motivated you are, balanced by the other demands your life places on you. If an issue seems small to you, then you maybe do something about it occasionally. But if your house is about to get bulldozed, then you drop absolutely everything to go all out to fight it. It's up to you to make that evaluation.

"But just tell me how much needs to get done? How much is enough?" Yeah, who wants to do more than they have to, right? So let's figure out exactly how much needs to get done, and then just do that. Give us the goal—what's it going to take to fix this?

The problem is, we don't know. Remember, there are no certainties in this game, only probabilities. And we won't know where a tipping point actually is until we

cross it. But the most recent climate science seems to indicate that it is probably already too late to avoid significant climate change. Sorry. However, the speed and extent of our actions will affect how quickly that change comes, and how severe it will be. So we can't afford to be fatalistic, because that would only make it worse.

[At grid] As a general rule, the greater the action we take—that is, the more demanding the government policies and the greater the personal sacrifices—the more we decrease the probability of this down here, and increase the probability of this up here. So how much strikes the right balance? That's the next discussion we need to have, and it'll be messy, because it will involve all sorts of values—like how risk averse you are, how much weight you place on the welfare of others, etc.

I just hope that this time, with this discussion, we'll listen to the scientists a little more, and guys like the Heritage Foundation and the Competitive Enterprise Institute a little less. As you recall, the Heritage Foundation was the one who argued against the Kyoto Protocol in 1998 because the resulting drastic economic harm could result in gas costing as much as $1.91 a gallon by 2010. And CEI was the one with the "Carbon dioxide. They call it pollution. We call it life." I'm getting the feeling these guys don't have the best interests of the whole at heart.

What you personally do, depends on how motivated your research makes you. I've got my opinions, but I hope I've made it clear through this whole thing that I think you should form your own, with conscientious, self-critical effort. And I want to avoid a repeat of President Carter's famous sweater speech, where he asked for more sacrifice than people were willing to make, and thus his call to action was dismissed, with the net effect of his cause **losing** ground instead of gaining it.

So how about I suggest a range of personal actions, from less demanding to more-demanding. And once you've mulled it over and decided how much the threat of global climate change balances against the other demands in your life, you can pick something from the menu.

With all of these personal actions, the goal is nothing less than to change our culture, so that a policy maker can't turn around without a constituent asking "What are we—you—going to do about global climate change?" Because the only way to really buy ticket A is with policy changes.

That's because the actions required to address this global problem are too big to be borne by the few. The demands must be spread out amongst everybody, so that we can make significant changes in our total carbon emissions without asking such great sacrifices from individuals that people will refuse to support the effort. In today's media-saturated world, policy makers will not get too far out ahead of their constituents—they will only make changes when they sense that enough people demand them. And the bigger the change, the greater the clamor must be. So we must enlist our fellow citizens in demanding policy changes. Here are some ways you might help accomplish that:

First, the easiest: Forward the video "How It All Ends" to everyone you know. A few clicks, and you get back to your life.

Next up: Forward the video to everyone you know, and then follow up, asking them what they thought, and listening sincerely to their answers. Make this part of your thinking, part of your daily mindset, part of your conversations and concerns. Talk to

your friends, and family, and coworkers about this—not on a crusade, but gently, as it comes up. "Do anything interesting this weekend?" "Well, you know, I watched this interesting video that got me thinking. . ." You don't need to become an evangelist to have an effect. If we have enough people who just sort of go about with this in their daily lives, then that can change the culture. Because in today's interconnected world, one vote is not just one vote—it can be ten thousand.

Next up: Write to your lawmakers. It's way easier than you think. Handwritten letters are actually best, because then the staff member who reads it knows someone actually put time into it, rather doing a cut-and-paste as part of a funded campaign. Those are more likely to get passed up the food chain in the legislative office

Next up: This one is actually the overarching idea of all of the actions, but I'm putting it farther down the list of difficulty because it has the word "everything" in it, so it might come across as pretty demanding. It seems clear to me that this is the action that will give the "biggest bang for your buck" because it multiplies itself.

[BOARD, CHECKLIST] You do:

- ☐ everything you can to
- ☐ increase public demand for
- ☐ significant and immediate policy action to
- ☐ combat global climate change. (Here's the part where you get creative [pointing to top line].)

Next up: You make changes in your own lifestyle, from small to substantial. Anything from changing your lightbulbs to compact fluorescents, to weatherizing your home, buying Energy Star-endorsed appliances, driving less, driving an economy car or hybrid, driving a biodiesel vehicle, asking your power company if they offer renewables and if not, why not? There are a ton of suggestions out there. Go find ones you can get excited about, and then talk them up to your friends and family.

And my last suggestion is a special one, a radical one for those of you who like to spend time online, or like writing letters to the editor, or just feel really agitated about this—like a firehose that can't be turned off—and need some direction to point your energy to feel like you're doing something useful. I'm calling for some Information Warriors. If you're interested, you've got your own video, titled "Your Mission."

I've lost count of the number of times I've seen a comment along the lines of this one.

[SCREEN] "First, he is confusing my 'not understanding' with my 'not giving a crap'. If we extinct our own species, then we deserve to be gone."

Apathy is a personal choice, and an individual liberty. As long as it doesn't impinge on my liberties. But this is sort of militant apathy—"Nothing matters to me. And it doesn't matter to you, either, bub" is not tolerable. "Fine!" I think. "If you think humanity is a failed experiment, then you're welcome to check out. **But don't take me—and my kids—with you!**" He doesn't have to care. But he does need to get the hell out of the way of those of us who do care, those of us who want to save our bacon. This guy may never be convinced, but he doesn't have to.

What's necessary is for the rest of us to make a great enough effort that the militant apathetics and the unreachable denialists become irrelevant. We're just going

to drag them along as dead weight and save them along with the rest of us. If you've been watching this whole time, hopefully you realize this isn't hyperbole—I'm not talking the end of the species. I'm talking the end of our standard of living. It's not likely, but it's increasingly feasible. Why take the chance? We just need to overwhelm these people with enough people who are awake and rational, so that we can implement sufficient solutions in time.

As you decide how much time and money you want to put into this, I would remind you of my anecdote about driving the tractor I shared at the end of "Scare Tactics." The old saying "A stitch in time saves nine" pretty much sums it up: the more you invest now, the less that will be required later. And in a complex system, sometimes a small difference in what we do now can have a huge difference in what's demanded later. The guys who know best know how the physical world works have already warned us:

[SCREEN] "The longer we wait to tackle climate change, the harder and more expensive the task will be. (AAAS Board statement)"

". . .delayed action will increase the risk of adverse environmental effects and will likely incur a greater cost." (NAS, Joint Science Academies' Statement)

I would also remind you of the disturbing trend that, over the past 30 years of studying the climate, as the science has gotten better, the picture it paints of climate change has only gotten more severe, and more imminent.

One strategy in deciding what's worth your time to do, is what I like to think of as choosing your future regrets. We each want to act so that we don't have any regrets, but there are no guarantees about that. So think about what possible regrets your actions today may be setting you up for in the future. Years down the road, assuming you end up in a regret-able situation, would you rather look back and wish you had worked harder to combat climate change, or that you hadn't worked so hard? Which is the more likely regret for you to have? Which is the more tragic regret? You can probably guess my opinion. But you ask the question for yourself.

I continually do that exercise, and the more I learn about climate change, the harder I work. It kind of sucks. But I've got two little kids, and I'm not at liberty to quit just because it's hard. In a way, now that I've been exposed to the knowledge, I'm infected with possible future regrets. And the only way to inoculate myself—to prevent the possibility of ending up in the lower right corner of the grid, knowing that I could have done more to prevent it, but just didn't find the time, or couldn't be bothered—is to invest a reasonable amount of effort now. Because strangely, the effort itself is what prevents the future regret, not the success. Because even if we do end up hosed, I can feel okay about myself, knowing that I did everything that could reasonably be expected, and that history (or myself, or my daughters) won't judge me too harshly, because even though I may have failed, I made a conscientious effort.

I don't know. Sometimes I guess ignorance IS bliss. Until the carbon hits the fan, that is. Which—it looks like more and more—is going to happen during my lifetime. And so I am obliged to do all I can to soften the blow. And hope that my assessment turns out to be completely wrong.

And now, of course, I've removed the "ignorance is bliss" option for you, by telling you all this. I probably should have warned you before, but it selfishly serves my purpose to infect as many people as possible, so that they accomplish my goals by working to prevent their own future regrets. You're welcome.

The situation is quite likely urgent—we may be near a tipping point. In a complex system, the only way to identify a tipping point is from the other side. (Oops, there it went.) The only thing we know for certain is that the longer we wait, the more likely we are to pass one.

If we continue operating according to our Saber Tooth Tiger Reflex—where we need to see the danger big, violent, and immediate before we act—we may be doomed, because at that point in a complex system, probably no action would be sufficient. As I mentioned, current climate research seems to indicate that at this point, it may already be too late to avoid significant changes. We can probably still affect how quickly it will happen and how bad it will be. But the longer we wait, the less likely that becomes. And right now, we are choosing ticket B by default.

If that gives you a panicky feeling like it does me, I can suggest moving your choice on the menu of personal action down a couple notches. It helps with the butterflies a bit to know you're doing all you can.

Which reminds me of how that professor of mine summed up the importance of the issue. Do you remember it? Paper or plastic? Doesn't matter. Save the whales? Doesn't matter. Save social security? Doesn't matter. Sometimes the Chicken Little turns out to be the Paul Revere. Isn't it worth your time to figure it out, and then decide where this fits in all the other demands in your life, what level of effort you can spare?

As I film this, it's been only 4 days since I started posting the videos in this project. Happily, I've already had a number of people contact me asking if I wanted to work with them on making a website or something around these videos.

No. My wife needs her husband back, my daughters need their daddy back, my students need their teacher back, and I need to get some sleep finally. I can't take on new project. But YOU can. That's exactly what I'm talking about. As the knowledge spreads, so does the realization and the motivation, like a virus, or a meme, which is what I'm **really** talking about.

You have my explicit permission to take these videos and the ideas and phrases and images and words in them, and use them as your own. So build that website around them—even see if you can make some money off them. And you don't need to contact me for permission or a contract—just do it! Contact me if you want higher resolution versions, or if you want to spread some of your massive profits around. (I have spent a ridiculous amount of money on energy drinks during the last few months—don't tell my wife.)

But no need to contact me to collaborate—they're yours now. I give them to you. Mash 'em up, transcribe them and make a hyperlink index, read them at a poetry slam, expand on them, for goodness sake condense them—tighten them up. Re-post them on other video sharing services. Burn DVDs and sell them at your band's gigs, pass them out on the street corner—I don't care! As far as I'm concerned, claim the ideas

are your own, record yourself making the arguments, get famous doing so, and make lots of money—I've got no ownership here. I just want the ideas to infect as many people as possible, so that we get a shift in the culture that allows our policymakers to enact significant enough action that we can substantially reduce the likelihood of abrupt climate change. And for Pete's sake, the least you could do is come up with a better tag line than what just came out of my mouth.

In fact, that's my fantasy, to see this project, these videos, spin completely out of my control. I don't want to spearhead anything—I'm just trying to kick some pebbles down the slope—you guys are the avalanche.

I've worked really hard for this video project to be self-contained, so that it can self-replicate as many times as it needs to without me. Because what we need is a change in culture, and **I** can't do that. But a virus—a meme—can. So I've designed and released the "virus." Now it's your job, as it's host, to do whatever you can to spread it. I know in today's terrorism-dominated mentality, speaking of a virus isn't generally a positive thing. But ideas can be viral too. Let's use that power. How about you host this one, multiply it, and infect a bunch others.

If you spread the idea of risk management, the understanding of the threat of abrupt climate change and how it works, the motivation to do something about it—that can be orders of magnitude more powerful than simply following the traditional "10 Simple Things You Can Do To Be More Green." Those are useful, but I'm afraid in this case, they're not sufficient. I've been watching this for a while, and I've come to the conclusion that the biggest bang for your buck, the greatest payoff for your investment—and in fact the only thing that will get us into column A—is in spreading the concern. "Many hands make light work," and all. A number of my friends have complained that that seems like a cop-out—asking other people to change before making big changes yourself—but I've been studying it for a while, and I'm convinced.

Think of it this way. If you get 10 people on board, and they each get ten, and each of those gets ten, and each of those gets ten, and each of those gets ten, in just 5 steps, that's over a hundred thousand people who've had their thinking shifted. Because of you. That's how we shift the culture. That's how we get policies changed. That's how we make significant action happen.

In both the natural world, and the computer world, viruses are strong and successful in part because they are decentralized. Still, more gets done if everyone is pulling in the same direction. So I'll make a suggestion here that might be helpful. How about if you want to find other people or projects interested in working on this kind of thinking about climate change, on this kind of approach in bringing about substantial action by changing the culture, you could use the keyword "Manpollo" or "Manpollo Project," simply because it's unique.

As of this taping, the only Google hits on the word are from my previous videos on global climate change. So it'll be a useful, decentralized way to find other people of similar interests—you just talk about the Manpollo Project, and do your Googling on it to find others. In fact, it'll be a really cool trick, because it won't require any organization—so it's robust, and zero maintenance. And yet there won't be any confusion, because no one else is using the word, because I just made it up. Cool! So you can easily find each other by using the keyword, and I can go back to my life for a bit without playing

traffic control. Of course, I would like to hear what's going on out there. I've invested a huge amount of personal sacrifice in these videos and a few warm fuzzies would help make that worth it, since my ultimate goal of "saving the world" is a little hard to measure, and doesn't really provide much concrete feedback of a job well done.

So I'm passing the torch. I'm deputizing you. I'm lighting your fire. Cuz, as you may have inferred from the increasing size of the bags under my eyes, this freaking project has consumed me, and it's time that I go back to being a husband, and a father, and a teacher. And not some sleepless zombie, or corporate shill for the energy drink industry. . .

