Misleading Graphics and COVID-19: The History of Visualizations and How They Can Help or Hinder Solutions to Big Issues

Featuring:

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Podcast Transcript

Kiser: How have some COVID-19 graphs misrepresented data and how big of a problem is the use of intentionally or unintentionally wrong charts or graphs? This is Shelly Kiser, communications manager for the Radow College of Humanities and Social Sciences at Kennesaw State University. I'm the host of the Thought Provoking podcast, where today we'll find out the answers to these questions as I talk with Dr. Sara Doan, assistant professor of technical communication here at KSU. We'll learn how visualizations, like charts, graphs and maps, helped birth the modern practice of epidemiology, and we'll examine how you can be a savvy consumer of technical information. Welcome, Sarah. We're really glad to have you with us today.

Doan: Thank you so much. It's great to be here. I'm excited to chat about technical communication and misleading COVID-19 charts and graphs.

Kiser: Wonderful. So, speaking of technical communication, for us laypeople, what is technical communication and what kind of things do you teach your students?

Doan: Well, technical communication as a discipline has been around for a very long time. There were technical communicators helping to build monuments and pillars and palaces in ancient Rome. We are the people who look at communication and translate and summarize and explain and interpret expertise. Anytime that you see a user manual, anytime that you see a set of instructions, anytime that you see a user interface, those are technical communicators at work. In technical communication, one of the fun things is when our work is done so well that people don't notice it. People typically only notice if there are mistakes.

Kiser: So, if the doctors want to tell us something or the engineers want to tell us something and we can't really understand their jargon or their high level of speak, you're the folks that help us understand it.

Doan: Exactly. We're the people who make things like hurricane maps or disaster warnings so people know to evacuate if there's a hurricane. We're the ones taking that and putting that into plain language that people can understand.

Kiser: Okay, that's very important stuff. So, you study charts that actually misrepresent data. They're kind of the opposite of helpful, right? How big of a problem is this?

Doan: I would say that misinformation is one of the big problems of our time. Anything that purposefully or unintentionally misleads people is one of the biggest problems in the information age, that we're currently part of within COVID-19 There have been so many times

where data has been misrepresented or downplayed or minimized. And so, I've been looking especially at charts and graphs from the early part of the epidemic, when people were just starting to realize that, "Oh, COVID is actually going to be a big thing."

Kiser: You talked about technology. Is that why this is a big problem, because we have so much technology, so it's kind of easy to share stuff these days?

Doan: We're in the second golden age of data design. Back in the 1850s, there were a ton of charts and graphs coming out, and that's when the field really got established. But today we're in that second golden age. People are starting to make charts that bend rules. People are starting to make charts that don't look like charts did 30, 40, 50 years ago. And technology has been great because it's enabled us to play with genre and to play with the ways in which data is being distributed, in the ways the data is being represented visually, and in the ways that we talk about data. However, the flip side of this is that anybody who wants to can now make a chart or graph and can kind of become their own publicist as Alberto Cairo says in his book *How Charts Lie.* So, I can go and make a really accurate chart. I can make it very beautiful and appealing and usable. But then someone with either ignorance of the data, or someone who might not have the greatest intentions can also go and do the same thing. It's very easy to lie with statistics and lie with charts and manipulate information. So, one of my jobs as a technical communicator is helping people understand it with the lowest barrier to entry possible. One of the things about technical communication that I love is its ability to democratize information. I want everyone, or as many people as possible, to be able to see my charts and understand them.

Kiser: Technology has been a blessing because I've seen some really cool charts that really helped me understand things. But it's been a curse because when we put it in the hands of everyone, some people don't always have the best motivation.

Doan: Exactly. We tend, in the United States and Europe - in the West, we tend to associate visuals with logical and scientific thinking. If I can see it, I can trust it. And that's not always the case.

Kiser: I was just going to ask you why people tend to believe charts and graphs. Somebody will say, "I see a chart and once it's in a chart, it's the truth."

