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According to a New Study:

When Bad Journalism Meets Questionable Science

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According to a New Study:

When Bad Journalism Meets Questionable Science

by

Forrest Matthew Burnson, B.A.

Report

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This report is dedicated to my brother, William Andrew Burnson, who inspired me through his own example to attend graduate school and pursue my passion.

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According to a New Study:

When Bad Journalism Meets Questionable Science

by

Forrest Matthew Burnson, M.A.

The University of Texas at Austin, 2013

SUPERVISORS: Tracy Dahlby and Homero Gil de Zuniga

Accurately reporting scientific studies remains a challenge for journalists. Often lacking any formal background in science, journalists are expected to communicate the complex findings of scientific research in such a way that average readers can understand. As a result, news coverage tends to exaggerate, misrepresent, or sensationalize the findings of scientific studies. This report examines the common errors that journalists make when reporting on scientific studies, as well as the issues in modern scientific research that contribute to this problem. While total scientific literacy in journalism remains a lofty ideal, the democratizing force of the Internet not only holds journalists more accountable in their reporting, but also provides platforms for skeptics and experts to weigh in on the news treatment that studies receive.

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Percentage of respondents dissatisfied with country's direction, Pew Global Attitudes Project, 2012

Percent responding **Dissatisfied** (2012)

COUNTRY	2012
Greece	98%
Spain	88%
Pakistan	87%
Italy	87%
Lebanon	84%
Czech Republic	83%
Tunisia	78%
Japan	78%
France	71%
Britain	65%
United States	64%
Mexico	63%
Poland	62%
India	59%
Brazil	56%
Jordan	53%
Turkey	51%
Russia	45%
Germany	45%
Egypt	41%
China	11%

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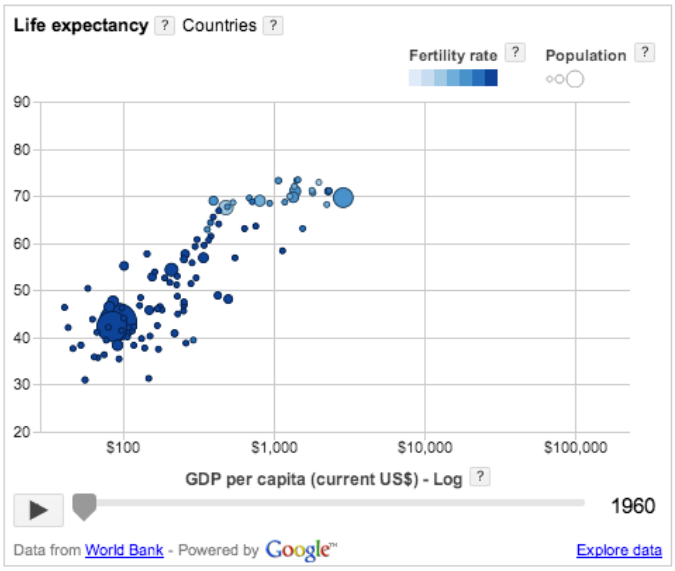

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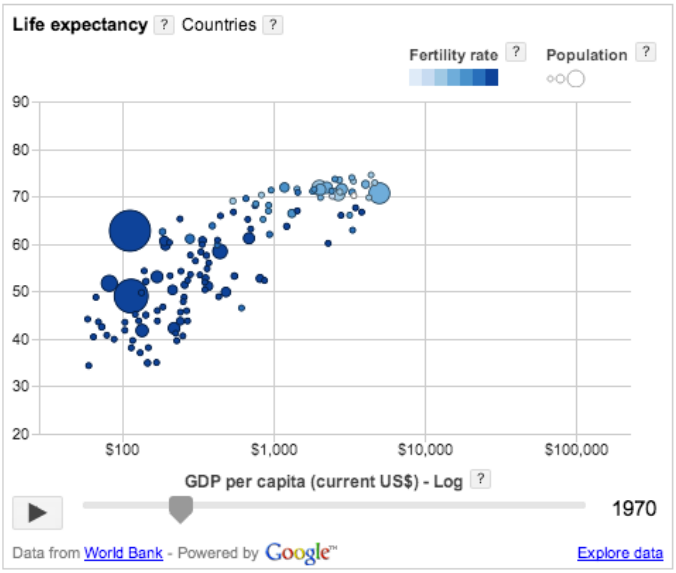

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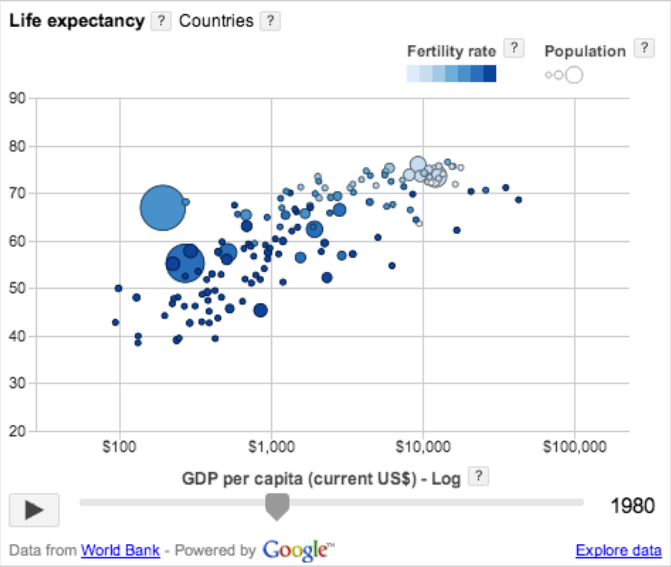

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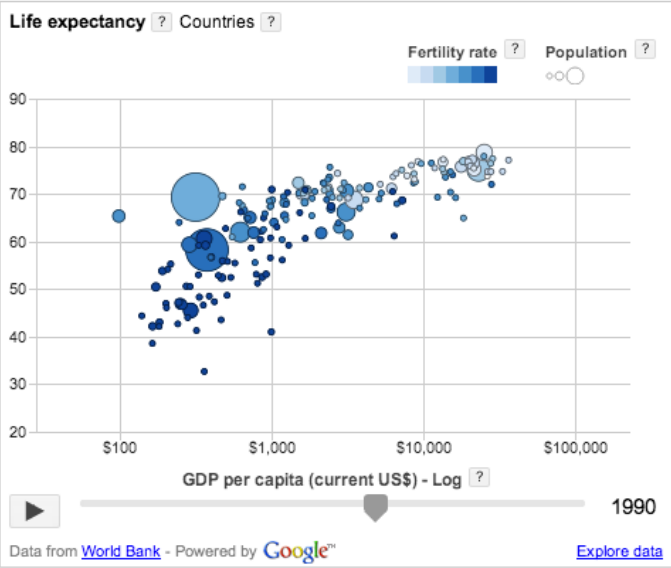

