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Clive Thompson on Why We Should Learn the Language of Data

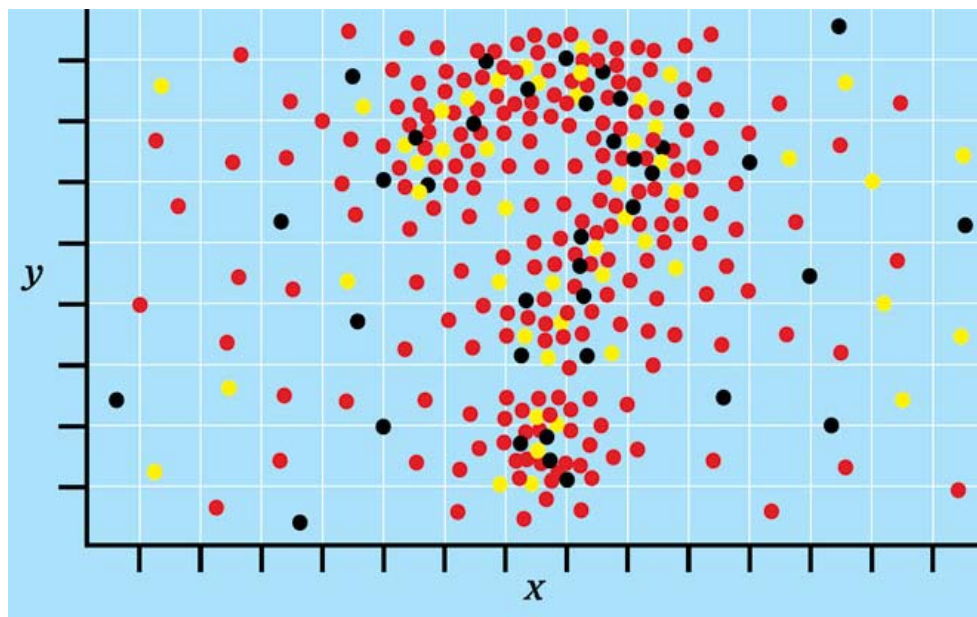By Clive Thompson ✉   April 19, 2010 | 12:00 pm | Wired May 2010

Illustration: Ellen Lupton

How can global warming be real when there's so much snow?"

Hearing that question — repeatedly — this past February drove Joseph Romm nuts. A massive snowstorm had buried Washington, DC, and all across the capital, politicians and pundits who dispute the existence of climate change were cackling. The family of Oklahoma senator Jim Inhofe built an igloo near the Capitol and put up a sign reading "*Al Gore's New Home*". The planet can't be warming, they said; look at all this white stuff!

Romm — a physicist and climate expert with the Center for American Progress — spent a week explaining to reporters why this line of reasoning is so wrong. Climate change, he said, is all about trend lines. You don't observe it by looking out the window but by analyzing decades' worth of data. Of course, snowstorm spin is possible only if the public (and journalists) are statistically illiterate. "A lot of this is counterintuitive," Romm admits.

Statistics *is* hard. But that's not just an issue of individual understanding; it's also becoming one of the nation's biggest political problems. We live in a world where the thorniest policy issues increasingly boil down to arguments over what the data mean. If you don't understand statistics, you don't know what's going on — and you can't tell when you're being lied to. Statistics should now be a core part of general

education. You shouldn't finish high school without understanding it reasonably well — as well, say, as you can compose an essay.

Consider the economy: Is it improving or not? That's a statistical question. You can't actually measure the entire economy, so analysts sample chunks of it — they take a slice here and a slice there and try to piece together a representative story. One metric that's frequently touted is same-store sales growth, a comparison of how much each store in a big retail chain is selling compared with a year ago. It's been trending upward, which has financial pundits excited.

Problem is, to calculate that stat, economists remove stores that have closed from their sample. As New York University statistician Kaiser Fung points out, that makes the chains look healthier than they might really be. Does this methodological issue matter? Absolutely: When politicians see economic numbers pointing upward, they're less inclined to fund stimulus programs.