Doan: Exactly. But charts can be so cherry-picked or a chart might be perfectly accurate, but what we call the annotation layer - so the captions or the data labels or what have you - might not tell the whole story. There was a chart that came out on April 9 from Governor Cuomo's daily media briefing for COVID, and it was talking about net hospital admissions in New York City. But the annotation layer became separated from the chart when it was taken out of the video conference. Then it was disseminated in print media or online media without the video of Cuomo explaining it. That was misleading because it looked like only 200 people were admitted to any New York hospital. Instead, it was just the net gain or loss of cases from the day before. So, making sure that the annotations stay with the chart is really important.

Kiser: I'm going to include a link to your paper and the COVID-19 charts that we're talking about in the episode description so that our listeners can take a look at them. For people that might not understand what an annotation layer is, what is that? What was missing?

Doan: The annotation layer is any of the verbal elements on the chart or graph. We have the visual elements - the slices of pie on a pie chart, the bars on a bar chart, the lines on a line graph - but then we also need that annotation layer to explain things. You need to tell the people what the chart is. You need to tell people where it's from; citing your sources is extremely important. If there was a previous version - say, for example, the World Health Organization pulled out a chart, and then the next day they updated it with corrections - they would definitely want to include an annotation, saying, "Hey, this chart had inaccurate information and we've now corrected it. This is the version from December 15, not from December 14. Here are the two or three little changes."

Kiser: Okay, that makes sense. They need all of the information not just part of the information.

How did data visualization help bring about the modern practice of epidemiology, and the beginnings of germ theory? And why is it a problem when chart makers don't humanize the data? We'll find out when we come back.

This is Shelly Kiser. I'm the host of the Thought Provoking podcast and communications manager for the Radow College of Humanities and Social Sciences at Kennesaw State University in Kennesaw, Georgia, just outside Atlanta. Kennesaw State is the second largest university in the state with over 41,000 students. It's a Carnegie designated R2 doctoral research institution, placing it among an elite group of only 6% of U.S. colleges and universities with an R1 or R2 status. The Radow College of Humanities and Social Sciences is the largest college at KSU with over 400 faculty members and over 8000 students. It houses 11 departments and schools with more than 80 programs of study. Our show features the amazing researchers in our college, and their amazing, and thought provoking, research.

I know that in some of your research, you explain how charts in some sense brought about the modern practice of epidemiology, or the study of disease in different populations. I noted this had something to do with a cholera map, am I correct on that?

Doan: I am happy to talk about John Snow's cholera map.

Kiser: Okay, tell us all about it.

Doan: Not the "Game of Thrones" character, John Snow was an epidemiologist and physician in London in the 1850s. He worked for Queen Victoria, and he did a lot of thinking about cholera, because he was exposed to it when he was young and it deeply affected his life. He spent a lot of time thinking about how cholera actually spreads. Back in the 1850s, people didn't think that cholera and other diseases were spread by germs. They didn't know what germs were. Instead, they thought it was miasma or bad air. Because, if something smells bad, you probably want to avoid it. For example, if you have your system of waste, you probably don't want that to be next to your drinking water, things that we know now very obviously but this was something that they didn't know so obviously then because germ theory changed the game. There was a cholera epidemic in London in the summer of 1854, and John Snow got out a map of the streets of London because this was mostly located in an area around Broad Street in London. John Snow went and talked to people and looked at the death tolls that were coming out in tables. Tables that have your rows and your columns of numbers are great, but sometimes they take a little bit

