



# GROWING UP WIRED

Smartphones and other tech pose special challenges — and opportunities — for young brains.

BY ALEX ORLANDO

**In just one generation, childhood went digital.**

Even before they can say the words, “Hey, Siri,” kids are awash in smartphones, tablets and a torrent of interactive content. The average child younger than 2 spends around 40 minutes a day looking at screens — and that daily dose only increases as the years go by. One survey estimates that almost half of all American teenagers say they’re online nearly constantly.

The proliferation of screens — and their potential impact — has sparked concerns. The American Academy of Pediatrics has recommended that kids under 18 months avoid screens altogether, apart from the occasional video chat. The group’s 2016 report on media use for children cites risks ranging from poor sleep to stunted language skills. Many Silicon Valley parents, including tech titans like Mark Zuckerberg, restrict their children’s screen time.

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But research into the consequences of screens on actual brain development is still in its infancy. Some scientists are probing how toddlers process information from video chat. Others are exploring whether smartphone use among teens is linked to mental health issues. Even video games, a childhood staple for decades, are getting a closer look: Advances in high-resolution scanning techniques now enable scientists to see how young brains have been shaped by years of playing games like *Call of Duty*.

The goal of the various projects is to answer the same basic question: What does growing up immersed in this tech do to the most malleable minds?

#### TODDLERS, SCREENS AND REALITY

Maybe they're watching the latest episode of *Peppa Pig* on the family iPad. Or shrieking with delight at the grinning face of Dad, Skyping from a conference halfway around the world. For infants and toddlers, screens can be just as attention-grabbing — if not more so — as they are for the rest of us. But some recent research suggests that the little ones might not be taking away much information from those experiences.

**“Action games are associated with improvements on a pretty broad range of perceptual and cognitive skills,” psychologist C. Shawn Green says.**

“In general, under the age of 3, it's relatively [more] difficult for children to learn from video or from another kind of screen than it is to learn from another person,” says Vanderbilt University psychologist Georgene Troseth.

The bulk of research shows that, unlike older children, infants and toddlers are less likely to learn from a screen than from a dynamic, face-to-face interaction — a phenomenon known as “video deficit.” As early as the 1980s, researchers discovered that children learn language skills better from shows such as *Sesame Street* if an adult is watching with them and reinforcing the material. A 2007 study, published in *Media Psychology*, found that toddlers struggled to learn new words simply by watching television.

Some studies have suggested, though, that video chat — in which parents interact with their child in real time — is different. (The American Academy of Pediatrics even lists an exception for video chat in its oft-cited recommendation that infants avoid screens.) In a 2018 study, Troseth, who specializes in early childhood development, wanted to see if receiving social cues on a screen was enough for toddlers to learn new words.



## A PEDIATRICIAN'S GUIDE TO SCREEN TIME

When you hand a child an iPad, says John Hutton, a pediatrician and researcher at Cincinnati Children's Hospital, you're not just giving them a toy. “It's a really powerful tool,” he says. “It's more powerful than the computers that sent rockets to space 30 years ago.” And despite how quickly children might seem to adjust to new tech, that doesn't mean they know how — or when — to use it.

Here are a few tips from Hutton on helping kids navigate our increasingly wired world:

#### REMEMBER TODDLERS ARE NOT SMALL GROWN-UPS.

At different ages, children's needs change along with their brains and emotional development. And while children under the age of 2 might be drawn in by flashing screens, they're still not learning much from them at that age.

**GO SLOW.** For preschoolers, gradually introduce different types of media that are slower-paced and encourage learning. (Think shows like *Sesame Street*, says Hutton.) From there, work your way up to more challenging — yet still age-appropriate — content.

**HELP CHILDREN CHOOSE THEIR OWN CONTENT.** While it's important to limit your child's choices, give them some control over what they're watching. For example, ask them if they'd rather watch *Cinderella* or *Cars* rather than letting them go hog wild.