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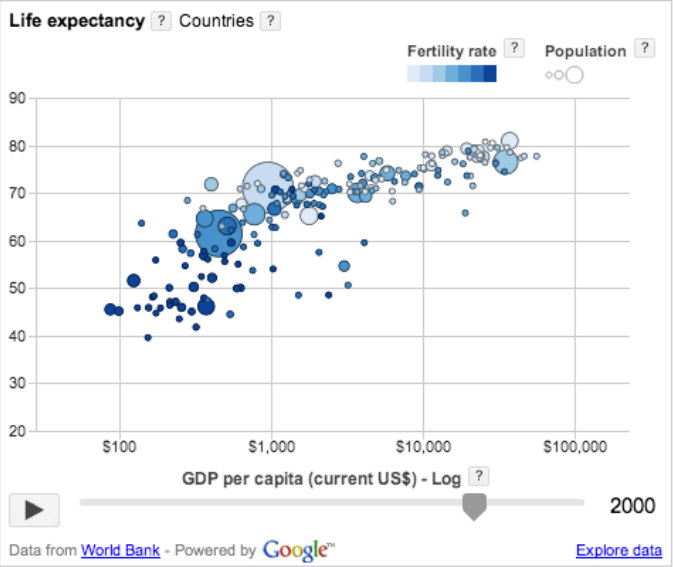

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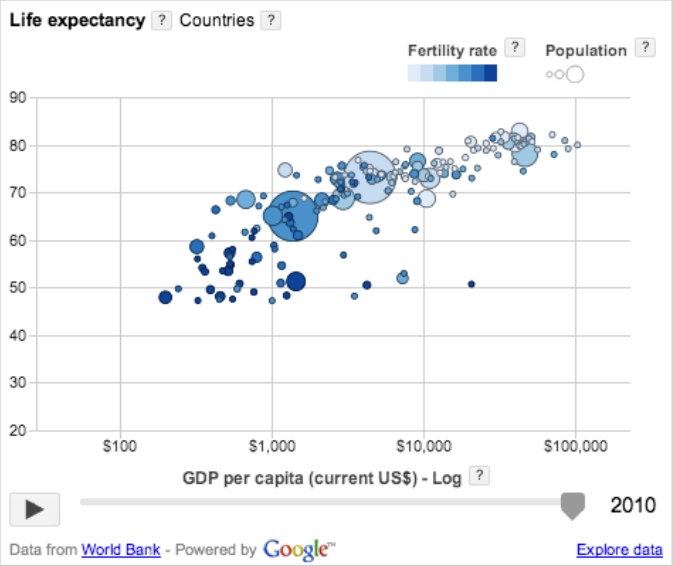

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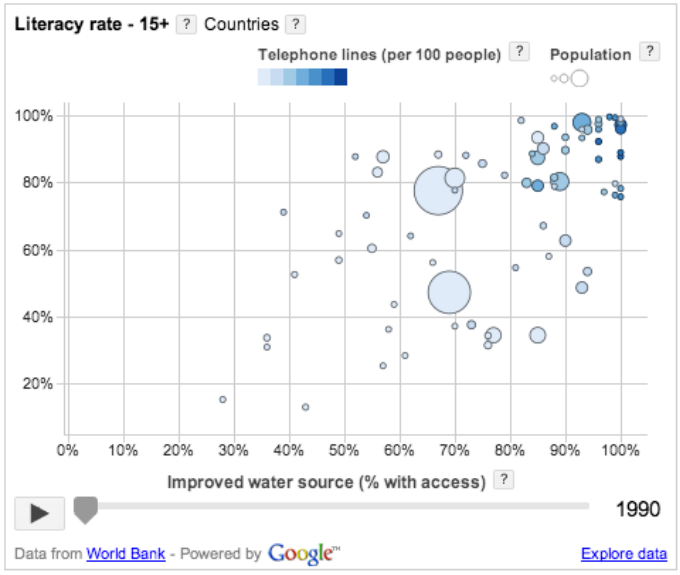

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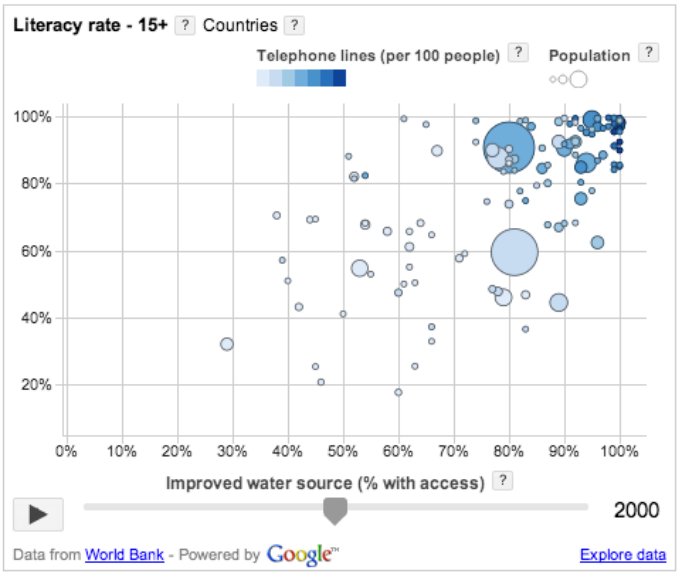

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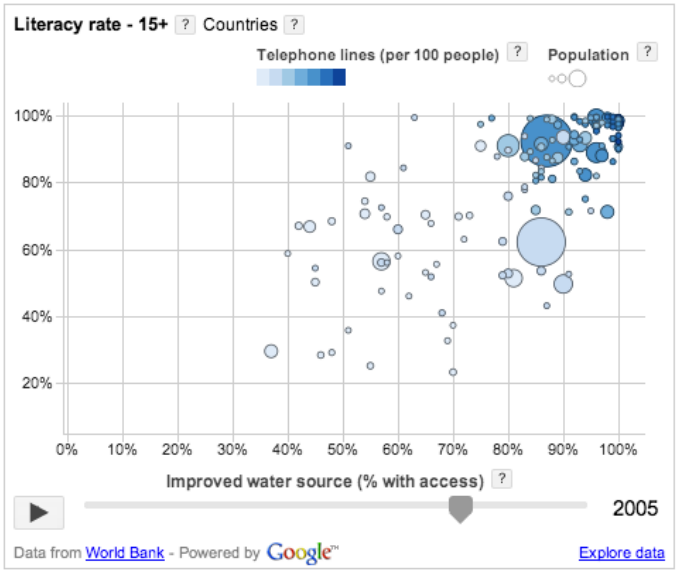

