AMERICAN PSYCHOLOGICAL ASSOCIATION

INTERCONNECTIONS
of Psychology and Technology

Introduction

The technological revolution has made it almost impossible to separate how we conduct our social lives, business, health care, and education from the technology that allows us to do so. With vast information flowing to and from our fingertips, the way people interact with the world has fundamentally changed.

It has also forever altered the way that scientists study human behavior and the brain.

Today, psychologists are playing a pivotal role in many of these innovations, helping to collect and mine the deluge of data our digital lives are creating. They are harnessing technologically based therapies and bringing behavioral research and psychological insight to the responsible design, use, and evaluation of new technologies. Working in increasingly multidisciplinary teams, psychologists are a key part of the effort to keep humanity at the center of technological innovations—especially when they alter our perceptions of reality, our identities, and our relationships with each other.

Recent worldwide events have put an unparalleled focus on the interconnections of technology and psychology. This publication highlights some of the promise—and perils—of how they overlap, and shows some of the ways that psychologists are having a profound effect on the human-technology interaction.

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APA Brings Psychology to the AI Table

What happens when you assemble some of the world's top brains in artificial intelligence (AI) and ask them to identify what's most important to understand about human-AI interactions?

You get a room full of ideas. And walls covered in sticky notes. Lots and lots of sticky notes.

This decidedly human approach to problem-solving was just the starting point for a deep dive by a group of 50 scientists, academics, researchers, and industry leaders who met together in 2018 as part of the Partnership on Artificial Intelligence to Benefit People and Society (PAI).

The nonprofit PAI was founded in 2016 by six of the world's largest tech companies, including Facebook, Google, Microsoft and Apple, to "serve as an open platform for discussion and engagement about AI and its influences on people and society."

"From a psychological perspective, it was fascinating to watch the dynamics of a group of people from vastly different expertise areas as they riffed ideas," said Amber Story, PhD, APA Associate Executive Director for Scientific Affairs.

Story led that day's meeting, along with Hiroaki Kitano, President and CEO of Sony Computer Science Laboratories, her working group co-chair.

"People put out all sorts of topics; there were sticky notes all over the room," said Story. In the end, she said, two "burning questions" emerged.

First, was the challenge of identifying the characteristics that fundamentally define human-AI collaboration—and how these features present themselves in real world examples.

A subgroup met for months to explore the nuances:

"If my yard is being mowed by my robotic mower, is that a collaboration?" said Story. "If an algorithm is deciding if I get a bank loan, is that a collaboration? Is communication back and forth, or is it synchronous? What are the dimensions we could articulate that differentiate different kinds of collaboration?"

This wasn't merely an intellectual exercise: Developing best practices for these collaborations is a key part of PAI's mission to advance the responsible and socially beneficial development and deployment of AI.

Initially, Story said she hoped their findings would yield an overarching rubric for defining the critical dimensions that characterize human-AI collaboration. "My dream was … that we could even plot a three-dimensional space of where these things would lie."

While their findings were not quite so concrete,

the group did develop a Human-AI Collaboration Framework containing 36 key questions to help "explore the relevant features one should consider when thinking about human-AI collaboration," as well as case studies highlighting a variety of those collaborations currently taking place.

Another PAI subgroup studied the dynamics of trust between people and artificial intelligence systems. This is an increasingly critical topic as humans rely more and more on technologies to perform complex functions (e.g., driverless cars, robotic surgeries, and even augmented cognition).

"A computer science approach to trust is, 'To the extent that we can explain what the system is doing, what the algorithm is picking up, then we can trust it,'" Story observed. "But a behavioral or cognitive scientist will likely say, 'No, that's not the way trust works. I can fully understand why a system is doing it, but it doesn't mean I'm going to trust it when it's something important to me.'"

Also, trust is multifaceted, she noted. "Sometimes people over-trust systems. Or they might trust the data upon which an intelligent system was trained, but not the organization using that system."

Because the literature on trust varies greatly among disciplines, the group developed a thematically-tagged bibliography of 78 aggregated research articles, as well as an overview document presenting seven key insights to help guide future AI collaboration.

"Sometimes that human element isn't considered at the forefront of a new system," said Story. "Sometimes it's an afterthought. So, it's important to consider these insights at the start, to say, 'Here's what we know about trust and here's how you could code for trust and build a more trustworthy system.'"

"I think psychologists could have more of an impact on [AI] systems and how they are designed than they currently do," said Story, adding: "Collaborations between psychologists and computer scientists can result in rich science and better, human-focused products and systems."

PAI now includes more than 100 industry and nonprofit collaborators. The American Psychological Association is the only behavioral science organization in the membership. ●

Wearable Technology for Mental Health

The worse for wear?

By Delia O'Hara

Portable devices that can gather information, assess activity and other biomarkers, and even deliver interventions have tremendous potential, say the scientists who study them.

But opinion is mixed among mental health professionals. Some cite poor design and lack of longitudinal research, while others are jumping on the expanded clinical opportunities they provide.

Stephen Schueller, PhD, is assistant professor of psychological science at the University of California at Irvine, and executive editor of PsyberGuide, an online library that rates and reviews mental-health apps. He estimates that upwards of 10,000 applications are available. "Most are pretty bad; some are even potentially harmful," he says, adding: "[We] generally review only the two to four percent of apps that are evidence-based. We want to get those out to the public."

One 2015 survey concluded that most informational apps skimped on core psycho-educational principles, while monitoring apps generally failed to track such critical information as medication and sleep. Additionally, there are widespread concerns over what data is being gathered and who has the right to access it. A recent investigation in the *Journal of the American Medical Association*, for instance, found that 29 of 36 top-ranked apps for depression and smoking cessation shared data

with Google and Facebook that could have compromised individuals' privacy.

In light of the 21st Century Cures Act of 2016, in which Congress loosened regulation of some medical and mental health innovations, and with the FDA asserting plans to "reimagine" its oversight role when it comes to digital health technology, caution is imperative among clinicians and consumers alike.

The most ubiquitous conduit of portable mental health technology is the smartphone, even though it's not a perfect tool for gathering data. Current studies show that more than 80 percent of American adults own a smartphone, and they check it 96 times per day. About half of people who own a smartwatch, the most common consumer wearable, stick them in a drawer after acquiring them.

"The uptake doesn't require any additional thought. It's embedded in what people are doing on a day-to-day basis," says David Mohr, PhD, professor of preventive medicine at Northwestern University's medical school in Chicago, an APA Fellow, and founder and director of the Center for Behavioral Intervention Technologies at Northwestern.

Mohr's team has developed and studied a suite of apps called IntelliCare that offer interventions for anxiety and depression. Mohr also worked with a team that used GPS and other smartphone features to estimate the moods of unseen subjects by their level of movement and phone use, measuring both frequency and duration.

A side benefit of the study was to point up "numerous clinical opportunities" the smartphone offers, including "continuous monitoring of at-risk populations with little patient burden" and just-in-time adaptive interventions (JITAI), appropriate supports delivered when an individual needs them.

But Mohr says that his and other studies have been hard to reproduce because of demographic variabilities. For instance, the activity level of a 60-year-old in Milwaukee, Wisconsin, in January, is going to be different from that of a 25-year-old resident of Key West, Florida.

"I've become very skeptical about a lot of data," he says. "We're going to need to do much larger studies."

Future wearable devices may be even more individual, such as a sensor attached to the skin like a temporary tattoo, which sends data around the clock to a smartphone. Those data could be more precise than the information a phone can gather, and "the subject wouldn't need to remember to put it on every day," Mohr says.

At the same time, he says, researchers are going to have to do a better job of testing effectiveness—whether a device or an app will actually be useful in a care setting. Testing protocols for digital innovations must also be speeded up and otherwise adapted to reflect how quickly things change in the field, he says.

"Digital technologies are not fixed," Mohr says. "Even during a trial, we have to be continuously optimizing and updating. And so, what we should be testing is not the application but the principles. What is the digital service trying to do?" ●

"THERE ARE WIDESPREAD CONCERNS OVER WHAT DATA IS BEING GATHERED AND WHO HAS THE RIGHT TO ACCESS IT."

