Statistics Communication: Early Thoughts about a New Model of Engagement

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Shop Talk
Pew Research Center
September 21, 2018

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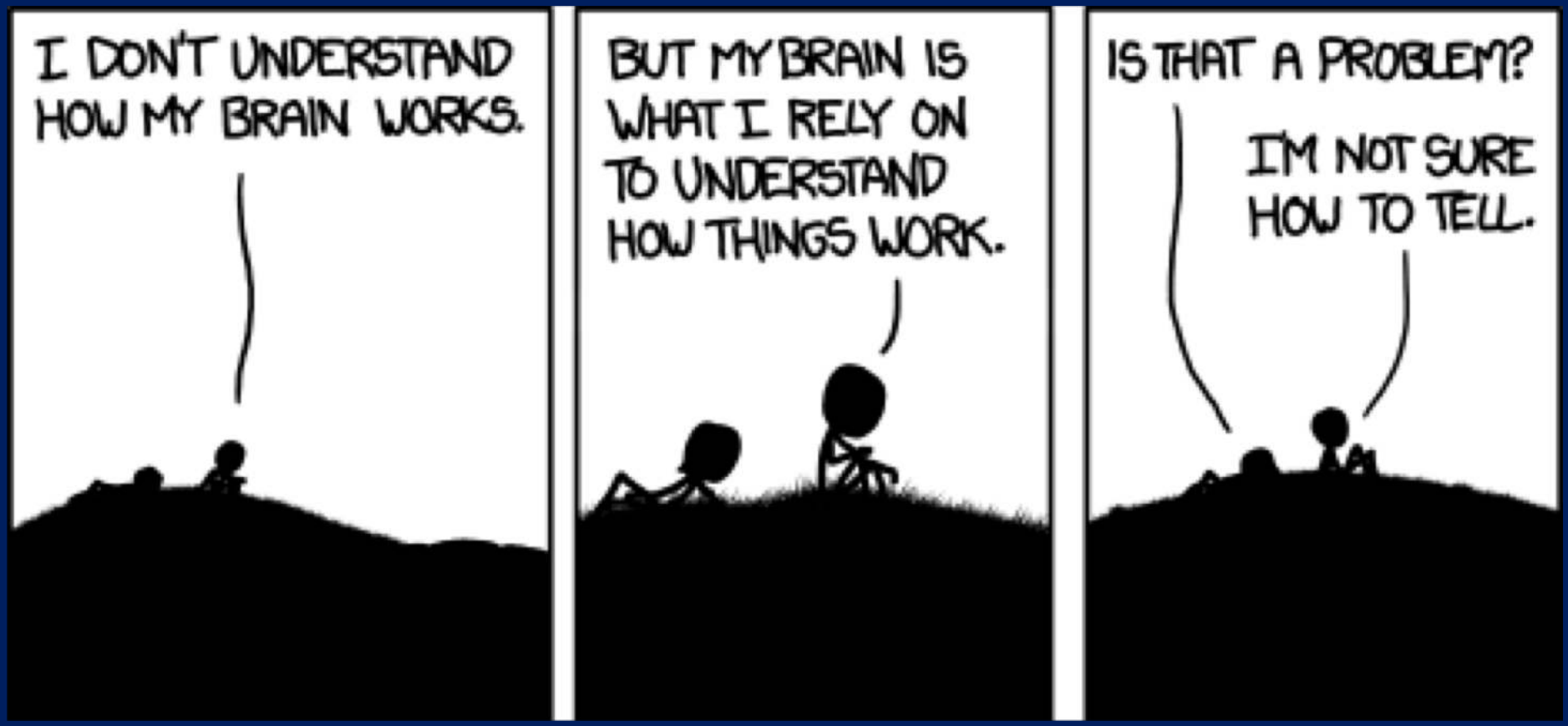

https://xkcd.com/1163/

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FINANCIAL TIMES

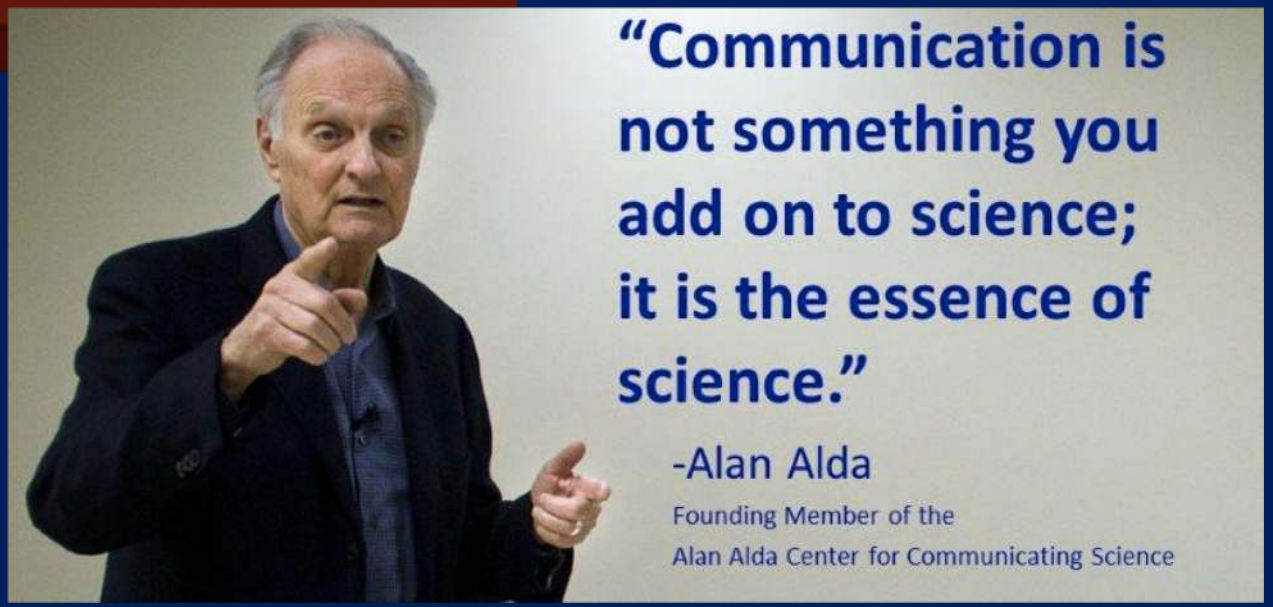
Clive Cookson, Science Editor JULY 6, 2017

Science communication: a graduate's guide to a growth industry

A centuries-old tradition becomes a necessity in an age of shrinking research budgets

Alan Alda Center
for Communicating Science

AT STONY BROOK UNIVERSITY



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Science Communication Strategies

- ✓ Know your audience
- ✓ Ditch the jargon
  - ✗ Don’t use too many numbers
  - ✗ Be concrete
  - ✗ Don’t equivocate
  - ✗ Tell narratives of discovery

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Human-Centered Data Communication

Numbers

Evidence

Uncertainty

Expectation & Surprise

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Numbers

"No one ever made a decision because of a number. They need a story."