longer to tell a story. So, John Snow got out his map. He talked to people. He figured out where people in that Broad Street pump neighborhood were dying. And he went over and talked to people in a poor house. There were very bad conditions in a poor house in London in the 1850s. They were colloquially known as debtors' prisons. You do not want to wind up there. But the poor house had a lot fewer deaths than the surrounding area. He also visited a local brewery that, again, had a lot fewer deaths than the surrounding area. John Snow is like, "Hey, guys, when you're making this beer, do you sample it?" They're like, "Yeah, we get free samples all day long." So, drinking beer actually kept the brewers from getting cholera, because they weren't drinking the contaminated water. Eventually, John Snow figured out through talking to people that the water was what was contaminated, and he wouldn't have found this out except that he was starting to mark things off on the map. So these outliers of that poor house and that brewery, and then another couple of deaths caused by someone who had actually transported water a couple miles away out of the neighborhood for someone who wanted that specific well water, helped him figure out that cholera was coming from the pump and the pump had been contaminated. The source of water was actually right next to a leaking sistern of human waste. Even though the water smelled and tasted good. This actually led to the creation of germ theory because he figured out that the water was what was contaminated. And all thanks to this map.

Kiser: That's interesting. He did the map and that helped him figure this out and probably saved some lives.

Doan: Exactly. He actually went down, and they shut off the Broad Street pump. There's a pub there now called the John Snow.

Kiser: If I ever go to London, I will have to visit. It's part of history, isn't it?

Doan: Yeah. To sum up, charts have great potential as a means of invention, as a means of figuring something out, not just as a finished product of data itself.

Kiser: Going back to what you've talked about with your COVID-19 paper where you talked about all the charts that misrepresent data, and that you had mentioned earlier, we are in the second golden age of data design. So, what is happening right now that would make you categorize this as a second golden age in data design?

Doan: Right now, one of the things that's been very different is how easy it is to make a chart. I can go in and with three numbers and five clicks, I can make a chart that I can publish on the internet somewhere. So, the ease of being able to make charts is one of the hallmarks of our second golden age of data design. Another thing is charts have gotten weird again. This has been really exciting, and one pandemic-related example is the fan chart. This is a line graph where the line goes up and down according to whatever is being measured over time. The vertical y axis is measuring, whatever is being measured - so interest rates or rates of spreading a disease perhaps - which will become important in a moment. And then after a certain point, these charts tend to project future amounts of something. They were invented within the last 10 years as a way of tracking interest rates, and they were pretty weird. I taught them during the spring 2020 semester and I'm like, "Nobody really uses these." February 2020 was a more innocent time.

Kiser: Yes, it was.

Doan: I turn around and all of a sudden, it's COVID, and there are fan charts of epidemiology rates of spread everywhere. So, I was teaching fan charts before it was cool.

Kiser: Yeah, you were ahead of your time. I see what you mean because I'm a National Geographic magazine fan and I've read that magazine forever and ever. It used to be mostly text, and now you really see a lot of data visualization. There are infographics and charts and maps and things like that to help you understand the information. I can see how we've really embraced that kind of thing.

Doan: Yes, and people are hungry for this kind of information. People actively want to learn, and charts are a great way of making data persuasive and making data memorable.

Kiser: I think you're right. So, in that same paper, the first visualization that you talked about was actually in *Time Magazine,* which we think of as being pretty darn accurate, and I think you said that, factually, it was accurate. So, if it showed factual information, how can that make it misleading?

Doan: Oh, the *Time* chart! I spent a lot of hours thinking about this chart and being frustrated by it. It was shared back in March 2020 when people didn't quite know what to make of COVID yet. I found it really fascinating, because it's a series of four pie charts that are all technically correct. The pie charts are meant to be what Edward Tufte calls "small multiples," multiple small charts that are meant to be compared. There's a series of four pie charts, and the first one talks about COVID-19 fatal cases being 3.4%. There's the massive big part of the pie and then there's the tiny sliver out of it. The next one is the seasonal flu going from left to right. So, second from the left seasonal flu fatal cases .1% The rest of the pie charts are in red and teal, but this one has such a narrow slice out of it that they don't even fit in any red; it's just the white outline. The next one is SARS, which has a 10% fatality rate during the previous epidemic. The last one on the right is MERS, and the fatal cases were 34% So, that's a pretty big slice of red. It's about a third of the pie chart. What this chart did, even though all of the information is accurate and being presented accurately, is group COVID with the seasonal flu. It is a giant mistake because the seasonal flu has such a low mortality rate and the COVID-19 fatal cases is 3.4%. It's just a different rate of spread. These pie charts don't take into account the rate of spread and the fact that COVID is very, very contagious. It's contagion rates are a lot more like SARS and MERS, which Americans or people in the United States typically don't take as seriously because we didn't have as big of a problem with SARS and MERS, because the United States epidemiology policies were enforced very well for those two outbreaks, whereas with COVID, once it got over here it's spread like wildfire. So, these pie charts, don't take into account the rate of spread. They also don't humanize the data. This is a big problem in some visualizations, because if you look at these pie charts - you're probably reasonably educated if you're reading *Time* - and you might say, "Oh, this isn't going to be a problem for me. It shouldn't be a problem for anybody else." But really, COVID-19 is having such a disproportionate impact in African American communities, in Native American communities and with people who are working class. Working in a grocery store, you're going to almost certainly be exposed to COVID. So, it just flattens the data to a point where it looks like it's going to be safe, but it's really not. Humanizing the data