Or take the raging debate over childhood vaccination, where well-intentioned parents have drawn disastrous conclusions from anecdotal information. Activists propagate horror stories of children who seemed fine one day, got vaccinated, and then developed autism. Of course, as anyone with any exposure to statistics knows, correlation is not causation. And individual stories don't prove anything; when you examine data on the *millions* of vaccinated kids, even the correlation vanishes.

There are oodles of other examples of how our inability to grasp statistics — and the mother of it all, probability — makes us believe stupid things. Gamblers think their number is more likely to come up this time because it didn't come up last time. Political polls are touted by the media even when their samples are laughably skewed. (This issue breaks left and right, by the way. Intellectually serious skeptics of anthropogenic climate change argue that the statistical case is weak — that Al Gore and his fellow travelers employ dubious techniques to sample and crunch global temperatures.)

Granted, thinking statistically is tricky. We like to construct simple cause-and-effect stories to explain the world as we experience it. "You need to train in this way of thinking. It's not easy," says John Allen Paulos, a Temple University mathematician.

That's precisely the point. We often say, rightly, that literacy is crucial to public life: If you can't write, you can't think. The same is now true in math. Statistics is the new grammar.

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Posted by: Buzzcut | 04/20/10 | 8:59 am |

This opinion is juvenille. First of all, the amount of data that we're talking about analyzing with a subject like, say, global warming, is monstrous. None of us, no matter how brilliant with statistics, has the resources to go through ALL the data and rerun the regressions used to "prove" it.

And I'm not even going to get into how the data has been "massaged" (as all data needs to be in order to run these regressions, but the devil is in the massaging details).

I think the problem with intellectuals is that they overestimate their own intelligence. There are things that are unkowable by any one person, and even the best efforts of entire fields may very well be inadequate to "prove" something as complex as global warming.

As an engineer, I get to use statistics on a regular basis, and that use makes me humble as to what I can actually prove with data. It is nowhere as easy as Thompson makes it out to be, and I'm working under controlled conditions with modern instrumentation. God help the climate researchers, with uncontrolled conditions and historical data taken with very primative instruments.

Posted by: scienceiscool | 04/20/10 | 10:44 am |

@Buzzcut:

I think that I understand a different conclusion from this article. The more the general population understands statistics the better off we all are, but the key is that most people don't understand even the most basic statistics. If people in general understand the difference between possibility and probability or that correlations don't equal causation it would be a significant improvement. You seem to suggest that because we can't all master all aspects of statistics there is no validity to aspiring to improve understanding at all. Please correct me if I am mistaken about your position.

Posted by: Buzzcut | 04/21/10 | 9:22 am |

No, I don't agree. Quite frankly, if correlation isn't causation, then entire fields of social science and soft science (climate science, for example) is suspect.

Indeed, Wired had a cover story last year advocating massive data analysis, claiming that the very nature of science (where you try to prove a theorem using data) needed to change. Why bother with a theorem, just go where the regressions tell you to go, so said the article.

Again, it is the conceit of the intellectual to believe that, if we all just more like intellectuals, the world would be a better place. Self serving, isn't it?

When it comes to complex systems, I put faith in customs, traditions, norms, and perhaps things such as betting markets, where the "wisdom of crowds" can exert itself. In fact, that's why market systems perform so much better than central planning, even so called "scientific socialism".

Posted by: scienceiscool | 04/21/10 | 11:17 am |

Buzzcut:

1) I don't think that you are trying to state that correlation is causation but if you are please explain. If instead you are using that to support a claim that social and climate science is suspect I think that you need to be more specific.

2) Could you reference the article you are discussing, and even better if you could quote the text stating what you are claiming the article states. I am a somewhat new Wired reader and I may have missed the article. One aspect of science is hypothesis testing. Another important aspect is establishing parameters. With climate science one goal is to develop models to predict the range of change in temperature over a defined period of time. In my opinion point estimates receive too much attention as the point estimate doesn't matter much if the confidence interval is wide enough.

3) Sorry, but the term intellectual has been redefined by so many people that I don't know how you are using it here. I think that it is beneficial to have more knowledge. It helps to better understand the world. If you think that knowledge is bad, I would be very interested to read why you think that way.

