aps
ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

The Sisyphean Cycle of Technology Panics

Perspectives on Psychological Science
2020, Vol. 15(5) 1143–1157

DOI: 10.1177/1745691620919372
www.psychologicalscience.org/PPS
SAGE

Amy Orben
MRC Cognition and Brain Sciences Unit and Emmanuel College, University of Cambridge

Abstract

Widespread concerns about new technologies—whether they be novels, radios, or smartphones—are repeatedly found throughout history. Although tales of past panics are often met with amusement today, current concerns routinely engender large research investments and policy debate. What we learn from studying past technological panics, however, is that these investments are often inefficient and ineffective. What causes technological panics to repeatedly reincarnate? And why does research routinely fail to address them? To answer such questions, I examined the network of political, population, and academic factors driving the *Sisyphean cycle of technology panics*. In this cycle, psychologists are encouraged to spend time investigating new technologies, and how they affect children and young people, to calm a worried population. Their endeavor, however, is rendered ineffective because of the lack of a theoretical baseline; researchers cannot build on what has been learned researching past technologies of concern. Thus, academic study seemingly restarts for each new technology of interest, which slows down the policy interventions necessary to ensure technologies are benefiting society. In this article, I highlight how the Sisyphean cycle of technology panics stymies psychology's positive role in steering technological change and the pervasive need for improved research and policy approaches to new technologies.

Keywords

digital-technology use, social media, screen time, well-being, adolescents

In 1941, Mary Preston published "Children's Reactions to Movie Horrors and Radio Crime" in *The Journal of Pediatrics*. The American pediatrician had studied hundreds of 6- to 16-year-old children and concluded that more than half were severely addicted to radio and movie crime dramas, having given themselves "over to a habit-forming practice very difficult to overcome, no matter how the aftereffects are dreaded" (pp. 147–148). Most strikingly, Preston observed that many children consumed these dramas "much as a chronic alcoholic does drink" (p. 167). Preston therefore voiced severe concerns about the children's health and future outcomes: Children who consumed more radio crime or movie dramas were more nervous and fearful and suffered from worse general health and more disturbed eating and sleep.

To truly understand these claims, one needs to consider Preston's work in the context of her time. The decade preceding her work saw both broad social and technological changes; the explosive growth in popularity of the household radio during this period, however, is especially striking. In 1922, 6,000 radios were owned by the American public; this number grew to 1.5 million by 1923, 17 million by 1932, and 44 million by 1940 (Dennis, 1998). In 1936, about nine in 10 New York households owned a household radio, and children in these homes spent between 1 and 3 hr a day listening to these devices (Dennis, 1998). This rapid rise in popularity sparked concerns not limited to Mary Preston's article. A *New York Times* piece considered whether listening to the radio too much would harm children and lead to illnesses because the body needed "repose" and could not "be kept up at the jazz rate forever" (Ferrari, as cited in Dennis, 1998). Concerns voiced by the Director of the Child Study Association of America noted how radio was worse than any media that came before because "no locks will keep this intruder out, nor can parents shift their children away from it" (Gruenberg, 1935). This view was mirrored in a parenting magazine published at the time:

> Here is a device, whose voice is everywhere. . . . We may question the quality of its offering for our children, we may approve or deplore its entertainments

Corresponding Author:
Amy Orben, Emmanuel College, Cambridge CB2 3AP, UK
E-mail: aco35@cam.ac.uk

> and enchantments; but we are powerless to shut it out . . . it comes into our very homes and captures our children before our very eyes. (Frank, as cited in Dennis, 1998)

In recent decades, concerns about the effects of radio on young people have practically disappeared—but societal concerns about emergent technologies have definitely not done so.