Tag lines

"If you think abrupt climate change is a monster, you should try this stuff!" [Monster]

"Red Bull gives you wings. And hallucinations."

"Que Sobe Sobe—no! You grab life by the tail. And hope it doesn't come off in your hand while life scurries away under a rock?"

"Unless you drink this stuff, abrupt climate change is going to open up a can of it on you." [Whoop Ass]

"NOS—For when you can't afford to nos not sleep!"

"Can you believe the size of this? Pretty soon you'll just open one of these and then climb in."

"Wired X344—brings out the wonderingmind42 in you!"

I'm just waiting for the endorsement contracts to roll in.

The internet functions like a non-linear "complex" system. What if this turned out to be the tipping point for public perception and political will on climate change in the US? How would it feel to be part of history?

Here's where you influence which future you'll have. You can't predict it for certain, but you can change the probabilities.

Throughout its history, America has led the world in so many ways. Yet on this, we've been asleep. But now we wake. And there's work to do.

It's time for the best in us to come out.

——end——

"How It All Ends: God's Will"
(original script—final version)

*AUTHOR'S NOTE: This is the original script, but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution*," please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck!*
(wonderingmind42@gmail.com, 25OCT2007)

This video is titled "God's Will" and is part of the expansion pack accompanying "How It All Ends."

Let me start by saying I know little of theology or hermeneutics. But the subject of God has come up enough times in my discussions with people about global climate change that I want to address it briefly here, without delving into the fundamental questions of faith. I certainly have no answers, only questions, which might have some bearing on how you feel about global climate change and your personal relationship to it.

I recently had a very interesting conversation with an optometrist about climate change. We were sincerely asking what the other thought about it, since she knows I teach science and she hasn't looked into it too much, and I'm always curious about the process by which people arrive at the opinions they hold.

She's devoutly religious (Christian), and it turns out that she feels that global climate change is probably God's will, perhaps in punishment for the sins of mankind. I don't share that conviction, but it seemed fair enough to me.

But when I asked why she thought that, it sparked a question in my mind. She said that the issue was so big, so—well global—that it seemed beyond the purview of humankind, and could only be the realm of a higher being. I wanted to understand better how she made this judgment. So I asked her a hypothetical question, to try to illicit the principles underlying her belief.

I said suppose you live on a river, and you catch and eat the fish from the water. If you eventually noticed that there were fewer and fewer fish, and then that the water started to smell, and then dead fish turned up, you might go looking upstream. Say you find someone has installed a pipeline that is dumping foul-smelling stuff into the river. You wouldn't call the dead fish God's will and ignore it. You'd tell the guy upstream to knock it off. She agreed with that.

If he assured you it's not his stuff that's causing the fish to die, you might even hire a water-quality expert to come out and analyze the water, and you'd probably weigh his statements about the foul-smelling stuff more heavily than those from the guy with the pipeline. She agreed with that, too.

So I asked, what's the difference between this situation, and global climate change?

Her answer was again, that it's just so big. It's hard to imagine it in the hands of humans, and quite easy to imagine it in the hands of God. She agreed that she wouldn't consider the dead fish to be God's Will—or at least, not in the sense that she wouldn't take action to change the situation. You don't have to be a strict Calvinist to believe that in a certain sense, all is God's Will.

So I gave a larger version of the fish scenario—say instead of it being a local river, it's an entire region that's affected, like the acid rain from industrial emissions in the Northeastern US. She agreed again that she'd do something to get the emitters to stop, because the phenomenon was clearly the direct result of human action, and it was harming people both directly and indirectly.

So I asked: if we keep scaling the issue up, where is the line where it goes from being of humans, and therefore subject to our judgment and our action, to being of God, and therefore subject only to prayer? She hadn't really thought about it like that before, and didn't have a ready answer. That's where the conversation ended.

Since then, I've thought about it a lot, and I think perhaps what might be causing the blurring is that with the fish, it's clear to our intuition that the problem is caused by humans. And when you jump straight to the globe, your intuition now opposes the idea that the problem could be caused by humans—it's just so big, and we are so small. As my dad put it—intellectually, he believes the scientists and all—but at a gut level he still doesn't believe that we can change the planet just by driving cars around. We just seem too small.

Which is why I scaled the same problem up gradually, starting with the fish in the river, looking for at what point the issue crosses the line

And that's also why I introduced the idea of the water quality expert. That represents someone whose judgment about the physical situation you trust, because he's studied long and hard, and has lots of experience. Well, with climate change, that's exactly the role that the scientists play. And the statements of AAAS and NAS really leave no question as to their judgment of whether humans are playing a role or not. It is of course correct to say that the climate has changed often, without us ever playing a part. But that doesn't mean we're not the ones doing it now. If you watch the videos "The Mechanics of Climate Change" and "Scare Tactics," you may see that it's not too hard to upgrade your intuition, so that it no longer opposes the conclusions of scientists when they say that it is "highly likely" that the observed warming of the globe is driven primarily by human activities. It worked for my dad, when I explained the mechanics of climate change to him—now his guts agree with his head, and all's well.

So if you've thought in the past that global warming must be God's Will, or even perhaps the start of End Times, I don't have any answers for you. But I would respectfully request—for the benefit of all—that you too ask yourself the question about the fish in the river. Would you consider it God's Will and continue fishing, or would you

ask your upstream neighbor to stop putting things in the river you share? And then make the scenario slightly larger and ask again. And keep making the scenarios gradually larger, until you get to a global scale. Where, in that progression, does the issue go from being a human-caused problem that we can and want to address, to being the Will of God, which we can't?

——end——

"How It All Ends: Get What You Want"
(original script—final version)

*AUTHOR'S NOTE: This is the original script, but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution*," please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck! (wonderingmind42@gmail.com, 25OCT2007)*

All right skeptics, here's the first of the three videos I did just for you: "Get What You Want," followed by "I Hope I'm Wrong" and finally "No Holds Barred," all part of the expansion pack accompanying the video "How It All Ends."

I suggest that before you watch this video, you first make sure you've watched the following parts of the expansion pack to "How It All Ends": "Nature of Science," "Risk Management," "Why There Is Still Debate," "The Manpollo Project," "Mechanics of GCC," "Scare Tactics," "The Solution," and "God's Will." This is because we are entering the home stretch of the argument—the really outlying details, and those videos contain rebuttals to most common objections to the idea of human-caused global climate change, which I'll sometimes just refer to as AGW, since that's how I've found most skeptics refer to it. And notice I'm referring to you as skeptics, not denialists. In a debate, it's just way more productive for each side to refer to the other as that side prefers. If you'd like to return the favor of civility, you can refrain from calling me an alarmist, though, I am alarmed, and I think others should be more alarmed than they seem to be, and—truth be told—if there were a big red handle that said "global alarm" on it, I'd probably pull it. But I wouldn't run. No running. Anyway, a lot in your camp use the term "alarmist" as an epithet, so how about just referring to me and my ilk as a "warmers," and I'll stick to calling you "skeptics," which you may notice turn into "hard-line skeptics" the farther you make it through my videos.

If, as you watch this, you find rebuttals popping up in your mind, please pause and ask yourself if I've already said something in a previous video which may answer your rebuttal. There's a lot of back-and-forth lines of reasoning, and it would take too much time to haul out each one for review every time we hit on a piece of it.

When I posted "The Most Terrifying Video You'll Ever See" in the Spring of 2007, it garnered over a million views on various sites within a month. I quickly put out three

more videos titled “Patching Holes” to answer the objections raised. Over the course of that online debate, I read well over 5,000 comments on my arguments, most of them critical. So I learned a bit about the skeptical viewpoint.

In any technique of conflict resolution or negotiation, the most useful strategy is always about finding common ground—what is it that the two disagreeing sides both need, and is there a way to satisfy those needs? So I just started brainstorming, listing universal human needs, and it jumped right out at me. Common objections to action on AGW like “We need to protect the economy” and “The government just wants more control of our lives,” seem to me to really all come down to one thing: the need for self-determination. No one wants to be limited by others or told what to do. Specifically, it seemed a majority of the comments could be lumped into two subcategories: economic self-determination (sort of the “I need to put food on the table” idea), and social/political self-determination (sort of the “Don’t tread on me” idea).

So, this video is going to proceed with the assumption—hopefully a reasonable one—that if you are a hard-line skeptic who has watched all my other videos and still isn’t convinced that action on climate change is worth it, it’s because you feel a very strong need for economic and political self-determination, and you feel that need is threatened by taking action on climate change.

The purpose of **this** video is not to argue you out of those totally valid needs, but to show you how taking action is actually your **best bet** in getting those needs met. And that not taking action on climate change is actually a greater threat to your economic well-being, and to your political and social liberties, than is taking action.

You wouldn’t be at all misguided to ask me why am I taking such a great effort to do all this. What do I have to gain? That’s a good question to ask. Please remember to ask this of **all** your sources, not just the ones you disagree with.

I don’t have anything more or less to gain than the next guy. In fact, my motivations are completely pragmatic. I don’t get paid for this, I’m not looking for a job, and I’m not running for office. What I hope to gain. . . is a less nasty world a few years down the road. Because I’m a science guy, and when I learned the specifics of the science of climate change, it’s scared the willies out of me.

“But you won’t be around to see the difference,” you might say. I’m not convinced of that, and if you watched my video “Scare Tactics” you’ll know why. Plus, I’ve got two little girls that mean more to me than anything. I want to do whatever I can to eliminate the possibility that they inherit a Mad Max world. That’s my motivation. So I guess it’s kind of selfish—I want to feel like I was a responsible father, and did everything in my power to protect my kids.

I point out that my motivations are simply pragmatic, because in my experience, that’s the case for a lot of you, as well, so it’s common ground for us. As one commentator wrote in response to what he thought was my environmental do-gooder pitch:

[SCREEN] “I can tell you right now that when the rubber meets the road, people are more concerned with their own personal economies than they are with the distant specter of global climate change. My personal economy, for better or worse, ends at my property line.” So you and I are really motivated by the same thing: we just want the best for ourselves and our loved ones. And as I think you’ll see, we don’t need to be

in conflict about that.

So really, don't dismiss me as just another greenie shouting "Save the Planet."

In fact—screw the planet! Save us! (Don't tell the tree-huggers I said that.) The planet will do fine on its own! And it's not even the race I'm concerned about—I think humanity will survive. What I'm concerned about is me and mine, and our lifestyle.

I'm doing all this because my careful study of the science has shown me a future scenario that's unlikely—but still terrifyingly feasible—where I end up holding people off at gunpoint to keep them away from my grandkids' clean water supply. I'll do that—but I'd really rather not end up there.

In evaluating how to meet our needs of self-determination, let's take a look at the problem as if we were a business, because if there's anything the free market does well, it's evolving businesses that are good at figuring out what's in their own best interest. How does a business go about deciding what to do? In general, couldn't we say that a business would do a careful analysis of future threats and opportunities, and then research which courses of action would be most likely to maximize benefits and minimize costs?

So if you're a business, and you discover the potential of a drastic threat to you, what would you do? You'd study it, right? You'd ask "What is the likelihood, and what are the costs and benefits of various courses of action?" You'd want the highest quality answer possible, so you'd hire professionals. And the greater the potential threat, the more resources you'd be willing to devote to looking at it. If it might threaten the very existence of the business, you'd delay less important projects and divert funding so that you could hire the best experts available.

And in that process, you'd be careful to combat your own psychology, because you know that no one—not even you—wants to change "business as usual," and your hired help certainly doesn't want to end up being the bearer of bad news about who gets shot. So to get the highest quality answer, you do everything you can to make sure you hired unbiased, independent people. You don't want yes-men telling you what they think you want to hear. You want smart people telling you what is the most likely thing to happen, regardless of whether you like it or not.

You'd tell them "Everything may be riding on this. So make darn sure your answer is correct," and being the best, they'd tell you "It's impossible to make sure, because there's always uncertainty." And you'd be self-aware enough to know that it's a waste of money to hire experts and then not listen to them simply because your own human shortcomings of bias, fear, and stubbornness got in the way.

So then you'd tell them "Okay—then do it carefully, check your answers, and then do it again. And then, run it by others."

And if, after all that, they came back to you with bad news, and you found yourself dismissing their answers, thinking "that can't be right," you'd be self-aware enough to stop and ask "Do I just think that because I don't like their answers? Am I unconsciously letting that influence my judgement of their quality?" Because after all, you did go our of your way to hire expert, unbiased professionals. That doesn't mean they're infallible, but it does mean you'd better have some really compelling reasons to ignore what they say.

So let's translate all this into the climate change debate. Before we examine what various experts say, let's put ourselves in the business leader's shoes when he asked himself whether he might be letting his likes and dislikes interfere with his judgement. It's my observation that a lot of climate skeptics have very strong Republican or libertarian leanings. As I explained in the video "Why There Is Still Debate," this isn't surprising, since those philosophies have a general distaste for government, and acknowledging AGW would seem to imply increased government action.

But let's be very explicit: it is not in your own interests to let your distaste for government (or Senator Gore, for that matter) influence your judgment about physical reality. Those are two totally different things. It's also the very definition of bias, and it doesn't serve you. So be very deliberate to not confuse hostility towards government with uncertainty in climate science.

Okay let's examine what the experts out there have to say about protecting our economic self-determination in the face of action on climate change. And as we "hire these experts" let's remember the credibility spectrum we developed in the video "Risk Management" and focus on sources from here up. Sources down here (think tanks and individuals) can be useful for giving insight or new ideas, but are less useful for analysis because of the greater potential for bias. Generally that's what I mean when I say "credible."