4) When you say "market systems" in this context I assume that you mean free market. I am sure you are aware that the "freedom" in the markets is a continuous and not a dichotomous state. On what measures and at what point on the continuum are markets optimally free?

I think that it is interesting to note that our conversation is predicated on understanding statistics, which I said previously is what I thought was the point of the Clive Thompson's article.

Posted by: zombified | 04/22/10 | 3:13 pm |

I'm trying to figure out wtf Buzzcut's point is too: Is he saying we shouldn't try to understand statistics better?

The climate researchers with the historical data and "primitive instruments" aren't stupid. They know very well the limitations and their "data massaging" as you put it is taken into account by a very well established peer review process. Thier data is reproducable and varifiable and their conclusions are tested and tested again.

When a politician or pundit says "look it's snowing so there can't be global warming." he's being deceptive and counting on his listener being ass-hat retarded. Is that how we should think?

It was those darn intellectuals who created vaccines, put men on the moon, etc. –all with that "suspect" process. I'll take my chances with them thank you very much.

Posted by: zombified | 04/22/10 | 3:22 pm |

…furthermore, no matter how solid climate researcher's results are, no matter how much evedence they have or how hard they work to find the truth it will never be enough because Exxon will still have million dollar teams of psychologists, public relations experts, lobbyists, politicians, and Fox news pundits who will work tirelessly to make sure the general public remains as confused as possible lest they be held accountable for anything or have to adheare to any standards for anything.

Posted by: Buzzcut | 04/25/10 | 2:09 pm |

What's Buzzcut's point? There are limits to statistics, there are limits to what is truly knowable, especially when it comes to complex phenomenon, and a lot of what's "proven" is certainly not. Maybe, if it's a large and complex enough system, there are things that are simply unprovable. Having everyone be able to run a regression in Excel isn't going to change that.

Posted by: tehb2 | 04/26/10 | 9:54 pm |

The main problem is that there are too many ignorant and uninformed people who do not try to learn anything on their own. They form political/social opinions early in life, largely by way of being taught what to believe in, and they only listen to those that match similar interests/beliefs, and deny anything said by those that don't have their same beliefs.

This works both on the left, right, and anywhere else in between and its frustrating to listen to so many

seemingly normal intelligent people have so much bias in their beliefs and an unwillingness to explore various perspectives on an argument. And when you take the time to explain how to look at an issue from various perspectives, they go wide eyed and go "Oh, I didn't think of that."

The problem here is that people are not well educated academically, and socially. Instead of trying to teach people to understand issues and make sound decisions based on many if not all the aspects of an issue, they are taught to believe one thing and never give in to the other side in order to protect interests. Its depressing.

Posted by: RoxyinVA | 04/26/10 | 10:09 pm |

When I went to College in the 70's computer time was just beginning to get to the point where researchers could run numbers multiple times to get the result they wanted. I agree with Clive if people don't understand the difference between a fact and a statistic then they are doomed to misleading conclusions.

For those who don't know ………

If we say there were 100,000 people who were over 70 years old that died in the US in a given year, that is as close to a fact as we can get. Yes there can be some missing deaths in the number or some misjudged calculations of age at death but the information is as close as we can get to a fact. The number is not derived from a sample of the deaths in a given area or city, the number is what has been reported by ALL the coroners across the entire US. If we look at the data from several years we can spot a trend and the trend that we spot would again be a fact because again the trend is not derived, we have all of the data points.

In mathematics and the world of Probability & Statistics, there are math calculations that can be done to see if we have a large enough sample to make a relevant conclusion. Scientists who proclaim Global Warming as the current Earth trend DO NOT Understand math. It would take a minimum of 200 years of ACCURATE Climate data from hundreds of thousands of locations around the globe to have a great enough sampling of climate data to be able to predict or notice with mathematical relevancy, whether the Planet was on an upward or downward trend against climate changes that take thousands of years.