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KEYNOTE SPEAKERS

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MAJA MATARIĆ, PHD
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Can Psychologists Devise Smart Solutions for Smart Devices?

By Summer Allen

There are numerous advantages to adopting smart-home technology: positive health effects from being able to control a home's temperature; financial savings from using less electricity; and environmental benefits from decreasing one's carbon footprint. Plus, the ability to actively work against climate change may help alleviate what is being termed "climate grief," a growing phenomenon of sadness, grief, and guilt felt by those who observe or anticipate ecological devastation caused by climate change.

Despite these benefits and growing adoption of smart devices, only 13 percent of homes in the United States had a smart thermostat in 2018.

So why aren't more people adopting energy saving smart-home devices—and what can psychologists do to help?

Barriers to smart home technology adoption

"If there's a new technology, there's always skepticism, there are always concerns about privacy," says Chaiwoo Lee, PhD, research scientist at the Massachusetts Institute of Technology's AgeLab. "It's especially important for smart-home technologies, because the home is such a private environment."

Privacy concerns aside, some people find smart-home devices difficult to use. Lee has seen this in her research on older adults. Related to that is a lack of interoperability—or perceived interoperability—between different types of devices.

Cost is another barrier: People often can't afford or don't feel the need to upgrade to a pricey smart thermostat or water heater when they already have equipment that works.

And for some people, using smart devices can actually make them feel less in command, says Lee. "If [smart devices] are really monitoring you and managing your behaviors, there's a lack of autonomy that people feel, and they don't feel that they're in control," she says.

Unfortunately, when people have a hard time ceding control to their devices, it can cancel out the technology's environmental benefits. A recent study by Nicole Sintov, PhD, assistant professor of behavior, decision making and sustainability at the Ohio State University, and colleagues, found that people frequently adjusted their thermostat whether or not they had programmed it to run by itself.

"Ideally, the way that you would want this technology to work is for you to program it to an energy-saving setting and then you just let the program run, and that hopefully meets your comfort needs

as well as reduces your climate emissions," says Sintov, adding: "We did not necessarily see that.

"On the surface, and technically, these devices do offer the potential for energy savings," she says, "but then human behavior intervenes and can take that goal off course."

How psychologists can help

Fortunately, there are many ways that psychologists can help the planet, by encouraging more people to adopt smart-home devices and to use them in energy-efficient ways.

This work begins with the design of smart devices.

"The smart-home industry is really developer-driven at this point," says Lee. "There is still a shortage of research around who the users are, what they really need, and what's the context of use. I think psychologists can come in to fill that gap through user-experience research and design."

There's also a gap when it comes to marketing smart-home devices and communicating why and how to use them.

Lee and her colleagues have been studying how smart-home devices are advertised. "They're written in technical language that even I can't really understand—and I have an engineering background," says Lee. "That's another area where psychologists can come in so that products that can benefit people are not actually scaring people."

Clear messaging is particularly important when it comes to encouraging people to use smart devices in ways that decrease energy use.

"I think messaging can be improved," says Sintov. She notes that more successful messaging could use evidence-based approaches such as tapping into people's identity or social norms.

For example, one way to increase the use of smart-home devices might be to leverage dynamic social norms, communicating how more and more people are using smart devices to lower their carbon footprint—rather than giving a single number or percentage.

"Dynamic language is more effective at encouraging the target behavior than just describing the static state of affairs," says Sintov. Previous studies have shown this to be the case when it comes to encouraging people to engage in other positive environmental behaviors like eating less meat or avoiding disposable cups.

On the horizon

There's a lot we don't know about why people do and do not adopt both new technology and pro-environmental behaviors. This means there's plenty of opportunity for psychologists to put their skills to use in this space.

One exciting research avenue that could be applied to smart-home technology is the concept of behavioral spillover—which is when adopting one behavior leads to the adoption of other behaviors. A 2017 study by Sintov and colleagues found that people who began composting also started engaging in more energy- and water-conservation behaviors. A similar effect might be seen with the adoption of smart-home technology.

However, Sintov cautions that behavior doesn't always work that way: "There's been evidence showing that when you engage in one green behavior, you think, 'I've done my part,' and it makes you less likely to engage in subsequent positive behaviors," she says. "We have a lot more to learn in terms of what makes you likely to go down one pathway versus the other."

Sintov also notes that longitudinal studies could be useful for determining how people interact with smart-home devices in the real world over a period of time.

And then there's the question of whether and to what extent engaging in pro-environmental behaviors—like adopting smart-home technology—increases happiness or well-being.

"We're very focused on getting people to do more sustainable behavior," says Sintov. "I think we've paid less attention to how that impacts people's lives in other ways. How does it impact their well-being?"

If psychologists can help provide answers to these questions, it may encourage more people to turn their homes into smart homes—another part of trying to protect the well-being of our Earth home.

As the U.S. Stays Home, **Psychology Moves Online**

By Kirk Waldroff

From Monitor on Psychology, *May 11, 2020*

The COVID-19 pandemic forced thousands of psychologists to retool their practices for telehealth and move research online.

AS THE U.S. STAYS HOME, PSYCHOLOGY MOVES ONLINE

Prior to 2020, Nina Shiffrin, PhD, a psychologist in Rockville, Maryland, conducted about 10% of her therapy sessions with patients online. Teletherapy was a flexible solution she used to accommodate the occasional adult patient unable to leave work at midday or children who couldn't get to Shiffrin's office on their own.

But in March 2020, when a state of emergency was announced in the United States because of the coronavirus pandemic and state governments began issuing stay-at-home orders, she quickly pivoted to move 100% of her patients to telehealth services.

Thousands of psychologists have made the same pivot. Many, like Shiffrin, are practitioners who are rapidly getting themselves—and their patients—up to speed on telehealth. Others are research scientists who are rushing to adopt new data-gathering methodologies or to protect animal subjects. Likewise, educators have been called on to become more versed in distance learning software and are building robust online connections with students.

The common thread for all psychologists dealing with the new reality ushered in by the pandemic has been the need for flexibility and creativity. "We're finding new ways to help, mostly small, but we're doing what we can. Across my university faculty, staff and students have really pulled together," says Jeff Zacks, PhD, head of the Dynamic Cognition Laboratory at Washington University in St. Louis.

