





TECHNOLOGY

# THE KIDS ARE ALL RIGHT

New findings suggest that the angst over social media is misplaced and that more nuance is required to understand its effects on well-being

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IT WAS THE HEADLINES THAT MOST UPSET AMY ORBEN. IN 2017, WHEN SHE WAS A GRADUATE student in experimental psychology at the University of Oxford researching how social media influences communication, alarming articles began to appear. Giving a child a smartphone was like giving a kid cocaine, claimed one. Smartphones might have destroyed a generation, said another. Orben didn't think such extreme statements were warranted. At one point, she stayed up all night reanalyzing data from a paper linking increases in depression and suicide to screen time. "I figured out that tweaks to the data analysis caused major changes to the study results," Orben says. "The effects were actually tiny."

She published several blog posts, some with her Oxford colleague Andrew K. Przybylski, saying so. "Great claims require great evidence," she wrote in one. "Yet this kind of evidence does not exist." Then Orben decided to make her point scientifically and changed the focus of her work. With Przybylski, she set out to rigorously analyze the large-scale data sets that are widely used in studies of social media.

The two researchers were not the only ones who were concerned. A few years ago Jeff Hancock, a psychologist who runs the Social Media Lab at Stanford University, set an alert to let him know when his research was cited by other scientists in their papers. As the notifications piled up in his in-box, he was perplexed. A report on the ways that Facebook made people more anxious would be followed by one about how social media enhances social capital. "What is going on with all these conflicting ideas?" Hancock wondered. How could they all be citing his work? He decided to seek clarity and embarked on the largest meta-analysis to date of the effects of social media on psychological well-being. Ultimately he included 226 papers and data on more than 275,000 people.

The results of Orben's, Przybylski's and Hancock's efforts are now in. Studies from these researchers and others, published or presented in 2019, have brought some context to the question of what exactly digital technology is doing to our mental health. Their evidence makes several things clear. The results to date have been mixed because the effects measured are themselves mixed. "Using social media is essentially a trade-off," Hancock says. "You get very small but significant advantages for your

well-being that come with very small but statistically significant costs." The emphasis is on "small"—at least in terms of effect size, which gauges the strength of the relation between two variables. Hancock's meta-analysis revealed an overall effect size of 0.01 on a scale in which 0.2 is small. Przybylski and Orben measured the percent of variance in well-being that was explained by social media use and found that technology was no more associated with decreased well-being for teenagers than eating potatoes. Wearing glasses was worse. "The monster-of-the-week thing is dead in the water," Przybylski says.

Furthermore, this new research reveals serious limitations and shortcomings in the science of social media to date. Eighty percent of studies have been cross-sectional (looking at individuals at a given point in time) and correlational (linking two measures such as frequency of Facebook use and level of anxiety but not showing that one causes the other). Most have relied on self-reported use, a notoriously unreliable measure. Nearly all assess only frequency and duration of use rather than content or context. "We're asking the wrong questions," Hancock says. And results are regularly overstated—sometimes by the scientists, often by the media. "Social media research is the perfect storm showing us where all the problems are with our scientific methodology," Orben says. "This challenges us as scientists to think about how we measure things and what sort of effect size we think is important."

To be clear, it is not that social media is never a problem. Heavy use is associated with potentially harmful effects on well-being. But effects from social media appear to depend on the

#### IN BRIEF

**Anxiety about** the effects of social media on young people has risen to such an extreme that giving children smartphones is sometimes equated to handing them a gram of cocaine. The reality is much less alarming.

**A close look** at social media use shows that most young texters and Instagrammers are fine. Heavy use can lead to problems, but many early studies and news headlines have overstated dangers and omitted context.

**Researchers** are now examining these diverging viewpoints, looking for nuance and developing better methods for measuring whether social media and related technologies have any meaningful impact on mental health.

user—age and mental health status are two important factors that make a difference. Also, cause and effect appear to go in both directions. “It’s a two-way street,” Hancock says.

The hope is that the field will use these new findings to embark on a new science of social media that will set higher standards for statistical analysis, avoid preposterous claims, and include more experimental and longitudinal studies, which track people at multiple time points. “We don’t want to be a field in which we say that potato eating has destroyed a generation,” says clinical neuropsychologist Tracy Dennis-Tiwary of Hunter College. “Despite our concerns, we need to pull ourselves together and act like scientists. We have to have adequate evidence.”