I covered a lot of this in detail already in the video "Risk Management," but it's worth a brief recap here. After a conscientious search for credible economic disaster scenarios arising from taking action when it wasn't necessary, the worst-case scenario I could find from a credible source was: a 3% reduction in GDP growth. That's the outside figure, from a DOE report that Prof. Ross McKitrick sent me. Most credible predictions put the worst case somewhere around 1.5-2%. Also note that it's GDP **growth**, which in the U.S. over the past 30 years has averaged a bit over 3% per year, and has actually been negative several times. So the worst case credible scenario is that the GDP continues to grow, but very slightly. I did have a chuckle when I came across a dire prediction from a 1998 Heritage Foundation article warning that if the U.S. followed the Kyoto Protocol, by 2010 gasoline could cost as much as. . . $1.91 a gallon.

So what might a business leader make of this? "That's it?" He might say. "That doesn't sound catastrophic. What else is out there about the economic effects of taking action? And fire that Heritage guy—he's lost his credibility and I don't have time for histrionics."

Well there is [Bjorn] Lomborg's Copenhagen Consensus, which had 4 Nobel Laureates on board. They concluded that action on global climate change shouldn't be a priority compared to other world issues. But they didn't really talk so much about the negative economic impacts of action on climate change, and anyway whatever credence we give to their advice is pretty much cancelled out by the conclusions of the [placard: "Economists' Statement on Climate Change"—a petition with 6 Nobel Laureates, but who's counting—which concluded that the right course of action would actually **make** money]. Plus, both of those were sort of think tanks anyway, so we're not going to listen too much to them.

There's also the [placard] Stern Report, prepared by Nicholas Stern for the British government. As we think about how much credibility to assign to him, technically, he's an individual. But he headed up a whole working group, and the government of the world's 12th wealthiest country listens to him, so I'd place his report somewhere in the high middle—higher than the Copenhagen Consensus for sure, cuz a lot more work went into it, and a lot more was riding on it, so its methods were probably way more rigorous. [grid, on placard] His study concluded that this up here would cost about 1% of GDP. Note that they're talking GDP, not GDP growth, so don't try to compare it to the GDP number I mentioned earlier. 1% doesn't sound like much, but in dollars (or pounds sterling, in their case), that's a huge amount of money.

"That sounds significant," our business leader might say. But then we'd be obliged to point out that the Stern report estimated that this down here would probably cost around 20% of GDP.

"Holy cats!" our boss exclaims. "Is this guy for real?"

Well, I had the good fortune of having a brief email exchange with Prof. Richard Tol, a critic of the Stern report who has publicly said that the report is too pessimistic and "could be dismissed as alarmist and incompetent." When I sent professor Tol my standard request for credible worst-case economic scenarios, he pointed me to the Stanford Energy Modeling Forum (EMF), calling it "the most authoritative source on these matters." After digging around for a while in their reports, I couldn't find any doomsday scenarios, but I did find this conclusion in a 1993 report:

[SCREEN] "Thus it is possible to reduce emissions significantly from their non-controlled level without significantly reducing the growth of the economy." (EMF WP 12.1 Global Climate Change: Impacts of Greenhouse Gas Control Strategies, Executive Summary, page iii) This was the exact opposite of what I was looking for!

So I emailed the quote to Prof. Tol, telling him that and asking:

[SCREEN] "If Stanford's EMF is 'the most authoritative source on these matters,' am I left with NO defense to the alarmist's argument 'No one knows for certain, so why not act, just in case'??!!? Help!!!"

He never answered. I'm sure he's a very busy guy, but still—I'd like to know his response.

"Hmph," Says our boss. "Are there any other sources towards the top of the credibility spectrum—you know, the really solid stuff—who have weighed in on the economic threat of action on climate change?"

One of our topmost categories is statements from organizations that contradict their normal bias. Remember the U.S. Climate Action Partnership—that group of heavyweight companies like Ford, GM, GE, Dupont, Shell, BP and others that I mentioned in previous videos? Their statement about the economics of action on climate change is pretty unequivocal:

[SCREEN] "Each year we delay action to control emissions increases the risk of unavoidable consequences that could necessitate even steeper reduction in the future, at potentially greater economic cost. . . . Action sooner rather than later preserves valuable response options. . . and should lower the costs of mitigation and adaptation."

Remember, this is coming from groups whose acknowledged bottom line is to build value for shareholders. If you want to argue with them, you'd better have some

pretty good stuff.

And, as long as we're at the top of the credibility spectrum, it's worth mentioning that the American Association for the Advancement of Science (AAAS) said:

[SCREEN] "The longer we wait to tackle climate change, the harder and more expensive the task will be."

And the National Academy of Sciences (NAS) said that:

[SCREEN] "Delayed action will increase the risk of adverse environmental effects and will likely incur a greater cost."

True, those are organizations of scientists, not economists. But as long as you think you and I are qualified to do armchair evaluations of the threat to the economy, why not let a few tens of thousands of Ph.D.s have their say, too?

"Criminey!" exclaims our business leader, leaning forward on the conference table. "Why the heck are we still talking about this? It seems pretty clear what's in our best economic interests. Any other arguments to be made?"

Well, there's the argument that if planned, debated spending would cause economic hardship up here, then last-minute, panicked spending, compounded by natural disasters, would certainly be even worse down here.

And if the idea is to protect the economy (a phrase I got from the talking points of a Cato Institute presentation on AGW), then really, how good for the economy are floods, droughts, landslides, hurricanes, wildfires, epidemics, wars, and refugees?

And even if we take the outlandish extremes—at least in a depression you can still plant a subsistence garden. Down here in a chaotic climate, your area may not even have topsoil or a growing season.

But then a voice of dissent rises from the opposite side of the conference table. "I'd rather not take action on an uncertain threat, so that we can face any real threats that **do** materialize down the road with the wealth that an unfettered economy would bring us."

"Hmmm," sez our boss. "On the face of it, that sounds appealing. But isn't that just like the practice of 'leveraging' in the investment realm? Where you borrow money from one place and then invest it somewhere else? As long as the interest you pay on the loan is lower than the yield you get from your investment, you make money. But if the rates flip, you're totally hosed. Essentially, we'd be betting that our unfettered economy would grow faster than any potential threats to it. And given the odds we've gotten from the eggheads who actually know the science, and the consequences if we're wrong, that seems like an extremely high-risk bet. Not prudent, not prudent at all," he mutters.

"Before we adjourn, are there any other arguments to be made that acting on climate change—even in the face of the stated uncertainty—is pragmatically in our best economic interests?"

Well, how about this: the solutions are exciting and can maintain our standard of living—like hydrogen fuel cells, cars that "run on water," and biodiesel. And before you let someone pile on with all the shortcomings of alternative energies, let me point out—they're comparing it to fossil fuels. And it's not a fair comparison, because we're already set up for fossil fuels, which makes them very cheap and easy compared to the technologies of the future. That's why those energy technologies are called

"alternatives," rather than "perfects."

But here's a news flash: there's only so much fossil fuels left in the ground; we're going to run out of the stuff, probably in your lifetime. We WILL move to the new technologies, almost certainly in the next 50 years. There's a good chance we're right now around Peak Oil, having already burned more than what remains in the ground. And before you parrot the old "we've got enough coal for 500 years," you'd better watch the video titled "The Most Important Video You'll Ever See" on my wonderingmind42 account. All it takes is some simple arithmetic to show that anyone knowledgeable who feeds you that line about coal is either woefully ignorant, or unforgivably manipulative.

So, it is inevitable that our energy technologies will change. And isn't it true in business that the early innovators are the ones who make the big bucks? Like Ford, Goodyear, Microsoft? So it's going to happen—you can't deny that. Why not start now, mitigate possible downsides, and make some money in the process?

The U.S. could be leading the world in this. We've got the world's greatest higher education system and the best research resources—we could use those to lead in new technologies and to sell it to the rest of the world, increasing our own economic prosperity. The ones that change last, lose out—just look at history. So do we want to be left behind? To make money, you hire the best people to look ahead, and then you position yourself to get in early so that YOU have the expertise, YOU have the product, YOU have the brand, and EVERYONE buys from you. Who's going to be the next Bell? Not those that rely on oil and coal technology.

Given all that evidence and reasoning, from such credible sources, don't you think that the prudent business leader would agree that the course of action which is most likely to maximize opportunity and minimize cost—to "protect the economy"—is to take significant action now to combat global climate change? Doesn't it just seem practical?

Now, as for protecting our social and political self-determination—our liberties—the case seems much simpler to me, and can be summed up in a single sentence: democracy cannot survive in a Mad Max world.

There's a reason martial law exists. It's so that when the asteroid hits the fan, the government can do whatever necessary—even suspending the rights of the individual—in order to secure the greater good for the greater number. Do you think anyone in New Orleans in the days after Katrina gave a rat's ass about civil liberties? No—they were busy looting bottled water and disposable diapers. And had the National Guard gotten there faster, they would have opened up the fire hoses on the looters to ensure order. There's nothing like large scale natural disasters or threats to national security to bring out the draconian in any government.

I often hear the very strident objection: "Action on AGW would lead to government control of our lives!" Well, given the probability of AGW being real versus it being a huge, elaborate hoax, isn't it more likely that the greatest long-term threat to your liberties is **inaction**?

And if you're concerned about national autonomy, here's two words to whet your appetite for developing renewables: "energy independence!" Here's two more: "goodbye OPEC!"

So back to protecting your economic self-determination. . . . When I was asking around for credible predictions of the economic costs of unnecessary action, one exasperated skeptic finally complained:

[SCREEN] "predictions of economic models are even more uncertain than climate models."

I did a double take. Cuz if that's the case, then where the heck is the wisdom in ignoring the warnings of the climate models based on the even less reliable predictions of the economic models? But it's even more lopsided than that, because none of the economic models actually even predict nasty economic consequences of action. All of the economic doom-and-gloom predictions seem to be conjecture by sources at the bottom of the credibility spectrum! Does this really sound like the best bet for protecting your economic well-being?

How well is field economics known for making correct predictions? That is, how often do economists' predictions come true? Sometimes, sometimes not. How often do the predictions of science come true? When you fly in a jet airliner, or use your cellphone, or turn on your tap water, or get on the Internet, or take Advil. I'm not saying science—or the scientist—is infallible. I'm just saying when it comes to comparing the predictive power of science versus the predictive power of economics, who's your daddy? No—wait—I'm not saying that.

I'm saying—in our business analogy—when you're looking for a reliable track record in making predictions, the résumé of science far outweighs the résumé of economics. Both have their place, both are useful, both make mistakes. One isn't intrinsically better than the other. But if you're going to put them head to head—which, make no mistake, is what you're doing if your answer to "Why not act, just in case?" is "Because it would cost too much"—then you've got to give the job to science.

"Hey, wait a minute," someone says. "Science isn't so hot. Remember when the eggheads were all certain in the 1970's that the globe was going into an ice age that never materialized? They're always screaming some Chicken Little story. So why should we listen now?"

A totally understandable sentiment. But it turns out the claim that scientists in the 70's were warning of an impending ice age is a classic urban myth, originating in some over-hysterical media coverage about an NAS report that was actually trying to say: the climate is changing, and we'd better figure out how to understand it better. That's why it's so important to distinguish between media stories, and what the organizations are actually saying. There was nothing back then even comparable to the unprecedented statements today that most every scientific society is making. But don't believe me—go look up for yourself what the scientists said during the 70's "Ice Age" scare—not just what the media said the scientists said. The NAS report that was the source of that urban myth is available in its entirety online. Remember to evaluate your sources. George Will is not a reliable source on what NAS said. NAS is.

It' true, you can always find some doom-and-gloom story in the history books and newspaper archives. But look around now, and then do some digging. Look at the extent and quality of the warnings made now about global climate change. When you have all these scientific societies, and all these profit-driven companies lining up with

the usual suspects of all the environmental organizations, something profoundly different must be going on now. You will not find—ever in history—a warning with this level and widespread extent of weighty opinion and analysis behind it.

I'm serious—go looking for yourself. And remember the warning about confirmation bias from the video "Nature of Science": don't just stop when you find something that supports what you already think. Go further. See if you can find the refutation to that. You'll see that never before have so many professional societies issued so many warnings in such strong words. Never before have so many companies vested in the status quo publicly called for change—for government regulation of themselves. I think you'll see that to dismiss this as another Chicken Little story just because it seems to predict doomsday—like so many failed doomsday predictions before—is not just irrational, it's downright reckless. Sometimes the wolf is at the door.

I believe you want the best for yourself. I even believe you probably want the best for the whole world. I think if you try to become brutally aware of your thinking—your biases, whether your goal in looking for information is to get closer to the physical truth or just to strengthen your opinion, whether you are starting from belief or starting from evidence—and you analyze this in historical perspective, you will see that we are in a time like no other. Because our population and our technology are large enough to change the planet, and the old way of thinking, where we could tolerate mistakes, no longer serves us. Because this time it's global, there's no longer anywhere to move on to.

Whether you're a tree-hugger or a tree-logger, pro-life or pro-choice, communist or laissez-faire, fascist or libertarian, you still want economic and political self-determination. And I hope you've seen that, using basic risk assessment and weighing all the factors from all the sources, [checklist on board] it is in your best interests to do all you can to increase public demand for policy changes to combat global climate change as soon as possible.

If you're still not convinced, then I'll meet you at your next video: "I Hope I'm Wrong."

——end——

"How It All Ends: I Hope I'm Wrong"
(original script—final version)

*AUTHOR'S NOTE: This is the original script, but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution*," please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck! (wonderingmind42@gmail.com, 25OCT2007)*

This is video is titled "I Hope I'm Wrong," and is the second of three prepared just for hard-core climate skeptics in the expansion pack to the video "How It All Ends."

I want to show you that I think a lot about the question "What if I'm wrong?" To be totally frank, my purpose in doing so is that I hope to inspire you to do the same for your own thinking. Because, although I hope **I'm** wrong, I **think** you're wrong. How's that for clear?