Given the option, many parents of today would enthusiastically welcome the consumption of radio dramas, especially if they would take the place of their children playing around on their phones or chatting to friends on social media. Just as was the case with the radio, academic publications and other reports now routinely liken these new digital pursuits to drug use (Royal Society of Public Health, 2017; see commentary, Przybylski & Orben, 2017). They once again raise the specter of vast proportions of the adolescent population becoming addicted to a new technology (Murali & George, 2007) and that this will have diverse and far-reaching negative consequences (Greenfield, 2014; see commentary, Bell, Bishop, & Przybylski, 2015). Although previous parents' fears of radio addiction might seem amusing now, contemporary concerns about smartphones, online games, and social media are shaping and influencing policy around the world (Choi, Cho, Lee, Kim, & Park, 2018; Davies, Atherton, Calderwood, & McBride, 2019; Department for Digital, Culture, Media and Sport & Secretary of State for the Home Department, 2019; House of Commons Science and Technology Select Committee, 2019; Viner, Davie, & Firth, 2019; Wait Until 8th, 2018). These technology panics—times in which the general population is gripped by intense worry and concern about a certain technology—are influential and reoccurring. Current worries about new technologies are surprisingly similar to concerns about technologies that have preoccupied parents and policymakers in the past but are met with amusement today.

The similarity between concerns about the radio and social media provides a striking reminder that in every decade, new technologies enter human lives and that in their wake there will arrive widespread concerns about their effects on the most vulnerable in society. Technological advances and the concerns they engender form part of a constant cycle. Nearly identical questions are raised about any new technology that reaches the spotlight of scientific and public attention. These are then addressed by scientists, public commentators, and policymakers until a newer form of technology inspires the cycle of concern to restart. Understanding how these different spheres of academia, policy, and the public interplay is crucial to understanding how the reaction to new technologies might be improved.

In this article, I argue that people's reactions to new technologies, and researchers' approaches to studying them, are best understood through the lens of a comprehensive framework I have named the *Sisyphean cycle of technology panics*. The framework highlights the diverse actors that interact to cause technology panics to develop in repeated and almost identical cycles and outlines the consequences this has for academic and policy progress. In this article, I first examine technology panics of the past century and then move on to discuss why technology panics routinely evoke concern. I then discuss the role of politics and academia in addressing and magnifying these widespread worries, critically reflecting on the positive and negative influence of the psychological sciences. Finally, I look ahead and touch on what can be done by researchers to ameliorate or address the negative effects of this cycle of technological panics in the face of an increasingly accelerating technological revolution.

The Rise of Modern Technology Panics

The waxing and waning of concern about new technologies, driven by the want to comprehend and explain their influence on society, is an age-old component of societal debate. Especially those concerns focused on the youngest generations have been present for centuries. In Ancient Greece, philosophers opined about the damage writing might do to society and noted youths' increasing lack of respect (Blakemore, 2019; Wartella & Reeves, 1985). Novels became increasingly popular in the 18th century, and soon there were concerns about reading addiction and reading mania being associated with excessive risk-taking and immoral behavior (Furedi, 2015). I have already described similar fears about radio addiction in the 1940s. Concerns about new technologies and young people are therefore very common and have a cyclical nature, something that has been noted for decades. I am not the first to observe such a pattern: In 1935, Gruenberg wrote,

> Looking backward, radio appears as but the latest of cultural emergents to invade the putative privacy of the home. Each such invasion finds the parents unprepared, frightened, resentful, and helpless. Within comparatively short member, the "movie," the automobile, the telephone, the sensational newspaper or magazine, the "funnies," and the cheap paper-back book have had similar effects upon the apprehensions and solicitudes of parents.

Although technology panics have existed for centuries, some researchers have highlighted the 19th and 20th centuries as the beginning of a new era for

technology panics (Wartella & Robb, 2008): an era in which concerns are magnified and academic impact is heightened. The modern expansion of technological concerns was driven by a variety of trends (Wartella & Robb, 2008). First, the idea that adolescence is a distinct part of childhood emerged between the 18th and 19th centuries, and state involvement and general concern about this age group increased (France, 2007). Concerns specifically about adolescent and child leisure time began to appear in the 19th and 20th centuries (France, 2007). Leisure time was not previously available to a large proportion of the population but started becoming more common in society. It therefore began to be considered as a distinct entity in children's days that could affect their health and well-being (Wartella & Robb, 2008). In addition, media time was increasingly a substantial part of children's lives. In 1934, children reported about 10 hr a week using media; 50 years later, children spent 14 hr and 40 min a week watching television alone (Wartella & Robb, 2008). This has now increased further; British children spend 20.5 hr a week online (Ofcom, 2019). In America, nearly half of teenagers report they are now online "almost constantly" through their use of many different devices (M. Anderson & Jiang, 2018). A burgeoning interest in adolescence as a separate life stage, an understanding of leisure time as important for health outcomes, and increasing amounts of time spent on media therefore provided a more nourishing basis for the cycles of panics about technologies to take root.