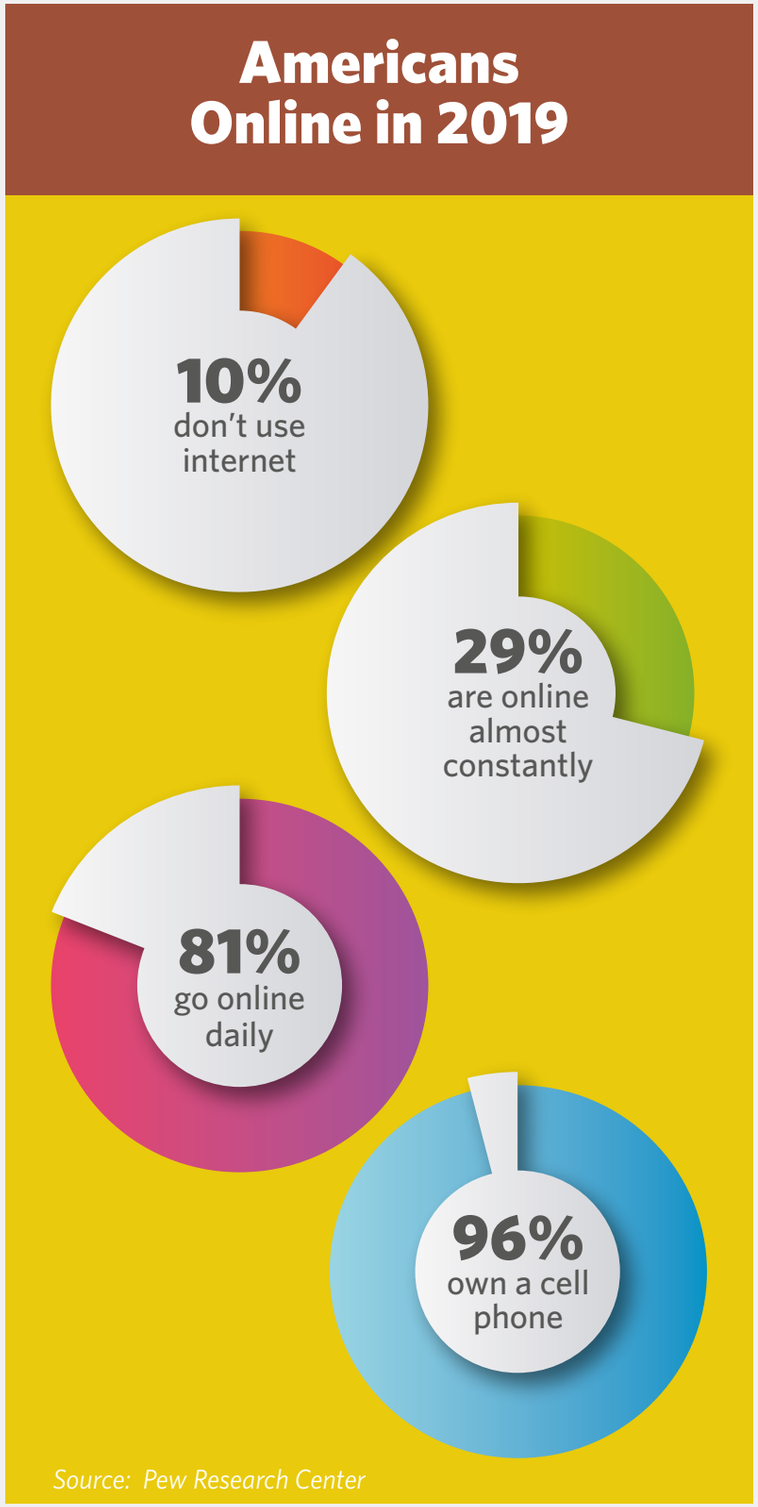
Telehealth hassles and rewards

While many practitioners had some experience using telehealth platforms prior to the onset of the pandemic, few were using them as their exclusive means for conducting therapy sessions. In just a few weeks, that changed dramatically. Like Shiffrin, many practitioners moved their entire caseloads online as federal and state regulations changed to encourage expanded access to telehealth (see article, Technology expands to meet demand).

For some psychologists, issues with logistics, such as having a spotty internet connection or not having a laptop with a built-in camera, have proven challenging. And since patients may be dealing with the same issues, practitioners have, at times, had to play the dual role of health-care and IT service provider.

There are also case-specific challenges that have forced psychologists to get creative. For example, practitioners have reported advising patients who live in close quarters with others to get in a car and drive to a parking lot for their telehealth sessions. "While not ideal, joining a session from the privacy of a car is preferable to potential eavesdropping by a roommate or partner," says Kristi K. Phillips, PsyD, chair of APA's Committee on Rural Health and a psychologist in Litchfield, Minnesota.

Meanwhile, providing online care to children comes with its own set of challenges. According to an APA fact sheet, without the control of the clinical setting, practitioners must pay close attention to the space on the other side of the screen



as children may become more easily distracted or may require more room for hands-on activities. And psychologists working with vulnerable children must also be more vigilant about looking for warning signs of abuse and neglect during this time.

Despite such challenges, some practitioners also are experiencing pleasant surprises while shifting to telehealth. Several of Phillips's patients, for example, have told her that learning to use Zoom during their telehealth sessions empowered them to use the platform to better connect with friends and family as well—for Phillips, an unexpected and rewarding side effect. Others note that having a glimpse into where their patients live offers them insights that they previously wouldn't have had access to.

Studies on hold

Psychological scientists are also confronting major challenges as the COVID-19 crisis unfolds (see article, Researchers mobilize to study impact of COVID-19). Even labs that were already conducting a significant amount of online research are feeling the effects. Zacks's Dynamic Cognition Laboratory, for example, has been conducting both small- and large-scale online studies for several years now, and it launched two new online studies in April, which likely won't be severely affected by the pandemic. But Zacks has had to place fMRI and eye-tracking studies on hold because they rely on face-to-face interaction.

Besides the research studies that are taking a hit, Zacks and his colleagues are concerned about students who were assigned to participate in experiments as part of their learning coursework. "At my university, instructors have altered the assignments, and we're making more experiments available online; these seem to be helping," he says.

Many researchers and students question whether they'll be able to continue to use funding for studies that now require altered (from in-person to online) data-gathering methodologies.

Meanwhile, other researchers simply have no online options. Researchers working with animals, for instance, are not able to interact with their subjects online. The setbacks go well beyond forfeiting data collection. Animal lineages that were created over months and even years—while being kept physically safe by essential staff—are now missing the meticulous level of attention provided by research staff and, as a result, may fall outside the parameters of experiments and be rendered unusable.

"This loss means much more to me than deficits of time and resources and is something animal researchers in particular will have to bear moving forward," says Siara Rouzer, a behavioral neuroscience graduate student at Binghamton University in New York who uses rat models to study fetal alcohol disorders.

Empty classrooms

Psychology teachers and students have experienced massive changes as well. Fortunately, most academic institutions had e-learning capabilities in place prior to the COVID-19 pandemic. In these institutions, teachers have been able to draw heavily on support from their institutional technology office or instructional design team (see article, Enhancing online learning).

Regan Gurung, PhD, director of the general psychology program at Oregon State University and executive director of the Center for Teaching and Learning (CTL), says his university's eCampus unit and CTL have been working long hours to help faculty get up and running with remote teaching.

Yet even with tools and tech support in place, there are formidable challenges for teachers. Helping students who have never used online learning resources and figuring out effective ways to keep track of students who are not participating are particular challenges, Gurung says. Other concerns include helping remote students learn from one another and promoting a sense of community among remote students.

Overall, the rapid shift to working online has touched every corner of society, and psychology. While some psychologists were already familiar with working online before the pandemic, most are now fully embracing online platforms in a more comprehensive way out of necessity. "We're all being creative to make sure everything we do is in the best interest of our patients, subjects and students," Phillips says. •

Read the full article.

How Did You Get That Job?

UX expert Laura Faulkner, PhD, is head of user experience research at Rackspace, a company that helps businesses develop and manage cloud-computing solutions. She uses her psychological expertise to help companies better understand how people experience, perceive, and respond to products or services.

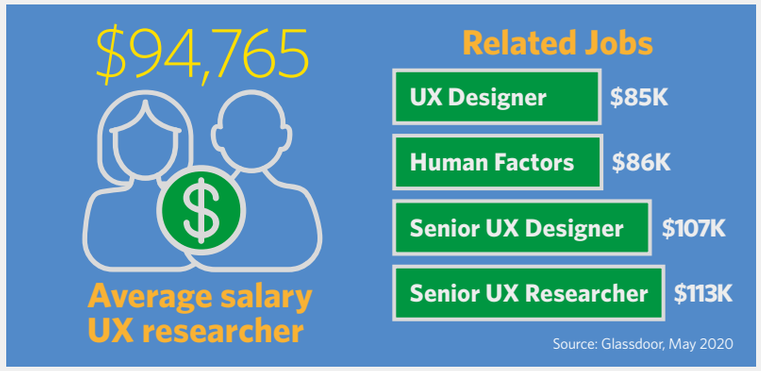
What Is a typical day like?

We meet with the business and product people about what they want to create, then we spend time with engineers and software developers to understand what outcomes are needed, what the problems are, and which interventions helped. A lot of what I do is to apply what I know about how the human mind works in terms of goals, motivations, perceptions, and behavior. The idea is to make things easy for a wide range of audiences while accounting for individual differences and business goals. It's challenging and never dull.

How did you train for this?