Frankly science doesn't have data, and certainly not accurate data. Current complex climate models are based upon incomplete data and hence their inability to predict the weather more than three days in the future. A newspaper in England followed 2000 weather sites around the globe for 2 years and found weather men using sophisticated climate models could not predict the weather more than 3 days out with any better than 50/50 accuracy.

Logically if you can't even reasonably predict the weather 30 days out than you can't use the same models to predict the weather years in the future.

I don't know if the planet's trend is up or down, we don't have the information as of yet to make that determination. I do believe in treating the planet well and the less we can pollute and the less we can send money to nations that don't like us, is a good thing.

Posted by: jerry34 | 04/26/10 | 10:49 pm |

data itself is useless — it should be disseminated to become a usable information. So far, that's the reason **why Google is dominating.**

Posted by: okgreat | 04/26/10 | 11:39 pm |

The Wired article Buzzcut refers to is here:
http://www.wired.com/science/discoveries/magazine/16-07/pb_theory

The following is more tangential, but related:
http://www.wired.com/wiredscience/2009/04/newtonai/

Posted by: Marasbaras | 04/27/10 | 12:34 am |

" I do believe in treating the planet well and the less we can pollute and the less we can send money to nations that don't like us, is a good thing."

This is the conclusion that we should all come to. And yet, those who claim that nothing is happening with our climate also seem to think that giving money to those who fund terrorists (the Saudis) and polluting are both good, good things because us dirty Lefties are against them.

Posted by: Parhelion | 04/27/10 | 1:05 am |

@RoxyinVA
Climatology and weather forecasts on the news, though closely related, are 2 different fields of research. To say compare their accuracies is wrong.

@Buzzcut
The point of the article, as stated by @scienceiscool, is not that everyone needs to know statistics to the point of being able to reproduce what others have done but that people as a whole should be more thoroughly educated such that things like "Snowpocalypse" aren't misconstrued as science and a valid counter argument to the possibility of global warming.

Both of you, and others, may very well be right about global warming not being true. But to say that it is wrong because the weather man can't accurately predict tomorrow or because you don't feel that these intelligent people doing the research can't possibly have any clue as to what they are talking about, even though their knowledge on the topic far exceeds your's or my knowledge on it, is juvenile.

P.S. @Buzzcut
There is no need for CAPS LOCKS, or "quotations", unless of course you are actually quoting someone. Those are very juvenile are more about arguing than have a rational discussion.

Posted by: DrNeroCF | 04/27/10 | 3:11 am |

@Parhelion: YES! Complaining about how someone communicates! This is SURELY the next step forward in our quest for understanding!

The only true thing that the statistics show is that the earth doesn't stay the same. We can argue correlation to shareholders to get more money for a green initiative till we're blue in the face, but at the end of the day, it's still snowing outside.

Posted by: aethr69 | 04/27/10 | 3:56 am |

The comments that are made about statistics and working from incomplete data sets are important for many reasons. Yes, people should know more. They should at least understand the basics as this makes any choice more informed.

As far as anthropogenic climate change goes, I have a question for all the sceptics.

What difference does 6 billion people, all burning things, make to the climate?

If you think it has no relevance then I would like to know why. Burning = CO2. More people = more burning = more CO2.

As RoxyinVA said about analyzing climate change. "It would take a minimum of 200 years of ACCURATE Climate data from hundreds of thousands of locations around the globe to have a great enough sampling of climate data to be able to predict or notice with mathematical relevancy…"

If this is true it will still be inaccurate as humans have been affecting the climate since we discovered fire. In order to get an accurate figure on anthropogenic changes we would have to know how the system was before the change and how it would be without humans then the effect of humans on the climate can be figured out. But what is the point? To debunk Al Gore? or prove him and about 98% of scientists right?

I think the answer is already clear. Those who think that having 6 billion people on the planet is not affecting global climate change, they are wrong.

Posted by: curio50 | 04/27/10 | 8:33 am |

"Statistics is the new grammar" I hate when Wired uses this same silly wording over and over. How about "Statistics is becoming more relevant"….period. This issue has nothing to do with Grammar, proper Grammar is as valuable today and it always was.