-- Daniel Kahneman

Anecdotes → Data → Stories?

The deep history of the number words

Mark Pagel, Andrew Meade

Published 1 January 2018.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B

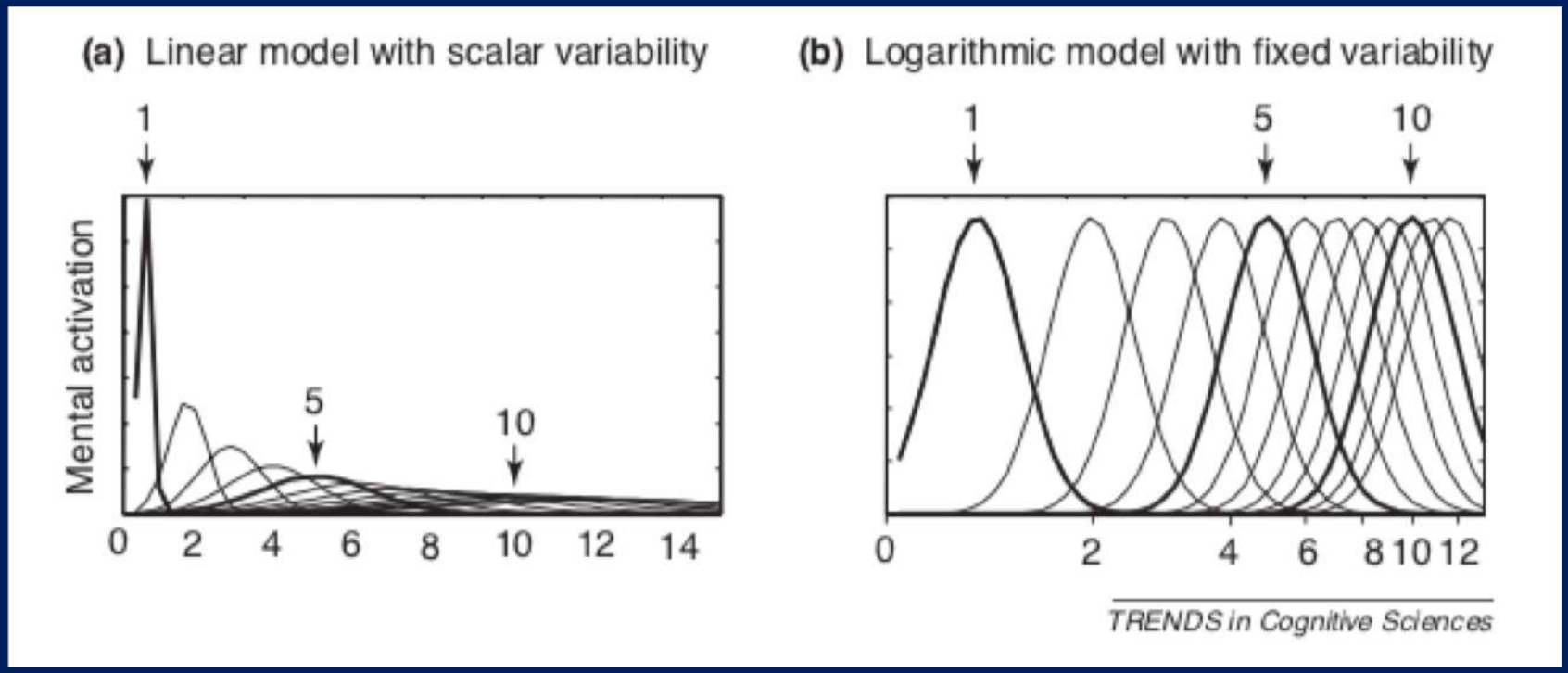
BIOLOGICAL SCIENCES

"The sounds that you and I use to say 'two' or 'three' are the sounds that have been used for tens of thousands of years," said Mark Pagel, a biologist who studies the evolution of language at the University of Reading.

"It's not out of the question that you could have been wandering around 15,000 years ago and encountered a few of the last remaining Neanderthals, pointed to yourself and said, 'one,' and pointed to them and said, 'three,' and those words, in an odd, coarse way, would have been understood."

That continuity, Dr. Pagel added, "should astonish us."

Numerosity on the Log Scale?



Feigenson, L., Dehaene, S., & Spelke, E. (2004). Core systems of number. Trends in cognitive sciences, 8(7), 307-314.