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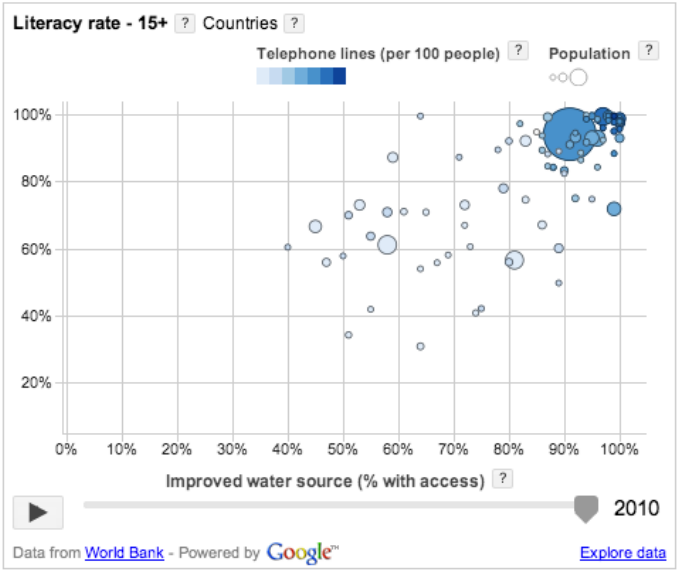

Introduction

When Samer Hattar started getting phone calls from journalists across the world about the findings of a study he had authored, his delight over the attention his work received soon turned to dismay when he read the stories they wrote.

The Johns Hopkins University professor had spent months researching a link between a hormone related to stress and exposure to irregular light cycles in mice, eventually publishing his findings in Nature, a prominent scientific journal, in November of 2012. So he was surprised to read in The Huffington Post that his study found that "[reading] on your iPad, surfing the web on your laptop and watching TV late into the night might not only be bad for your sleep—it could also be bad for your mental health." The treatments of his study from Time magazine, The Daily Mail, and The Times of London, among others, were no less sensationalized.

His study said nothing about iPads or watching television at night causing depression in human beings—it was a study that examined a hormone in mice that were exposed to irregular light cycles.

"I don't want to diss these reporters, but I am quite disappointed," said Hattar in a telephone interview. "The only thing they seemed to care about was iPads causing depression."

Hattar's frustrations are not unique. For many scientists and researchers, it is something of a rite of passage to spend countless hours slaving over a complex problem, only to have their work misrepresented, exaggerated, or otherwise dumbed down by the news media. In an evolving news environment where web clicks determine revenue and consumers demand more content than ever, the

sensationalism in science reporting appears more pronounced. Scientific studies make for quick content. They come prepackaged as press releases to the journalist's inbox, often requiring nothing more than a rewrite and a phone call or two to make a publishable story. News editors, lacking backgrounds in science, tend to provide little oversight as to how journalists cover these stories.

"Certain publications tend to go with the sensational news," said Anahad O'Connor, science reporter for the New York Times, in a telephone interview. "They go with the sensational angles. There are a lot of reporters who don't have a hard science background and might not even realize that they are sensationalizing the study's findings."

Scientists, too, are part of the problem. So much of the research they conduct remains fundamentally flawed due to common methodological practices concerning data collection and interpretation, which diminishes the significance of their findings. Conflicts of interests and the pursuit of grant funding call many researchers' supposed objectivity into question. Despite being the experts on their own work, they often struggle to effectively communicate their studies' findings and significance to the public. And in the worst cases, fraudulent research makes it to print and into the news cycle, sometimes taking years to be refuted.

But the journalist and the scientist are quite similar. They are the principal investigators at the forefront of expanding our knowledge about the human existence, seeking the elusive beast known as truth. They are judged by their output. A journalist's worth is determined by how many hits his or her story gets; a scientist is judged by the number of citations his or her study receives, and both are judged by the amount of truth they are able to uncover.

Yet while the goal of the journalist and the scientist might be similar, the means to that end stand in opposition to each other. It is not just the public's collective scientific literacy that it is at stake when the media fail to accurately and critically report scientific studies. When bad science meets bad journalism, people can die.

Chapter One: The Worst of Both Worlds

In 1998, a controversial study published in the British medical journal *The Lancet* alleged that the vaccination for measles, mumps, and rubella could cause autism in children. The study—which received extensive media coverage—caused many parents to not vaccinate their children, igniting a hullaballoo among doctors and public health officials.

The study, entitled "Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children" had examined the medical records of 12 children who had developmental disorders. Its author, Dr. Andrew Wakefield, claimed the vaccinations they received as toddlers resulted in the autism and colitis in as little as a few weeks after the shots were administered. The British media quickly ate up his findings, giving rise to an anti-vaccination movement that spread to the United States.

"People make momentous health decisions based on what they read in the news," said Tara Haelle, a health and science reporter for DailyRX News and DoubleXScience.org, in a telephone interview.

The study, it turned out, was completely wrong. After its publication, a number of studies were published in the ensuing years that thoroughly debunked the claim that vaccinations could cause autism. Furthermore, a five-year investigation beginning in 2004 by the Sunday Times in London found that Wakefield had

committed fraud by manipulating data obtained from patients' medical records, producing false results in his study. More disturbingly, he had received the equivalent of approximately $600,000 in British pounds from trial lawyers seeking to file a class action lawsuit against the vaccine's manufacturer. But the damage caused by the news media that hyped up and uncritically covered the study's findings had been done. "There was some good coverage of the study. And there was some really terrible coverage of it," said Dr. Ivan Oransky, executive editor of Reuters Health, in a telephone interview.

According to the Times' investigation, inoculation rates among children in the United Kingdom declined from 92 percent in 1998 to hover around 80 percent in the years after the study's publication. Their most sobering finding: In 1998, there were only 56 reported cases of the measles in the United Kingdom. In 2008, there were 1,348 reported cases. At least two children in the United Kingdom had died of the measles since the study's publication, the investigation noted.

Haelle notes that misleading news stories about scientific studies have arguably more of an impact on people than misleading political stories. "Unintentionally misleading people about what the House Republicans are doing, for example, will most likely not result in people making bad decisions about their health or their children's health," she said.