Posted by: killtacular | 04/27/10 | 8:38 am |

Love the illustration

Posted by: galadiman | 04/27/10 | 9:22 am |

Curio50: Allow me to clarify what I think the auhor meant by his phrase, "Statistics is the new grammar." Grammar is the context we use to communicate, the way we put words together to communicate ideas. As mathematics becomes more prevalent in our daily lives, we need a 'grammar' with which to put numbers together to communicate ideas. That language, according to the author, might be statistics. Not agreeing or disagreeing, just trying to clarify, with my limited understanding.

Posted by: senthe | 04/27/10 | 9:33 am |

I think that the whole thread is a proof that people need a lot more education on science.

First of all, science is not trying to know everything as that is an impossible quest. Science is a set of methods and tools that we can use to understand some phenomena in our world, but it's not perfect. There are two theorems that debunked the myth that science is everything: Gödel's theorem that states that science, math to be precise, is not complete and Heisenberg's uncertainty principle that states that measuring we alter the sample being measured. I think there's another important theorem, but I can't remember right now.

I think that a better understanding of science is crucial, at least a good understanding of what it can and can't do and why science is used and accepted even when it can't give complete and precise answers.

Obviously, I'm an intellectual. I think the world would be a better place if we all have a good education but I also know that my beliefs are questionable, they are just my way of living. We can start questioning what is education, why science and not religion (or other knowledge), what's the meaning of good and bad and a lot of other philosophical question out of the scope of this comment. One thing that is undeniable is that we are living in a world that relies on science for almost everything and, unless we change completely our world, we need a basic knowledge of it to understand the world.

To end up, a quote by Einstein: "A little knowledge is dangerous, so is a lot"

Posted by: mwilk | 04/27/10 | 9:43 am |

Just as we don't need to be able to write our own novel to be literate we don't need to do all own data collection and number crunching to make use of statistical data. Indeed, none of us would ever have the time or resources for such a thing. We do need to understand basic principles enough so that we can at least recognize common fallacies such as presenting snow storms in Washington DC or individal hurricanes, tornados or other weather events as proof or disproof of Climate Change. Or that most pundits' predictions on the direction of the stock market are no more likely to be correct than a prediction on the result a random coin toss. Or that a lot of "science" presented by the media today, especially regarding health or the environment, is nothing more than trolling for correlations, "Cancer Clusters" for example.

Posted by: galadiman | 04/27/10 | 9:50 am |

Buzzcut:
I think, as scienceiscool says, the article promotes learning more about a subject as being helpful to understanding it. I'm sure you cannot argue against that.
Regarding your argument that we don't have enough data, we have to begin to understand correlations/causations/analysis SOMEWHERE. Just because we don't have ALL the data, does not mean we can't get SOME idea of trends and tendencies. (Often, correlation is all we have to go on, as causation is rarely provable. So we 'go with what we know,' look for roadsigns and counterexamples along the way, and act using the knowledge we can use. Isn't that logical?)
I think the problem is not that intellectuals overstate their intelligence. [Now I'm not sure what you mean by 'intellectuals', but I'll ignore the implied perjorative for now.] Granted, 'intellectuals' are human, just like everyone else, and are fallible. But I think the current culture degrades 'intellectual' as 'less than',

certainly the rise of Mr. Bush (43) and Ms. Palin reflect this deep distrust of "learnin'" and "thinkin'"[sic]. How much learning is too much? Do you have an iPod, a computer, a cell phone? Which of these would you give up, so we can have less 'intellectuals' ruining our great country?

People think they hear 2 things on TV, then they can decide some theory's validity (be it climate change or evolution, or any other host of things), as if they knew better than someone who had spent 40 years doing rigorous scientific research. It's truthiness, as defined by Stephen Colbert -check it out. You're an engineer and you trust, 'customs, traditions, norms, and perhaps things such as betting markets, where the "wisdom of crowds" can exert itself.'?? That's a fascinating statement. What is it you engineer?

Not being able to define everything discretely should never be a limit on using data to inform your decisions. No scientist worth his weight in salt would ever claim to know 'everything' about something – new theories pop up hourly. But they do make educated decisions, as opposed to letting the whim of the masses, or the luck of the draw, rule every decision, whether simple or complex.