and remembering that people make a lot of decisions emotionally is really important with data visualization.

Kiser: I think that's a really good point. I know when it first started, a lot of people were saying, "Oh, it's just the same as the flu." Maybe that's one of the reasons why they did that because it made it look like it's not as bad as these really bad illnesses that we could have. It's just like the flu. But, like you said, they didn't tell the whole story. The next chart you looked at in your paper was on a Fox channel in Denver, and that was a scale problem, right?

Doan: That was a scale problem. This was a fascinating case of a chart actively manipulating information. This chart adjusted it's logarithmic scale. On the y axis, the vertical axis of a graph, usually a logarithmic scale will be predictable. It'll go 30, 60, 90. It's a little bit different than our scales where we usually divide by 10 or 100 or 1,000. It usually skips. So this was fascinating because the first three markers on the line graph were at a predictable logarithmic-ish scale. The first marker was 30, then 60, then 90. Then, it increased from 90 to 100 to 130. It tried to look like the surge of cases that happened in Colorado between March 21 and March 22 was smaller. This was hugely problematic. And it makes way more sense when you can actually see the chart, but this was a massive, massive deception. I just found it extremely fascinating.

Kiser: So, they just changed the scale to make it look like it wasn't going up very high, but in actuality they weren't being consistent with how they talked about it?

Doan: Right, because then the y axis starts randomly skipping by 50, and then by 10, and then by another 50. So, it's like 30, then 50, then 10.

Kiser: It changes back and forth, and that was just to try to make it look not as bad as it really was?

Doan: Exactly.

Kiser: Oh, wow. When we return, are most errors intentional manipulations of data, or just the work of some really bad chart makers? We'll also learn how everyone can ensure their charts don't misrepresent data, and how you can avoid being misled by charts and graphs.

How does hip hop help bridge the South's past to its present? Join us next month to find out. For Black History Month we'll be talking to Dr. Regina Bradley, Assistant Professor of English and African Diaspora Studies here at KSU, about her research on southern hip hop. We'll find out how hip hop has helped tell the story of the modern experience of black southerners, and how the group OutKast and other southern artists aid our understanding of the post Civil Rights Era south and help black southerners, "speak their truth to power."

You had talked earlier about the examples which the New York Governor used in the media briefing. When you think about these charts, do you think that most of them are purposeful? Do you think they're trying to push a certain agenda or is it just really bad chart makers?

Doan: I hate to, as they say, cast too much shade on other chart makers. But I would say the *Time* article felt intentional, but through ignorance. Not really understanding the full repercussions of COVID, especially with COVID being a problem specifically for Black Americans and specifically for Native Americans. And COVID often leaving people chronically ill. There are people who came down with COVID in March and who still haven't recovered yet. So, COVID is something

you definitely want to avoid. In the New York one, that might have just been a case of people taking something and not taking all the information. Then the one on Fox looks like it might have been more purposely manipulated. The media briefings are very comprehensive. I have sat and watched them because I'm a nerd. Yeah, yeah, I'm very lucky to do purposeful nerdy work. The media briefing, if you sit down to watch it all, is very comprehensive. But New York's chart makers there did not fully take into account that these would be taken out of context, especially since Governor Cuomo was one of the people, very early in the pandemic, who took it seriously and would provide factual information that people could trust.