It seems to me that being honest with yourself means being willing to acknowledge when you're wrong, and then fixing it, so that you are less wrong. I'm wrong all the time, and by being conscious of that, I think I get better and better all the time. So could I be wrong about this? Let me tell you—I sure hope I am. But I haven't been able to escape this conclusion. And as time has gone on, my assessment has done the same thing as that of the scientists studying climate change—the picture just gets worse.

I used to get wound up about all sorts of issues, but I don't anymore. You know why? Because I'm terrified. It's become clear to me that the potential threat is big enough that nothing is more worth dealing with than this. So in an ironic—and bizarre—sense, having a fairly deep understanding of climate change has really mellowed me out. I used to regularly read the letters to the editor and get all ticked off. Now I never even open to that page. Pretty much all other concerns have dropped away, because this issue has the potential to so dominate our—my, my kids'—future. It's almost a sense of: nothing else may matter much if we don't deal with this.

And if you've watched all my videos up to this one, I think you'll see that it's not just a knee-jerk reaction to some sensationalist magazine article. I've done a bit of homework. I teach science. I have a deep understanding of the basic principles,

though I also try to recognize when my knowledge falls short. My terror results from my own cold, rational assessment of the science of climate change and complex, non-linear systems, not from someone's scare tactics or appeals to my emotions. They didn't need to: I was already paying attention.

A while ago I noticed something that I still haven't quite been able to figure out. I realized that when I'm debating climate change with someone, I'm hoping to change their minds, but at the same time I sincerely hope that my arguments are wrong. Kind of odd. And I don't sense that the other person can say the same thing about their own arguments. It was a sort of "huh" moment, though it's since grown into this sense that there must be some significance to it, but I can't figure out what that would be. I mean, isn't it a little odd to find yourself arguing vehemently for a point of view, and you just as vehemently hope you're wrong? It's sort of a strange feeling.

An interesting exercise is to ask yourself: in 20 years, how would I feel if I turned out to be wrong? Personally, I'd be thrilled. Drinks'll be on me. I'd even feel okay about any economic damage that happened as a result of mistakenly taking action, because I'd feel that I'd done my best. I haven't stopped at the first answer that made sense, or that I liked the sound of. I looked for the rebuttal to that answer, and then the response to that rebuttal, and then the critique of that response. I made as thorough and conscientious of an effort as can be expected of anybody. I tried to be uncomfortably self-critical so that I could root out my assumptions and unconscious biases, to be sure that in my research my goal really was to get closer to the truth, rather than just to retain my beliefs. And after all that, my evaluation says that the risk of not taking action is clearly greater than the risk of taking action.

I'm certainly no expert, but I've spent literally hundreds of hours researching and studying. Yeah, it's exhausting, which is why I don't do that for the debate in the chemistry education community over why Mentos causes Diet Coke to go wild—because it's just not that important. But since global climate change can't be dismissed as "certainly not a threat," I think the time is worth it.

There are many possible future worlds. Imagine for a moment you're in the world where catastrophic climate change has come to pass, wrecking the economy, leading to brutal dictatorships, and so on. Now imagine looking back on this moment, when you had enough information to connect the dots, but you argued against action because you weren't sufficiently convinced it was even possible. You were afraid that it might hurt the economy, or give the government more power. Looking around in that future at the economic ruins and draconian governments, how would that feel? Maybe I'm wrong. What might be the worst consequences of that? Maybe you're wrong. What might be the worst consequences of that?

As you probably picked up from watching the previous videos, I'm pretty big on the idea of trying to be aware of one's own biases. I mention it here because I think that's often the cause when we turn out to be wrong—a bias we didn't know we had, interfering with our judgement about things that seemed obvious. And the really dangerous part is that these biases can be so bloody stealthy, so in the moment it doesn't even occur to you to ask if you're being objective, and all the while you're carrying an unknown assumption that totally throws off your judgement.

Here's a graphically personal example.

I'm 38 now and don't exercise, but I used to be an athlete, and have always been blessed with a very forgiving metabolism, so my. . . widening. . . process has been extremely gradual. And—just like all you other humans—I have a deep psychological need to have a positive view of myself. As a result, when I happen to see myself in the mirror without a shirt on, [WARNING: images may be objectionable to some viewers] I still occasionally catch myself thinking "Hey—not too shabby. You've still got a hint of a six pack." Six pack??! Those are rolls of fat!! [Show]. What am I, delusional?? No—just human. The point is, our desire for something can be so strong that it totally influences what we think is a simple perception of reality—without us even realizing it.

What does this have to do with climate change? I'm not saying that if you're still doubtful about climate change you must be delusional. Who am I to make that judgement—I'm no professional. But I am saying: this is a powerful and stealthy psychological phenomenon. Isn't it worth taking a step back and examining it, so you can make yourself confident that it's NOT influencing your opinions? I try to do that every so often with my thoughts about climate change, because the stakes are so high. I want to end up with the most robust, solid viewpoints I can, so that I don't find myself holding on to something flimsy just because I really like the idea, or I really dislike the alternative.

Along those lines, I had an interesting experience recently. I'd been having an extensive back-and-forth debate by email with a climate skeptic who was civil and thoughtful. And fairly far into the conversation, I was trying to make sense of this long response of his. I just couldn't do it. I re-read and re-read, and was befuddled, thinking: he's all over the place—I just don't know how to respond to this. And then I thought—ahh, maybe that's a clue to examine my own thinking. Maybe he's being perfectly clear, and I don't know how to respond because he's right, and I just can't let myself see it.

So I approached the text again, this time able to hear what he had to say, instead of trying to deconstruct it to form a counterattack. Turns out I didn't think he was right after all. But taking the step back did allow me to figure out that the reason I didn't know how to respond was that I didn't think that I could ever convince him. He was starting from belief instead of evidence, which is simply impossible to refute. He finally admitted to something along these lines, writing "I just don't like the idea of politicians and an unelected bureaucracy making decisions based on special interest groups and the prevailing political wind. Lol! Maybe I should have said that from the get go!" Like I said, a nice guy, but when you start from belief rather than from evidence, you end up keeping or ignoring evidence as it fits your belief, which means you will never be convinced, no matter how compelling the evidence. We all do that sometimes. I'm just saying, if there was ever a time in our individual and collective lives to be extraordinarily careful to not make that mistake, it would be now, with this issue.

Still, it was a good lesson for me, remembering it's good to be willing to take a step back and ask myself "Could I be the one who's wrong here?" Trying to be as unbiased and intellectually honest as I can is a service I try to offer my opponents in a discussion, and I like to ask that they offer it to me in return. We all come out feeling less angry that way, and hopefully a bit closer to the truth.

Finally, one more personal anecdote in humility. I teach high school chemistry, and I'm very thoughtful and cautious about safety. For example: late one night I was

testing a demonstration in my classroom, and I knew I was all alone in the building. The demo involved big flame and glass, and I asked myself "What's the worst that could happen?" Well, I could imagine the glass exploding while I was sitting right in front of it, and I thought through the worst-case scenarios. So in addition to the goggles, apron, gloves, and fire extinguisher, I wrapped cloth towels around my pressure point so that I couldn't get a major artery cut and bleed to death before I could reach the phone to call for help. Extremely unlikely, but hey—why risk it?

Anyway, this last Spring, for one of my "Patching Holes" videos, I was videotaping a bunch of flashy demos. [Show video of demos.] In addition to all these exploding demos, which went off like I expected them to—shattering glass and all—I did one that simply oozes. [Show video of oozing.] Now, like I said, I'm really cautious, and I know what I'm doing. This one gives off aerosolized concentrated sulfuric acid, so it's a good idea not to breathe it in, and I was doing it in the fume hood. I did three or four takes, each time setting aside the jar when I was done with it.

So I'm done with all the takes, and I'm standing about 10 feet away from the fume hood, messing with the video camera, when a gunshot goes off. The jar that I had used 20 minutes before exploded like a bomb, shooting carbon-gooed, concentrated acid-coated shards of glass the length of my 40 foot room, including all along my left side. Here's the aftermath in the fume hood after I came back the next day. Right after the explosion, I'd inspected the room to make sure everything was stable, and then I left to let it air out and let me settle down. Seemed like a good time to take a break.

Now, I'm a pretty smart guy, and I've been doing this for a few years. This is a demo that oozes and sizzles. It doesn't explode. If someone had told me third hand that it had happened to their buddy's colleague, I would have been sure that they'd gotten their story mixed up, because I couldn't have even come up with an explanation that would have this demo exploding that violently. I would have judged it to be impossible. And I would have been wrong. Like we humans sometimes are. In fact, it was only by being forced by the very undeniable evidence on my left side to acknowledge it **was** possible, that I was able to later construct a feasible explanation for what had happened, because I simply couldn't accept the conclusion "Nope, not possible" when my understanding of the chemistry led me to that.

The reason I'm telling you this is: when it exploded, I was still wearing all my safety equipment, even though I was finished with the demos. And boy, was I glad that I tend to play "better safe than sorry," rather than going with what's more convenient, so that I still had on the gear out of simple habit. Because then I was protected a bit from my misjudgement—a judgement I wasn't even aware I had made, because it was an assumption—by definition, unconscious. That's the insidious part. "Assumptions are the things you don't know you have." That is exactly why they can be so dangerous. Could **you** be holding any of those in the debate about climate change? If there's ever a time to be conscientiously self-critical, it is now, with this issue.

So, I've learned it's in my interest to be brutally honest with myself and ask "What if I'm wrong? What would be the consequences then?" I try to employ that thoroughness and humility in my approach to the debate about what action to take on global climate change. Please, join me in that.

And if not—still, well. . . . Then I'll see you in your final video: "No Holds Barred" [sic].

——end——

"How It All Ends: No Holds Barred"
(original script—final version)

*AUTHOR'S NOTE: This is the original script, but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution*," please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck! (wonderingmind42@gmail.com, 25OCT2007)*

This video is titled "No Holds Barred" and is the final video just for skeptics in the expansion pack accompanying the video "How It All Ends." A lot of the arguments in this video assume that you've viewed all the other videos first.

I'm going to try to not be sassy, but I gotta tell you. If you've made it this far through all my videos and you still insist that taking action on global climate change is not in our best interests, I'm getting a little frustrated. But then so are you probably, and I realize no one has ever changed their mind because they're being attacked. In fact frontal assaults *"with attitude*" tend to just cause people to hunker down in their opinions. So I'm going to try to be civil, even though it's not nearly as satisfying as being righteous. Please forgive me if I slip.

And this is sort of a grab-bag of the topics left over, so also please pardon the lack of narrative flow, and eloquent exposition, or whatever.

Before we get to the last stand, here's a basic recap of my argument given over the course of all these bloody videos.

You say: "We don't know that AGW is true. Isn't it still being debated?"

I say: "Science is never certain," show you the statements from AAAS and NAS, and point out that you're in the test tube.

So you say: "Well, then, how are we to decide something if we can't know **for sure** what's going on?"

And I say: "Use risk management. Here's a grid that might help."

And you say: "Can't that argument just be used for the dire threat of the Flying Spaghetti Monster?"

And I say: "You're right, so we've got to estimate the probabilities, making sure to establish the credibility of our sources by using this here credibility spectrum" and I suggest that the statements from AAAS, NAS and pretty much the rest of the national science academies in the world should convince us that AGW is more probable than

not.

And you say: "But unless we caused it, we shouldn't interfere with it."

Then I explain the mechanics of climate change and forcing.

Then you say: "Well, it's way too big for us to stop. And if we try we might overshoot and end up in an ice age, or make the warming worse."

And then I say: "No, it's really simple—stop the forcing of the climate system. There's lots of great ways to do that without reducing our standard of living."

And then here we are.

First and foremost, I can perhaps save you time here by pointing out that if your opinions about global climate change are not falsifiable, then you don't even need to watch the rest of the video—you can go google Paris Hilton or something. [Cut to squeamish look.]

Falsifiability is an idea in science that establishes whether a claim someone makes is even worth examining. Here's how it works. Let's say I claim aliens exists—the truth being out there and all—and you claim they don't. It's not even worth your time to try to convince me that I'm wrong, because no matter what your evidence or reasoning, I can always counter with "Well, we just haven't looked hard enough."

In fact, with this claim, there's no way even **in principle** for you to prove me wrong—even if you are correct—because you could have all the star drives you want and search every rock and gas ball in the universe, and come back to me with that, and I could still say—"You missed a spot." Or "They moved when you weren't looking." Or "They're invisible."

Unless I can provide you ahead of time with a test and a hypothetical result that I would accept as disproof of my claim, there's no use arguing with me, because my claim is not falsifiable.

That's why conspiracy theories aren't worth arguing about. They will always be around, because they are not falsifiable. Which is to say: even if they're not true, that fact cannot even in principle be demonstrated. If you ask the conspiracy theorist: "Well, where's your evidence?" they can always claim "It's being suppressed." And if you try the other direction and say: "Well here's evidence against your claim," they can say "It was fabricated." Or biased. Or just faulty.

Please note: I'm not saying that the means the conspiracy is wrong. Or that it's right. I'm just saying if the claim is not falsifiable, then there's no way to ever know, and so it's just a lot of wasted effort to even debate it.

I often find myself thinking of this when I'm debating hard-line climate skeptics whose claim is "anthropogenic global warming is a hoax." No matter what the evidence I provide, they claim it's biased, or just plain wrong.

So before we go further, stop and answer the question: "What **would** convincing evidence look like to you?"

How about a bunch of really smart people who are experts in the field working with supercomputers and a worldwide network of data sensors for 30 years? We've got that. Maybe a public statement from the largest, most well-respected scientific body in the world, calling for action? We've got that [AAAS]. A statement from an honorary scientific body, comprised of the most credentialed and respected scientists in the country, one-in-ten of which have a Nobel Prize? We've got that [NAS].

Statements from the national science academies of other major countries? We've got those [Google "joint academies climate change"]. A statement from a collection of businesses with vested interests in the fossil fuels themselves? We've got that [USCAP]. Still not good enough? How about if the biggest, most notorious corporate holdout around finally publicly admitted that climate change is a threat, and it finally stopped funding climate skeptic think tanks? We've got that [Google "Rex Tillerson prudent"].