## FEAR OF TECHNOLOGY

ANXIETY AND PANIC over the effects of new technology date back to Socrates, who bemoaned the then new tradition of writing things down for fear it would diminish the power of memory. Thomas Hobbes and Thomas Jefferson both warned that communal relationships would suffer as industrial societies moved from rural to urban living. “Before we hated smartphones, we hated cities,” write sociologists Keith Hampton of Michigan State University and Barry Wellman of the NetLab Network, based in Toronto, both of whom study the effects of technological innovation. Radio, video games and even comic books have all caused consternation. Television was going to bring about the dumbing down of America.

Even so, the change that came about from mobile phones, the Internet and social networking sites feels seismic. Cell phones were first widely adopted in the 1990s. By 2018, 95 percent of American adults were using them. Smartphones, which added instant access to the Internet, entered the mainstream with the introduction of the iPhone in 2007, and now more than three quarters of U.S. adults have them. Eighty-nine percent of those adults use the Internet. There is near saturation for all things digital among adolescents and adults younger than 50 and among higher-income households. Nonusers tend to be older than 65, poor, or residents of rural areas or other places with limited service. Between 2005, when the Pew Research Center began tracking social media use, and 2019, the proportion of Americans using social media to connect, keep up with the news, share information and be entertained went from 5 to 72 percent—that means it jumped from one in 20 adults to seven in 10.

Because social media is so new, the science investigating its effects is also new. The earliest study Hancock could find that examined social media use and psychological well-being was done in 2006. It came as no surprise that early approaches were limited. Physician Brian Primack, who headed the Center for Research on Media, Technology, and Health at the University of Pittsburgh until moving to the University of Arkansas this year, likens the field to initial research on nutrition: “It took a while to say, ‘Let’s split out fats and proteins and carbohydrates, and not just that, but let’s split out trans-fats and polyunsaturated fats,’” he says. “It’s important for anyone who is doing good research to adapt to what’s going on.” Primack points to his own early work,

such as studies that looked only at overall social media use, as examples of what will not cut it anymore. “You might be spending two hours a day clicking ‘like’ on pictures of cute puppies, and I might be spending two hours a day having violent clashes about politics and religion and other hot-button issues. Studies like my early one would count [those activities] the same.”

Many people in the field have been particularly critical of work by psychologist Jean M. Twenge of San Diego State University. In addition to her research papers, Twenge’s popular 2017 article in the *Atlantic*, based on her book *iGen*, was the one that asked: “Has the Smartphone Destroyed a Generation?” Twenge is hardly the only researcher to publish negative findings about social media use, but the publicity around her work has made her one of the most high profile. She points to a steep rise in mental health issues among the group born between 1995 and 2012 and writes that “much of this deterioration can be traced to their phones.” Her work compares rising rates of depression and anxiety among young people to the proliferation of smartphones in the same time period. Twenge acknowledges that the link is correlational but argues that her conclusions represent “a logical sequence of events” based on the evidence—and care is warranted: “When we’re talking about the health of children and teens, it seems to me we should err on the side of caution.”

# The science of social media needs to set higher standards for statistical analysis, avoid preposterous claims and study people for a longer time.

No one disagrees about the importance of young people’s health, but they do think that Twenge has gotten ahead of the science. “Why wait for causal evidence?” says Dennis-Tiwary. Because the story might not be so straightforward. She points to a longitudinal study done by researchers in Canada in response to one of Twenge’s articles. They studied nearly 600 adolescents and more than 1,000 young adults over two and six years, respectively, and found that social media use did not predict depressive symptoms but that depressive symptoms predicted more frequent social media use among adolescent girls. “This is a much more nuanced story,” Dennis-Tiwary says. “We know that problematic smartphone use may as likely be a result of mental health problems as a cause, and that calls for a different set of solutions.”

Correlational studies have their uses, just as epidemiological research can suggest a link between pollution and increased cancer rates when a randomized clinical trial is not possible. While he thinks it is important not to overstate findings, economist Matthew Gentzkow of Stanford, who studies social media, says of Twenge’s work that “there are some pretty striking facts there. They don’t tell us whether smartphones are causing mental health problems, but they really shine some light on that



possibility. What we need now is to dig in and try to do more careful studies to isolate what's really going on."