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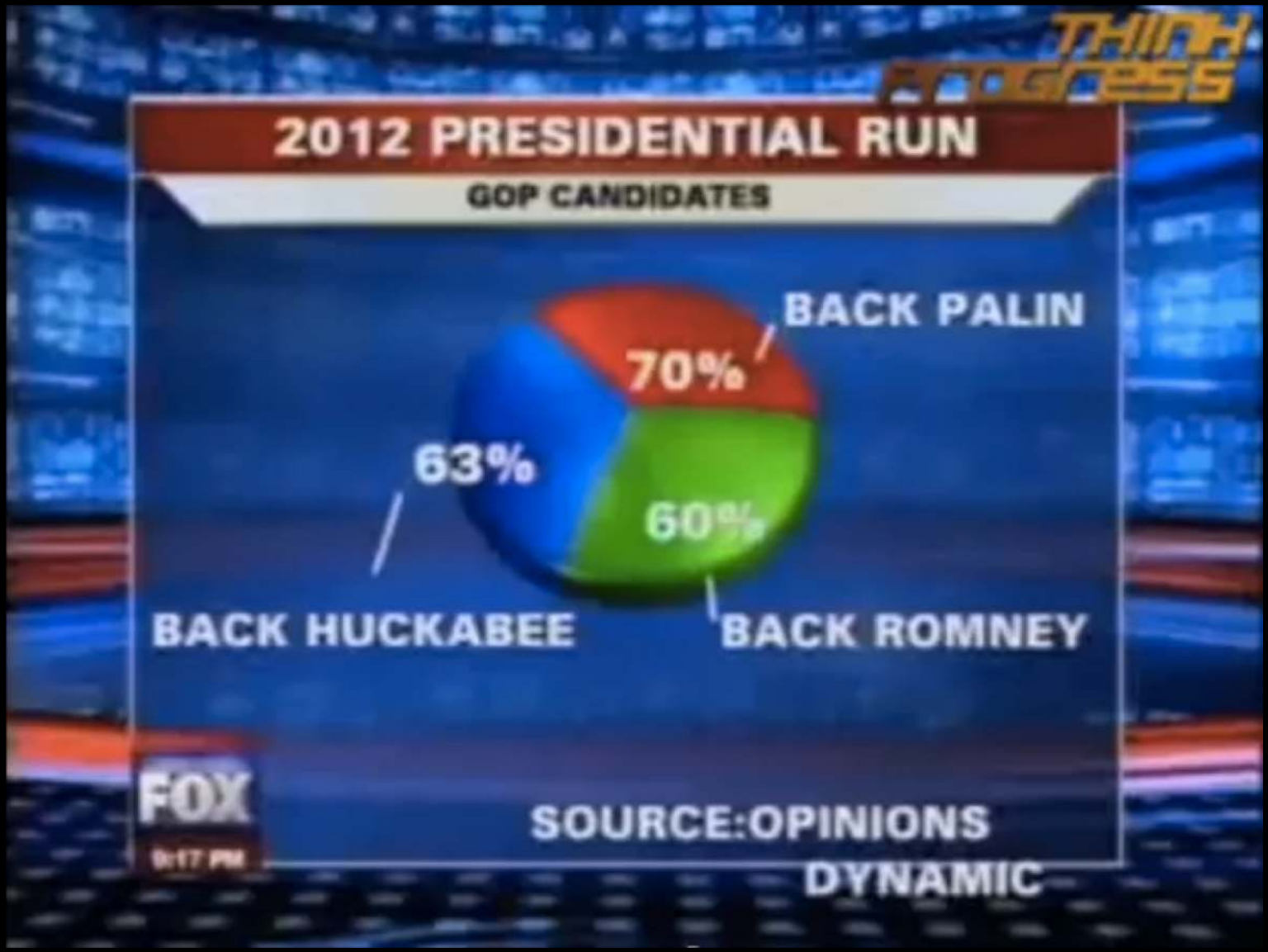

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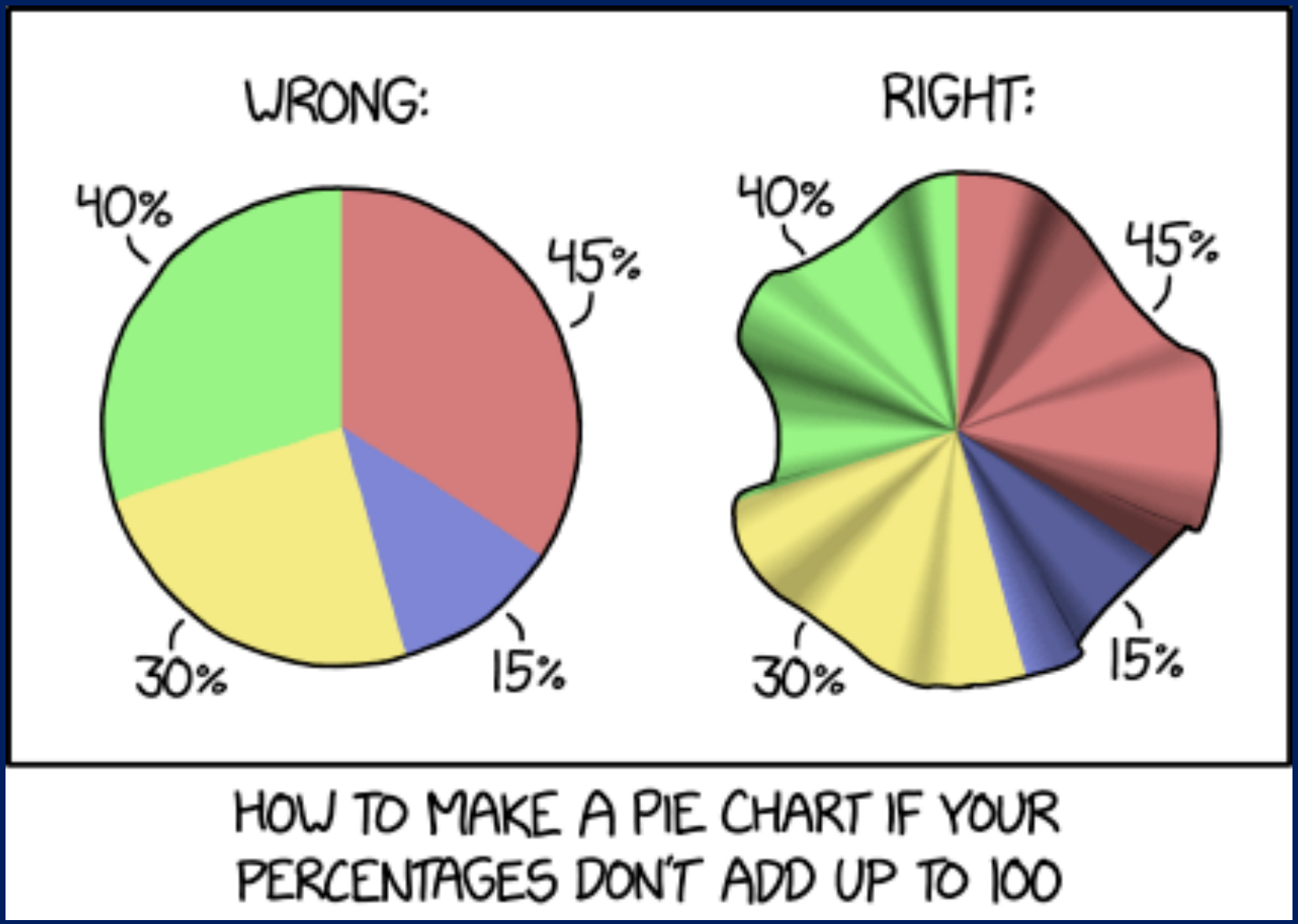

HOW TO MAKE A PIE CHART IF YOUR PERCENTAGES DON'T ADD UP TO 100

Absolute or Relative Numbers?

