The Psychology of Smart Devices: How the Use of Smartphones Affect Our Minds

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On my honor as a University Student, I have neither given nor received unauthorized aid on this
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In the past ten years, smartphones have become an integral part of modern telecommunications, and it is estimated that more than 2.5 billion people, which is almost one-third of the entire human population, have smartphones (Silver et al., 2019). The smartphone market is ever-growing as seen in many countries with at least half of their population using mobile phones (Naeem, 2014). Smartphone users are fairly diverse as reported in a 2015 survey from the Pew Research Center which found that more than half of men and women within the US own smartphones and 53% of people, age 65 and over, use a smartphone (Pew Research Center, 2021).

With this much exposure, smartphones—and the social media they deliver—have logically informed and shaped many things in the lives of individuals. The smartphone is seen as a technology that has revolutionized society in less than a decade. With the launch of the iPhone in 2007, mobile telephones transformed from devices only capable of communication to smartphones that provide users a multitude of functionality from internet access to video streaming. The rapid technological development and capabilities of the smartphone led to the idea of the smartphone being a fix for many human-related issues, influencing users to see the smartphone in a more positive light.

With this societal-created enigma around the smartphone, this paper was inspired to research how using smartphones affect our minds. Do we gain other skills by having more social opportunities or reacting quickly to stimuli? What other, positive or negative, ways do smartphones affect our brains? Is the existing research comprehensive? This research paper will aim to address the potential positive and negative consequences of using smartphones using published psychological research papers and articles. Then, I will highlight how we actually

know very little about the relationship between technology and humans, and finally, conclude with suggestions about future research that feature the limited aspects of current research.

Smartphone Controversies and Potential Harms

Even though most see the smartphone as a positive technological invention, an important question is what are the effects of smartphones on the mind? Given the widespread use of smartphones today, it is important to understand the potential harms caused by smartphones.

Smartphones and Mental Illness

In a study with over 200 college students, Glenn Geher, chair of psychology at the State University of New York, found that 59% of students reported being diagnosed, at some point, with a psychological disorder (Geher, 2017). In his book *Evolutionary Psychology 101*, Geher discusses two ways smartphones are harming young people. First, smartphones and social media teach adolescents what social-psychologists refer to as deindividuated communication; in other words, when they communicate via smartphone messaging or social media, they feel faceless, absent, or anonymous and unaccountable for what they are saying (Geher, 2014). This leads to more cyberbullying since it is easier to be mean and hurtful to others when you're not present physically to get a reaction. Additionally, he notes that smartphones are vastly addictive, and the brain circuits associated with addiction of any kind are mostly the same—regardless of the content of the addiction—which leads the way for negatively affecting users' mental lives.

Furthermore, smartphone and social media overload lead to a decrease in users' time spent outside; more specifically, the average American child is said to spend 7 minutes a day in unstructured play outdoors while over 7 hours a day in front of a screen (Cohen, 2020). The mental and physical health benefits of time spent in nature are well documented, for example, children who play outside are more self-aware, intelligent, happy, attentive, less anxious, and not

as stressed as those that spend more time indoors. The long-term epidemiological Monitoring the Future (MTF) study has surveyed thousands of 12th graders since 1975, and recent results could not be clearer: teens who spend more time, than average, on non-screen activities are more likely to be happy (Twenge, 2017). In contrast, individuals who spend more time, than average, on-screen activities are more likely to be unhappy, lonely, suffer anxiety, and deal with depression.

Mental illness, like depression, has always been present within society, however, with the introduction of smartphones, the prevalence of the illness has drastically increased. As an example, in 2011, for the first time in 24 years, the teen suicide rate was higher than the teen homicide rate, but more specifically, statistics show that from 2012 to 2015, depression in boys increased by 21 percent, while depression in girls increased by 50 percent (Schrobsdorff, 2016). Depression is not only an increasing issue for younger individuals as a 2014 report in Psychology Today found that one-fourth to one-third of college students meet the criteria for anxiety or depression (Homayoun, 2017).