**KEEP DEVICES IN A CENTRAL LOCATION.** You should be able to monitor how they're being used. In other words, don't let them disappear from view. “I would never let it go into a child's bedroom,” says Hutton.

**DON'T LOSE SIGHT OF REAL-WORLD EXPERIENCES.** Whether it's going outside, playing with blocks or drawing a picture, be mindful of the things that screens might be replacing. “It's not all about ‘restricting’ screen time,” says Hutton. “It's being open to all of the other things out there that are healthy for kids.” —A.O.

The researchers looked at 176 toddlers, 23 to 32 months old, to see how they would best learn the name of a new object. They set up four different conditions: a person interacting face-to-face with the child, a live person reading from a script without responding, a recorded video of a person reading the same script and a person interacting with the child on video chat. Then they tasked the children with learning the name of a strangely shaped object. The team found that, regardless of age group, the toddlers didn't learn the object's name (dubbed a “modi” for the study) in either of the video scenarios. What happened?

In short, for tiny tykes still learning about the world, what is shown on a screen is not reality — and thus can't convey substantive information about that reality. “If something is on a screen, it makes it harder for [young children] to remember what they saw,” says Troseth. In the word-learning study, the flattened image of an adult on a video screen didn't match the reality of the bulky, three-dimensional modi. Beyond that, by the time they turn 2, most toddlers have seen enough implausible things on screens — Wile E. Coyote floating in midair, for example — that they've decided what is shown on-screen isn't real. It is only over time, says Troseth, that children learn that an image on a screen, like that tiny thumbnail of Uncle Joe on video chat, *can* represent the real world.

While screens might not be ideal for learning new information, video chat apps like FaceTime may help toddlers solidify and strengthen connections with others. “For some things, that [responsiveness] is really good,” Troseth says. “And what it seems to be really good for is emotional connection ... That social closeness seems to be carried by the fact that it's a back-and-forth.”

But even though screens may help children build social bonds, recent research shows they might also pose neurobiological risks to growing brains. In November, a study of preschoolers' brains using MRI scans found that screen time changed the structure of the organ itself. Higher screen use was linked to lower amounts of white matter, the fibrous tissue that connects different parts of the brain. These connections support the development of emerging abilities like literacy and language skills.

The research team notes that the findings are preliminary, with some of the biggest unanswered questions beyond the scope of the study. “And the elephant in the room is looking at parents' screen time,” says lead author John Hutton, a pediatrician and researcher at Cincinnati Children's Hospital. “That's one thing we didn't measure in the study that I wish we had. Because kids that grow up with a lot of screen time tend to have parents using a lot of screens.” If parents are habitually glued to screens, he continues, it might interfere with the time they're spending with their children.

“The point of the study isn't to scare parents or make them feel guilty,” says Hutton. “It's to get people thinking about the idea of ‘readiness.’ We make people wait to do all kinds of things. The idea that children should wait to use screens until they're developmentally ready is totally appropriate.”

#### AN EDUCATION IN ACTION GAMES

You might not expect a 12-year-old's time playing *Fortnite* to improve their language skills. But a growing body of research



CAGKAN SAYIN/SHUTTERSTOCK

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suggests that action video games — fast-paced shoot-'em-ups — might offer a variety of benefits for learning, such as improvements in depth perception, visual memory, spatial awareness and the ability to switch between tasks.

“Action games are associated with improvements on a pretty broad range of perceptual and cognitive skills,” says C. Shawn Green, a psychologist at the University of Wisconsin-Madison who specializes in cognitive neuroscience.

Not all video games — or video game players, for that matter — are created equal. But due to the importance of hand-eye coordination and lightning-fast reflexes in action games, they offer certain cognitive upgrades that other genres don't.

In 2007, a *Psychological Science* study showed that college students who were avid action game players were better than nonplayers at picking out targets, such as the orientation of the letter T, even when it was flanked by distracting objects, like an upside-down T. In the same study, when players unfamiliar with action games spent a total of 30 hours playing the shooting game *Unreal Tournament*, those skills received similar boosts. That time spent gaming may have improved certain visual abilities for the action-game newbies.