Critics skewered the media over their botched, uncritical coverage of the study. In a 2008 column for The Guardian, physician and science writer Ben Goldacre lambasted the journalists who contributed to the misleading coverage. "Journalists are used to listening with a critical ear to briefings from press officers, politicians, PR executives, salespeople, lobbyists, celebrities and gossip-mongers, and they generally display a healthy natural skepticism," he wrote. "But in the case of science,

[general assignment reporters] don't have the skills to critically appraise a piece of scientific evidence on its merits."

Chapter Two: The Reporter's Report Card: A in English, D in Science

Though journalists can easily delve into the world of reporting politics, culture or business, their reporting often has more immediate implications—inaccurate reporting in those fields is arguably easier to weed out. If a journalist gets the story wrong when covering a hot-button political or cultural issue, for example, he or she will likely be subjected to the loud criticisms of everyone involved.

When reporting science, journalists essentially use their layperson's understanding to communicate complicated and unfamiliar ideas to other laypeople. And the voices of criticism—the scientists and researchers involved—do not always have the same platform as the rich and powerful to respond to inaccurate reporting. Too often, this means it is the uninformed trying to inform the even more uninformed, while the scientists—the informed, so to speak—sit on the sidelines.

"There is a lack of nuance in a lot of science reporting," said Brad Love, professor of advertising and public relations at the University of Texas, in a telephone interview. A former newspaper reporter, Love's research focuses on public health communication.

"Reporting norms are driven by things like headlines, interesting leads, or news values, such as novelty, which is where science comes in," he said. "Science isn't interested in those things, when it's done well." A study's title, generally speaking, will be decidedly less sexy than the headlines of the news articles written about it.

Consider the case of Jonah Lehrer, the former staff writer for The New Yorker who was found to have fabricated quotes from Bob Dylan in his 2012 book "Imagine: How Creativity Works." While the media focused heavily on the quote fabrications, his other journalistic transgressions—involving his long career doing science reporting—went largely unnoticed for years.

In a blog post published on Aug. 1, 2012 on his personal website, neuroscientist and researcher at the University of Sussex Daniel Bor—whom Lehrer had interviewed on several occasions—provided a litany of examples where the once-esteemed science writer had gotten it wrong throughout his career without his editors—or readers—ever noticing. Because unlike the scientific process of peer review, journalistic work does not, as a rule, undergo the same degree of scrutiny when it goes through the editing process.

In one instance found in Lehrer's 2009 book "How We Decide," for example, Bor ripped apart his inaccurate and misleading explanations of how the different regions of the brain operate, contending that he would expect such mistakes from "less able undergraduate students." In particular, he takes aim at Lehrer's characterization of Neanderthals not possessing "rational thought," rhetorically asking "[…] can you make advanced tools and use fire, as Neanderthals did, without 'rational thought'?"

Bor contended that these errors flew under the editors' radar, apparently because none of them had any background in science. "Most reviewers know little science in detail, I suppose, so don't they notice these errors that scream off the page to a jobbing research scientist. But at what point should these errors be caught?" Bor wrote.

In defense of journalists, it is a merciless balancing act. On one hand, their reporting must be factual and accurate. On the other hand, they must write the story in a manner that the average reader can comprehend. They must appeal to the lowest common denominator while still fairly representing the scientists' work. Doing both is, suffice it to say, difficult.

For some researchers, the balancing act is the crux of the conflict between science and journalism. "Journalism has an interest in whatever is the most shocking and the most compelling, which is at odds with careful science," said Al Bardi, professor of psychology at the University of the South in Sewanee, Tennessee in a telephone interview.

Chapter Three: So Many Studies, So Little Time

News stories about the latest developments in scientific research are popular among readers, and their importance cannot be downplayed. The announcement of a "functional AIDS cure" developed by researchers, for example, apparently cured 14 patients in France of the virus in March of 2013. The story received extensive coverage from the New York Times, Al-Jazeera, Reuters, among other major outlets, setting off a flurry of excitement across the world. Those news stories presumably gave hope to the millions of people who suffer from the virus.

Scientific studies contribute to the public dialogue over hot-button issues. They give—or take away—weight to arguments on controversial issues. The ongoing debate in the United States about climate change, for example, is predicated entirely on a large body of scientific research that is difficult for the layperson to comprehend—so it is up to journalists to accurately convey and interpret the findings, while contextualizing their significance within the broader field of research. For every hot-button issue, one can find studies that seemingly prove

either position. But scientific studies are not definitive until they have been independently replicated and verified—repeatedly.

"Journalists treat every study as if it were the final word. As if every study could change the world. Generally a new study is just another study," said Oransky, noting that "most studies don't hold up when they're repeated." Because of this, "studies were never intended to be a part of the 24-hour news cycle," said Haelle, noting that a single study does not close the books on any problem.

And there is a wealth of new studies to be reported on. As many as two million scholarly articles are published every year, according to a 2009 analysis published by the Association of Learned and Professional Society Publishers. Yet the wealth of source material has not necessarily meant better or more in-depth coverage. The shakeups in the journalism industry have meant less space—and time—devoted to science reporting in traditional news outlets, according to a 2008 report by the Pew Research Center's Project for Excellence in Journalism.

Surely, journalists alone are not to blame for the state of science reporting. Scientists struggle to concisely and simply explain the significance of their findings to the public. There are always limitations to any piece of research, and systemic methodological flaws are quite common in some scientific fields. To understand the problem, one must trace it back to its roots. Namely, where these studies come from, and the mistakes scientists themselves make in the process of research and experimentation.

"The larger issue is context and caution," Love said. "Historically, journalists have treated any new study as definitive without examining the previous body of research done on that field. That's not good science. Any study is open to errors or problems."

Chapter Four: On The Origin of Studies

The precursors to the fully evolved news story about a scientific study are the data—those kernels of information extracted by researchers that provide the foundation for all scientific research, collectively shedding light on a particular phenomenon. Yet the significance of any dataset is contingent on how, where, and from whom it was collected. To understand where the problems in modern scientific research begin—and by extension, the bad journalism that results—start with American college students, who are indirectly responsible for so much of the questionable science that ends up making it to print.

For a study's findings to have universal meaning, its sample must be representative of a broader population. Yet due to the constraints with how psychological and behavioral research is conducted, undergraduates—often students in the researchers' classes—are the go-to source for collecting data.