Concerning smartphones, Canadian researchers found that most of the evidence connecting technology and mental distress or suicidality is observational, making it difficult to establish a correlation; however, they discovered several—randomized and controlled—studies that show social media and smartphone use may be contributing to mental distress among young people (Abi-Jaoude et al., 2020). These researchers conducted cross-sectional surveys of university students in the U.S. and Germany and found students who spent more time on Facebook, were more likely to feel envious of others and worse about themselves, eliciting a "Fear of Missing Out" (FOMO) effect. This concludes that the use of social media promotes negative effects on a person's sense of self. With these studies, the researchers also found young women—between the ages of 17 and 25—reported a more negative mood after just 10 minutes

of browsing Facebook. FOMO and envy increase with browsing social media, like Facebook, which leads to distress in mental state. Additionally, a systematic review—published in the National Library of Medicine—found that youth who reported high levels of internet use were more likely to harm themselves or engage in suicidal behaviors (Marchant et al., 2017). Smartphones allow users to easily find and connect with like-minded individuals, which means youth who connect with other youth, who self-injure, can normalize the behavior and even encourage it.

Smartphones and Social-Emotional Skills

While many research studies have found children under the age of 30 months cannot learn from television and videos as well as they can from real-life interactions, there are fewer studies if this is the case for smartphone-interactive applications. However, early research suggests that interactive media such as smartphone learn-to-read applications can be useful in teaching vocabulary and reading comprehension in children pre-school age or older (Boston University Medical Center, 2015). In a journal called *Pediatrics*, an article details commentary from Boston University School of Medicine researchers that suggests using smartphones or iPads to entertain or pacify children can have a detrimental effect on their social and emotional development (Radesky et al., 2015). If these devices evolve to be the primary method of calming and distracting young children, then they will "not be able to develop their own internal mechanisms for self-regulation. Even though researchers note that there are many undiscovered interactions between smartphones and child development, they suggest that overuse of smartphones interferes with the development of social skills—like empathy and conflict resolution—which are more effectively developed through unstructured play with other children.

Moreover, a study published by the University of California Los Angeles (UCLA) has found that smartphone use can be a roadblock in children's ability to read emotions. The UCLA psychology department looked at two groups of 12-year-olds: one group deprived of all digital media and the other encouraged to text or use social media. During the research, the group deprived of all digital media performed significantly better at recognizing emotions than those allowed to keep texting, tweeting, and using Facebook after just five days (Kellog, 2015). Therefore, compared to face-to-face interaction, it is very difficult to learn nonverbal emotional cues from a smart device, and participating in communication through the smartphone can promote the loss of important social skills. The connection made during in-person interaction greatly boosts the deepness of a relationship, which is lost during communication through a smartphone. Complex aspects of relationship skill building are degraded through less, or even non-existent, in-person connections.

Additionally, adolescence is an important time for developing social skills. People learn how to give and receive friendship, social etiquette, and how to resolve conflict by interacting with their peers. However, as young people spend less time with others face-to-face, they have fewer opportunities to practice these social skills. These fewer opportunities, elicit discomfort in social settings and the desire to communicate by text or call rather than in-person. Despite all the possible digital connections, a false and lonely existence is created instead. For instance, according to Dr. Steiner-Adair and Barker (2014), authors of *The Big Disconnect: Protecting Childhood and Family Relationships in the Digital Age*, "There's no question kids are missing out on very critical social skills. Texting and online communicating—puts everybody in a nonverbal disabled context, where body language, facial expression, and even the smallest kinds of vocal reactions are rendered invisible".

Smartphone and Cognitive Ability

In a Pew Research study, 46% of Americans say they cannot live without their smartphone (Smith, 2015). With people becoming increasingly dependent on smartphones for information, communication, mathematics, and reminders—questions on the immediate and long-term consequences of such habits arise. In one study presented to the Radiological Society of North America, researchers found that young people with an internet and smartphone addiction demonstrated imbalances in brain chemistry compared to a control group. Using magnetic resonance spectroscopy (MRS) exams, it was found that compared to the healthy control group, the ratio of gamma-aminobutyric acid (GABA) to glutamate-glutamine (GLx) was significantly higher in the anterior cingulate cortex of the smartphone and internet-addicted youth, which the researchers say can contribute to the loss of integration and regulation processing in the cognitive and emotional neural network (Jeong et al., 2017).

Moreover, a study appearing in the *Journal of the Association for Consumer Research* confirms the brain drain hypothesis, which suggests the mere presence of one's smartphone occupies limited-capacity cognitive resources—thereby leaving fewer resources available for other tasks—leading to an undercut in cognitive performance (Ward et al., 2017). In other words, the proximity of a smartphone and smartphone conscious thought, negatively affects a user's memory, learning, and recall ability.