I began my own tech career in technical writing. Within days, I realized that the pages of instructions were indicators of complexity in the experience. I learned that simplifying interfaces to be more intuitive could replace user stress with delight! Applying my human sciences background, I went on to complete a doctorate in research psychology.

User-experience research is done through qualitative research sessions, some statistical research, and user analytics. The practice has specific methodologies you can learn in degree programs, professional workshops, or certification courses. A psychology research background is a powerful and competitive foundation for the UX research practice. It prepares you beyond methods into ways of thinking: You can understand how to design instruments and studies to reveal what humans are thinking and how they are likely to behave. This foundational knowledge of neuroscience, behavior, motivation, and perception can enable you to simplify experiences for real-world users and design effective and enjoyable digital products.



Where are the most jobs?

UX research and UX design are potential career paths which overlap and complement each other through discovery and problem-solving. Companies like Microsoft, Google, and Twitter hire from psychology backgrounds—especially in the research practice—because we combine human science with disciplined research methods. Psychology can bring respected, valuable, and impactful contributions to the experiences of humans everywhere.

Being There: **VR and the Compassion Factor**

By Katharine Carter

Researchers are using VR simulations of mental illness, homelessness, and racism to help increase compassion for disenfranchised groups.

BEING THERE: VR AND THE COMPASSION FACTOR

Virtual reality (VR) has been used for more than 25 years by psychologists to research, assess, and treat mental illnesses—most notably as exposure therapy for those suffering from phobias, anxiety, addiction, and post-traumatic stress disorder.

The tactile, interactive nature of VR also has made it a fertile medium for exploration of empathy, by placing users in immersive environments where they experience a specific situation from another person's point of view.

The lasting effects of this "in another's shoes" approach are being studied by psychologists and others with various results, but researchers believe that VR-based empathy may have powerful implications for destigmatizing disenfranchised groups, including the mentally ill.

At the Media Effects and Technology Lab at the University of Florida (UF), researchers conducted virtual simulations of psychosis, where participants experienced an augmented reality experience of auditory and visual hallucinations. Their goal was to measure whether VR could be used to help battle negative stereotypes of schizophrenia.

One group of participants was able to interact with voices, visions, and experiences inserted into their real environment. Another group participated solely in a textual exercise that described a schizophrenic episode and asked them to write about how they would feel if it were real.

In general, study results showed that VR was more effective in generating empathetic attitudes towards people with schizophrenia than the written exercise alone. Feeling greater empathy doesn't always translate to feeling more comfortable around people with different life experiences, however.

James Ivory, PhD, a co-author of the UF study, notes: "While the VR experience was effective at making people feel empathy, it was also disturbing enough that it made them less comfortable being around people with schizophrenia."

Personalizing the experience of homelessness

Stanford's Virtual Human Interaction Lab is in the forefront of teasing out the subtleties of empathy and immersive virtual-reality technology. Among their work is a longitudinal study of VR and empathy, an examination of racism with VR, and a virtual reality experience of being homeless.

"These types of VR programs use your senses and movement to trigger experiences inside the VR world," explains Jeremy Bailenson, PhD, the founding director of Stanford's lab. "Turning your head and moving your hands is what makes the VR program interactive," he explains. "If you aren't doing that, you might as well be watching TV."

In his lab's "Becoming Homeless" project, which simulates an actual eviction that leads to homelessness, virtual participants find themselves inside their own apartment, with a landlord banging at the door to collect rent. Eventually, participants have the virtual experience of living in their car and spending a night trying to survive on the street.

"VR takes the distress another person is experiencing and makes it personal," notes Bailenson.

A 2018 study showed that those who were immersed in a VR scenario of being homeless reported more positive attitudes toward the homeless, compared to those who heard a story about being homeless, differences that were evident even 8 weeks later. They also were more likely to sign petitions to advocate for them months after their participation.

VR can also be used to address racial and gender bias, including discrimination in the workplace. Bailenson points to VR role-playing programs that corporations have used in training where users become immersed in a learning scenario where non-inclusive behavior has taken place. Within this controlled setting, participants are then able to engage in what are often difficult conversations and can gain confidence in developing more sensitive behavior through virtual role-play activity.

"VR brings empathy out of people through trial and error—something we can't always do in real life, but is easy in a virtual world where experiences can happen on demand," says Bailenson. Situations can also happen repeatedly and can be adjusted to fit different outcomes.

Virtual racism

Empathy-building VR tools also are becoming a part of the public discourse around other hot-button issues, including racism.

Dr. Courtney Cogburn, PhD, associate professor at Columbia University, conducts research on the characterization and measurement of racism. She has developed a virtual video game that allows the viewer to experience multiple forms of

racism through the eyes of the main character.

Her research focuses on measuring the physical effects of the racist narrative on participants, including heart rate and blood pressure, to examine how virtual reality can "induce empathy for people different from oneself."

An extension of that work, which is highly scalable for public consumption, is an immersive virtual-reality film experience that she co-created with Stanford's Virtual Human Interaction Lab, that allows the viewer to experience multiple forms of racism through the eyes of the main character.

The film, 100 Cut Journey, which premiered at the Tribeca Film Festival in 2018, is their first-person embodiment of an African American male experiencing various forms of racism within a single day. Experiences include seeing news reports that relate to you personally and encounters with police that fill you with fear.

"Black men and police violence were dominating the discourse so that seemed to be a good place to put the VR experience," notes Cogburn, especially since data show that black males are more likely to encounter police violence than any other group.

"I didn't want it to feel like entertainment, wanted it to be more literal; I wanted it to be more completive and more reflective," she says.

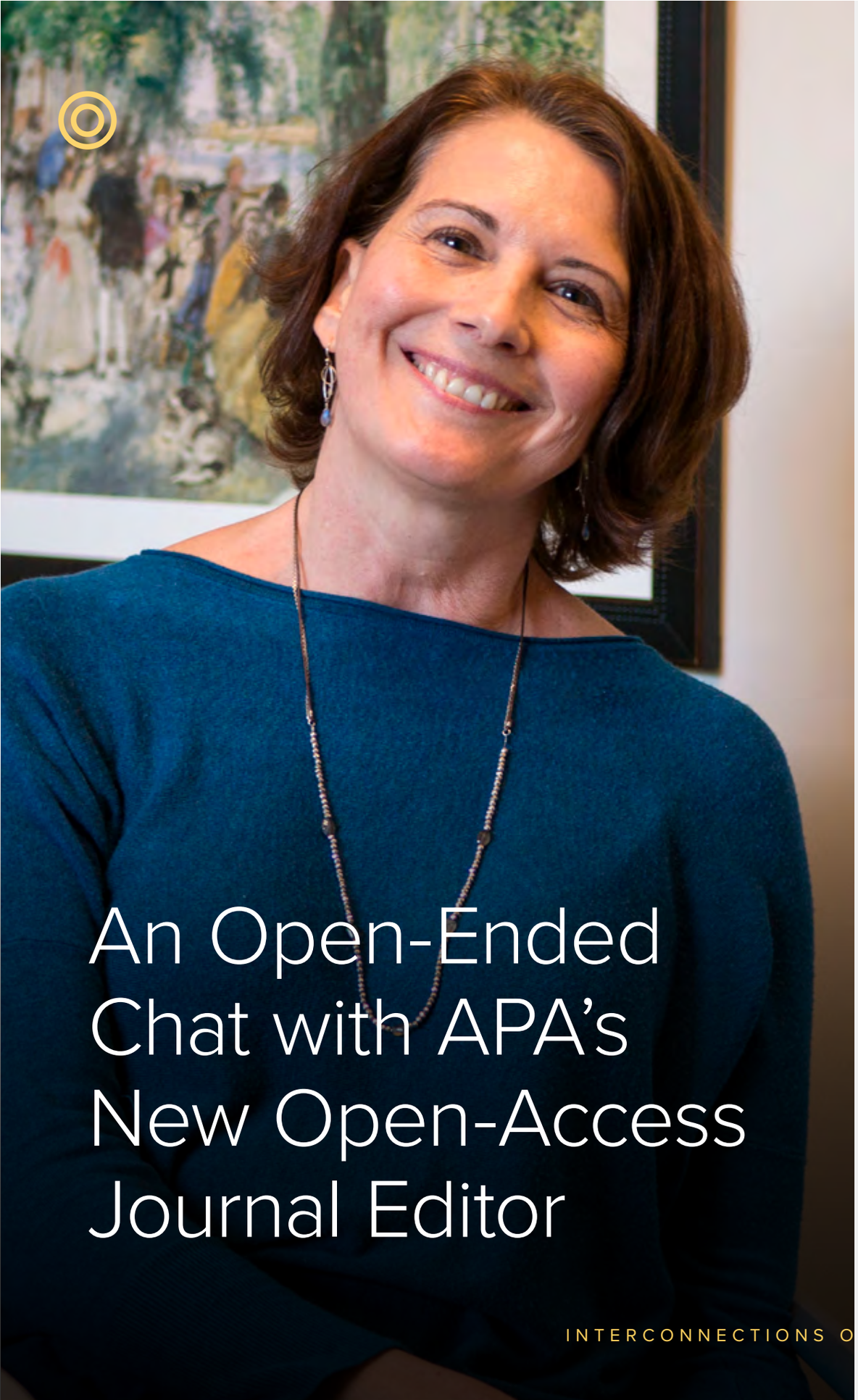
After viewing the VR film, semi-structured interviews with participants revealed that people were more willing to talk about race issues after the experience of being on the receiving end of racism.