Researchers estimate that over a 15-year period, the chances of a woman dying of breast cancer if she's not screened are 0.52%. That number will drop to 0.41% with regular screening.

Researchers estimate women who are regularly screened are 21% less likely to die of breast cancer.

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Gigerenzer, Gerd, et al. "Helping doctors and patients make sense of health statistics." Psychological science in the public interest 8.2 (2007): 53-96.

Percentages or Natural Numbers?

Researchers estimate that over a 15-year period, the chances of a woman dying of breast cancer if she's not screened are 0.52%. That number will drop to 0.41% with regular screening.

Researchers estimate that for every 10,000 women who are not screened, about 52 will die of breast cancer over 15 years, compared to about 41 who will die even if they are screened.

Big Denominators or Tribe-Sized Denominators?

. . . for every 10,000 women who are not screened, about 52 will die of breast cancer over 15 years, compared to about 41 who will die even if they are screened.

. . . for every 1,000 women who are not screened, about 5 will die of breast cancer over 15 years, compared to about 4 who will die even if they are screened.

. . . for every 10,000 women who are not screened, about 52 will die of breast cancer over 15 years, compared to about 41 who will die even if they are screened.

. . . for every 1,000 women who are not screened, about 5 will die of breast cancer over 15 years, compared to about 4 who will die even if they are screened.

. . . for every 100 women who are not screened, about 0.5 will die of breast cancer over 15 years, compared to about 0.4 who will die even if they are screened.

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Varying Denominator or Varying Numerator?

. . . without regular screening, about one in every 192 women will die of breast cancer over a 15-year period, compared to one in about 244 who do get screening.

. . . for every 1,000 women who are not screened, about 5 will die of breast cancer over 15 years, but this number will drop to only about 4 deaths for women who are screened.

SEPTEMBER 20, 2017

Trust, Facts and Democracy

Science News and Information Today

A majority of Americans rely on general outlets for science news but more say specialty sources get the facts right about science

BY CARY FUNK, JEFFREY GOTTFRIED AND AMY MITCHELL

Pew Style Guide?

Roughly one-in-six U.S. adults (17%) both get science news at least a few times a week and tend to seek it out.

Taken together, a minority of Americans (17%) are what can be termed "active science news consumers," those who

informing Americans about science news. Most social media users see science-related content but only a quarter (25%) see "a lot" or "some" science posts on these sites, and only a third (33%) consider it an important way they get science news.

An overwhelming majority (88%)

following science news; nearly every active consumer (97%) cites it as a reason, with 77%

About one-in-five Americans (18%) report they have what they consider to be a "science-related hobby, interest or activity they do outside of work."

About two-in-ten adults (18%) have a science-related hobby or interest such as outdoor and naturalist activities, astronomy, computer programming and technology-related hobbies.

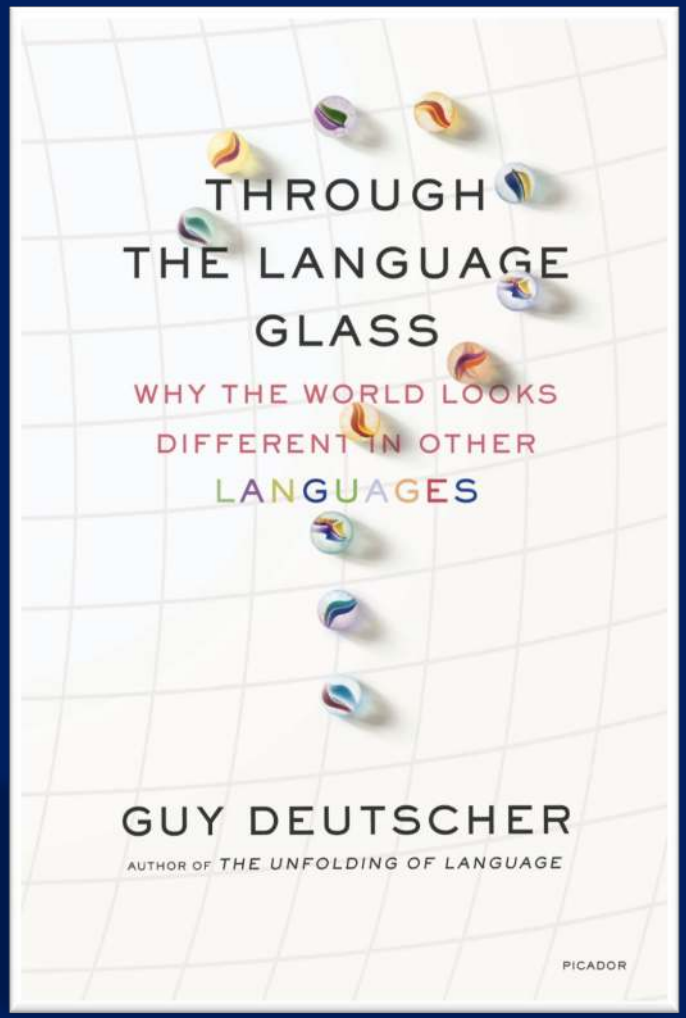
And about one-in-six Americans (16%) say they have participated in a citizen science research activity, whether helping to collect data samples for a science research project, contributing to an online crowdsourcing activity, or participating in a maker movement or hack-a-thon.

bits of "surprisal" = $-\log_2 p \approx -\frac{\log(p)}{0.3}$

Can we take advantage of our internal log scale and love of natural numbers?

Royal flush	0.0000015	predicting	~ 19 coin flips
Snake eyes	0.028		~ 5
p = 0.05			4.3
p = 0.001			10
Evidence for Higgs boson			25
Being struck by lightning	0.0000038		18
California Powerball win	0.0000000037		28

Evidence



Evidentiality in verb form:

Direct experience?
Inferred from experience?
Conjecture?
Hearsay?