Posted by: opsimath | 04/27/10 | 11:15 am |

"…Lies, Damm Lies, and Statistics!…" (MT or BD – depending upon whom you ask!)

Posted by: someone_else | 04/27/10 | 11:41 am |

I can't believe someone would argue that because global warming is a difficult subject to understand, people don't need to understand statistics. (Buzzcut, I'm looking at you.)
.
I don't bloody care about global warming one way or the other. Regardless, we should be teaching our children to a higher standard with respect to probability and statistics, because an educated, informed citizenry is critical to the health of any complex, modern, technologically dependent democracy. FFS, how can so many people be so stuck on one political problem that any discussion even remotely related gets instantly sucked into a black hole.
.
Here's one for curio50: Numeracy is the new literacy. Are you going to upbraid me for undervaluing literacy?

Posted by: bvirgin | 04/27/10 | 11:45 am |

If the people who use igloos to portray climate change as false do not understand statistics, then people who use polar bears to support the climate change argument don't either. I suspect that both sides realized that a QQ chart does not make good marketing. Statistics do not lie but statisticians do. I am skeptical of any statistician and their results if they have a vested interest in the outcome.

Posted by: galadiman | 04/27/10 | 12:06 pm |

So in that case, you must not go to doctors, because if they make you well, you don't come back to them for more visits so they can make more money. Sounds kinda silly, right?

Perhaps you should look deeper than that. Perhaps when 98% of a group of scientists agree on something, you might want to take their advice.

Posted by: wraithnot | 04/27/10 | 12:27 pm |

The real world is best described with probabilities rather than with certainties or mathematically rigorous proofs. I agree that we can never completely understand all the nuances of complex systems and historical data can never be used to predict the future with complete accuracy. And sometimes people put too much faith in overly simplified and/or flawed statistical models (look up Long-Term Capital Management for a perfect example).

But I think the author makes a valid point that most people in this country suffer from a severe lack of understanding of quantitative methods rather than overconfidence in those methods. And even if you don't completely understand every detail of something, statistical methods can allow you to make some pretty good guesses.

For example, I don't claim to have a complete understanding of the global climate. But the trend visible in the "Global average sea level" plot from the 2007 IPCC synthesis report looks pretty convincing to me. Any global warming skeptics interested in making a $1000 even-money wager that the global average sea level in 2020 will be lower than it was in 2010? I imagine we could find a lawyer to draw up the contract. I'm not certain about the outcome. But I'd personally consider the global average sea level continuing to rise in the next 10 years to be a much better bet than any of the positions in my retirement account at the moment.

As an aside, I think some sort of climate futures market that would allow people on both sides of the issue to put their money where their collective mouths are would be a much better way to settle things than all the hysterical screaming that's happening right now.

Posted by: trrll | 04/27/10 | 12:40 pm |

RoxyinVA writes: "It would take a minimum of 200 years of ACCURATE Climate data from hundreds of thousands of locations around the globe to have a great enough sampling of climate data to be able to predict or notice with mathematical relevancy, whether the Planet was on an upward or downward trend against climate changes that take thousands of years."

This is a good example of the what the article is all about, because it is a statement could only be made by a person utterly ignorant of probablility statistics. The reason is that even to know how much data would have to be collected to determine the magnitude of the climatic trend, you would already have to know both the magnitude of the expected trend and the magnitude of the variance, which would require that you already have in hand a reliable climate model. But if you already have a reliable climate model, it would no longer be a problem in statistics, becaue you could predict the climate trend based upon energy inputs (solar radiation, CO_2, etc.) –you would just measure these few inputs and plug it into the model (which is actually how climate predictions really work–they are not extrapolations from data collection).

RoxyinVA also writes: "Logically if you can't even reasonably predict the weather 30 days out than you can't use the same models to predict the weather years in the future."