Another important aspect that changed the nature of technology panics at the turn of the 20th century was the inclusion of science and scientists as actors trying to address societal concerns. Scientists increasingly studied children, mirroring the rising interest by policymakers to understand and address children and their needs. Academic fields such as communication science developed in the United States in the early to mid-1900s focused specifically on new media and mediums for communication, information, and entertainment. This further increased the amount of research done in the area and the amount of public discussion informed by research outputs (Neuman & Guggenheim, 2011). Previously, scientific commentators played a small role in the technology panics about radio or comic books (Preston, 1941; Wertham, 1954) because most of the debate was held outside of scientific arenas. Yet in the modern era of technological panics, conversation became increasingly influenced by scientific findings derived from studies of leisure time and child health. This surge in importance of scientific evidence induced a massive shift, and academic research about new technologies such as social media began taking up a significant proportion of space in psychology's top journals and academic conferences.

It is often assumed that this increasing influence of academic research and expanded role of researchers in technology panics will help steer and improve debate, but such a process is often marred by prominent shortcomings. These barriers are highlighted in the examination of the interplay of politicians, researchers, and parents during the panic about television's effects in the mid-20th century (Dennis, 1998). Television was a key point of concern at a time in which relatively high levels of violence in adolescence were considered a problem in the United States. A contemporaneous rise in the amount of time young people spent watching television therefore became of such political interest that a U.S. Media Task Force was set up to examine the scientific evidence behind these effects. The Task Force concluded that television violence was "one major contributory factor which must be considered in attempts to explain the many forms of violent behavior that mark American society today" (Lowery & DeFleur, 1988, p. 309). Yet high-quality evidence was lacking in this decision-making process because important studies had previously shown that television did not increase aggression levels and that children's lives were not dominated by the home TV (Himmelweit, Oppenheim, & Vince, 1961). During times of panic, however, this evidence did little to alleviate the worries of critics and the pressure to implement policy change. An editorial in *Pediatrics*, for example, noted that professionals need to "avoid the intellectual trap of minimizing the importance of television's effect on child and adolescent behaviour simply because the literature does not contain straightforward, statistically validated research" (Strasburger, 1989, p. 446). Thus, policy and public had started interacting to make a volatile mix that enlists academic scientists to collect scientific evidence on the effects of technologies yet selectively engages with the evidence that such efforts provide.

The trend of increasing scientific work done on technology panics did not stop at the concerns about television; the quantity of science done to inform technology panics is still increasing. This development is unsurprising given that scientists are operating in an increasingly industrialized scientific space in which they are expected to solve practical problems in society (Ravetz, 1971). In other words, it is now an expectation that science can provide answers to those issues that are most prominent in the public or political eye (Sanbonmatsu & Johnston, 2019; Wartella & Reeves, 1985). There are also fewer areas of life in which previously inherited commonsense wisdom is valued more than the evidence provided by so-called scientific experts, and the assumption is growing "that every problem, personal and social as well as natural and technical, should be amenable to solution by the application of the appropriate science"