Kiser: You also looked at something else and that is COVID-19 messaging through Twitter accounts. You compared state run accounts with accounts run by African American organizations. What was the big difference there in how they shared information?

Doan: I am still analyzing that data. I am working with my research assistant undergraduate student Christy Kennedy, and we are looking at that data over break.

Kiser: Oh, okay.

Doan: She's scraped about 10,000 tweets from Georgia, South Carolina, and Alabama state public health Twitter accounts. And then we're comparing that with African American run organizations within the same state.

Kiser: What are you trying to learn?

Doan: We are trying to learn strategies that African American communities are using to be able to talk about COVID and to help people engage with protective behaviors like washing your hands and wearing a mask. It's really important, particularly, because African Americans have been so impacted by this pandemic. We're hoping in the spring to be able to do some focus groups and a survey to talk about how African American men, especially ages 18 to 24, are engaging with public health and proactive health behaviors around COVID-19.

Kiser: Well, we look forward to seeing what you find out.

Doan: Thank you, there's definitely an opportunity there to be able to help more people because often what we hypothesize that we'll find is that public health Twitter is very general, whereas African American organizations probably have a lot more credibility, as they should.

Kiser: Interesting. So, if you are a chart maker - I'm a communications person, so I do charts sometimes - how can those of us who make charts ensure that they create something that's accurate and not misleading?

Doan: That is a fantastic question. The first suggestion I would have for them is to think about proximity and placement. That set of pie charts from *Time* magazine was not necessarily truthful because of the placement of the data. Grouping COVID with the flu… not a great move because COVID is very much not the flu. I would also recommend that people never minimize non-fatal instances of disease. COVID is real. COVID is not something that you want to get very often. People are becoming chronically ill, having to go on dialysis, having limbs amputated. COVID is really something to be taken seriously, especially if you think you might be asymptomatic. Then, if you're using a Y axis, use clear representative scales, and label all of your data. Label as much

data as possible. Back in March and April 2020, Stephanie Jolly, who is now in New York but was living in either Tennessee or Kentucky at the time, started to create charts to be able to compare the information and policies that were coming out of Kentucky and coming out of Tennessee. She showed substantial differences in the amount of testing that was being done and in the amount of cases that were happening because she was able to add so many data labels. She was getting her information from the CDC. She was citing her sources. So, this was just someone random who was able to make these really compelling charts, especially since she color-coded Tennessee's in Wildcat orange and Kentucky's in royal blue to go with the sports teams for the flagship universities of those states that people would be able to recognize. She did a really good job of adding all of these descriptive labels, like "this is when the governor of Kentucky closed schools." "This is when the governor of Tennessee closed schools. You can see the difference in the cases, as they're being represented compared with these policies.

Kiser: Very interesting. I actually worked in tobacco prevention in a previous job, and we did a similar chart that showed smoking rates over time and how public health interventions really impacted the reduction in smoking. That was a powerful thing to show people. You can actually see that things are happening. Speaking of that, the person that you were talking about, I thought what she said really encapsulated the impact that visualizations have. She said, "This data has given people hope, which is an infinitely more powerful outcome than any I could have anticipated when I sat down to make a graph. For every critique of scale or scope, others have said, "I've been really scared, but this makes me feel like we can tackle this." So, visuals can obviously have, as we said earlier, a negative impact, but also a positive impact.

Doan: Exactly. That is absolutely true. That goes back to when visualizations were starting to be invented back in the 1850s. Florence Nightingale, the legendary nurse, actually was in charge of some hospitals during the Crimean War in 1855, 1856. She created these visuals to persuade surgeons and Parliament, and I believe it was read by Queen Victoria as well, that more people are dying from bad sanitation in our army hospitals during war than they are of wounds or of any sort of direct bloodshed. It's been a long tradition for charts and graphs to have the potential to persuade people to take action, especially around health.