This is a statement that could not be made by anybody with the least amount of knowledge of statistics or logic–or even a modicum of common sense. In fact, there are numerous examples familiar to students of statistics in which long term trends are easier to predict that short-term events. A casino cannot predict what the next roll of the dice will be, yet it can reliably predict that it will make a profit over a thousand rolls. And as anybody with commons sense knows, while it may be difficult to predict reliably whether tomorrow will be warmer or cooler than today, one can often predict with a high degree of confidence whether it will be warmer or cooler in, say 3 months.

Posted by: defaultuser1 | 04/27/10 | 12:49 pm |

So global warming skeptics. What if you're wrong? What are the consequences?

Posted by: oceanfish | 04/27/10 | 1:43 pm |

@RoxyinVa Climate models and weather models, while related are not the same thing. You do not use a climate model to predict the weather. Someone on wikipedia has explained it much better than I can.

http://en.wikipedia.org/wiki/Global_climate_model#Relation_to_weather_forecasting

Posted by: minstrelmike | 04/27/10 | 2:23 pm |

Citizens (voters) need to understand stats viscerally.
That takes training and good sound bites.

1. Half the people you meet are below average (above avg if you're a glass half-full kid of person). Weight, height, health, energy level, as well as IQ. That's basically what average means as you try to come up with solutions for social problems

2. Variability within a group is usually far greater than between groups. Men are heavier than women on average but not all men are heavier than all women and if you split a random group of people into weight categories, then you know nothing at all about the gender makeup of the groups.

As far as climate and weather is concerned, the days get generally warmer from Dec 21 to June 21 but not every single day is warmer than the previous one. And while you can say that summer is warmer than winter, you cannot guarantee that Aug 12th will be warmer than Feb 12th. Colorado is drier than Seattle, but that doesn't mean it won't rain sometimes in Colorado when it is dry in Seattle.

You cannot measure climate by weather anymore than you can measure groups by individuals. There as a silly article in Utne Reader recently claiming folks don't understand the real differences between Republicans and Democrats. The writer used personal differences of Bush and Obama to outline his misaligned point. He should look within the parties. The difference between Obama and Hillary Clinton is huge. The difference between her and her ex-president hubby Bill may be even wider. Or not. We don't know for sure but people within the same party can be much farther apart from each other than the actual platforms of their party and a different party.

i.e., intelligent people make the same kinds of errors as the other kinds of people.

Posted by: catchersmitt0 | 04/27/10 | 2:39 pm |

Yes – last winter, many forgot, or failed to realize that "weather is not climate."

Posted by: hammerbutt | 04/27/10 | 3:03 pm |

Zombified
The climate researchers with the historical data and "primitive instruments" aren't stupid. They know very well the limitations and their "data massaging" as you put it is taken into account by a very well established peer review process. Thier data is reproducable and varifiable and their conclusions are tested and tested again.
If this was really true then why did it take an outsider like Steve McIntyre an amatuer skeptic to find errors in Hansen's data? I'm not using this as a platform to support denial but would any of the so called peer reviewers who test things again and again have ever found this error?

Posted by: trout007 | 04/27/10 | 3:29 pm |

I agree with Buzzcut. I'm a mechanical engineer with lots of experience testing. I know when people are trying to pull data out of the mud. When you work in the noise of your data it is very dangerous and easy to convince yourself you know what is going on. There are times when your data resolution and sample rate can trick you with aliasing.

Does anyone know if the raw data is available anywhere? I mean actual thermometer or tree ring data? One site I've seen that is interesting is surfacestation.org. There are some really interesting things there that show how dangerous it is to make decisions when the data is in the noise. One example shows that just changing from whitewash to white latex paint on the box covering the thermometer raised the average temperature. Also there are stations that have been in place for 100 years but an air-conditioner compressor was installed near the thermometer in the past 20 years. Things like that happen all the time in testing. When it happens to me I can correct the problem and rerun the test. The problem for the climate scientists is they can't rerun the test. They have to "massage" the data.