In a thorough meta analysis of hundreds of studies conducted in the behavioral and social sciences published in 2010 in the journal Behavioral and Brain Sciences, researchers at the University of British Columbia found that 67 percent of subjects used in American studies were undergraduate psychology students. Moreover, 96 percent of studies' subjects were "WEIRD"—that is, they came from the West, were highly Educated, and lived in Industrialized, Rich Democracies. The "weird," suffice it to say, do not represent all of humanity. "WEIRD subjects may often be the worst population from which to make generalizations," the researchers conclude in their study, entitled "The weirdest people in the world?"

Consider one study that made the rounds in the news in May of 2011, entitled "Happy Guys Finish Last: The Impact of Emotion Expressions on Sexual Attraction" and published in the journal Emotion. In its coverage of the study, The Daily Mail

reported that “scientists discover happy men are ‘significantly less attractive to women.’” Reuters lead with “Guys, want to look sexy and get the girl? Don't smile too much. Look brooding or show a bit of shame instead.” But do not throw away the Prozac yet.

Just who were these women that apparently found depressed men more attractive? The study consisted of experiments performed on several samples of Canadian undergraduate students and one sample of online survey respondents, with 1,041 participants total. Of that, more than half of the participants were of Asian descent, with the median age ranging from 20 to 28 in each separate sample. The researchers showed the participants pictures of men expressing various moods and asked them to rate which ones they found more attractive.

The researchers attempted to address this lack of diversity by including a small sample of online respondents who participated through targeted ads posted on Facebook and Twitter. They collected 96 responses from North American women online—a small, self-selecting sample. And that is the other problem: Could it very well be that women who opt to take an online survey might have different preferences than women who ignored the ads?

In a 2005 analysis on the validity of data obtained from online surveys, University of Oklahoma professor of communication Kevin Wright expressed concern over the limitations of the practice. “In any given Internet community, there are undoubtedly some individuals who are more likely than others to complete an online survey,” he wrote. “In short, there is a tendency of some individuals to respond to an invitation to participate in an online survey, while others ignore it, leading to a systematic bias.” This means that one cannot generalize the results from the study’s sample to the broader population.

Attractiveness, no doubt, is a social and cultural construct. So it becomes problematic to try and ascertain universal truths about what people find attractive when the sample used represents an infinitesimally narrow subsection of humanity.

Had the study sought to examine the preferences of this thoroughly "weird" sample in the context of explaining the "weird" population, it could have succeeded. But it did not do that. Instead, it attempted to define what is attractive in thoroughly ethnocentric terms. "If a study uses a small sample with a certain population and the study is trying to make broad implications, then that is a red flag," said Bardi.

Even the most exhaustive datasets have their limitations. One study published in February of 2013 in the Journal of Health and Social Behavior examined the differences in self-reported health among cohabiting married straight couples and cohabiting unwed homosexual couples, using 12 years worth of data pooled from National Health Interview Surveys. Out of a total set of 686,486 survey responses, the researchers were able to identify more than 3,000 homosexual couples—a significant, nationally representative sample.

Their results found that after controlling for socioeconomic factors, cohabiting homosexual couples were more likely to self-report poorer health compared to their heterosexual married counterparts. The researchers surmised that this could be due to institutionalized discrimination against homosexuals, who might not receive the same health benefits associated with marriage.

Problematically, the surveys did not ask respondents to indicate their sexual orientation (starting in 2013, however, the Department of Health & Human Services will begin collecting those data). They determined which couples were homosexual "if a household member with the same gender as the reference person is listed as a 'spouse' or 'unmarried partner' of the reference person," according to the study. The

researchers noted that this approach could "increase the potential risk for misclassification bias because of miscoded gender."

This prevented researchers from comparing homosexuals who cohabitate with their partners to homosexuals who live alone—a key step for determining a correlation between self-reported health and the sexual orientation of cohabiting couples. If such data did exist and homosexuals were still more likely to self-report poorer health regardless of cohabitation status, then clearly other factors might be at play. "The data can only go so far," said study co-author Dustin Brown, a doctoral candidate in the sociology department at the University of Texas, in a telephone interview.

It could be the case that cohabiting homosexuals self-reported poorer health due to lifestyle factors not measured in their study, he added. In a data analysis published in 2010, the Center for Disease Control reported that sexually active homosexual men were 44 times more likely to contract HIV than straight men, with as many as 989 reported infections per 100,000 people, compared to 12 per 100,000 for straight men. The National Survey of Substance Abuse Treatment Services reported in 2010 that as many as 20 to 30 percent of the LGBT suffer from substance abuse issues, compared to about nine percent of the general population.

That is not to say that those in the LGBT community do not experience institutionalized discrimination—and it is entirely plausible that those who engage in risky sexual behavior or substance abuse do so as a coping mechanism—but the study neglects to address how these compounding factors might have affected their findings. Brown readily conceded these few caveats to his research, noting that much more research needs to be done on the topic. "What we're trying to say is that marriage might have an impact" on the health of same-sex couples, he said.

While there were some limitations to Brown's study, the dataset it relied on was fairly straightforward—they measured self-reported health among the survey participants. Yet some data are easy to manipulate. One common way to do so is to quite literally change the definition, or "operationalize" the variables being measured to suit the researcher's purposes. To be clear, operationalizing variables is a necessary practice in scientific research as it eliminates confusion over the terminology being used—but it still leaves room for researchers—and journalists—to insert their own biases when evaluating the study's findings.

Consider this spicy headline from the Huffington Post, published in January of 2012: "Intelligence Study Links Low I.Q. To Prejudice, Racism, Conservatism." The article says that the study "showed that people who score low on I.Q. tests in childhood are more likely to develop prejudiced beliefs and socially conservative politics in adulthood."

The study, entitled "Bright Minds and Dark Attitudes: Lower Cognitive Ability Predicts Greater Prejudice Through Right-Wing Ideology and Low Intergroup Contact," and authored by researchers at Brock University in Ontario, Canada, utilized two nationally representative longitudinal surveys (respondents were surveyed multiple times over the course of several decades) in the United Kingdom as their first sample to compare childhood I.Q. with adoption of conservative ideology later in life. The second sample consisted of—no surprise here—American undergraduates, who completed two surveys that measured their attitudes toward homosexuals and their abstract reasoning ability.

The Huffington Post article went viral, receiving over 50,000 shares on Facebook, ruffling the feathers of a few conservatives—and statisticians—in the process. In a post on his personal website entitled "Low IQ & Liberal Beliefs Linked to Poor Research?", Cornell University statistics professor and Wall Street Journal

contributor William Briggs decried the study as a "textbook example of confused data, unrecognized bias, and ignorance of statistics." Briggs took issue with how the researchers used ambiguous survey questions to identify conservative ideology among respondents. For example, respondents were asked if they agreed or disagreed with propositions such as:

- "Schools should teach children to obey authority."
- "Family life suffers if mum is working full-time."