Still not enough? How about a statement from the US military, not known so much for it's environmental advocacy, but for its bottom line interest in preserving national security above all other concerns? We've got that [Google "Pentagon climate change"].

Perhaps it would take unanimous support from anyone remotely connected to the issue, so that no journalist could dig up a single scientist, author, or think tank analyst who is ever willing to say that AGW might be bunk. Well, as you've seen in my video "How It All Ends: Nature of Science," we'll never have that on ANY issue, simply due to the inherently uncertain nature of all science. So wouldn't that make your claim unfalsifiable?

Perhaps it would take you personally feeling the climate effects in your life. Well if that's the case, I'm afraid we're doomed to no longer be actors in our own lives, purposefully influencing our fate, but merely powerless victims of circumstance. Because as you saw in the video "How It All Ends: Scare Tactics" the feedback loops of the climate system are long enough that by the time the effect is obvious, it's too late to do anything about it.

Who **would** need to issue a call to action in order for it to be convincing to you? If you say "No one—I go by the EVIDENCE"—I'd ask you to watch the "Nature of Science" and "Risk Management" videos again, and remind you that there's a reason it takes a Ph.D. to get a job as a researcher.

So is there someone—some expert whose expertise, experience, and judgment you trust—so that if they came out for action on climate change, you'd be on board? If so, then your claim is indeed falsifiable, and worth debating. But I'm not sure you're left with a good thing, because aren't you giving that person or organization an awful lot of power over you and your world?

I'm comfortable with AAAS and NAS playing part of that role of advisor for me, because as far as I can tell they're probably the smartest, most careful, most knowledgeable people on the planet, and the issue is smack-dab in the middle of their expertise. They're not infallible, but they're the best we've got. Seriously—who is better or more credible on matters of science? And my knowledge of the scientific process tells me that only the most unequivocal, robust statements make it very far through such organizations, much less being announced as public calls for action.

Whose advice would **you** care to stake your (and my) future on? It's not a rhetorical question. Let's get it out in the open. Leave a comment—who would have to come out in favor of action on climate change in order for you to be on board? I think it's an interesting question, and I'm very curious to read the answers provided.

Really, what would it take to convince you? And if your honest answer is "Nothing can convince me," then fine. But then please admit that your belief is one of

faith, not reasoning, and step aside. Isn't it disingenuous to debate when you don't consider debate itself—the examination of evidence and reasoning—to be a valid means for getting closer to the truth?

I'm sorry if I'm getting a little sassy, but the hard-line skeptical view is really starting to look a lot like a conspiracy theory. It seems like it's not falsifiable, and therefore, not worth even arguing. So, like I mentioned before, here is the test to see if your belief is falsifiable: ask yourself "Can I come up with a reasonable scenario that would convince me that we should take big action now on climate change?"

And if you find that you can't, then what does that tell you? Wouldn't that send up a little red flag that maybe you need to check your thinking? That maybe you're not being completely rational about this? Maybe you're letting a bias blind you to any evidence that contradicts your opinion, and therefore your unconscious goal is no longer to figure out reality, but instead is to preserve your beliefs? That may feel good and righteous, but does it really seem like it's in your own pragmatic self interests?

Of course it would be fair of you to turn the question to me, and ask if **my** claim is falsifiable. Can I sketch out a scenario which would convince me to convert to the skeptic's side? The answer is yes. I'll wait until the very end of this video to give it to you, so that you can put it in context.

On either side of this bitter debate, you hear accusations that the other side is in somebody's pocket. From the skeptics you'll hear "It's just a liberal plot to get control of our lives," and it's not uncommon for a warmer to imply that anyone who argues hard for the skeptical side must be a corporate shill. I figured that the idea of vested interests hiring people to surf the net and argue for the skeptical side wasn't too outlandish, but I also thought it sounded a little too sinister to probably be true.

Well, a couple months ago, I was reading a back-and-forth discussion about Grist.com's "How to Talk to A Climate Skeptic" [Google the exact phrase "We're all seekers for truth here" WITH THE QUOTE MARKS] and there was one guy really taking the lead for the skeptical view, talking quite reasonably how there's a lot to be said for both sides, and the science on the issue is divided, which is why people are divided, etc. He was saying stuff like "The truth is that reasonable people of good will can look at the same evidence and come to opposite conclusions, including scientists. This is what makes the climate change debate so interesting. It is one of the greatest scientific debates in history." Seemed like a very reasonable, nice guy who just happened to hold a different opinion than mine.

Imagine my surprise and horror when someone outed this guy as a consultant hired by the electric power industry! And as soon as that was revealed, the guy immediately disappeared, though he had been countering most every point up to then! It was really creepy! Especially when I looked back on the stuff that he had written that I had excused before as being simply uninformed, but really, was deliberately manipulative, and downright intellectually dishonest. "This is what makes the climate debate so interesting. . ." It's not "interesting" you jerk—it's potentially life or death for real people if the worst case scenarios actually come to pass! We're not **sure** it'll happen, but that's what the rest of us are sincerely trying to avoid. And you find it an "interesting" discussion. It's hard to convey how angry that makes me, to see someone so careless about their impact on other people's lives.

I felt so violated! I share this with you here because you should know that there are indeed selfish, dishonest people out there who will try to manipulate you for their own benefit, regardless of any harm to you. And be aware, if you've made it this far through my videos and still think AGW is bunk, then you may be a hard-line skeptic, and this is the character of the people you are keeping company with.

I'm just pleading with you to ask the hard questions, to be self-critcal, and aware of your biases, and to do research. Go check out the discussion on the website for yourself. It makes you feel really icky.

In response to my "Most Terrifying" video, I got a lot of responses that had a common quality that I couldn't quite put my finger on. I finally figured out it could be described as sort of an arrogant ignorance. I don't think the word "ignorant" is an insult—it just means there's an opportunity to learn something you don't know yet. We're all ignorant, just in different areas.

But when that is taken on the offense, it can become offensive. Like when people would so vigorously attack me for being so stupid or alarmist or thick-headed, and they did it while totally misapplying some basic concept, like mixing up carbon dioxide and carbon monoxide, or dismissively calling the grid Pascal's Wager, or confusing the ozone layer with global warming.

This mix of aggression and ignorance puzzled me, and I think I now have an explanation. I think people are tired of feeling like they're constantly being told that they are the problem, that they are bad for just going about their lives. And so they lash back, with whatever small bit of terminology or concept they may have picked up. So I want to be clear: we're not bad for causing global climate change. It's not a moral judgment. We're just doing stuff that ends up being bad for us. What's the saying? "Don't poo in your own bed?" That's really all we're talking about.

Okay, here's something that'll make you hostile, but I've just gotta point it out. I came across a cynic on RealClimate.org who observed that there seem to be three phases of skeptics' response to environmental problems:

Phase 1: "There is no problem."

Phase 2: "OK there is a problem, but it's exaggerated and not really serious."

Phase 3: "Now it's too late to stop it."

I share this because it was stunning how well the comments I got on my previous video tracked with those phases. It really wasn't funny how many times I got comments along the lines of: "Actually, the globe isn't warming; it's the urban heat island effect!" (Phase 1). There are actually entire web projects devoted to bulldogging the data collection sites—check 'em out if you're looking for a hobby to get you outside. Or "There is little argument on the existence of global warming, but there's still a lot on its causes" (Phase 2). (That one creepily reminded me of how careful that corporate guy in the Grist.com discussion was to appear reasonable.) Or "In the next 20 years, China will triple its emissions, no matter what. It can't be stopped" (Phase 3).

Where's the phase in that progression where the problem is big enough to be acknowledged as important, but not yet so big as to be intractable? Can you imagine

what that situation would look like? And if you can't imagine such a scenario that would convince you that action is both necessary **and** still possible, shouldn't that send up a little red flag about your thinking?

Here are some of the more outlandish comments my videos got from die-hard skeptics, in bursts of sometimes surreal logic:

[ON SCREEN] "You might consider that column B 'true' is the best place to be (after column B 'false') as we will be strong and have the capital and confidence to tackle a true climate catastrophe."

Oh, that's right, a pound of prevention is worth an ounce of cure. No wait, an ounce, gram—metric?

[ON SCREEN] "I would rather be strong enough to face any threat that may or may not materialize than to be weak and find out we did the wrong things, to stop a real threat that arises, whether it be from the weather or from somewhere else. Remember the planet-killer asteroids?. . . What about an ascendant Chinese/Russian communist alliance? How could we defend ourselves and react to those things, which are <u>actual demonstrable long-term threats</u> if we have so weakened ourselves because we are afraid of a possible longer growing season in Canada?"

Um. "Actual, demonstrable long-term threats?" I really wonder how he would go about deciding that something is an **actual** threat since in the case of climate change, official statements by the most capable and respected groups of professionals in that field don't seem to be enough for him. And yet a Chinese/Russian communist alliance qualifies as an actual, demonstrable threat. Maybe I haven't been reading the papers carefully enough. And it's the longer growing season in Canada that has everyone in a tizzy? Did I look away for a second? Are we talking about the same thing?

[ON SCREEN] "Scientists can say the sky is falling all they want (and they've been doing it for centuries) but until I see it, I don't want POLICY MAKERS getting their hands on my prosperity and my independence."

So, <u>I've</u> just gotta sit and take whatever the natural world dishes out until <u>you've</u> been <u>personally</u> inconvenienced enough to agree to let us take action, despite whatever some trained scientists may think. Thanks a lot. He's definitely not an alarmist about big government.

[ON SCREEN] "No, I'll fight the very real threat of global central planning with its return to the Dark Ages until my last breath before I worry about some nebulous idea of global climate change."

Sounds like this guy is pretty level-headed. Doesn't get too excited or overreact about things. I wonder if he listened to the scientists when they came up with the alarmist plan of immunizations against some nebulous idea of viruses in the germ theory of disease. Pah. Germ theory. It's just a theory.

[ON SCREEN] "If we squander our resources on speculative global warming and then we're left exhausted and poor, what happens when we have to face a <u>real</u> threat, like the asteroid Apophis, which might intersect the earth in 2036?"

I looked that one up. That reasoning is just bizarre. The scientists who study asteroids give it a 1 in 45,000 chance of hitting the Earth. The scientists who study human-caused global climate change give it a 9 in 10 chance of being true ["IPCC:

‘very likely’ = 90%”]. Asteroids?

[ON SCREEN] “I truly don’t care how many scientific organizations line up for global warming, I still think column B would save us.”

Yeah. Pfff—scientists. What do they know anyway? That’s why I never use plastic. Or rubber. Or synthetic cloth. Or medications. Or a telephone. Or cars. Or electricity. I don’t care how many scientists line up behind it, it’s just common sense that it’s impossible for 300 tons of metal to stay up in the sky. Stupid 747.

[ON SCREEN] “Don’t you know that the AGW spin is nothing more than a socialist/communist attempt to take over the world? They are playing you!”

Man. As if being called a Chicken Little when you’re trying to warn people isn’t bad enough, but to be called a Chicken Little by people like this. That’s just insulting. And sad. Doesn’t “a socialist/communist attempt to take over the world” have just a smidge too much comic book premise in it to not be laughed at? In fact, it sounds almost more paranoid than simply Chicken Little—who, after all, was just too excitable—doesn’t it? Well, not compared to this one:

[ON SCREEN] “So what we have witnessed in the Global Warming debate is a perfect storm of anti-Christian philosophies parading as science. Materialists, Socialists, and Left-leaning types found common cause with neo-pagans and anti-Christian spirituality to advocate a New World Order dressed as a movement to save the planet.”

Wow. I’m kinda surprised he didn’t throw in there: “people who eat their bread with the butter side down.”

[ON SCREEN] “Action would lead to goverment control of our lives. Couldn’t a private organization deal with this?”

Look, we already tried laissez-faire and it didn’t work. Everyone agreed that it sucked. “Tragedy of the Commons” and all that. Pay attention in class there, buddy.

[ON SCREEN] “The climate has changed before. It’s inevitable.”

Oh right, I get it—it’s going to happen sometime anyway, so why get all in a hissy fit when it threatens. Sort like of like dying is inevitable, so don’t worry so much trying to avoid it.

[ON SCREEN] “Because action on global climate change doesn’t generate wealth, it would be an overall drain on the economy.”

My God, you’re right—anything that doesn’t actually generate wealth is a bad thing that must be shunned, like disaster preparation, and a standing army, and air traffic control. Let the invisible hand of the market gently move one plane to the side when it’s on a collision course with another. I think that’ll work.

A lot of people expressed that they’d pick column B in the grid because it contained the only box in the whole grid that they like the look of. It **was** the only one with a happy face, but is that how you decide the fate of the planet? And I can’t help but think about how—by that logic—someone standing on the road in the way of an out-of-control truck would choose to just stand there instead of jumping into the muddy ditch, because the only scenario where he ends up unequivocally happy is the one where he stands still and the truck happens to swerve around him. “Sweet! Didn’t even muss my hair. . . .”

Sorry. Sassy again.

But don't these objections strike you as being a little bit more towards the side of fearful dogma, and less towards the side of rational assessment?

Be aware if you've made it this far through my arguments and you still just think AGW is bunk, then these are the people you're going to be seen as keeping company with. And it's starting to sound a bit like a conspiracy theory.

[BOARD, CREDIBILITY SPECTRUM] Because here's the picture so far: [columns labeled "significant action" vs. "no significant action" on either side of credibility spectrum running vertically]: all of these organizations that fall on the top of our credibility spectrum [AAAS, NAS, IPCC, USCAP, Exxon, Pentagon report, Stern Report, Economists' Statement on Climate Change, Scientists' Warning to Humanity] vs. this individual, or that think tank, or the other self-selected group signing a petition lower down on the spectrum [Lomborg (Copenhagen Consensus), Cato, Lindzen, Landsea et al., Leipzig Declaration, Oregon Petition]. The best you've got over here is the Copenhagen Consensus with its four Nobel Laureates, which is pretty much balanced out by the Economists' Statement on Climate Change, with its six, so we'll call it a wash there.