Cognitive Offloading

Smartphones offer more than distractions: people no longer have to memorize phone numbers as information is neatly stored on a phone's contact list, people no longer ponder questions about the world as information is presented through internet search engines, and people no longer remember important appointments or dates as information is stored on apps. In a recent

study, experts warn that over-reliance on mobile devices might lead to mental laziness. In other words, cognitive misers forgo effortful and analytic thinking instead of fast and easy intuitive processing through smartphones, lending to cognition's overreliance on simple processes and mental shortcuts (Barr et al., 2015).

Furthermore, technology is promoting the dependence on devices to store information, commonly referred to as cognitive offloading. This finding, dubbed by Kaspersky Lab (2015) as the "Google Effect"—and later referred to as "digital amnesia" by other researchers— demonstrates that the expectation of having later access to information can make us less inclined to encode and store that information in long-term memory. In their article on Google's effect on memory, researchers argue that we are becoming symbiotic with our technology by remembering less actual information, and instead, committing the location of such information to memory (Sparrow et al., 2011). The authors use this finding to claim that, "the processes of human memory are adapting to the advent of new computing and communication technology" (Sparrow et al., 2011).

Possible Benefits of Using Smartphones

Despite the possible negative effects of smartphone use, across 11 surveyed countries, more than 50% of each country's citizens have a positive attitude toward mobile phones—saying mobile phones have made positive impacts socially, educationally, and mentally (Silver, 2019). Given these positive claims are largely based on personal accounts, is there research to support them?

Building and Improving Skills

The smartphone can be seen as a technological tool, and—in some ways—it is shaping the skills of its users. Instead of only using the Smartphone for entertainment, it could be used to

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access useful information, such as general knowledge, the latest technology advancements, and real-time world news. This knowledge builds a mental warehouse of information, increases a user's acquisition of knowledge skills, and makes the user a better communicator (Sarwar & Soomro, 2013). In addition, the credibility of sources comes into play when users search for information. Specifically, in one study, researchers found that smartphone use was positively associated with the ability to judge the credibility of information (Frost et al., 2019).

Regarding in-classroom education, Astrid Natley—an English teacher at a secondary girls' grammar school in Lincolnshire—incorporates phones into her classroom, and details when students utilize their smartphones for research, they learn "that they have a fantastic power in their hands" (BBC News, 2019). In other words, the student can see how education and information can be accessed at home, without seeing it as a despised departure from their world. Additionally, by completing more searches, students become better at asking refined and targeted questions to find information more efficiently.

Similarly, smartphones can help users overcome major obstacles, such as learning a new language. With the onset of language-learning smartphone applications, users can learn at their own pace, which is rarely the case with traditional language courses. According to a survey conducted by the research company CivicScience, 25% of respondents rely on apps to become fully fluent in a new language (Brode, 2019). Not only do smartphones help users build a language skill, but they also help build consistency and acceptance of mistakes (Rosell-Aguilar, 2018).

Additionally, a study from the University of Zurich in 2014 showed that people who used their smartphones—especially touchscreens—have brain development similar to a violinist, which develops a larger somatosensory cortex, the area of the brain responsible for detecting and

responding to touch, the position of the body in space, pain, and temperature (CTV News, 2014). This finding suggests that those who actively use their smartphone, have higher response rates to sensory information and quicker reaction time to stimuli.

Socializing

Smartphones and social media allow individuals to accomplish many offline tasks in an online setting, such as staying connected with family and friends, creating new connections, and sharing ideas. Additionally, smartphones and social media grant individuals with deeper benefits that include defining a sense of self through profile development, expanding their view of the community, and exposure to world cultures (Boyd, 2007).

Furthermore, smartphones promote more opportunities to talk with people, without having to be next to them. Being able to consistently communicate increases the bonds you have with other people. In a recent study, researchers found that people are more likely to have successful conversations about difficult topics if they are not face-to-face (Tong & Walther, 2012). More specifically, speaking through voice call or messaging forces the user to articulate what they want to say into words, instead of relying on gestures or tones, therefore, increasing a person's understanding of language and their proficiency with it in social settings. Moreover, with better means of communication through the smartphone, social networking becomes easier and leads to enhanced friendships, decreased loneliness, reduced stress, and social support (Child Mind Institute, 2021).