Here is where operationalization comes into play. "Conservative" and "right-wing" are political descriptors whose meaning derives from the context in which they are used. Conservatives in the modern day United States would probably have little ideologically in common with conservatives in the French Revolution, for example. Even a present-day comparison between conservatives in the United States and in the United Kingdom is problematic—whereas the Conservative Party in the United Kingdom has long advocated for universal healthcare, to take one example, Republicans in the United States have opposed even the comparatively more modest healthcare reforms enacted by the Obama administration.

The study operationalizes conservatism in terms of "respect for and submission to authority"—a far cry from the word's vernacular usage in modern political discourse in the United States. Similarly, the study operationalizes "right-wing authoritarianism" for use with the American sample using a definition and survey concocted by retired psychologist Bob Altemeyer in his 1996 book, "The Authoritarian Specter," where he emphasizes that his definition is limited and tailored to his academic field. "When I modify authoritarianism with the phrase 'right-wing,' I do not necessarily mean anything political (as in liberal versus conservative) or economic (as in socialist versus capitalist). Rather, I am using

'right-wing' in a psychological sense of submitting to the perceived authorities in one's life," he wrote.

The results from the United Kingdom sample found that those who displayed lower cognitive abilities as children tended to have more respect for authority and were more likely to submit to it. In the American sample, results indicated that abstract reasoning negatively predicted anti-homosexual prejudice. Returning to the blight of American college students on scientific research, those results are quite suspect—the study gives no demographic breakdown of the American participants beyond gender, nor does it even identify the university where the survey was performed. As attitudes toward homosexuals vary greatly between generations and geographical location, a more representative sample, as always, is needed.

Good data are hard to obtain and even harder to interpret with even a nominal degree of objectivity, particularly when the focus of the research centers on hot-button political issues. While the Brock University researchers made it clear that their operationalization of "conservative" and "right wing" was for this limited, perhaps even esoteric context, it is up to those who report on their findings to use a modicum of common sense to see what they really meant.

"A lot of reporters don't read through the studies as thoroughly as they should. A study could have interesting findings, but if you look at the methodology it could raise some questions," O'Connor said.

Chapter Five: Muckrakers' Mistakes

"Journalism," George Orwell once famously wrote, "is printing what someone else does not want printed. Everything else is public relations." If the objective of

journalism is to hold power accountable, then it is not enough for journalists to act as mere stenographers.

Reporting on scientific studies is no trivial pursuit, as the MMR vaccine controversy illustrates. Even when lives are not necessarily at stake, scientific studies are used—or misused—to validate peoples' political viewpoints, demonstrated by the UBC study on the supposed conservative psyche. Studies inform readers about the dangers of certain behaviors. They guide—or attempt to guide—public policy as the abundance of climate change research shows.

Once these studies are peer-reviewed and published, they make their way to the communications offices at universities, where public relations specialists attempt to highlight and publicize the cutting-edge research being conducted at their institutions. These press releases make it to journalists' inboxes, offering a quick-and-easy story if the study appears juicy enough. For some veteran journalists, this is a troubling development, as press releases in the digital age offer a shortcut to producing content. "Press releases can be used as tips to go on to do interviews, but cannot be the basis for news stories. If they are, it's simply PR, not news," said Philip Hilts, director of the Knight Science Journalism Fellowships at the Massachusetts Institute of Technology, in an email interview.

Encumbered by tight deadlines and the public's tireless demand for fresh content, journalists face an uphill battle when it comes to accurately reporting scientific studies. It is far easier to merely read a study's abstract, lift a couple of quotes from a press release, and produce short, sweet, and most likely sensationalized story. It is rare that journalists ever read the study—due to either a lack of time, a lack of interest, or a lack of access, as Hilt argues. "No one in the newsroom likes to read journal articles—they're boring," said Hilts, who also covered the science beat for

The New York Times and The Washington Post for over 20 years, in a subsequent phone interview.

It is not uncommon to see one-source stories about scientific studies, either. When Time magazine and NBC reported on Brown's study online, for example, they only used quotes from the lead researcher, Hui Liu, a sociology professor at Michigan State University in their articles. No other critical perspectives were offered, despite the study's limitations. For Hilts, "the most important thing is that there are no one-source stories."

The field of journalism, no doubt, attracts individuals who most likely excel at writing, researching, and interviewing. They might not excel, however, at math and science. "There is some discomfort for journalists working on that side of things," said Ben Colmery, deputy director of the Knight Journalism Fellowships at the International Center for Journalists in Washington, D.C., in a telephone interview. "Your average journalist doesn't have any training with quantitative analysis."

One such example: In Time's article about Brown's study, reporter Alexandra Sifferlin writes that the study's findings indicated that those "living in same-sex relationships were 61 percent more likely to report being in fair or poor health compared to men in heterosexual marriages, and women who were living with their female partners were 46 percent more likely to report the same lower health status compared to women in heterosexual marriages."

Those percentage changes are meaningless without a point of reference. To put it in simpler terms: If there is a one-in-one-hundred chance that as of Sunday, it will rain on Tuesday, and that probability increases to a two-in-one hundred chance by Monday, then that means that the likelihood of rain increased by 100 percent. Still, the actual chance of rain—two-in-one-hundred—is very unlikely.

Numbers need context. In a recent article on Today.com, reporter Steve James wrote about a new study released by the CDC that surveyed American's daily fast food consumption, which accounted for 11.3 percent of total intake between 2007 and 2010, down from 12.8 percent for the period between 2003 and 2006. "Americans' love affair with fast food may be far from over, but there are signs we may be cutting down on French fries, greasy burgers and other artery-clogging food," said the article's lead.

According to the most recent figures published by the CDC, daily caloric consumption for American men and women clocks in at approximately 2,700 calories and 1,800 calories, respectively. So that 1.5 percentage point decline in fast food consumption means approximately 30 fewer calories—or about four French fries—are consumed everyday. The decline becomes more meaningless when overall caloric intake in the United States appears to be steadily increasing, and there are no indications that Americans are eating any healthier to boot.

If there is one lesson that every statistics professor mercilessly beats into the heads of their students, it is that correlation does equal causation. In January of 2013, a deluge of articles were written about a study published in the British Journal of Sports Medicine, which apparently linked men's sperm count to their television watching habits. "Guys may now have another reason to get off the couch: Watching TV has been linked to lower sperm counts, a new study suggests," Fox News reported.