Let's be clear: if you side with these guys, then you are explicitly dismissing the conclusions of the best science on the planet, as well as a bunch of heavyweight industry leaders. Now, they may indeed be wrong—no one is infallible. But remember, since we're using basic risk management, in order to convince the rest of us that we shouldn't take action "just in case," you need to do way more than show that AAAS and NAS **might** be wrong. We already know that. Anybody might be wrong.

[BOARD, GRID] What you'll need to do is convince us that this line actually belongs down here—way down here if you want this column to have the better expected value, because you'll remember the consequence of this box **by definition** is greater than this one. You need to provide some extraordinary evidence that the most well-respected scientific societies on the planet are completely out to lunch.

[DESK] So it's going to take more than a couple of good-sounding ideas, like "it's the sun," or "climate has always changed—it's a natural cycle," or "the Medieval warming period wasn't so bad," or "Mars is warming too, you know," or "CO_2 is only .04% of the atmosphere," or "water is a stronger greenhouse gas than CO_2," or "who's to say what the right climate is?" or "CO_2 lags temperature in the ice core data," etc. [Google "how to talk to a climate skeptic"] Do you really expect us to think the scientists haven't heard those and taken them into account already?

And it'll take more than saying "the scientists are biased because their grant money depends on people caring." You would need to somehow explain how such erroneous statements as those of AAAS and NAS made it all the way through the bruising peer-review process of the two most well-respected scientific organizations on the planet. Organizations that arguably have a greater stake in never making wrong statements than any other organization in existence. Essentially, if you wouldn't listen to them, why would you listen to anybody? Because NO process is more careful and self-critical than science.

Plus, since you could say "the scientists are biased, because their funding depends on it" about any topic, why is it valid to only bring that up here? Why don't you

reject all science, then? **And** why are you perfectly happy to put your well-being in the hands of the companies that sell you your car, your food, your power tools, and anything else that might possibly harm you when **their** paychecks depend on you wanting more of what they have to offer, just like you accuse the scientists of? And the companies don't even have an element of greater good in their job description like "pursuing knowledge" for the scientist. Business' only universal mission is to increase value for shareholders.

[BOARD, SPECTRUM] Really it's some elaborate denial, don't you think, requiring quite a conspiracy to explain it. It's starting to sound a bit like the shadow government or black helicopters or the hoaxed moon landing or aliens in Roswell or the faked Holocaust or the U.S. government bringing the towers down. So you'd best be prepared for people lumping you in with the conspiracy theorists as they start to see this much expertise stacked up, and you thrashing at the tide. Perhaps that's fine with you. I'm just saying—be aware of it, and make it a conscious choice, instead of an accidental one because you couldn't be bothered to research and rebut all of my arguments.

And aside from protecting your cred or your rep or your character or whatever, does this really look like the best bet for getting what you want out of life? To ignore these guys when you're betting the world on what I might remind you is a scientific issue? These are really smart people who spend way more time researching it than you do. Why do you trust them on so many other topics that contribute to your comfort, health, convenience, and safety of daily life, but not on climate change? Why is this the one topic that's different? Aren't you starting to suspect some strong bias in your views, say a deep hostility toward government? But is that really the same as uncertainty about climate change?

[BOARD] I want to go back and take a closer look at the truck example I gave earlier, this time with a grid. Cuz everything's better with a grid. Remember, the argument is: column B is a better bet, because it's the only one with a box that looks at all attractive. A similar argument for column B was that choosing column A would doom us to economic harm, no matter what ended up happening with climate change. At least with column B, humanity's got a chance to be happy.

On this side is what the truck ends up doing when it passes your spot, and up here is what action you choose to take. Your only option is to jump to a rock in the middle of a muddy ditch. If you do that, you may slip and get muddy or you may not. But you're a worst-case kinda guy, so you assume the worst WILL happen if you jump, and we put in muddy for both these boxes: here muddy for no reason, here muddy but relieved.

Wait—if you were a worst-case kinda guy, you wouldn't still be standing in the road, would you? I guess you're only a worst-case kind of guy when it comes to threats to your clothes, but if it's a substantive threat to your physical well being—well, bring on the adrenaline. So we'll assume muddy in this entire column.

Now, let's say you see the truck weaving a bit because the driver is texting someone, but it's far away. It's got your attention, but this line is down low, because the driver has plenty of time to see you. You don't want to end up here—muddy for no reason, so you wait a bit, because you like the look of this box. But as he gets closer,

you can see that it must be a very engrossing conversation, because he's now using both hands for his phone, so this line moves up. Still, you don't like the look of any of these three boxes. You really want this box. So you hope. He'll see you. He's gotta. I can't imagine getting creamed by a truck, so it's not gonna happen.

How long would you let your desire for this box keep you in the middle of the road? Until the last possible moment, just before the truck is certain to hit you? What if you miscalculated that moment? What if it comes, and you slip? What if it's not just your life, but you've got a family that depends on you? What if you're not the one in the road, but it's someone who holds the key to your own life? How long before you scream at him that he's not just making a personal choice?

[DESK] If we are sincere in getting closer to the truth, whatever it is, rather than just preserving our opinion, then we are obliged to follow the debate back and forth, and not just stop when we find something that pleases us. What do I mean? Let's say you keep hearing a claim that really bugs you, so you look up a counterargument that seems to neutralize the claim. So now, whenever you hear the claim, you repeat your counterargument to yourself and move on, confident that the claim doesn't hold water.

What you should do—in fact, I'm arguing it's not only your obligation, but it's in your own best interests—is go looking for any rebuttals to that counterargument that you're carrying around in your pocket. Whether your counterargument is solid or not, either way you benefit by actually trying to rebut it yourself. Why? Because if it's really solid, then your thorough looking will turn up no good rebuttals to it, and thus your confidence in your counterargument is increased.

And if your counterargument is lousy and full of holes, well then you probably would like to know that before you go betting your house on it, wouldn't you? So you can rid yourself of the weak points in your arguments, and strengthen the strong points, by conscientiously tracing the back-and-forth refutations of the debate yourself.

I do this all the time—I'm actively looking around for new arguments and evidence against my viewpoint. Why? To make it stronger—to get rid of the weak points and find even more effective ways to convey the strong points. For instance, that's what I did with my "Most Terrifying" video—I pretty much threw down with the whole freakin' internet. A million views and 5000+ critical comments later, I emerge battered and bruised, but with a better argument. In argumentation, at least, it's true that whatever doesn't kill it makes it stronger.

So do some more homework. Look up your objections to human-caused global climate change on Grist.com's "How to Talk to a Climate Skeptic." [Google "How to Talk to a Climate Skeptic"] Then consider the rebuttal to your argument you find there. In fact, that site is such a good resource for you that I'm jealous, because it lays out exactly what you need to refute to make your point. I'd like to find a "How to Talk to a Warmer" site of equal quality that would give the skeptic's responses to the rebuttals on the Grist site. And I've got to tell you, the lack of such a site reinforces my view that the warmers are more probably correct than the skeptics.

The pitfall to avoid in this whole back-and-forth process is stopping when you find an argument that supports what you believe. It's very hard to resist. But if you make the effort to persist, the robustness of your opinion increases. You hopefully get closer

to the truth.

Have you done this for your viewpoints? If not, why? I know we're all busy as heck, but if there was ever a time to really know our stuff, wouldn't this be it, when the debate is about whether our future is on the line or not? And if you still find yourself not seeking out the weaknesses in your own arguments, don't you need to question whether you're being intellectually honest with yourself? Is that really in your own best interests?

Along the lines of how a thorough debate serves us best, you should distrust (and please do not yourself engage in) simple dismissals of arguments: either "just a bunch of chicken little scare tactics designed to get control of my life," or "just another rabid neocon in the pocket of big oil." If you name call instead of refute, you concede the point. Only when faced with an unfalsifiable claim is it valid to decline to answer the points presented.

I know I've laid out a ton of arguments over the course of all these bloody videos. But I'll challenge you right now: if you disagree, and your response is along the lines of "That's just typical liberal scaremongering," but you don't actually rebut my points, then you'll have to understand if all those watching take that as a concession on your part, and assume that you are resorting to name-calling because you know I'm right, but you just won't admit it to yourself. So: if your response to all this is name calling rather than direct refutation of each of my points, then we'll just have to assume that it's because you <u>can't</u> refute them. How's that for throwing down the gauntlet?

You may notice that in these videos I haven't addressed a lot of the most common technical arguments and objections about AGW. That's because it's already been done in such a thorough and well-organized way on the Grist.com site. I highly recommend you check it out. And please, if you have—or can find—good refutations of any of the points made on that site that have yet to be resolved in the comments section, please bring it to my attention, with references. I would love to see the next step in the back-and-forth.

For what it's worth, as you research the back-and-forth debate, I've found the Wikipedia articles on climate change to be excellent as a starting point in looking for sources with opposing viewpoints.

Okay, I've been avoiding this, because I didn't want to open the can of worms, but we've got to talk about the valid role of government. Now before you get all up-in-2nd-amendment-protected-arms, let me just point out that believe it or not you—yes even you—do believe that government has a valid role to play in society. You may just not realize you do, because it's so distasteful to you. But unless you are a literal anarchist, I'm sure you believe that government at least has the minimum role of protecting **you** from **my** liberties, like getting my kicks by hotwiring your car. You also probably agree that another valid function of government is to pool resources and do things that we cannot efficiently do for ourselves, like building roads, or securing our national defense.

A good analogy would be back in the pioneer days, a bunch of pioneers might pool their efforts to dig an irrigation canal that no single one of them could have dug, but which benefits all of them. The next project is complex enough that the pioneers agree

to have one of them coordinate it, and they compensate that coordinator for the time lost in his own fields. That's government. The modern examples that most people would probably agree are pretty nifty include things like universal electrification, universal phone service (back in the pre-cell days), the interstate highway system, and food safety.

Here's a comment I got: "But everything the government touches turns to shit. So the solution is not in public policy, but in the free market." Now that's just crazy talk. Just because there's lots of stuff the government does that you dislike is no reason to let yourself be blinded and start sounding you have a religious faith in Our Omnipotent Father the Immaculate Market. Not everything the government touches is bad. How about having a police force? A fire department? Roads? Food safety laws? How about banning lead paint in 1978? Was that a lousy, heavy-handed government intrusion into the free choice of consumers? How many more kids would have been crippled if we waited for "market forces" to drive lead paint out of business? Would those kids be an acceptable price to pay for your liberty to buy whatever darn paint you want? So let's stop the hyperbole about draconian government control of your life, and discuss its functions and limits rationally.

Global climate change is a problem that is—well . . . global in scale. And, as we saw in the video "Scare Tactics," it has feedback loops too long for market forces to effectively react to. That is, by the time the effects are strong enough to spur the market to change, it's too late for change to have an effect. So the market is doomed to failure in addressing such issues with long feedback loops and potentially irreversible consequences (at least, irreversible on a human time scale). So action on climate change fits perfectly, right into the most minimalist definition of the purpose of government: to protect you from the effects of me exercising my liberties (like burning as much fossil fuels as I please—it may be my private car, but it's our shared air that I'm venting my waste to), and to pool resources to address a problem on a scale far larger than any other organization could hope to.

Here's a related objection: "But people need to trust that the money spent to stop climate change will be spent effectively and honestly." Yeah, you're right. But does withholding the money in the face of an imminent threat because we're afraid of waste sound like it's in our best interest? Here's something no one will ever say out loud: we're not going to hit it spot on—we will end up either overspending or underspending. We just need to be big girls and boys about it, and accept that there's going to be some inefficiency.

We cannot be perfect, so we are either going to spend more money than absolutely necessary in order to ensure that we accomplish what we need to, or we are going to accomplish less than we need to, in order to ensure that we waste no money. Given what's at stake, which sounds like the more important goal to ensure: that we waste no money, or that we accomplish what we need to? Given that we may be threatened with irreversible harm—including to our economy, by the way—why don't we err on the side of caution, make sure everything gets done that needs to, and follow up to minimize the waste as best we can? But it's just silly to sit here paralyzed in the path of that truck, trying to figure out which would expend less energy—jump over the guardrail, or run for the other side? We don't want to risk possibly wasting any energy,

now do we?

Here's one that rocked me back in my seat: "I'm currently on the fence about the ultimate cause of global warming." "I'm currently on the fence??" Why do **you** need to decide? "**I'm** currently on the fence??" Who are YOU to judge? What are **your** qualifications? Why the **heck** is our policy (and our collective neck) riding on Joe Schmoe's armchair analysis of one of the most complex scientific issues in the world? What on earth is going on here? Why are we allowing the popular debate to even continue like this, when the overwhelming conclusion of those who are actually qualified to judge—scientists, economists, business leaders—is that we need to take significant action as soon as possible to avoid losing our hides.

I'm sorry. Self-righteous again. I just get worked up about this stuff, cuz I'm really worried about where we seem to be heading, and sometimes it seems that so many skeptics are just cavalier about the potential threats, dismissing them with a wave of their hand and the label of "alarmist" about anyone who is concerned.

Did you ever think about how Paul Revere is revered in American history for spreading alarm? Would you have dismissed him at the time as an alarmist? Is everyone who spreads an alarm an alarmist? And if your answer is "No, he wasn't an alarmist, because that was his job—he was designated ahead of time to watch for threats. If he was the lookout, then what are the scientists but high tech lookouts—meticulously studying the physical world to see what's going on, and letting us know what they find. And now, when they raise the alarm, encapsulated in the unequivocal statements from AAAS and NAS, you would dismiss them as hysterical, incompetent, biased?