She hopes to gather additional data to determine if the experience of the VR film translates to action. "I want to analyze the effects over time, not just when someone comes out from the movie, but months later," she says.

While a VR experience like Cogburn's is targeted to people who have expressed that they are willing to experience a lot of discomfort in order to be more empathic, that doesn't mean it would be less effective for people who didn't sign up for it, she says.

The real value of immersive experience in other worlds is its positive effects in this one, she observes.

"We want to go beyond people saying, 'That's just awful that this is happening,'" says Cogburn. "Personal feelings don't do anything for the social good, it has to translate to acting differently. [Empathy] can change how you engage the world around you." ●



An Open-Ended Chat with APA's New Open-Access Journal Editor

Danielle S. McNamara, PhD, inaugural editor of APA's flagship open-access journal, Technology, Mind and Behavior, *is professor of psychology and director of the Science of Learning and Educational Technology Lab at Arizona State University. The author of more than 400 papers, her research focuses on understanding cognitive processes involved in comprehension, writing, knowledge acquisition, and memory—and the development and testing of educational technologies. She has served as associate editor of five peer-reviewed journals, most recently,* International Journal of Artificial Intelligence in Education *(2011–2020) and* Journal of Learning and Instruction *(2018–2020).*

She sat down to speak with APA editorial staff just before the open-access journal launched in June 2020.

Q How does this journal carve out new space in the technology-psychology literature?

There are journals that focus on engineering and the development of systems … but few have the ability to talk about research that involves technology and how it impacts behavior and the mind—from a psychological perspective. For example, I might do research that involves creating algorithms, or do AI, creating a model that is mimicking human behavior. But that doesn't necessarily show me how it impacts behavior or help me to understand why a human being is doing it.

Q Who is the intended audience?

One aspect of the journal is that the authors are being asked to write to a diverse audience, so the topic and how the topics are written will be more accessible than a cognitive research journal. It's often hard to understand research that doesn't have a link to practical experience. It is going to have information that is useful. I hope that there are going to be clinicians who don't do research, but who are simply practicing in the field, who will find information we offer useful. That said, this isn't a journal that necessarily targets the lay person.

Why open-access publishing?

APA wanted to promote broad access to the most current, high-quality research—and online access to articles is an important part of staying relevant in this interdisciplinary market. When open access first started 15 years ago, it was held in disdain by many researchers, who assumed that if you are paying to publish … that might mean that it was lower quality. Now, many universities, governmental agencies, and granting institutions are starting to even require it; they want all of the papers put online. APA pays one-third of the journal's nominal article-processing fees and even offers waivers in some circumstances.

How is this editorial experience different from your previous ones?

I think for every journal I've done I've stepped just a little over my comfort zone. This was a grand leap into the precipice. One of the things that I really like about the journal is that every time I open a submission, I'm excited. It's like, 'Oh! I didn't know someone was researching this!' The topics are fascinating. There are really exciting avenues of research in this domain and questions that can be asked from many perspectives.

Who is on the editorial board? How were they selected?

My first associate editor is Shawn Greene, and I plan to bring on others as the journal unfolds. We have an editorial board of about 30 that is representative of a mix of disciplines, including clinical psychology, industrial/organizational, social psychology, educational technologies. The objective was to choose people who have the right expertise to represent the diversity of articles we expect. I say that with the caveat that I don't fully know what to expect. After this first year, I'll be better prepared to understand where the readership and submissions are and what gaps to fill.

"I'M PERSONALLY VESTED IN WRITING QUALITY … THE NECESSITY OF FEEDBACK, HAVING CO-AUTHORS, GOING MULTIPLE ROUNDS."

What's your approach to guiding editors in working with authors?

Well, there are different thresholds among journals in how much they will work with an author so that the good science is well-conveyed. With some, if it's going to take more than two revisions, the associate editors call it off in the beginning. I'm personally encouraging more of a mentorship journal. I'm only looking for the fatal flaw and the fix: Is there a fatal flaw in the science or can we fix it? Is it just a bad introduction or analysis? I'm personally vested in research on writing quality and how people learn to write, the necessity of feedback, how good it is to have it read to others before you submit, having co-authors, going multiple rounds … I could talk about this for a long, long time.

How robust was your opening call for submissions?

I'm happy with the number of submissions, although we have a pretty robust rejection rate as well. You try to choose a diverse set of reviewers and then we're being quite selective in what we're publishing. What I like about the initial set of four articles in our inaugural issue is that they really represent the diversity of topics. And they are implicitly linked to our situation in various ways in how technology has an increasing impact on us in the COVID-era.

While journals do publish independently of organizations, I'm wondering what TMB's association with APA means to you?

It's a new endeavor for APA in many realms—the topic and the fact that it's open access. APA is a very large association and it represents a diverse set of fields. I probably would not have taken it on if it were not an APA journal. That was exciting to me: It is reaching out to a very large audience and supported by a powerful machine. ●

Technology, Mind, and Behavior

APA Open

Technology, Mind, and Behavior (*TMB*) is an open access, interdisciplinary journal from the American Psychological Association. *TMB* publishes original work in the area of human–technology interaction with a focus on human behavior at the individual or group level.

Committed to open science and transparency, *TMB* is part of APA Open: a new, interactive open access platform. Authors are empowered to dynamically present their research findings to immerse readers in ways going beyond standard PDF experiences.

"There is one indisputable certainty in this new world: Like it or not, technology is at the heart of it ... We hope that TMB *provides a home for your research and a primary source when you have questions about the intersections among technology, mind, and behavior. I am confident that these intersections will surprise and inspire, and I am hopeful that they will also help to mend."*

Danielle S. McNamara, PhD
Editor of *Technology, Mind, and Behavior*

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TECHNO FERENCE

Is Our Attachment to Technology **Hurting Our Attachments?**

By Delia O'Hara

Digital technology has provided an unprecedented lifeline of communication during the coronavirus pandemic, but researchers haven't forgotten how troublesome it can be for relationships in more normal times.

The problem is that digital devices—often smartphones—can profoundly interrupt interactions among people in close networks, including spouses, children, and friends.

"Are we thinking about how these other people feel about the way we're using our devices?" says Brandon McDaniel PhD, a researcher at the Parkview Mirro Center for Research and Innovation in Fort Wayne, Indiana.

He and colleagues coined the term "technoference" in 2012 to describe the disruptions that often occur when devices, and our use of them, intrude on interactions between couples and among families.