Posted by: bobnjersey | 04/27/10 | 3:33 pm |

[The only true thing that the statistics show is that the earth doesn't stay the same. We can argue correlation to shareholders to get more money for a green initiative till we're blue in the face, but at the end of the day, it's still snowing outside.]

what math and statistics truly show is that the relationship between 'things' are not typically simple. whether it's correlation or causation … how simple or complex are these relationships … what are the criteria that feed the system and produce the result … are these things that define the result measurable and/or controllable?

in most cases these are valuable things to know. it's not that at the end of the day it's snowing outside … it's that you could predict it would occur … that it would affect only this region … that it will end at an approximate time … and that it's expected to be twice as or half as bad as another referential point that once can already relate to.

Posted by: trewbux | 04/27/10 | 3:34 pm |

Buzzcut completely misses the point. The point is not that everyone should be able to perform a regression analysis on large, complex data sets to verify results from peer-reviewed science journals. The point is that a basic understanding of statistics can make the general public less susceptible to idiotic talking points and marketing. No science is done with a sample size of one – one autistic child, one snowstorm, or one polar bear on an ice floe (this goes both ways).

Posted by: arkowitz | 04/27/10 | 3:58 pm |

Statistics is difficult for even trained scientists to understand and apply properly. Most scientists misapply statistics, in fact.

It is better to promote visualization of the ACTUAL DATA, rather than statistical analysis of the data. New visualization tools, in particular 3D ones, can show the data itself and we can draw conclusions using our excellent human facility of pattern matching and trend recognition – without resorting to the wizardry of statistics.

Perhaps I am biased, though, because I invented a 3D data visualization product…

http://www.youtube.com/watch?v=oolVy18×2fw

Posted by: ImmortalSoFar | 04/27/10 | 5:09 pm |

This Russian Roulette is completely harmless – I've pulled the trigger 5 times already and absolutely nothing has happened. Watch…

Posted by: trrll | 04/27/10 | 5:11 pm |

If you listen to Fox News, or global-warming-is-a-conspiracy cranks, you might get the impression that climate scientists refuse to share the raw weather data with the public. In reality, climate science is one of the more open fields of science, and a huge amount of information, including raw data, corrected data, algorithms, climate models, and even computer code is publicly available. A good index can be found here:
http://www.realclimate.org/index.php/data-sources/

Here is a one group that has been independently replicating historical climate analysis based on publicly available code and data:
http://clearclimatecode.org/

Posted by: robertmalthus | 04/28/10 | 8:06 am |

Actually the reaction to the snowstorm was logical: observing it reduced the probability that the global warming hypothesis is correct.

Posted by: imaduck | 04/28/10 | 11:19 am |

I agree with your points and really enjoyed your article. As others have pointed out, its not about having every citizen know everything there is to know about statistics, but instead, I'd be happy if people could just understand the difference between correlation and causation. It'd be great if people understood that their own personal experience or insight doesn't necessarily outweigh decades or centuries of research.

The snowstorm event is actually a bit amusing, because a big part of climate change isn't just that you expect the average temperature to be higher, but instead that you also expect larger temperature swings. If you inject more energy into a turbulent system, you can drive stronger turbulence; although your average temperature may end up being higher, you can also end up with more drastic temperature swings, upward or downward.

@RoxyinVA: Most people have hit on why your logic is so terribly wrong, and exactly what this article is talking about, but I'd also like to point out that your "it will take 200 years to collect enough data"

argument makes no sense statistically. It's not like there's some critical data threshold where you say "ah, this is truly proven" or "no, this isn't proven." When you're making a statistical argument, you're always making an argument within some confidence level. How many coin flips do you need to do to be sure it's a fair coin? If I flip a coin a hundred times, and it comes out 51 heads and 49 tails, does that mean it's not a fair coin? What if we only did 2 coin flips, and got a head and a tails, which would we be more certain of?

Statistics can tell you this answer. Your hard-fast rules and vague, meaningless interpretations of what you think about the weather cannot. Climate researchers got together and put a 90% confidence level on the notion of man-made global warming. This isn't just one researcher and one data set, but instead many different research groups using many different, independent data sets, coming to the same conclusions. It's not about picking one point and saying that disproves the whole of the climate argument, because the science is much much bigger and more rigorous than that.

Posted by: blockeduser | 05/25/10 | 5:18 pm |

The subtitle sounds like a recent IBM TV ad (to quote, "The more we understand data, the more answers we find")