Other studies point to different benefits. A 2014 study in *Computers in Human Behavior* suggested that action-game aficionados had enhanced visual short-term memory, such as the ability to remember what color tie their co-worker was wearing. In 2013, a study from the University of Padua in Italy showed that these games can even help dyslexic children read better by improving concentration and attention.

While Green's research primarily involves college-age adults, other scientists have dug into the effect of action video games on children's development. Overall, the research suggests that the benefits translate to kids. A 2010 study involving children 7 to 17 years old showed that gamers were better equipped than their peers to focus their attention on multiple objects at a time. At the same time, the amount of research on children is comparatively slim — mostly due to the genre's often mature, violent content.

The benefits of strapping yourself into a first-person shooter appear to have limits, however. According to Green, only the specific skills that are challenged through the genre's frenetic gameplay, like reaction speed, are improved. And while most of the research thus far has been done in the lab, Green thinks the skills tested still apply to the real world. Such studies, says Green, are “certainly not asking if you got better at playing the video game. [They're] asking, ‘Because you played that video game, are you now better at these other tasks?’”

Brain scans and other ways of seeing inside the brain seem to back up these findings, too. Scientists are now able to measure structural changes in gamers' brains through imaging

technology. Common techniques include certain types of MRIs, such as one that maps structural changes by measuring how water travels throughout the brain, and EEGs, which track electrical activity in the brain. A 2017 study using MRI scans showed more connections in the white matter of action gamers' brains. The authors suggest that these connections might account for improved cognitive and motor skills among players.

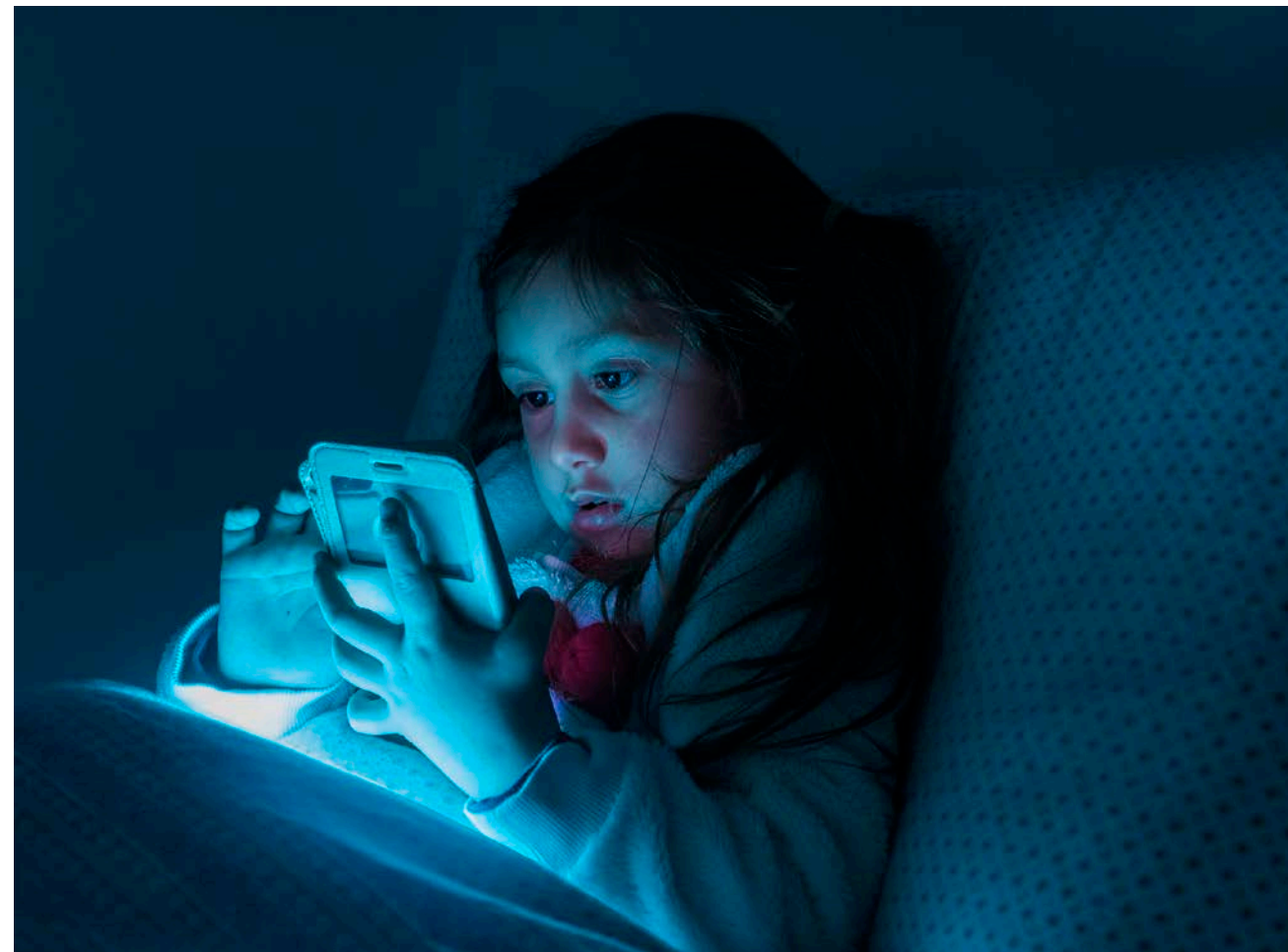
The potential drawbacks of video games have also been the subject of vigorous debate. Many action games receive criticism