The study, conducted by researchers at the Harvard School of Public Health, did find that men who watched more than 20 hours a week had significantly lower sperm counts than men who watched little to no television. But it had little to do with how much television the test subjects were watching, and it had everything to do with

how often they exercised; the researchers found that those who were watching television more than 20 hours a week exercised significantly less than those who watched less, indicating that the reporters who covered this study missed quite an important aspect to the findings.

It is understandable that many journalists struggle when it comes to using statistics in their stories. What is not understandable is forgetting what their primary duty is—serving the public by seeking the truth, and not just relaying what others have merely said.

Providing contrasting viewpoints in a news story is a fundamental tenet of modern journalism, yet such a practice is rare in coverage pertaining to scientific studies, despite the obvious political undertones they might have. This is particularly important when a study's funding may come from an outside organization or think tank with a clear political bias. "Reporters need to ask: 'where is the study's funding coming from?'" said Colmery.

A study's findings are not inherently worthless if there is a conflict of interest with who funded it—but that conflict of interest ought to be made clear to readers. Similarly, it becomes problematic when researchers become policy advocates.

One recent example of such scientific shenanigans called the career of researcher Chip Groat into question. A professor at the Energy Institute at the University of Texas at Austin, Groat came under fire after publishing a study in February of 2012 that claimed that hydraulic fracturing, or "fracking"—a relatively new and controversial process by which petroleum is extracted from beneath thick subterranean layers of rock—caused no contamination to nearby groundwater sources, a point of contention among environmental activists.

The problem? Groat sat on the board for Plains Exploration and Production, a petroleum drilling company, and had received nearly $1.5 million from the company over the previous five years and had failed to disclose his clear conflict of interest. After being investigated by the Public Accountability Initiative, a nonprofit watchdog group, the university conducted an internal review of the study in December of 2012, finding that it had serious problems with how it was conducted.

"In studies of controversial topics, such as the impact on public health and the environment potentially stemming from shale gas hydraulic fracturing, credibility hinges upon full disclosure of any potential conflicts of interest by all participants and upon rigorous, independent reviews of findings," the report said. "This study failed in both regards."

Difficulty with statistics, relying to heavily on too few sources, and not recognizing conflicts of interest are common problems that journalists have. Yet these are only amplified by the biggest constraint that every journalist faces: Space.

"When I write about a study, I generally shoot for 800 words. That sounds like a lot of words, but it feels like its not. I have to decide what things I'm going to leave out, which areas where I'm going to be concise," said O'Connor. "Some things are left out, and that's always the case. The reporter can only put so much into the story."

Chapter Six: Glimmers of Hope

Imagine a pipeline between scientists and the public. A flurry of data—the sum of all knowledge and experimental outcomes—swirls around the entrance of the pipeline. The scientists carefully sort and analyze this data to the best of their abilities, finding meaning and patterns in the chaos that exists around them. What they

produce is a trickle of new knowledge that passes through the filters of press releases, blog posts, and news articles, making its way to the public consciousness. How those filters respond to that new knowledge determines the quality of the end product, for better or for worse.

There are promising signs that science reporting can and will improve. More news outlets are foregoing the standard inverted pyramid model in order to report scientific advancements in new and innovative ways. The Boston Globe, for example, has revamped its science section to include perspectives and regular contributions from local scientists and researchers, giving them a voice and output to communicate their findings directly to the public. Some publications are toying with new formats, too. The Atlantic often reports scientific studies in a format that clearly and concisely explains their findings, significance, methodology, and caveats, resulting in more of a synopsis of the study, rather than a traditional reportage. "With digital media, it's easier to communicate," Love said. "It's easier to get into the nuances of the issue."

Increasingly, news organizations are seeking out reporters who have a background in science—O'Connor, for example, has a degree in psychology from Yale University. Oransky, executive editor of Reuters Health, is a clinical physician by trade.

It is far easier to access journal articles now than ever before. It is far easier to find expert sources to weigh in on the studies. And most importantly, now more than ever, journalists have to respond to their readers. The science beat is still being shaped by the Internet, responding to the growing power and influence of armchair analysts and fact checkers, evidenced by Daniel Bor's scathing critique of Jonah Lehrer.

Churnalism.org, a new website released in April of 2013 by the nonprofit Sunlight

Foundation, allows users to scan news articles to see how much of them have been lifted from press releases—a huge step to ensuring that journalists are writing original articles and not relying solely on press releases.

For scientists, too, the Internet has fostered an environment that holds them more accountable. Oransky, for example, is the co-founder of RetractionWatch.com, which monitors retractions in scientific journals. He points out that with the presence of so many science bloggers and writers, the Internet has raised accountability standards. "It keeps scientists honest," he said.

But paradoxically, as the media becomes held more accountable by the forces of the Internet—arguably setting the bar higher for journalists' standards and ethics—trust in the media has declined considerably over the past few decades, according to a report by Pew Research Center which found that 66 percent of readers in 2011 believed news stories were overall inaccurate, compared to just 35 percent in 1985.

That distrust might be an indicator that the readers of today are more skeptical than they were before. That is a good thing, as a healthy level of skepticism promotes good science and good journalism, while encouraging discourse and feedback. Still, science reporting is not for every journalist. "If journalists can't be analysts, then they should not report on scientific studies," Colmery said.

It is impossible to make sweeping generalizations about the current state of science reporting. Admittedly so, the journalistic transgressions in the field, detailed in this report and elsewhere, represent only a handful of data points in the chaos of news and information that defines the Internet era. Perspective and context, as always, are needed. "I don't know if science reporting is getting better or worse. We don't have a base line for good, bad or otherwise. Certain outlets are getting better. We have more and more competitors every year," Oransky said.

Love and O'Connor are a bit more optimistic. "My impression that things are getting better is an unscientific sample, to be fair." Love said. "But I am seeing better writing and reporting on science than I did 20 years ago."

O'Connor concurs. "It has gotten better. There are many more people looking at these studies. There are a lot of good science blogs out there that are very detailed and technical when it comes to analyzing these studies," he said. Because of this, O'Connor readily admits, "our interpretation of a study is not the final word."

Afterword

While there are countless blogs that examine how scientific issues are reported in the news, few specifically examine the treatment that scientific studies receive. For this reason, I started the website accordingtoanewstudy.com in order to make sense out of how scientific studies are covered and to encourage a greater dialogue between scientists, journalists, and everyday readers. Surely, the democratizing effect of the Internet has allowed such progress to be made.