### A TWO-WAY STREET?

THAT IS WHAT the newest studies set out to do. Hancock's meta-analysis highlighted the fact that many studies on social media and psychological well-being did not measure the same outcomes. Effects generally fell into one of six categories. Three concern positive indicators of well-being: eudaemonic happiness (having a sense of meaning), hedonic happiness (joy in the moment) and relationships. And three are negative: depression, anxiety and loneliness. Hancock and his team found that more social media use was associated slightly with higher depression and anxiety (though not loneliness) and more strongly associated with relationship benefits (though not eudaemonic or hedonic well-being). (The largest effect, at 0.20, was the benefit of stronger relationships.) He and his colleagues also found that active rather than passive use was positively associated with well-being. (They found no effect for passive use, although others have found it to be negative.)

And how researchers asked questions mattered. Framing questions around "addiction" rather than more neutrally makes a negative finding more likely. In all the literature, there were only 24 longitudinal studies, the "gold standard" that allows researchers to compare the relation between well-being and social media use at two points in time and statistically assess which variable is driving change in the other. In these, Hancock's team found a further small but interesting result. "When

you have higher well-being, you use social media less, which suggests that well-being is driving [how much use is made of] social media to some degree," Hancock says.

In a trilogy of papers about adolescent technology use, Orben and Przybylski tackled three major pitfalls they had identified in previous analyses of large-scale data sets. The first paper, published in January in *Nature Human Behaviour*, provided both context and a method for improving transparency. It included three data sets from the U.S. and Europe made up of more than 350,000 adolescents. Such data sets are valuable but make it easy to turn up statistically significant results that may not be of practical significance. Przybylski and Orben calculated that if they had followed standard statistical operating procedure, they could have produced roughly 10,000 papers showing negative screen effects, 5,000 indicating no effect and another 4,000 demonstrating positive technology effects on young people—all from the same data sets.

For their new analysis, they used a technique called specification curve analysis, a tool that examines the full range of possible correlations at once. It is the statistical equivalent of seeing the forest for the trees. Analyzed in this way, digital technology use was associated with only 0.4 percent of the

variation in adolescent well-being. The wealth of information in the data allowed for the telling comparisons with potatoes and glasses. It also revealed that smoking marijuana and bullying had much larger negative associations for well-being (at 2.7 and 4.3 times worse, respectively, than the average in one of the data sets), whereas positive behaviors such as getting enough sleep and regularly eating breakfast were much more strongly linked to well-being than technology use. "We're trying to move from this mindset of cherry-picking one result to a more holistic picture," Przybylski says. "A key part of that is being able to put these extremely minuscule effects of screens on young people in a real-world context." (Twenge and others question the usefulness of explaining percentages of variation and say it will always turn up small numbers that might mask practical effects.)

Their second paper, published in April in *Psychological Science*, included stronger methods for measuring screen time. They used three data sets from the U.S., the U.K. and Ireland that included time-use diaries in addition to self-reported media usage and measures of well-being. Over a period of five years the more than 17,000 teenagers in the studies were given a diary one day each year. They filled in 10- to 15-minute windows all day long about exactly what they were doing, including use of digital technologies. When Orben and Przybylski applied their statistical technique to the data, there was little evidence for substantial negative associations between digital engagement and well-being. The diaries also allowed them to look at *when* during the day adolescents were using digital media, including before bed. Even that did not make a difference in well-being, although they

did not look at hours of sleep as an outcome, only more general psychological measures.

And finally, in May, with psychologist Tobias Dienlin of the University of Hohenheim in Germany, Orben and Przybylski published a paper in the *Proceedings of the National Academy of Sciences USA*, incorporating longitudinal data to analyze the effect of social media on adolescents' life satisfaction over time. This approach allowed them to ask whether adolescents who are on social media more in a given year than average feel better or worse at year's end and whether feeling better or worse than normal changes social media use in the coming year. Here, too, the result was small and nuanced. "The change in social media use in one year only predicts about 0.25 percent of the variance in the change in life satisfaction over one year," Orben says. "We're talking about fractions of 1 percent changes." The researchers did, however, see slightly stronger effects in girls than in boys, a finding Orben intends to investigate further. The question of individual risk will also be important. "We really want to see if there are reproducible profiles of young people who are more or less vulnerable or resilient to different forms of technology," Przybylski says.