The Voice of America @VOANews · 2h

.@PressSec **Spicer**: This was the largest audience to ever witness an inauguration, period.

WH Press Secretary Sean Spicer delivers remarks

That Huge Mediterranean Diet Study Was Flawed. But Was It Wrong?

A highly publicized trial in Spain found that the Mediterranean diet protects against heart disease. Now the original work has been retracted and re-analyzed, with the same result.

The New York Times

By Gina Kolata

June 13, 2018

Despite serious problems in the way the study was conducted, their conclusions are the same: A Mediterranean diet can cut the risk of heart attacks and strokes by about 30 percent in those at high risk.

Mediterranean Diet Study Walks Back Strongest Claim. Here's What Researchers Got Wrong

FORTUNE

By GLENN FLEISHMAN June 14, 2018

landmark study published in 2013, and published a revised version that no longer makes the broad claim the diet could help everyone who is at a high risk of cardiovascular disease.

The original conclusion was: "Among persons at high cardiovascular risk, a Mediterranean diet supplemented with extra-virgin olive oil or nuts reduced the incidence of major cardiovascular events."

The revised conclusion: "In this study involving persons at high cardiovascular risk, the incidence of major cardiovascular events was lower among those assigned to a Mediterranean diet supplemented with extra-virgin olive oil or nuts than among those assigned to a reduced-fat diet."

Now, it will need to be scoped even further: If you don't live in the Mediterranean, following this diet may or may not help reduce your risks.

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ADAM ROGERS BUSINESS 03.12.18 12:00 PM

MAYBE ELECTION POLLS AREN'T BROKEN AFTER ALL

WIRED

"Ultimately it would be nice if we could assess polls on their methodologies and inputs and not just on the output," Cohen says. "But that's the long game." And it's worth keeping in mind when you start clicking on those mid-term election polling results this spring.

Jon Cohen, chief research officer at SurveyMonkey.

The credibility interval of this column is hard to figure | Shad Plank

Daily Press

DECEMBER 18, 2015, 4:01 PM

Reuters/Ipsos pegged his support at 35 percent of Republicans. The poll had a "credibility interval" of 5 percentage points, Reuters said.

The explanation started this way:

"The credibility interval assumes that Y has a binomial distribution conditioned on the parameter θ, i.e., Y|θ~Bin(n,θ)... Here, 'Y' is the answer, in this case that a Republican supports Trump, 'n' is the size of the sample and 'θ' is the proportion of the population that actually would answer 'Y' (Trump)."

It gets better, of course: "In effect, π(θ)~ß(a,b) is a useful representation of our prior knowledge about the proportion θ, while ß, the posterior distribution is also a beta distribution (π(θ/y) ~ ß (y+a,n–y+b))."

Exactly.

Methodology

independence, objectivity, accuracy, rigor, humility, transparency and innovation.

How can a survey of 1,000 people tell you what the whole U.S. thinks?

BY COURTNEY KENNEDY

Here at Pew Research Center, we are often asked about how we conduct our research. We work hard to make our methodologies transparent and understandable, but we also know

The ATP data were weighted in a multistep process that begins with a base weight incorporating the respondents' original survey selection probability and the fact that in 2014 some panelists were subsampled for invitation to the panel. Next, an adjustment was made for the fact that the propensity to join the panel and remain an active panelist varied across different groups in the sample. The final step in the weighting uses an iterative technique that aligns the sample to population benchmarks on a number of dimensions. Gender, age, education, race, Hispanic origin and region parameters come from the U.S. Census Bureau's 2016 American Community Survey. The county-level population density parameter (deciles) comes from the 2010 U.S. decennial census. The telephone service benchmark comes from the July-December 2016 National Health Interview Survey and is projected to 2017. The volunteerism benchmark comes from the 2015 Current Population Survey Volunteer Supplement. The party affiliation benchmark is the average of the three most recent Pew Research Center general public telephone surveys. The internet access benchmark comes from the 2017 ATP Panel Refresh Survey. Respondents who did not previously have internet access are treated as not having internet access for weighting purposes. Sampling errors and statistical tests of significance take into account the effect of weighting. Interviews are conducted in both English and Spanish, but the Hispanic sample in the American Trends Panel is predominantly native born and English speaking.

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Uncertainty

Opinion

What I Was Wrong About This Year

The New York Times

By David Leonhardt

Dec. 24, 2017

But I've come to realize that I was wrong about a major aspect of probabilities.

But I now think explanation is doomed to fail. For an individual event, people can't resist saying that a probability was "right" if it was above 50 percent and "wrong" if it was below 50 percent. When this happens, those of us who believe in probabilities can't just shake our heads and mutter about white Christmases. We have to communicate more effectively.

Projecting Confidence: How the Probabilistic Horse Race Confuses and Demobilizes the Public

67 Pages • Posted: 12 Feb 2018

Sean Westwood
Dartmouth College

Solomon Messing
Pew Research Center - Data Labs

Yphtach Lelkes
University of Pennsylvania

Date Written: February 2, 2018

A Taxonomy of Uncertainty

1st Order: Aleatory

- "Risk"
- What is random here?
- What is unknowable to us humans?

2nd Order: Epistemic

- "Confidence intervals"
- How uncertain are we about the parameters (or summaries or results)?
- What knowledge do we humans lack?

3rd Order: Ontological

- "Ignorance"
- What are the unknown unknowns?
- What do we need humility around?

Spiegelhalter, David. "Risk and Uncertainty Communication." Annual Review of Statistics and Its Application 4 (2017): 31-60.

"There is a 95% chance that the true percentage of people supporting Romney is between 44 and 50 percent."

-- "Understanding a 'credibility interval,'" AAPOR (2012)

“The researchers judge that based on their models, knowledge of other information, and this batch of data, the odds are 19-to-1 that the true proportion of Romney supporters is between 44 and 50 percent.”

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Fox, C. R., & Ülkümen, G. (2017). Comment on Løhre & Teigen (2016).“There is a 60% probability, but I am 70% certain: communicative consequences of external and internal expressions of uncertainty”. Thinking & Reasoning. Thinking & Reasoning, 23(4), 483-491.