for their explicit content. Some studies suggest that violent games might boost aggression and blunt empathy among players. But scientists are still continuing to unravel the mystery of how video games impact development. A 2018 *Nature* study on *Grand Theft Auto V* concluded that players experienced no negative effects after two months of playing the game. So far, researchers have failed to find a causal link between violent games and acts of criminal violence.

#### SMARTPHONE STRESS

By the time kids hit their teens, most have become veterans of the social media Wild West, flitting between apps like Snapchat, Instagram and TikTok. And increasingly, even *they* seem aware



that they're probably checking their smartphones a little too much.

According to a 2018 survey by the Pew Research Center, more than half of U.S. teens between 13 and 17 worry they spend too much time on their phones. And when they don't have a smartphone in their pocket, nearly 60 percent of teens reported feeling either anxious, lonely or upset. Tech companies have responded to the mounting unease, with Facebook, Google and Apple releasing new tools to help users cut down on screen time.

And a 2018 *JAMA* study indicated that the siren song of social media might be associated with attention-deficit/hyperactivity disorder (ADHD). The Centers for Disease Control and Prevention estimates ADHD affects nearly 10 percent of all U.S. children younger than 18. It has been linked to behavioral problems, learning disorders, anxiety and depression.

According to the researchers, the more teenagers used digital devices and checked social media, the more likely they were to show ADHD symptoms, including inattention, hyperactivity and restlessness. “We can't make a strong statement about any kind of causal association,” says co-author Adam Leventhal, a psychologist and professor of preventive medicine

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at the Keck School of Medicine of USC. There just isn't enough data yet, he adds.

During adolescence, the brain is developing neural pathways that underlie impulse control, attention, planning and other higher-level functions. Leventhal suggests that exposure to smartphones, where our impulses are immediately rewarded with likes and comments, could interfere with teens' ability to delay gratification — which is often associated with ADHD. “There's an element of visual media where we're always ‘on,’” he says. “And it can interfere with the ability to maintain attention on a single task over a long period of time.”

For now, parents looking for clarity about tech's impact on their children may not find easy answers. Yet as scientists continue to learn new pros — and cons — about screen time, researchers like Troseth think, as with so much in life, the key lies in moderation.

“These [technologies] are not gods,” she says. “They're tools. And maybe that's one of the big messages — children shouldn't be afraid of screens. They're just a thing to be kept in its place.” ■

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