Kiser: So, they do persuade people, as you said. Thinking of that persuasion perspective, do you think that the media or political officials are taking advantage of the fact that a lot of people are not able to really analyze charts and graph and decide whether they are valid? Do you think that happens?

Doan: I think it does. I think that one of the things that's happening with a lot of people, and I'm going to leave it very general, is that - and even I am guilty of this - looking at something, having a knee-jerk reaction to it, and then sharing it on social media. I know that this is cliche, but be careful what you share on social media.

Kiser: Things that might have pretty visual packaging or persuasive taglines might not always be the most accurate, because now anyone can go and make a chart or graph. Speaking of that, as lay people who are not technical communication professors like you, how can we not be misled by charts and graphs?

Doan: I would say take a second to actually deeply look at the chart. Does it label its X and Y axes, if it's a chart form like a line graph or a bar chart that has an x and y axis?

Kiser: The stuff we learned a geometry is actually relevant. Who knew?

Doan: Yeah, but it actually does help in this communicative context.

Kiser: I wish I'd known that when I was teaching my children and they said they wouldn't ever use this again.

Doan: Exactly. Just remember it's always Y to the sky.

Kiser: Y to the sky. There you go. Okay, so go ahead. How else? We can make sure that they're labeled.

Doan: Yep, make sure the charts are labeled. Make sure that the visual on the chart actually matches the title. You would be amazed at how many visuals don't actually align with their titles. For example, if there's an upward trend of something, see if it's represented over maybe five years instead of one year. For something that's longer term, a chart that represents 10 years is probably going to be more accurate at showing a trend than a chart that only looks at data in a one-year increment. The other thing I would think about would be, is the information cited? Can I go find it again? I see a lot of charts that say cdc.gov. I've spent a lot of time on the CDC website, and it's wonderful and I'm glad that we have this institution, especially in the Atlanta area. However, it is often difficult to find information on the CDC website unless you have a direct URL – go to XYZ website, give the exact page, and you find the exact numbers.

Kiser: Yeah, that's a massive website to find things on. Lots of good, valuable information but not easy to check on something. Do you have any last thoughts for us on all your research and everything you've learned?

Doan: If I could say anything to folks out there, it would be, please take COVID seriously. As much as I love studying it, I also want this to be over.

Kiser: Don't we all.

Doan: I think everybody does. So, please take it seriously. The sooner we all keep engaging or re-engage with these protected health behaviors, like wearing a mask, staying away from people who are not in your household, and being attentive to what other people around us need, the sooner we can just be done with it. Think about what's not being represented in the data. I've talked a lot about what's there, but sometimes what's not being represented, or certain groups of people who might not be represented, is equally as important.

Kiser: I'm feeling really hopeful because you are out there teaching our students who will be the people out there making the charts in the future when they graduate and have their jobs. I feel confident that you're giving them the skills they need so that we can get some really accurate information, especially related to health. It's so important.

Doan: Thank you. It's been my delight to be able to research this and to be able to teach it. One learning outcome I had for my spring 2020 data visualization course was students who told me, "Oh, I understand the news a lot better now."

Kiser: Awesome.

Doan: The more we can be thoughtful, mindful consumers of our news and information, the better.

Kiser: Yeah, media literacy is very important. Thank you so much for being with us today, Sarah. This was a fascinating look at technical communications. We're all going to be on the watch for misleading charts in the future. So, thanks very much.

Doan: Thank you. It's been my pleasure

Kiser: Thought Provoking is a production of the Radow College of Humanities and Social Sciences at Kennesaw State University in Kennesaw, Georgia, just outside Atlanta. You can follow our college on Facebook or Instagram at ksuchss or visit our website at radow.kennesaw.edu This is Shelly Kiser, and I'll be back next month with another episode. Talk to you then.