### WHAT ABOUT GENERATION Z?

TEENAGE MEDIA use has been a particular concern because of the ubiquity of smartphones today and because adolescence is such a formative period of development. In choosing what to worry about, parents have followed scientists' lead, says psychologist Candice Odgers of the University of California, Irvine. They worry mainly about how much time their children spend online without giving equal attention to the critical question of what they are doing there. Odgers's own work suggests that amount of use is not the problem. In a study published online this summer in *Clinical Psychological Science*, Odgers, Michaeline Jensen of the University of North Carolina at Greensboro and their colleagues followed nearly 400 adolescents for two weeks, sending questions to the teenagers' cell phones three times a day. The study design allowed them to compare mental health symptoms and technology immersion daily as well as over the weeks of the study.

Was media use associated with individual adolescents' well-being? The answer was not really. Routines in place at the start did not predict later mental health symptoms, and mental health was not worse on days teenagers reported spending more or less time on technology.

"It's ironic that in the end the real danger is not smartphones—it's the level of misinformation that's being directed at the public and at parents," Odgers says. "It's consuming so much of the airtime that it's causing us to miss potentially some of the real threats and problems around digital spaces." For her part, Odgers is far more worried about privacy and unequal access to technology for kids from families with lower socioeconomic status. She also suspects that some adolescents find much needed social support online and that adults should pay closer attention to what works in that regard.

### SOCIAL MEDIA 2.0

THESE STUDIES are just the beginning. They have helped clarify the big picture on social media usage, but far more work is needed. Variety in the types of studies conducted will help tease out nuance. In a recent experimental study, for instance, Stanford's Gentzkow asked more than 1,600 people to deactivate their

Facebook accounts, which was verified electronically. He and his colleagues were surprised that substitution of other digital technologies went down, not up. "People perceive they're spending less time on all these things," Gentzkow says. The effect size was small, however, and masked a lot of individual variation. Some people loved the break; others really missed their online social world. "Facebook is delivering a lot of value to people, but nevertheless they may be using it more than is really optimal for them," Gentzkow says. "There are many people for whom scaling back their usage a little could make them happier and better off."

Several researchers are trying to better measure screen time. Stanford communications researcher Byron Reeves and his colleagues have developed a technique called Screenomics, which takes a picture of people's phones every five seconds (with permission). Technology companies also have a role to play. Corporations are better able than scientists to count how much time individuals are spending on different activities, but they consider that information proprietary, and there are privacy concerns for users to be addressed. Przybylski is pushing for that policy to change. "Companies shouldn't get a free pass," he says.

New research also seeks to do a better job of predicting individual variation. In Hancock's lab, Stanford undergraduate Angela Lee developed a creative approach. She applied the idea of mindsets—that beliefs shape people's realities—to social media. Through interviews, Lee found that views about social media fell into two general buckets: whether someone thought social media was good or bad for them (valence) and whether or not they thought they were in control of it (agency). Over the course of three studies, she and Hancock tested close to 700 people and found that social media mindsets predicted users' well-being. A sense of agency had the strongest effect. "The more you believe you are in control over your social media, the more social support you have, the less depression you report, the less stress, the less social anxiety, regardless of how much you're actually saying you use social media," says Lee, who is now a graduate student in Hancock's lab. She presented the work in May at the Association for Psychological Science meeting.

The power of mindset serves as a reminder of the power of perspective. In the 1980s people were wringing their hands about the time kids spent staring mindlessly at television screens, says Gentzkow, who has studied that era. He imagines asking those worrywarts about new technologies that would allow kids to instead interact with one another by sharing messages, photographs and videos. "Anybody then would have said, 'Wow, that would be amazing.'" ■

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#### MORE TO EXPLORE

**Has the Smartphone Destroyed a Generation?** Jean M. Twenge in *Atlantic*, Vol. 320, pages 58–65; September 2017.

**The Association between Adolescent Well-Being and Digital Technology Use.** Amy Orben and Andrew K. Przybylski in *Nature Human Behaviour*, Vol. 3, No. 2, pages 173–182; February 2019.

**Screens, Teens, and Psychological Well-Being: Evidence from Three Time-Use-Diary Studies.** Amy Orben and Andrew K. Przybylski in *Psychological Science*, Vol. 30, No. 5, pages 682–696; May 2019.

#### FROM OUR ARCHIVES

**Your Brain in the Smartphone Age.** *Scientific American* eBooks; May 6, 2019.

[scientificamerican.com/magazine/sa](http://scientificamerican.com/magazine/sa)