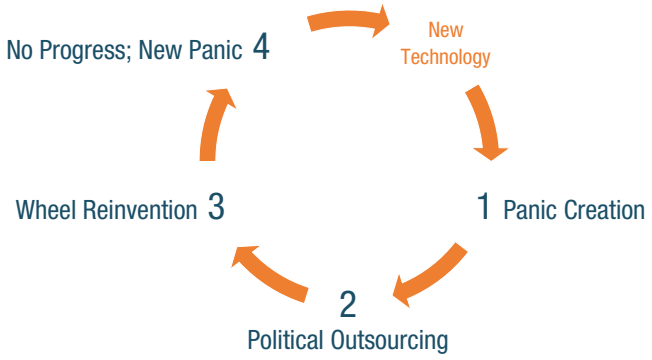

Fig. 1. The Sisyphean cycle of technology panics. The four stages of the Sisyphean cycle of technology panics: In Stage 1 (panic creation), psychological and sociological factors lead to a society becoming worried about a new technology. In Stage 2 (political outsourcing), politicians encourage or utilize technology panics for political gain but outsource the search for solutions to science. In Stage 3 (wheel reinvention), scientists start working on a new technology but lack the theoretical and methodological frameworks to efficiently guide their work. In Stage 4 (no progress; new panic), scientific progress is too slow to guide effective technology policy and the cycle restarts because a new technology gains popularity and garners public, policy, and academic attention.

(Ravetz, 1971, p. 12). This shift can be seen as a positive, promoting increased scientific evidence in diverse areas of life. However, it can also be seen as a negative influence, detracting attention from population intuition and putting increased pressure on a slow scientific process to provide simple and rapid answers to very complex problems.

This shift alters the stakeholders central to technology panics. For better or for worse, psychology—the science most closely related to child development and parenting—now plays an integral role in the Sisyphean cycle of technology panics. In Greek mythology, Sisyphus was condemned by the gods to roll a boulder up a steep hill in the underworld for eternity: Every time he reaches the top, the rock rolls back down to the bottom, forcing him to start the cycle all over again. Likewise, psychological research on technology effects is in an intricate cycle of addressing societal worries about technologies. With every new technology treated as completely separate from any technology that came before (Wartella & Reeves, 1985), psychological researchers routinely address the same questions; they roll their boulder up the hill, investing effort, time, and money to understand their technology's implications, only for it to roll down again when a novel technology is introduced. Psychology is trapped in this cycle because the fabric of moral panics has become inherently interwoven with the needs of politics, society, and our own scientific discipline (Grimes, Anderson, & Bergen, 2008). I outline the nature of this involvement at different stages of the Sisyphean cycle of technology panics below (see also Fig. 1).

1. Panic creation

Technology panics are a recurring feature of the societal landscape, especially when examining technology use and children, yet what drives the creation of these panics in the first place? Although the accumulation of societal concern is a complex process, there are certain drivers and reactions to technologies that do much to promote technology panics. In this article, I focus on *technological determinism*, which plays a crucial role in initial reactions to new technologies, and *moral panics*, a framework that establishes how societal panics can emerge and develop.

Technological determinism. The predominant approach to technological innovations has been technological determinism, the idea (a) that the technologies used by a society form basic and fundamental conditions that affect all areas of existence and (b) that when such technologies are innovated, these developments are the single most important driver of changes in said society (Leonardi, 2012). Technology is therefore seen as a foundation for and agent of change, whereas society itself is assumed to have little power to influence the technologies themselves. In other words, although technology is seen as a powerful driver of changes, the population feels it can do little to control or steer it. This view is common throughout the public and in policy circles: A study found that 53% of policymakers agreed that technology is an autonomous force that cannot be stopped (Hamelink, 1998).

When a technology is first developed, marketed, and introduced, it is often either construed as good or bad for society (Wartella & Robb, 2008). When the Internet increased in popularity, for example, many analyses either adopted stark utopian or dystopian points of view (Livingstone, Mascheroni, & Staksrud, 2018; Wellman, 2004). On the positive side, the technology was often construed as providing informative and educational content to children, leveling the social playing field, or providing better access to information. Yet there were also concerns about access to inappropriate content, promotion of violence, or child exploitation (Wartella & Jennings, 2000). Extreme utopian and dystopian views that vary in valence but not degree are common because they rest on the deterministic assumption "that technologies possess intrinsic powers that affect *all* people in *all* situations the same way" (Boyd, 2014, p. 15).

As observed earlier, most technological concerns are centered around leisure time and the assumption that the kind of leisure time engaged with predicts the health and development of a child. As new technologies start taking up increasing amounts of children's time, whether they be radio, comics, or television, they therefore become an increasingly salient pursuit that can be

taken to define a generation and be a crucial point of concern for parents and policymakers (Wartella & Reeves, 1985; Wartella & Robb, 2008). When more of the population starts to use a technology, widespread concerns start to appear.