In a 2016 study of 143 women in committed heterosexual relationships, McDaniel's team found that around 70 percent of participants thought smartphones and other technology interfered with their relationships by intruding on time the couple spent together. Even with brief, unintentional technoference, the partner using the device may appear to be sending "implicit messages about what they value most," the study found.

A growing disconnect

The scope of technical usage, and its potential to both connect and alienate users, is only growing. About 81% of all Americans own smartphones, according to the Pew Research Center, up from 35% in 2011. More than one-quarter of survey recipients told Pew in 2018 that they are online "almost constantly."

One prevalent example of technoference is so-called "phubbing," or phone snubbing. This occurs when we ignore the people we're with in a social situation to concentrate on a cellphone call, text, or other prompt. As with other types of technoference, research has shown that phubbing can negatively affect relationships by threatening a basic human need to belong.

"[Digital technologies] allow us to achieve so many goals," says Richard Slatcher, PhD, director of University of Georgia's Close Relationships Laboratory. They help us connect with other people, share thoughts, and ideally get positive feedback—such as "likes" on social media posts.

Many of these activities are based in behaviors that have helped people develop intimate relationships since the dawn of time. However, the same type of conduct, when performed on digital devices, can activate those satisfying feelings without truly bolstering our relationships, notes Slatcher.

"Over 80% of social media activity involves simply announcing or broadcasting one's immediate experience," the study states.

"You're not forming a deep connection with another person," Slatcher stresses. "Real closeness among people has to happen in small groups—one or two people, five at the most. Depth wins out over breadth."

A family issue

The phenomenon of technoference is even more complex in parent-child relationships, since parents are called on, variously, to be teachers, curators, and limit-setters of technology usage.

Alexis Lauricella, associate professor at the Erickson Institute in Chicago, notes that, while parents often express concern about technoference in their children's use of digital technology, they may show some lapses in their own usage.

"Parents' attitudes toward the technology don't always replicate their own behaviors," she says. "A lot of parents say, 'I'm concerned about my kid being on the screen too long,' but what we know from the data is that it's often kids asking parents to get off their device, to pay attention and talk with them."

Lauricella, who also directs Erikson's Technology in Early Childhood Center, found in a 2015 study that children's use of digital technology was "highly influenced by parental attitudes."

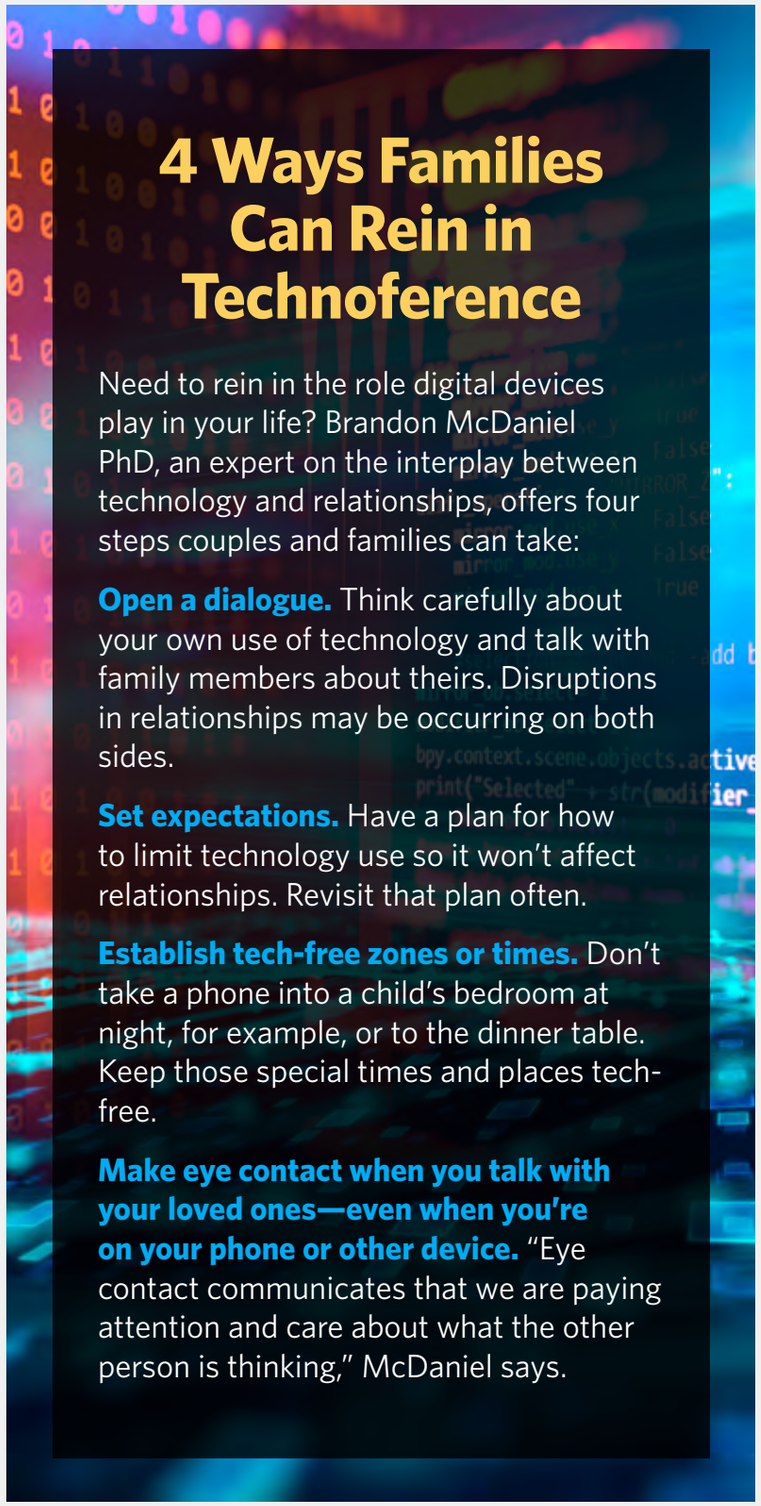
She recommends that parents turn their scrutiny about technoference on themselves as part of setting limits with children: "How are you modeling interactions around the device? Are you putting down your own phone and engaging?" she asks. "And parents should be having those conversations, talking with their kids about their own struggles. It's not easy for anybody and that's why everybody is on the phone so much of the time. It's hard to put it away."

In a 2018 longitudinal study of parental technology use, parenting stress, and child behavior problems, Brandon McDaniel identified a loop that can begin when parents seek solace in their devices when their children act out. This can "change whether the parents notice that a child has a particular need; it can change how they interpret that need; how they respond to it—even whether they respond at all."

For very young children, technoference can play a big role in their development, McDaniel says: "It can influence how they interact with others, and how they feel about themselves." As the prevalence of smartphone usage proliferates in the teen years, the emotional and social ramifications of technoference on children can ratchet up even further.

"Start the rules before you need them," Lauricella advises. "Your adolescent is going to fight you on phone use, but that's normal. Be consistent." Children don't need to think of the phone they carry as their particular possession, any more than the car they drive, she says.

In general, Lauricella appreciates the educational and social potential of digital technology. She is definitely not a fan of limiting children's digital "screen time" on principle: "If we're going to think about time, instead, let's make sure they're not doing anything too much. Sign them up for soccer, sit down and play Legos with them. Diversify their experiences." •



How Did You Get That Job?

As lead experience researcher at Airbnb, Christine Berry, MA, uses her psychology training to work with designers, product managers, and engineers to build technology products that people can easily use.

How did your graduate school training prepare you for this work?

The biggest skills are the research methods. I was in an interdisciplinary program with professors from psychology, anthropology, and sociology, so I was able to take classes in various fields and learn how different disciplines approach research. From the anthropologists I learned a lot about ethnographic research, which is great to apply now to my qualitative work.

Another thing that was useful for me was that I have one degree in counseling psychology. You don't have to be a counselor to become a UX researcher or even a qualitative researcher generally, but it was useful for me to have the training to sit with someone and interview them, to ask them questions.