HEALTH

New Ebola Vaccine Gives 100 Percent Protection

The New York Times

By DONALD G. McNEIL Jr. DEC. 22, 2016

In a scientific triumph that will change the way the world fights a terrifying killer, an experimental Ebola vaccine tested on humans in the waning days of the West African epidemic has been shown to provide 100 percent protection against the lethal disease.

THE LANCET

Efficacy and effectiveness of an rVSV-vectored vaccine in preventing Ebola virus disease: final results from the Guinea ring vaccination, open-label, cluster-randomised trial (Ebola Ça Suffit!)

www.thelancet.com Vol 389 February 4, 2017

No cases of Ebola virus disease occurred 10 days or more after randomisation among randomly assigned contact
and contacts of contacts vaccinated in immediate clusters versus 16 cases (7 clusters affected) among all eligibl
individuals in delayed clusters. Vaccine efficacy was 100% (95% CI 68·9–100·0, p=0·0045), and the calculate
intraclass correlation coefficient was 0·035. Additionally, we defined 19 non-randomised clusters in which w
enumerated 2745 contacts and contacts of contacts, 2006 of whom were eligible and 1677 were immediatel

New Ebola Vaccine Gives 100 Percent Protection in Trial

Epistemic:
It's not guaranteed that the vaccine will be 100 percent effective in the real world. Right now, researchers' best guess at a comfortable level of confidence is that it will be at least 69 percent effective.

Aleatory:
If true, tht means that for every 100 people who get the vaccine, at least 69 of them will be fully protected against the virus. (It doesn't mean that each person will be 69% protected.)

Ontological:
Researchers will have a better estimate of the true efficacy after more studies. It seems certain, however, that . . .

There are other important questions around the vaccine. For example . . .

Benjamin Wittes from the Lawfare podcast (legal and political wonks):

“What do we know?”

“What are the facts in question?”
“How confident are we in what we know?”
“What are the open questions?”

“Is there a path for resolving these questions?”

“If I were [on the Senate intelligence committee], what should I be doing now?”

Expectation & Surprise

”Organisms only learn when events violate their expectations.”

-- psychologists Robert Rescorla and Allen Wagner (1972)

Context + New Evidence = Updated Knowledge

Compared to what?
What would I otherwise expect?

How much?
What does that mean in human-centered terms?

Expectation + Surprise = Learning

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Conveying prior expectations through language: "Mirativity"

What's more, about twice as many social media users say they mostly *distrust* rather than trust the science posts they see on these sites. This finding is in line with internet users' very low assessment of the trustworthiness of information more generally that they see on social media.[2]

Many in the scientific community have worried over how such media influence public impressions of, support for and understanding of science.[3] The new Pew Research Center survey finds that while most Americans believe such sources sacrifice realism for

And, just 16% of Americans perceive their family and friends to be accurate sources of science news, far fewer than say general news outlets and most specialty sources get the facts right about science news most of the time. This finding is broadly consistent with a 2016 report that shows that

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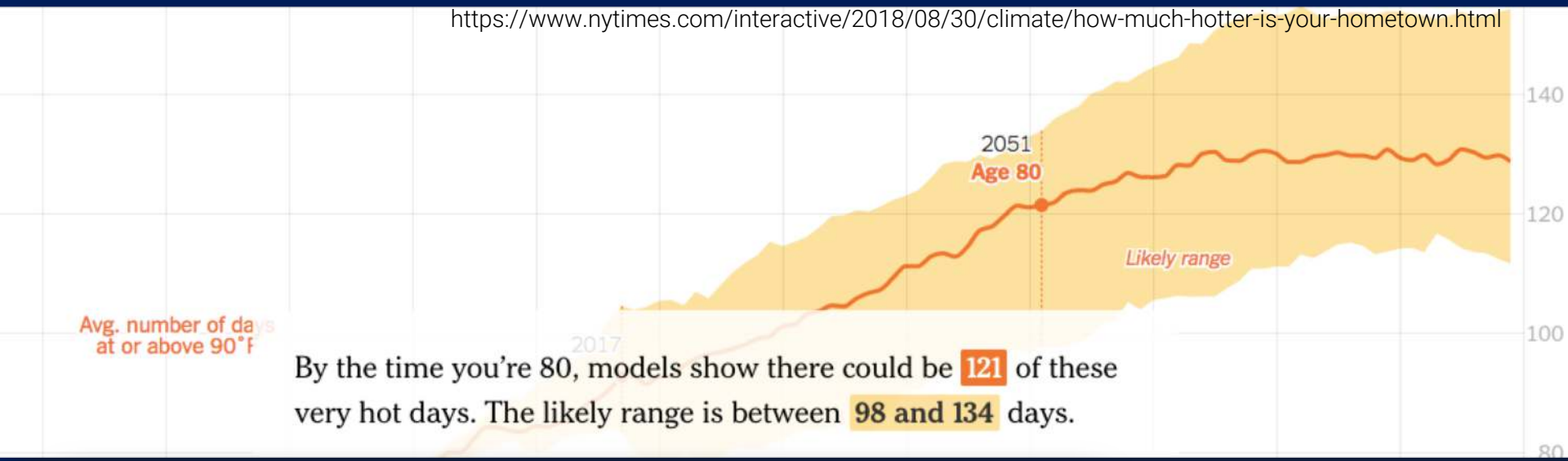
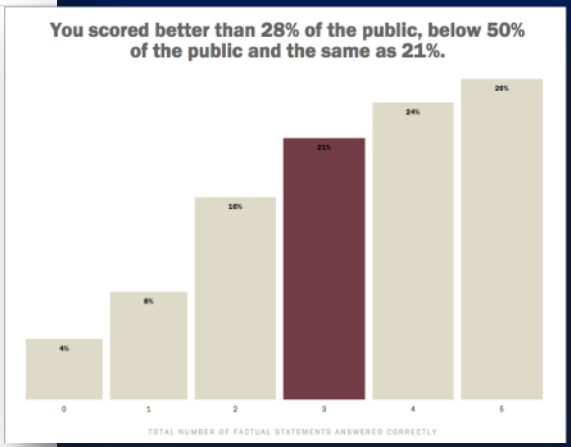
https://www.nytimes.com/interactive/2018/08/30/climate/how-much-hotter-is-your-hometown.html



By the time you're 80, models show there could be **121** of these very hot days. The likely range is between **98 and 134** days.

Quiz: How well can you tell factual from opinion statements?