Emotional and Health Benefits

Out of 11 countries surveyed, half of them have a majority of their population agreeing that smartphones free them rather than tying them down (Silver, 2019). More specifically, the smartphone has the potential to treat mental health issues, improve the quality of people's lives,

and promote emotional well-being. For example, many smartphones are equipped with programs that aid in reducing depression and phobias, by helping lift people's moods and getting users more active (Donker et al., 2013).

Additionally, applications that play relaxing music aid in reducing stress and anxiety (Association for Psychological Science, 2014). As a matter of fact, according to a survey on smartphone usage, smartphones are said to reduce stress in busy work life (Chun et al., 2017). With today's busy schedules, smartphones provide a quick and easy way to interact with friends and families. Instead of planning a meeting time around other commitments, people can use their smartphones for communication. Not only does this make people feel more connected, but it also alleviates the need to choose one activity over seeing others.

Moreover, smartphones provide greater access to mental health professionals through email and video calls, something that has increased in popularity due to the COVID-19 pandemic. Having this access enables individuals to see a doctor in their own space, which empowers, enables, and encourages the individual to take responsibility for their mental well-being (Paing et al., 2009). Not to mention, smartphones play an important role in the integration of people with special needs and elderly age. In other words, smartphones provide these groups of people the opportunity to live more independently, and the more they can do by themselves, the better their mental health will be (Verstockt et al., 2009).

Furthermore, an article published by the *Journal of Consumer Research* details the smartphone as a pacifying technology, one in which users derive emotional benefits like feelings of psychological comfort and stress relief (Melumad & Pham, 2020). The researchers mention that the comfort comes from a combination of properties that turn smartphones into a reassuring presence for their owners. Specifically, the portability of the device, its personal nature, the

subjective sense of privacy of the device, and the gratification it awards all contribute to the smartphone being reached for when a person is in uncomfortable situations.

Discussion: What Don't We Know?

Smartphones are relatively a new technology and, on the surface, negatively affect mental illness, social-emotional skills, and cognitive ability while positively affecting sensory skills, communication, and emotional health. As smartphones become a more immersive technology—and with vast limitations in current studies—more comprehensive research is needed to flesh out their effects on users.

The question at hand: how has society placed almost extreme measures to protect people from their relationship with technology—like placing labels on video games to protect people from being harmed by association to violence or requiring training to drive a car—but not with the smartphone? Why has society not stepped back and seen smartphones as a powerful technology, but rather, ignores their broad social and individual problems? There is not sufficient evidence on how humans interact with and are affected by smartphones. Scattered in the current research papers on this topic are nuanced perspectives on demographic variations of cognitive offloading and emotional health. Longitudinal studies that cover how smartphones affect humans over periods of years are non-existent. How do we know the fluctuation difference in social development due to smartphone usage over two months, two years, or two decades? For example, the mentioned study—presented to the Radiological Society of North America—failed to conduct longitudinal studies, making it impossible to say how long it takes young people with an internet and smartphone addiction to demonstrate imbalances in brain chemistry. Without studies that cover periods like this, we are unaware of how time affects the equation. Similarly, all of the mentioned research papers and articles discussed in this paper neglect the difference in

device ecosystems—like Apple or Android—and how they affect humans. In other words, do Apple devices decrease cognitive ability more or less than Android devices? The difference in operating ecosystems does matter as they impose different circumstances on users.

Moreover, researchers are not being attentive to the technological ecosystem that people are embedded in. Rather, they agree that we all use smartphones and they do operations for us but are not studying what types of smartphones, how often is the use-pattern, are there wearables, or is the smartphone connected to an Amazon Alexa? All of these factors matter as there is importance in the relationship between people and artifacts and that, in some ways, humans are becoming cyborgs. These studies detailed in this paper spend their time researching the human variable and forget why we are here in the first place—the smartphone.

Furthermore, once those in power have a clearer picture of how smartphones affect people, then they can better regulate the industry to avoid the negatives and promote the positives. With smartphones attracting more users around the world, these devices have the potential to spread benefits engagingly, but only if we effectively switch our focus away from the human side and to the smartphone itself.

Conclusion and Future work

This research paper has presented existing knowledge on the positive and negative effects of smartphones on humans, and within my discussion, I have pointed to very serious considerations for future work. The discussion calls into question the validity of existing research since many, if not all, are not attentive to the technology but overly emphasize the human.

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