What was your biggest challenge?

I think the most difficult thing for me personally was developing the technology and design skills. As a UX researcher, one of the things I have to do is to help inform our team on how the design should look and work, but I don't have a design background.

I got that knowledge through the research I did in my very first job as a UX researcher for a consulting company that works with lots of different brands. I learned about best practices for how certain kinds of buttons should look on the website, or how I should think about the checkout flow and someone putting in their credit card [information].

What advice do you have for psychologists just starting out?

The number one piece of advice is to build your network as wide as you can. Go wherever you can meet various people who are in that field. Connect with them on LinkedIn. You never know who is going to know someone who's going to know someone.

All companies hire entry-level researchers and higher-level researchers, so it really varies on what they need at that time. I found consulting to be a great place to get started because you can learn a lot of different skills in a short amount of time … working for different kinds of companies. After a few years, I could narrow down my next job search to be more focused on what I wanted to do. I also want to mention that a lot of the big tech companies do hire people straight out of grad school.

PRIMER:

Understanding Augmented Cognition and Brain Interference

By Sharat J. Vayttaden

Nowhere are the interconnections of psychology and technology more promising—and potentially concerning—than in the use of non-invasive brain stimulation technologies (NIBS) to modulate brain function.

Borne of rapid advances in understanding of human cognition and behavior during the 1990s, a range of powerful, non-invasive brain stimulation technologies (NIBS) have emerged that help us to study and monitor the brain, treat resistant psychiatric disorders, and even to enhance human cognition and performance.

Several of these augmentation cognition technologies—including Transcranial Direct Current Stimulation (tDCS) and Transcranial Magnetic Stimulation (TMS)—are evolving as tools with great promise in the treatment of a range of psychiatric disorders, including depression, schizophrenia, manic states, schizoaffective disorder, schizophreniform disorder, and catatonia.

As these technologies increasingly make their way into clinical practice, it is important to have a basic understanding of how they differ, which are most promising for therapeutic use, and how their proliferation in non-clinical settings is raising concerns for safety and privacy.

Applications for mental health

NIBS techniques have long been used to treat pain, migraine and tinnitus. They also have shown promise in addressing mental health disorders, notably, persistent depression. The two most commonly employed therapeutic techniques are TMS and tDCS.

TMS, which was introduced in 1985, entails application of a strong electric current to targeted regions of the brain via electromagnetic induction. Coils placed on the head deliver the currents, which can be delivered singly or repetitively to produce different effects—especially when targeting specific areas of the cortex. TMS has been shown to improve some symptoms of treatment-resistant depression and is FDA-approved.

With tDCS, a constant, weak current is applied to the brain by electrodes placed on the scalp. These techniques work by activating neurons in a region of the brain that either stimulates a response or inhibits an action. The excitory or inhibitory effect depends on electrode placement and other factors. Like TMS, tDCS is showing promise for the treatment of major depressive disorder.

Despite the promising research, the U.S. Food and Drug Administration (FDA) hasn't approved all these techniques for all outcomes; however, there are a few research programs around the country where these techniques are being employed as investigational therapies.

Using NIBs with other therapies

While there are many years of data on the efficacy of combining psychotherapy and pharmacotherapy for treating mental health disorders,

Common NIBS Techniques	
Electricity	
ECT	Electroconvulsive Therapy involves small electric currents passed through the brain under general anesthesia, triggering a brief seizure.
tDCS	Transcranial Direct Current Stimulation passes low-intensity direct current through two electrodes placed over the head, altering brain activity.
tACS	Transcranial Alternating Current Stimulation is similar to tDCS, but involves passing alternating current instead of direct current.
tRNS	Transcranial Random Noise Stimulation is similar to tACS, but passes alternating current at random frequencies.
Magnetism	
TMS	Transcranial Magnetic Stimulation involves passing magnetic pulses through an electromagnetic coil placed against the scalp which alters brain activity.
Ultrasound	
tFUS	Transcranial Focused Ultrasound involves passing low-intensity, low-frequency ultrasound to specific regions of the brain.

research is still relatively new on the effects of introducing non-invasive brain stimulation methods into the mix.

Some research findings are contradictory; however, recent studies show enhanced benefits of psychotherapy when coupled either concurrently or sequentially with tDCS to treat patients with depression—when combined with therapy and/or medication.

One meta-analysis of data taken from 289 patients receiving active tDCS for major depression showed a 33.3% reduction of depression symptoms compared with only 19% from the placebo group. The remission rate was 23.1% vs. 12.7%, respectively.

Of all the NIBS, tDCS is likely the easiest one to introduce into therapeutic settings. Because it is small and battery powered, it can be delivered by a trained health care professional in a much wider setting than TMS, allowing it to be paired easily with concurrent behavioral approaches, like cognitive behavioral therapy.

Application of tDCS during psychotherapy is quieter when compared to techniques such as TMS, in which stimulation produces an audible clicking noise. Additionally, TMS elicits sensations due to contraction of scalp muscles and excitation of peripheral nerves while tDCS only tends to cause momentary tingling sensations.

Non-therapeutic cognitive enhancement

NIBS methods to alter brain function don't require anesthesia, and since they are non-invasive, they are poised to play a role in the future of work, sports, AI, and the military.

The Federal Defense Advanced Research Projects Agency (DARPA) is funding research on an implanted, closed-loop diagnostic and therapeutic system for treating, and possibly curing, neuropsychiatric illness among military personnel, among other applications. It now is stepping up research on the nonsurgical future of brain-machine interfaces for both health and military applications. Non-invasive interventions could be used to support military training by accelerating and improving the performance of complex, military-relevant skills by healthy individuals.

"Just as service members put on protective and tactical gear in preparation for a mission, in the future they might put on a headset containing a neural interface," noted program manager Al Emondi in a news release.

A question of ethics and access

These applications have wider implications outside of warfare and raise a battery of questions.

Could developments in NIBS help improve a surgeon's skills? Would they lead to better trading on the stock market? What if children used NIBS in school to learn and perform better? And how might the cost and availability of augmented cognition alter the future of work in yet unknown ways and put some sectors of society at a disadvantage due to unequal access to technology?

The science behind augmented cognition through NIBS is still young. No two brains are

alike, and patients respond differently to different NIBS methods.

Much more research is required to understand how these augmented cognition techniques work—especially as these technologies are making their way, unregulated, into the consumer market.

"It is very easy to purchase a tDCS device from Amazon," notes Rajani Sebastian, PhD, Assistant Professor at the Johns Hopkins Department of Physical Medicine and Rehabilitation. "It is important to place the electrode in the correct location on the scalp and even a small change in a few centimeters could potentially change the effect of tDCS." Such safety issues are of pointed concern for other NIBS techniques too.

"Privacy issues are also important, as devices for augmented cognition are likely to be 'always connected' with access to highly detailed neural and non-neural and behavioral information that could be used in many different ways by third parties," notes expert Jose Contreras-Vidal, PhD, director of Noninvasive Brain-Machine Interface Systems Lab at the University of Houston.

"In fact," he adds, "if this information becomes available, highly detailed models of personalized brains (i.e., digital brains) could be built, which could be used to predict behavioral/neural responses, capabilities, and other variables in response to changes in environmental variables, including social interaction or interaction with the external world."

These questions—and the technologies that could make them a reality—are being studied and debated globally by scientists and others. Among the most wide-reaching of these is the IEEE Brain Initiative, a cross-disciplinary alliance of engineers and neuroscientists established by a public-private partnership in 2015. Their mission is to advance research, standardization, and development of engineering and technology that expands our understanding of the brain for the betterment of the human condition.

What does the future hold?

Using tools to become smarter is ingrained in human nature. With so many technologies on the horizon it is challenging to posit which will hold the most immediate promise.

Contreras-Vidal envisions a day when these techniques, combined with AI-driven digital assistants like Alexa or Siri, may change what it means to think like a human.