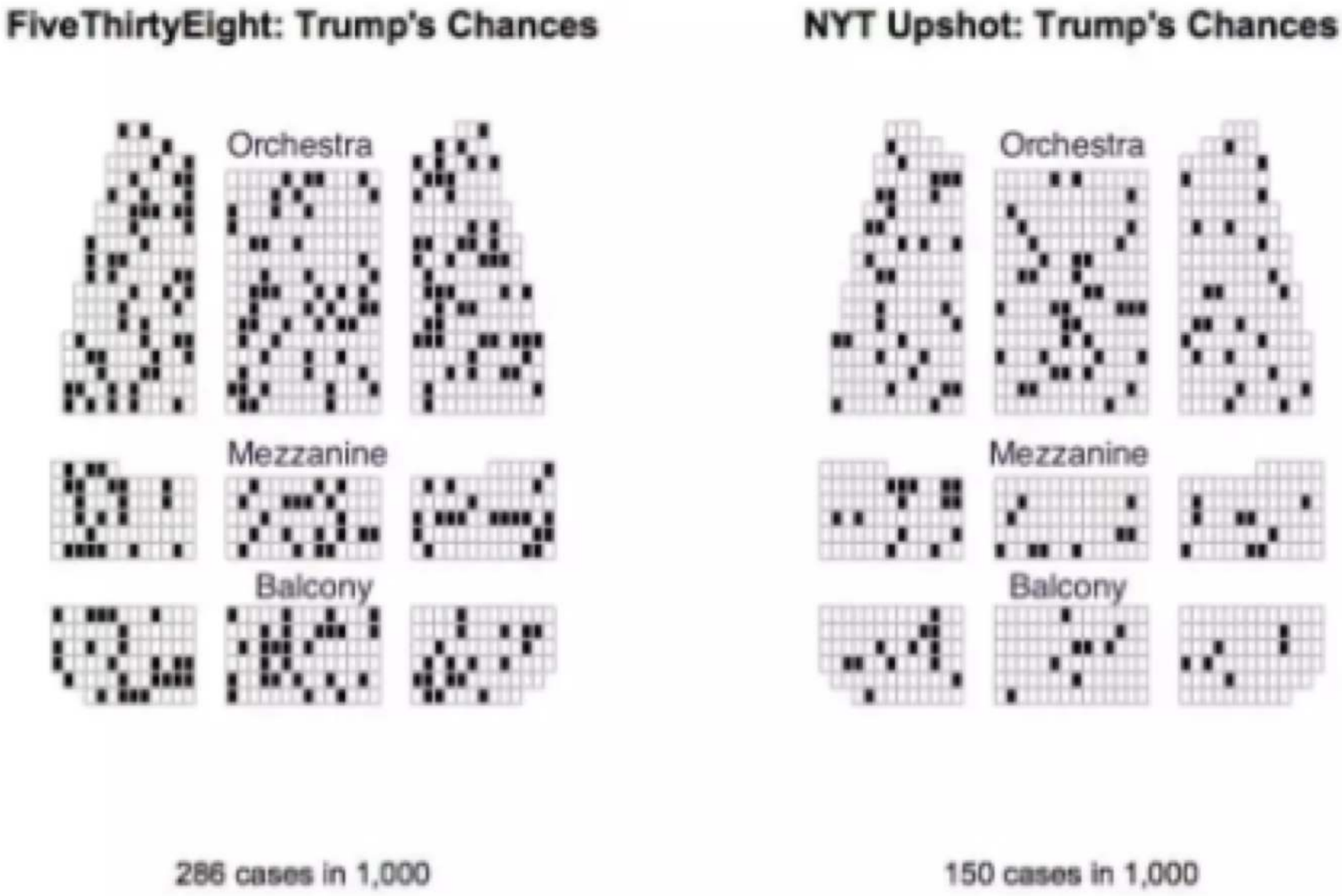
Can you tell the difference between factual and opinion news statements?