I do believe you want the best for yourself. I even believe you probably want the best for the whole world. I think if you try to become brutally aware of your thinking processes—your biases, whether your goal in looking for information is to get closer to the physical truth or to retain your opinion, whether you are starting from belief or starting from evidence—and you analyze this in historical perspective, you will see that we are in a time like no other. Because our population and our technology are large enough to change the planet, and the old way of thinking—where we could tolerate mistakes—won't work for us any more. There's no longer anywhere to run to.

I'm pretty sure I'm not being ideological. I'm trying to just be practical. Join me in that. When the stakes are this big, how can you—we—afford not to?

So, to recap:

I say "How do you account for the fact that AAAS and NAS issued such strongly worded statements."

And then you say "The scientists are biased. They get to keep their jobs if everyone believes them."

And then I say "Have you watched my explanation about bias in the video 'Nature of Science?' Because of all jobs on the planet, the job of scientist is the one that is most careful about identifying and eliminating bias. That doesn't mean it doesn't happen. But couldn't the accusation of a belief based on bias be also levelled at you, for your claim that climate change is a hoax? And do you really want to claim that **you** are **less biased** than scientists in general, who are specifically trained in how to avoid it? And sure—scientists are individuals, so they **might** be biased. But AAAS has

144,000 members and a huge reputation to uphold. Isn't it a bit extraordinary for you—a single lay person—to claim that you have **less** bias than a statement that represents 144,000 people who are specifically trained on how to avoid bias?"

And you say "But it's job security for scientists. If they scare people about it enough, all they have to do is put the word 'climate change' on their grant proposal, and they're on the gravy train."

I say "Aren't you just repeating your claim? How can our conversation be productive if you just repeat your claim, and not specifically counter my rebuttals?"

And then you say "Do you have a different question?

And then I say "Why do you apply the reasoning about job security in this case, but not in any other case, say when scientists warned us about lead-based paint, or mercury in fish, or arsenic in drinking water, or—here's a good one—that an atomic bomb might be possible, and Hitler might be working on it? The Manhattan Project was created—and gave jobs to scientists—because scientists gave a warning about a possible threat that they understood better than lay people or policy makers. Using your logic then would have resulted in the Manhattan Project not happening, and possibly a very different end to WWII. Doesn't that show your logic to be not useful?"

And then I'm not sure what you say to that. Maybe you can fill in the blank in the comments section.

And then I say "Okay, let's say that most of the scientists **are** biased or corrupt. Still, then how do you account for the statement from the companies in the USCAP, who are calling for mandatory emissions caps on their own businesses?"

And then you say "They've been duped by the scientists."

And then I say "Isn't the picture you're painting getting a little hard to believe? That global climate change is essentially a conspiracy—intentional or not—that includes all the most well-respected scientific organizations in the world, as well as a bunch of big for-profit corporations, which probably themselves aren't run by a bunch of dummies? Isn't the simpler explanation the one that says the scientists on the whole do know what they're doing, and aren't corrupt, and that the business leaders also know what they're doing? Let's face it, if there's been duping going on, which sounds more feasible: that business leaders—who make it their, well, business—to figure out what's in their best interest, have been duped by the most trusted organizations representing the most deliberate and self-critical profession in human history, or that individual lay people have been tragically misled about a complex scientific topic by a few well-funded and organized businesses trying to keep their current jobs?"

And then you probably say "I hate intellectuals. They're so condescending."

And then I say "I'm sorry, but I'm just trying to be thorough. You can't claim that you know for certain that global warming isn't a problem, can you? So isn't just the possiblility that it may be the greatest threat humans have ever faced make it worth the time to be thorough in our thinking about it?"

I'm not asking you to believe me. I think that's what gotten us into trouble—too much belief, and not enough questioning. I'm asking you to please, just consider the possibility that you're wrong. And think about the possible consequences of that.

You've probably been wrong before. Goodness knows I have. If there was ever a time in our individual lives—and our history as a society—to get it right, it's now. So

I'm asking you to be as unselfish, humble, and thorough as you will ever be in your life, step back from your belief, and take another look at the case for human-caused global climate change.

Because none of us is as smart as we think we are. I know, I know—you're very sure of yourself. So am I. But no one is infallible. Either of us may be wrong. So we've each got to ask ourselves: "What if I'm wrong?" Like I shared in the video "I Hope I'm Wrong," I've done that exercise, and I'm comfortable with my answer, because I think I've been as self-critical and conscientious as anyone could demand. Picture what that world might look like if you turn out to be wrong, and how it would feel to be there, looking back at this moment right now, when you knew you had the opportunity to choose "better safe than sorry," but you decided to risk it, because you were afraid it might hurt the economy. How much would that suck?

[BOARD, SPECTRUM] If you're not willing to even imagine that, if you're not willing to even entertain the possibility that you're wrong and **they** are right, then what does that say about the quality and honesty of your thinking—and your credibility with the rest of us? Do you really want to risk being sidelined as a conspiracy theorist and ignored?

If you're not yet convinced that action is in your own pragmatic best interest, then why aren't you at least campaigning for a Manpollo Project, to properly answer the question on which hangs your fate? If you're not even doing that, then doesn't that leave the rest of us with the conclusion that you do indeed consider yourself infallible? Because you'd be settting yourself up in opposition to all these people who call for significant action now—and you'd be looking them in the eye and saying: "Well, in <u>my</u> judgment of the evidence—it's not even worth looking at any further. We can dismiss the possibility of catastrophic climate change right now."

In fact, there's a silver bullet! Both sides of the debate will agree that we should have such a Manpollo, project, and here's why: because each side thinks the project will get us closer to the truth, and dispel the untruths that the other side has spun. So we all want this, because everyone thinks they're right, and would love further ammunition to prove the other side wrong. Wouldn't that be worth the cost?

Because a Manhattan Project is not going to cause a global depression. An Apollo Project is not going to going to bankrupt the US, or lead to government control of your life. So what's to lose? If we have a Manpollo project and it finds that human-caused climate change turns out to be bunk, then hey—okay, we diverted some government jobs from one sector to another. Isn't reducing the uncertainty about this at least worth that cost?

Given the stakes, it seems that at this point you as a skeptic have only two intellectually honest options: either step aside, or agitate for a Manpollo Project as soon as possible!

"Hey wait!" you cry. "That's biased! Why isn't agitating for the skeptic's side included?" Because, with the AAAS, NAS, USCAP and even Exxon lining up on the warmers' side, you'll **never** find enough credible evidence on your own to take on their judgment and expertise. If you think they're wrong, the only way to convince the public and policy makers of that is by having something as weighty as a Manpollo Project show it, to stack up its findings against all of those organizations.

Still if you don't believe the scientists now, then why would you believe them later as part of a Manpollo Project? Which means you'll never believe them. Which means even if it's **true**, you won't believe it! And now you're starting to look like the Iraqi Minister of Information, who was already known for being flagrantly out of touch with reality, but got just downright surreal during the invasion of Baghdad, you remember? Telling reporters that there were no US troops in the city, even as the reporters could hear the tanks outside! In fact, I'm a little surprised that no blogger on the warmers' side has yet taken to giving out monthly Mohammed Saeed al-Sahaf awards. They could go to the hard-line skeptic who best embodies the former Information Minister's talent for heroically persistent denial in the face of overwhelming evidence.

Make no mistake: as a skeptic you are left with only two defensible choices: either actively campaign for the Manpollo project, or get out of the way. Anything else, and you would be explicitly saying you don't give a rat's ass about the economic or physical well-being of anybody but yourself. Which is your prerogative. But if that's the case, then say it, and stop pretending to debate.

Because, while you aren't obliged to work for the well-being of others, it is immoral of you to actively hinder those who are working for their own well-being. We've had enough. Again, if you say "But hey, I could turn that right around and say the same to you, because your action on climate change is going to impinge on my liberties," then see above—because in the face of such overwhelming evidence, a Manpollo Project is the only feasible way of accomplishing the skeptic's agenda of convincing the rest of us to not take action.

So become a crusader for the Manpollo Project. . . or get the hell out of the way.

Well, you've come to the end of the line. That's it. That's my best effort in getting to the truth of the matter, with as much thoroughness, honesty, and self-criticism as I can muster. Thanks for taking the time.

Oh, and my test for falsifiability? My claim is based on very thorough and broadly-based research, and so would need similarly thorough and broadly-based disproof. The main lynchpin would need to be an answer to the question: "How could the most trusted and established scientific organizations in the world get it so wrong?"

I would need to see persistent and thorough evidence along multiple lines that the both the scientific processes of AAAS and NAS as organizations and the careers of a significant number of their most trusted and established individuals had been corrupted or brilliantly mislead by a tremendously well-organized covert campaign of manipulation. The reporting of the evidence would need to be picked up by the major news networks and hold up under scrutiny for a long period of time—say at least a year.

It would need to be an expose of significantly greater caliber, extent, and expense than any other in history, because the conspiracy would have included more individuals by an order of magnitude than any other cover-up or conspiracy, ever. Remember that AAAS has 144,000 members, and the NAS has been around since 1863. In effect, it would need to be of significant enough import to damage the credibility of the human endeavor of science itself for 100 years—essentially a paradigm shift away from the trust we place in science by using so much modern technology.

The claim of incompetence or corruption on the part of these organizations and

the majority of the individuals comprising them is extraordinary enough, that I would need extraordinary evidence of an extraordinary cover-up. That's an extraordinary number of extraordinaries. But it is—in principle—possible. Which makes my claim falsifiable, and therefore, not dismissable.

How about yours?

——end——

"How It All Ends: Your Mission"
(original script—final version)

*AUTHOR'S NOTE: This is the original script, but may deviate from what actually is said in the final video, because of ad-libs, last-minute changes, and straight-up flubs. As per my appeals in "*How It All Ends: Index*" and "*How It All Ends: The Solution,*" please take this script as the* ***starting point*** *in a folk process. That means that you are welcome and encouraged to improve upon it—whether that means correcting typos, bringing it into line with the actual video (so that it is an actual transcript), condensing it and re-filming your own version, adding to it with your own original material, whatever—go for it! I am explicitly putting this all in the public domain, so that you do not need my permission for anything. Do whatever you want with it—just get the ideas to spread as widely and quickly as possible! I'd suggest that you put a note at the top of any new version you create, specifying the nature of the changes you made, so that posterity can sort it all out when the history is written of how we all saved the world—I mean, our own hides—through the non-linear system of internet communications. Good luck! (wonderingmind42@gmail.com, 25OCT2007)*

This video is called "Your Mission" and is the final video—[Foil: "Thank goodness!" {sobbing}]

[Aside:] I thought you'd gone. Anyway, this is the final video in the expansion pack accompanying the video "How It All Ends." Actually, it's not really proper to call it the final video, because it's not part of a sequence.

You're here because you feel highly agitated about the threat of abrupt climate change, and you need something to do with that energy. In the video "How It All Ends: The Solution," I told you I'd give you a direction to point that fire hose.

After watching this whole series of videos, I'd like you to ask yourself: were my arguments and requests of the viewer reasonable? If you agree that they were in fact reasonable, then think about a person who would make it all the way through these videos and still claim to be so certain that human-caused global warming is not a problem, that it's not even worth shifting some government resources to launch a Manpollo Project to investigate it further. Someone who is not willing to even acknowledge the **possibility** that they might be wrong, despite the fact that it's the future of the globe that's at stake. Someone who sincerely feels that their judgment of the evidence on a scientific issue is not only equal to, but is better than the judgment of—at this point—every credible scientific organization on the planet. [Google: scientific statements climate change.] In fact so much better that it's not even worth doing more homework.

You've got to ask yourself—is that a person you want in any way influencing policies which might have a significant impact on you?

I'm very nervous about saying this next thing, because it could very easily be twisted or quoted out of context to seem megalomaniacal.

[Foil: "Megalahmamahma?"]

Kinda [Nordvedt's hand gesture "Vvvvvt!"]

[Foil: "Ah."]

But I think I need to, because after all my analysis I think that the stakes are so high that it's not only my ethical obligation, but is also in the pragmatic best interests for my kids, to put aside my own fears and to do what I conscientiously judge is necessary.

[Foil: "What are you talking about already?"]

So here's my radical request for you: if hard-line skeptics cannot be convinced by reason that action on climate change is in the best interests of all—that at the very minimum, a Manpollo Project studying the expected value of the various options, should be launched with the greatest urgency—then they must be eliminated from the discussion. They must be marginalized, so that their irrational, unfalsifiable, energetic claims do not **prevent** the rest of us from pursuing what we conscientiously believe to be the best interests of all.

They have had too much influence for too long. They have moved predictably through the three stages of denial of an environmental problem: there is no problem, okay there's a problem but it isn't significant, now it's too big to do anything about. They have done anything, given any reason, to deny change or sacrifice. They have started from belief and been impervious to opposing evidence and reason.

And they have been thoroughly discredited. No one now denies that the filmmaker of "The Great Global Warming Swindle" made up data for the graph on sun activity, and flat out lied about volcanic emissions of CO_2 being greater than human emissions—an objection you will still often hear people parrot. And remember that Heritage Foundation doomsday prediction I turned up from 1998, that the Kyoto Protocol would wreck the U.S. economy, for instance by leading to gasoline prices as high as $1.91 a gallon by 2010?

And people listened to them and their scare tactics. They accuse anyone concerned about environmental impact as being a Chicken Little or scaremonger, yet they hypocritically employ the same tactics they accuse others of, warning of **economic** doom if action is taken. But unlike the environmental Chicken Littles, the economic Chicken Littles don't have even a shred of credible evidence to back up their claims! Yet they continue to have huge influence in the discussions. It's time to pull back the green curtain, to deny them the power we have given them when we listen to their irrational objections and warnings.