The following chapters are posts from my website that were expressly produced for my report that have been formatted for print. The first highlights a new study and the questions it raises about a common form of survey methodology. The second takes a step back from the studies about the minute details of human existence to focus on what data there is about human existence on a macro level. Its purpose is to tell a story that does not receive as much attention as it should—that the world, perhaps, is getting better.

Case Study: When Southerners Self-Report, Stereotypes Strengthen

The South will rise again—but perhaps not on the obesity charts.

A new study authored by researchers at the University of Alabama-Birmingham and published in April of 2013 in the journal Obesity contends that southerners are not the most obese people in the country, contrary to popular perception. And not only are the denizens of Dixie less fat, but they apparently are more honest, too, when it comes to reporting their own weight.

The study, entitled "The geographic distribution of obesity in the US and the potential regional differences in misreporting of obesity," highlights a problem in epidemiological research—as self-reported data cannot be independently verified, it often differs substantially from data collected via direct measurement.

By examining four different surveys that tracked obesity rates across the nation via self-reporting and direct measure, the study's authors found there were stark differences between how much people said they weighed, and how much they really weighed. The greatest disparity was found in the Midwestern and north central states, which had the highest obesity rates in the nation when the researchers utilized the directly measured figures. In some Southern states, there was almost no disparity between the self-reported figures and the directly measured figures.

The study's lead author, Dr. George Howard, doesn't have any empirical evidence that explains the greater disparity in self-reported figures and directly measured figures in the Midwestern and north central states compared to the south, though he has one hunch.

"This is absolute speculation," Howard said in a telephone interview. "But I think there is less of a stigma to being overweight in the south. Southerners are less embarrassed about their weight."

Self-reported figures from the southern central states of Alabama, Mississippi, Tennessee and Kentucky collected by Behavioral Risk Factor Surveillance System of the Center for Disease Control indicated a 29.1 percent obesity rate, making it the most obese region in the country. But when another survey conducted by the CDC—the National Health and Nutrition Examination Survey—directly measured the height and weight of participants, that ranking fell to seventh in the country, with the obesity rate ticking up slightly to 31.3 percent.

The disparity between self-reported and directly measured figures was much greater in other regions of the country. In Texas, Oklahoma, Louisiana, and Arkansas, the self-reported obesity rate was 27.5 percent; directly measured it was 37.1 percent, though the region's ranking still fell from third to fifth.

Self-reported figures from the states of Wisconsin, Michigan, Illinois, Indiana and Ohio indicated a 28.4 percent obesity rate, ranking second in the nation; directly measured figures indicated a 40.2 percent obesity rate, securing first place.

The Midwestern states of North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa and Missouri self-reported a 27.5 percent obesity rate; directly measured figures indicated a 39.8 percent obesity rate.

Self-reporting has always been problematic in scientific studies—as this study demonstrates, what people think and say about themselves often differs substantially from reality. The CDC's self-reported survey—the Behavioral Risk Factor Surveillance System—happens to be the largest telephone survey in the

world. Despite its large, representative sample size—nearly 700,000 people—the fact that responses cannot be independently verified calls into question certain aspects of the survey's reliability—particularly when it comes to self-reporting height and weight.

“People can report reliably over time but there can be systematic biases in their self reports in socially desirable ways,” said Hernando Rojas, professor of journalism and mass communication at the University of Wisconsin, in an email interview. “For example, males tend to overestimate their height in self-reports and women tend to underestimate their weight.”

Self-reporting appears to become more inaccurate when respondents get older. In a longitudinal study entitled “Height and Weight Bias: The Influence of Time,” published in January of 2013 by PLOS One, researchers in Ireland found that as people got older, they were more likely to report weighing less than they really did. In particular, those who were obese were even more likely to underestimate their weight.

Despite the apparent problems with CDC's self-reported obesity figures, the perception of southerners as the fattest people in the United States persists. Time magazine bluntly asked in a 2009 article, "Why are Southerners so fat?" positing that the region's deep-fried cuisine or hot weather prevents people from engaging in a healthier lifestyle.

Ironically, an article published in August of 2012 by the Minnesota Post entitled “Mississippi most obese state: Southern diet or culture on the skids?” goes to great lengths to answer why Mississippi is the most obese state in the country—yet according to one set of self-reported figures collected in Howard's study, Minnesota is in fact the most obese state.

But while it is easy for residents of one region to poke fun at the poor health of those in another region, Howard feels such rivalry misses the point.

"The obesity epidemic is real and it is growing," he said.

Epilogue: Is The World Getting Better?

So much doom and gloom in the world right now—or so it seems.

The Syrian civil war, the Boston bombings, a faltering European Union, a bumbling global economy, cartel violence in Mexico, the threat of nuclear war on the Korean peninsula—to name a few stories—have been dominating the headlines.

Yet amid the chaos of the news ecosystem, it is important to contextualize all of these negative stories with the big picture story—just where, exactly, this world is going. By examining data collected by the World Bank and compiled into an interactive data visualization with Google's Public Data Explorer, a different story emerges. Each dot represents data from individual countries, measuring the gross domestic product per capita, life expectancy, and fertility rates of each over the past fifty years.

(See Figures 1-5)

By and large, the citizens of the world are getting richer, living longer, and having fewer children. Now take a look at this chart, which measures literacy rates, access to clean water, and telephone lines per 100 people.

(See Figures 7-10)

It not only appears that living conditions have improved dramatically over the past few decades, but that the trends do not appear to be reversing direction.

But that is not what most people seem to think. According to the Pew Research Global Attitudes Project, the vast majority of people surveyed in 2012 across 21 countries were dissatisfied with their countries' direction.

(See Table 1)

There appears to be as much nostalgia for the days of yesteryear as there is pessimism toward the future. A survey released in March of 2013 of 4,000 adults across two generations commissioned by health retailer Holland & Barret found that 68 percent of respondents over the age of 50 believe that today's youth have it harder than they did 40 years ago.

Why the disconnect? If the world is getting better, why are people so seemingly unhappy with the state of it? One can do nothing but speculate—or do a study on it. The state of the world, it seems, is in the eye of the beholder.

At its heart, this report examines how we interpret and communicate data to others. I attempted to illustrate how the meaning of data is muddled by the filters of a study's methodology, the biases of the researchers and journalists, the press releases written about the study, the news articles written about the press releases, the lack of formal science education among many journalists, and so on. In the case of the data visualizations I have presented, however, the data can speak for themselves.

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