How to better communicate election forecasts — in one simple chart

The Washington Post
Democracy Dies in Darkness

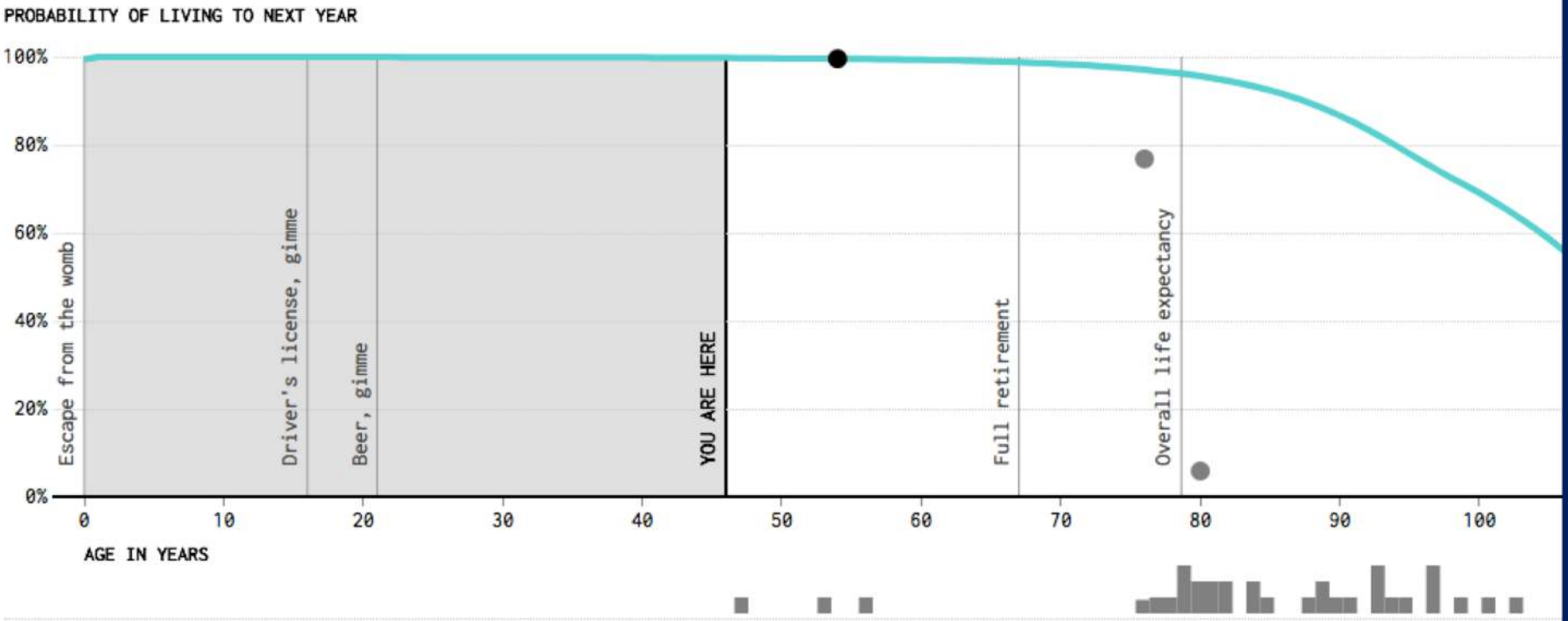
By Justin H. Gross November 29, 2016



Years You Have Left to Live, Probably

FLOWINGDATA

I am female and currently 46 years old.



Probabilities For Years Left to Live

0 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 or more
6%	3%	0%	41%	29%	21%
(2)	(1)	(0)	(14)	(10)	(7)

http://flowingdata.com/2015/09/23/years-you-have-left-to-live-probably/

http://www.cc.com/video-playlists/kw3fj0/the-opposition-with-jordan-klepper-welcome-to-the-opposition-w--jordan-klepper/h68it3

Human-Centered Data Communication

- Numbers
  - Embodied Quantification
  - Numerosity
  - Human scales
- Evidence
  - Evidentiality in language
  - Process, quality of information
- Uncertainty
  - Risk communication
  - Epistemic modality
  - Time-traveling counterfactuals
- Expectation & Surprise
  - Mirativity
  - Rooted experience leading to surprise
  - Bayesian nudge in belief

Stories

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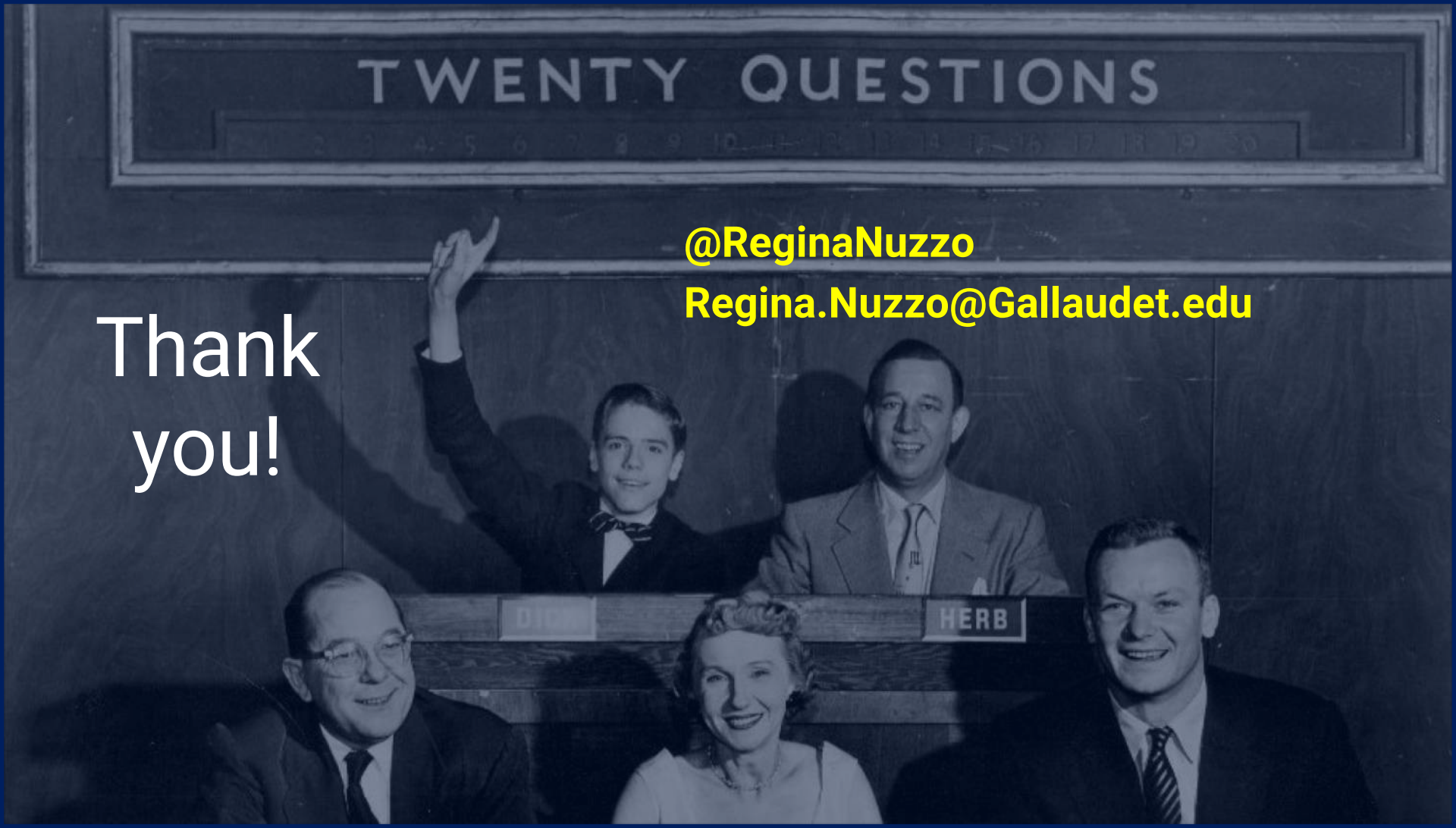

Thank you!

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If you were to lift your arms and spread them wide and hold them straight out to either side and think of the distance from fingertips to fingertips as representing the earth's entire history, then you would have all the principal events in that hillside in the middle of the palm of one hand . . . Look at one hand with its line of life. The Cambrian begins in the wrist, and the Permian Extinction is at the outer end of the palm. All of the Cenozoic is in a fingerprint, and in a single stroke with a medium-grained nail file you could eradicate human history.

-- John McPhee
Annals of the Former World