Maybe I'm wrong. If you think my risk assessment is faulty, please tell me where and how. But if you've watched all these freaking videos, you can see that I've done some research and thinking, and perhaps you'll understand when I say that it seems to me that anyone who still insists on obstructing any action on climate change—even a Manpollo Project—must either give compelling rebuttals to all the arguments I've set forth, or be dismissed as hopelessly irrational or intellectually dishonest.

Go read that online discussion I referred to in "No Holds Barred" on Grist.com's "How to Talk to A Climate Skeptic." [Google the exact phrase "We're all seekers for truth here" WITH THE QUOTE MARKS.] I searched for a while in the thesaurus for words to describe the behavior of that wolf in a sheep's clothing. But then I just ended up writing an angry diatribe that I had to delete. Anyway, once you see how deceptive that guy was, maybe you'll be motivated to bring on the fight, like I finally am.

And this isn't like us taking away their liberty to make their own choices about what risks to take.

[Foil: Yeah: Who are you to tell me I've got to wear a seatbelt—I'm free to make my own choices.]

The choice to not wear a seatbelt is a personal one, because it only places at risk the person who made the choice. But since climate change is a global thing, it's not just their risk that they are influencing—it's yours and mine. I've got no problem with them believing what they want. But if they place the rest of us at risk by preventing us from taking action because of their selfish refusal to even consider the possibility that they're wrong, then that's not their right. So they may not want to participate in the solution, but they don't have the right to stand in the way.

We shouldn't be dismissive, or cruel, or even angry with them, although we might feel like it sometimes.

[Foil: Or, often.]

We should just marginalize them, and stop allowing them to influence the discussion. We don't listen to the people who believe the moon landings were faked when we're making scientific policy, do we? We just leave them alone. We let them believe what they believe, and sideline them from serious discussion, because we've seen that their claims of conspiracy are unfalsifiable, and therefore, useless to even discuss.

But this isn't like the moon-hoaxers, who, left to themselves, don't harm anybody. Because the zealous deniers of climate science and basic risk management are influencing a lot of ordinary folks, who aren't irrational or selfish, but still resist any sort of action. There are a lot of people who haven't learned enough yet to realize the very real dangers involved here, and they are being duped by the impervious skeptics. So, these zealous denialists are preventing the culture as a whole from recognizing abrupt climate change as our greatest potential threat, and are thus delaying the significant policy changes which may be our only hope.

[Foil: "Help me, Obi-Won Kenobi. You're my only hope."]

Wouldn't you agree that at this point, the die-hard skeptic's outright rejection of the statements from AAAS, NAS, and USCAP essentially amounts to a conspiracy theory? And you should be aware of how influential they can be: there are members of the U.S. Congress who fall into this category.

We need some Information Warriors out there doing battle for the cause of evidence and reason, for risk management and forethought, for sacrifice and generosity. Not so much to defeat the impervious skeptics—who appear to be unreachable—but to protect the innocents from the skeptics' unreasoning faith. Because if you simply ignore the hard-line skeptics and let their comments stand, the next unsuspecting viewer who is inclined to not be concerned about climate change will have their misperception reinforced by the skeptics' comments.

So definitely do not ignore the skeptics. That would keep them from influencing <u>you</u>, but many of their arguments sound very convincing to the casual observer. They need to be **actively** countered, so they stop having an influence on the people who hear them. Online, they need to be followed and rebutted in discussion groups and video comments. In the grocery store line, where conflict is less comfortable, maybe a simple

"I don't know. . . seems like it's better to be safe than sorry" is a good option.

So your mission, should you choose to accept it, is to track and counter the hard-line skeptics at every turn online and in the media. Keep them from influencing the undecided. Drown them out with deliberate, level-headed, informed arguments, like a fire extinguisher of reason and logic. Their irrational and unrepentant comments online should be immediately smothered by a deluge of civil, well-informed, and logical responses from multiple Information Warriors, so that they realize the culture is no longer receptive to their dismissive attitude or militant apathy, and so that onlookers can see what a clear-headed assessment of the threat reveals. Demand that the media stop giving "the other side in the climate debate" equal time, because to continue to pretend that each side is equally credible at this point is dishonest and destructive. A reporter isn't obligated to interview a Holocaust denier every time she does a story about Israel, is she?

I want to be clear, because such a proposition is very tricky. It could easily be (and sometimes is) leveled at those of us on the other side of the debate. The warmer says to the skeptic: "I'm going to try to get people to ignore you, because it's no use even arguing with you. Whatever evidence or reasoning I come up with, you come up with a flimsy way to either explain it away or just plain ignore it."

And the skeptic says to the warmer:

[Foil: "That's funny, I was just going to say the same thing about you."]

So why am I asking you to conclude that it's the skeptic who's in the wrong? I'm not. Who the heck am I to tell you what to believe? I'm just some guy on the web.

[At board, with Spy Vs. Spy] What I am asking you to do is trace the points back and forth—to track the skeptic's rebuttal to the warmer's argument, and then the warmer's response to the rebuttal, and then the answer to the response, and so on. And I'm confident that you'll discover **for yourself** that it is the skeptic who falls down first, who dodges the rebuttal of their point by changing the subject, or—here's the most common stumble—by simply reasserting their claim, but in a different way. Usually that's your clue that they don't **have** an answer, and are basing their claim on belief, or a bias, rather than evidence and reasoning.

Make sure you watch all the other videos first, especially the ones for the skeptics, so that you know what you are up against—the strength of the logic they are impervious to—and so that you are well equipped to kick some tootie in the discussion forums. Remember, you are unlikely to convert a hard-line skeptic. Your mission is to show to any onlookers how nonsensical and extremist the hard-line skeptical claim has become once all the good-sounding fluff is stripped away.

Here's what I mean. You may recall some of the following quotes from people regarding my "Most Terrifying Video You'll Ever See" in the Spring of 2007:

- "I truly don't care how many scientific organizations line up for global warming, I still think column B would save us."
- "Don't you know that the AGW spin is nothing more than a socialist/communist attempt to take over the world? They are playing you!"
- "So what we have witnessed in the Global Warming debate is a perfect storm of anti-Christian philosophies parading as science. Materialists, Socialists, and Left-leaning types found common cause with neo-pagans and anti-Christian

spirituality to advocate a New World Order dressed as a movement to save the planet."

Pretty clearly irrational. "I don't care how many scientific organizations line up. . ." On a scientific issue. Is this someone want influencing the public which then decides on the policies that affect you?

Now it's critical here to realize that these were not the comments that these people made at first. Here, I'm going to use some figurines to help keep things straight. This is me, this is Joe Schmoe on the web, and this is the hard-line skeptic.

At first, these people were bringing up some the common objections which sound reasonable to someone who's on the fence, and hasn't done much homework—that is most of the population of the U.S. Things like: "humans are too small to change the planet," "climate is always changing, so this is natural," "taking action would doom our economy"—you've heard a ton of them. All of which sound very reasonable to anyone sort of cruising by.

The comments I just shared came only after long-back-and forth exchanges, where I was able to counter and take away every one of those reasonable-sounding, but in the end insubstantial, objections. And what they eventually fell back to—and revealed to everyone looking—was their actual motivating beliefs: "It's a communist plot to take over the world." "I don't care what scientists say about the science. . ." But it took dogged effort on my part to get there. That's why we need you.

So this is your mission—by knowing your stuff and being persistent, you sort of publically prune away all the easy excuses, so that the onlookers who were influenced by the reasonable-sounding objections these guys make—realize that at their core, these guys aren't reasonable, and therefore, maybe the case to be made against **action** on climate change isn't nearly as solid as it seems at a casual glance. That allows these people to be open to learning enough to make their own rational decisions based on the statements we've already got out there from AAAS, NAS, USCAP, the Pentagon, and even Exxon. In a nutshell, your mission is to smother the numskull comments and attitudes with a fire extinguisher of civil level-headedness. Deny them their audience.

We should patiently, compassionately educate those who are misinformed or misguided. And those who are left—the unrepentant and unreachable—we should deconstruct or smother, so that they no longer influence others who are listening. They should be bulldogged until they finally reveal to all listening how irrational or biased they are.

The image that I just can't get out of my head is from the movie "Demolition Man," where Sylvester Stallone's character in the future is in a car wreck, and instead of there being air bags that deploy in the car, there's some high-tech foam that instantly yet gently fills the compartment, and then solidifies fluffily so that he can break out of it when the impact is done. But, he was isolated from touching any part of the car during the wreck. That's the picture I get in my head about what I think should happen when someone pops up with a numskull comment or attitude, you know [psssshhhhtttt]. It's gentle, so they have a chance to reconsider, maybe become less confident, and are inspired to reflect on it more. But if they refuse to even consider that they might be wrong, and remain recklessly irrational or selfish, then they're effectively isolated from influencing others around them. So it's not violent—just overwhelming.

[FIGURINES: Information Warrior: "Climate change is a pressing problem, and we should take action." Skeptic: "There's no debate that the globe is warming, but there's lots of debate about what's causing it." I.W.: "Actually, no. If you google it, you'll see from the AAAS and NAS statements that say there's overwhelming agreement amongst scientists." S: "Of course—it's their gravy train. It's just common sense that we're too small to affect the planet. I.W.: "Actually, if you look at the Keeling graph and ice core data, you see that's not true. Besides, why do we need to be convinced of all the details—don't the statements from AAAS and NAS make it seem prudent to do some basic risk management?" S: "Shut your pie-hole already you moron! Mars is warming, too you know. I suppose we caused that, huh?" {psssshhht with whipped cream}]

We're not out to indoctrinate anybody—cuz history shows that always backfires in the end. But we are out to dispel the fog that a well-funded misinformation campaign has caused, supported by a small but vehement number of people who confuse their hostility towards government with uncertainty in climate science.

I should warn you: I made a mis-statement in the video "No Holds Barred." I told the skeptics that the only feasible way of accomplishing the skeptic's agenda of convincing the rest of us to **not** take action is a Manpollo Project. But that is tragically, dangerously, not quite true.

Because the denialist's agenda is not to **convince** the rest of us to not take action, it is simply to prevent or delay action. And that can by accomplished by simply mucking up the works: time is on their side. Every day that we debate about what to do, is another day that we haven't taken action. So they can actually accomplish their agenda without convincing anyone of the validity of their argument. All they need to do is continue to muddle, question, and confuse. As long as they keep alive a shred of doubt in the public's mind, they win. As long as they can keep people scared with their threat of harm to the economy, they win. As long as they can sow confusion and doubt—a task all too easy—they win.

[Foil: Oh really?? For certain??]

And we all—probably—lose. They do not need quality evidence or reasoning. That is why our task is so urgent, and we need to enlist people to the effort. The viewpoint of the hardline skeptic cannot be extinguished, because their claim is not falsifiable. Therefore it must be marginalized, so that it no longer affects people.

As you get ready to go do Information Battle, I want to share some insight from a commentor that has been tremendously helpful to me in keeping some perspective on online debates: "[Hard line skeptics] will stick to an opinion, right or wrong, in spite of all evidence to the contrary. And you can't tell them that because they will accuse you of the same thing, and then all logic falls into a death spiral. And yes, they're caught in the death spiral too, but they're crying "Wheeeeeee!!!!" all the way down while you're left trying to shout above the noise with whatever counter argument you can come up with."

So don't quit, but don't expect to convince them either. Remember, your mission is not to convert the hard-line skeptic, but to expose their nature to anybody else who might be listening or reading, so that their opinions are made irrelevant, and the rest of us can get policy changes implemented before it's too late.

[Foil: Too late? What's our deadline? How much time do we have?]

Unfortunately, in a complex system like the global climate, the only way to identify a tipping point is on the other side of it.

[Foil: As in "Oops—that's where we should have stopped?"]

I'm sorry if I don't sound very compassionate or warm and fuzzy here. But when people are either too selfish, or too irrationally stubborn to be reasonable, and that threatens me and mine, then I'm going to bring the fight. Please join me. It is our best hope. We cannot know the future for certain, but we can change the probabilities with our actions. Let us choose the actions which maximize the probability of a positive outcome. I need your help—if nothing else then, in coming up with a better rallying call than "Let us choose the actions which maximize the probability of a positive outcome."

[Foil: Yeah, I don't really see that coming across well on a t-shirt.]

So, the next time you hear someone saying or writing that human-caused global climate change is bunk, remind yourself—they just might be correct. Remember, truth is more likely to come to the humble. But at the same time, the question that you should ask them—publically, and in all seriousness—is: "What are the reasons why I should give your statement more weight than the statements of the two most well-respected scientific organizations on the planet?"

[Foil: Yeah, and if you want to be sassy, you can say something like: "So, are AAAS and NAS corrupt? Or just stupid?" Hey—maybe there's the t-shirt design! "Skeptical of climate change? Check one box. . ."]

Your bottom line mission as an Information Warrior is to help bring about nothing less than a change in the culture, so that we as a people finally have the political will to enact significant action to reduce carbon dioxide emissions, in order to reduce the chances of abrupt and catastrophic climate change.

Saying all this makes me extremely anxious, because there are some irrational people with very strong beliefs out there that this subject really riles up. I've had oblique threats made to me because of my videos. Used to be that wouldn't have really rattled me. But I've got two little girls that I love more than life itself, and it scares the bejesus outta me that someone might even make a joke about doing them harm.

But I can't just sit still. They are the reason I'm doing this, because I want them to have a decent world to live in. So I'm trying my hardest to be brutally thorough and honest with myself in my analysis, so that I get the answer with the best expected value. And what my careful, rational assessment of climate change has revealed. . . scares the hell out of me. So now I'm putting aside my ego, my fears, my sleep, to fight like hell to make the best happen.

You wouldn't do any less for your kids.

[beat]

Thank you for taking the effort to watch all this. But I think its worth it, because we are in a time like no other. It is time for the best in us to come out. Now it's up to you. I'm going to go get some sleep so that I'm not so. . . what was that word?

[Foil: Megalomaniacal?]

Yeah. That. Good luck.

——end——