"Intelligent cognitive assistants are one of the technologies with the most promise to be actually doable in the near future," Contreras-Vidal says. "We are designing cognitive assistants which monitor neural activity and behavior in real-time."

These assistants can hold actual conversations with users in natural language built on common heuristics and biases that speed human decision-making. In this way, the technology is now able to enhance—rather than replace—human intelligence.

"They can alter the future of work across areas, from medicine and design, to information processing and augmentation of human-device interaction," he says.

Given the transformative nature of these neurotechnologies it is essential that guidelines are in place for their use and development. "By design, augmented cognition requires the close interaction between psychologists, engineers and neuroscientists. Ethical and legal aspects are also very important, particularly for medical or prosthetic applications," says Contreras-Vidal.

"In the same way technology can 'change the game' in sports competitions," he adds, "augmented cognition may put some sectors of society at a disadvantage due to unequal access to technology, beliefs, and alter the future of work in yet unknown ways."

Working groups across federal agencies and professional societies—including APA, the Society for Neuroscience and the IEEE—are very much engaged in understanding the scientific, clinical, ethical, and regulatory issues this burgeoning field presents. ●

Watch the APA video:
Neuroethics: Addressing the Good, the Bad and the Ugly

Eldercare:

Has the Market Arrived for Social Robots?

By Steve Outing

Technology experts have long predicted an increased use of socially assistive robots in working with the elderly, as the work of caring for an increasingly aging population is compounded by a growing shortage of caregivers. There have been many experiments and early products with minimal sales, but social robots have yet to reach the point where they can be found in most elder-care facilities and seniors' homes.

That may be changing more rapidly than expected: The coronoavirus pandemic sent caregivers scrambling to deal with health threats and contagion, while increased social isolation has taken a pronounced toll on seniors' mental health.

Robot experts believe that the COVID-19 crisis will jump-start adoption of more robots being deployed—more social robots to address isolation and loneliness, and more functional robots to perform care tasks, thus reducing contagion risk.

"Robotics and automation could play a major role in combating infectious diseases, such as COVID-19," wrote roboticist Guang-Zhong Yang et al. in a recent editorial in *ScienceRobotics*, adding: "Robots have the potential to be deployed for dis-

infection, delivering medications and food, measuring vital signs, and assisting border controls. As epidemics escalate, the potential roles of robotics are becoming increasingly clear," they said.

The term "social robots" refers to a wide array of robots that are designed for working with, interacting with, or evoking responses from humans. Roboticists have recognized the need for developing companion and assistive robots for the elderly for decades.

Pearl the Nursebot was a prototype robotic assistant for the elderly developed by university researchers in 2004. A furry robotic seal, the interactive "carebot" Paro, has been used for more than a decade to comfort and calm people with dementia. A newer generation of interactive robot pets, such as Joy For All and Tombot, have been developed specifically to ameliorate behavioral and psychological symptoms of dementia.

A more ambitiously capable companion robot is Care-O-bot, a German project dating to 1998 and updated to its fourth and latest iteration in 2015. It has the look of a "stereotypical" robot: It wheels around independently, has articulating arms and a large screen head. Among its uses are transporting objects and serving food to residents or patients in care homes and hospitals.

Some of the most recent crop of social robots targeted at seniors try to get their users to respond to them as though they were living beings—which may not be so far-fetched.

Working with psychologists and social scientists, roboticists have made great strides in building

Snapshot of Companion Robots for the Elderly

Current prices range from up to $18,000 for the humanoid robot Zora, to $1,500 for the sidekick ElliQ, to less than $400 for robotic animal companions like Tombot.

ElliQ: AI-driven tabletop companion and family-communication tool marketed as a "dedicated sidekick" for the elderly.

Zora: Walking humanoid companionship robot that can be controlled by a caregiver to lead exercises and play games. Designed specifically for geriatric health care to serve as a "nurse's aide."

iPal: Cartoon-style moving humanoid robot companion for elderly, which can monitor safety, give medication reminders, and supplement human caregivers.

Buddy: Moving "emotional companion robot" and personal assistant with telepresence. Its "cute" digital screen face "has a range of emotions that he will express naturally throughout the day based on his interactions."

Misa: Small cartoon-style moving robot companion and personal assistant, with telepresence and Q&A capabilities, entertainment, and edutainment.

SAM: Robotic concierge with screen that connects with human caregivers or healthcare givers. Primarily used in healthcare and senior-living facilities.

Temi: Moving robot companion with telepresence to connect with caregivers and family, conversational digital-assistant functions, and safety monitoring.

Cutti: Non-humanoid mobile robot companion with wellness emphasis, featuring telepresence and facial and voice recognition.

Mabu: Tabletop personal health companion and "wellness coach," medication reminders, patient-health conversations, healthcare provider communication.

Aibo: AI robotic companion dog from Sony, first produced in 1999 and updated through the years.

Tombot: Realistic-looking interactive robotic emotional-support dog, with interactive touch sensors, voice commands, and real puppy sounds.

Joy For All: Interactive robot dogs and cats that react to voice and touch.

Qoobo: Furry, interactive robot pillow with a moving tail, designed to calm people. Responds only to touch.

emotionality into their prototypes, and people do indeed have the capacity to bond with machines and perceive them as social entities, studies show.

Researchers at Georgia Tech documented people getting emotionally attached to their Roomba robot vacuum cleaners by naming and assigning them genders. Some owners of Sony's Aibo robotic dog treat it like a real pet; some even live with their real pets and Aibo. The now-defunct tabletop robot Jibo, which was designed to be a "lovable" and friendly digital companion, had users mourning its "death" when the company shut it down.

Technology is moving toward social robot companions that are able to interpret facial expressions, speech emotion, body language, and vital signs and act based on that: Calling a doctor or family member when the person has a temperature or falls; modifying music selection based on how the person's expressions or health vital signs react to what's playing; suggesting a nap when the person exhibits indicators of being tired; alerting a health provider or family member when the robot interprets emotional distress.

One new product being developed for elders is ElliQ, a $1,500 cognitive AI-driven social robot companion coming to market soon from Intuition Robotics in Israel. The robot, which is stationary and looks a bit like a moving lamp with a removable e-tablet next to it, might be considered an extension of what an Amazon Echo or Google Home smart speaker is today.

ElliQ uses "body language" movement and lights on its "face" to supplement its verbal and tablet-screen communication, and is reactive and proactive, sensing when its person comes into the room, "looking" at them, and asking questions or even prompting users about appointments, medication reminders, or suggestions for cognitive activities. It makes it easy for seniors to call, message, or video chat with friends and family.

"SOCIAL ROBOTS FOR THE ELDERLY SHOULD BE ABOUT MAKING THINGS EASIER FOR THE CARED-FOR ... NOT REPLACING HUMAN CAREGIVERS."

"As a team, COVID-19 has helped us understand where to add more utility, either directly or with partners," said ElliQ co-founder Dor Skuler in The Robot Report. "Providing more utility is not as hard to do as understanding human engagement and routines."

It may be that the COVID-19 crisis has given the social robot industry the unexpected boost it needed to get more widely to market.

During the first wave of the crisis, Intuition Robotics expanded its beta program to give more seniors access to ElliQ in order to address the increased isolation and loneliness caused by the virus lockdowns and social distancing. A new fleet of personal assistants called Temi were deployed at an assisted living system in the New York Metro Area. And in Florida this year, the state's Department of Elder Affairs delivered several hundred therapeutic robotic pets made by Joy For All to socially isolated seniors living with Alzheimer's Disease and related dementia.

While roboticists are striving to develop more humanly interactive social robots, experts stress the importance of developing the technology so it can better facilitate and promote human interaction and relationships as well.

Selma Sabanovic, associate professor of informatics and cognitive science at Indiana University and founder/director of the R-House Human-Robot Interaction Lab, says that the COVID-19 crisis is very likely to promote more use of assistive robots in elder caregiving, but that the technology is not a cure-all.

"Social robots for the elderly should be about making things easier for the cared-for and caregivers, not replacing human caregivers," Sabanovic says.

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