Furthermore, technological developments are rapidly linked to ongoing and complicated societal changes (Grimes et al., 2008, p. 50), an example of which is the current concern that social media is causing observed decreases in teenage mental health (Twenge, 2018). This further accelerates and emphasizes concerns. The underlying causationist arguments are powerful because they are difficult to deny; critics of certain technology panics are routinely told that society will truly understand the impact of a certain technology only when a longer time frame is available to be examined (Leonardi, 2012). During the panic about television, for example, critics of the technology would routinely undermine the building scientific evidence that TV effects depend on the content viewed and are overall very variable (Strasburger, 1989). Technological determinism is therefore a widespread assumption that allows panics to arise quickly by linking technological developments to current societal changes that concern the population.

Moral panics. Flurries of public concern have historically been conceptualized as *moral panics* (Cohen, 1972). Moral panics are rapid increases in concern that occur regularly throughout public life. A person, group, thing, event, or other entity is perceived as challenging societal values and norms. This causes introspective "soul searching" in the population and moral condemnation (Garland, 2008). The moral panic, represented in stylized and stereotypical ways, progressively becomes defined as a severe threat (Cohen, 1972, p. 28). Powerful societal actors such as editors, policymakers, religious leaders, and people occupying positions of respect speak out about the problem and what they think could be a solution. The moral panic then stays in the public mind until it "disappears, submerges or deteriorates" (Cohen, 1972, p. 28). Cohen (1972) stressed that moral panics are therefore diverse, triggered by a wide variety of things, and that they can end up lasting a short or long time.

Moral panics are most often focused on "The Other": a group that does not constitute the main powerholders of society (e.g., children, immigrants, or women). There are concerns that these groups might become insane or aggressive or be otherwise harmed. The social critics, journalists, and researchers are therefore often "interestingly immune" (Grimes et al., 2008, p. 51) when it comes to the negative effects of the panic at hand. The moral panics about technologies are consistently reincarnated when a new technology or development initially gains popularity across society (Wartella & Reeves, 1985). The moral panic approach does not, however, completely represent the diverse stakeholders that are driving the here-described Sisyphean cycle of technology panics. Although the idea of moral panics is a key component in understanding why people can become so concerned about new technologies, it does not explain the whole ecosystem that is driving the repeated reincarnation of concerns about new technologies. I further describe this ecosystem in the stages of the Sisyphean cycle of technology panics.

2. Political outsourcing to science

Although people often assume science to be devoid of political influence or bias, science and politics are inherently linked. Indeed, certain political benefits accrue directly from societal panics about technologies (Garland, 2008). Politicians routinely embrace them as an opportunity to demonstrate their willingness to stand up to emerging technology companies and their deep concern for children and other vulnerable populations (Grimes et al., 2008). In 1954, for example, Senator Estes Kefauver headed a U.S. House subcommittee investigation into the original Superman series, making a name for himself and ultimately running for president (Grimes et al., 2008). Although his involvement in the media investigation was just one of many attributes that allowed him to run for presidency, it is hard to deny the opportunity that technology panics have granted such politicians. Intervening in ongoing technological panics gives politicians the "headline potential of being opposed to violence, a champion of children, and tough on a regulated industry" (Ramey, 1994). This can be seen in current UK politics; the Secretary of State for Health and Social Care Matt Hancock is touting screen time limits for teenagers and talks regularly about standing up to social media companies (Varghese, 2018). Although this stance routinely makes positive splashes in the press, relatively little has been achieved. Because profiling by itself can help bolster political success, however, politicians need to be considered when examining what drives technology panics.

Some people argue that technological panics are not just helpful for politicians wanting to enhance their public image but also that they allow them to "deflect social reform from the much more difficult issues of racial justice, economic opportunity and educational quality" (J. A. Anderson, 2008, p. 1275). Technology panics therefore provide a welcome vehicle for steering public attention away from intractable and uncomfortable issues such as structural inequality or health care cuts.

We have seen how television was blamed for uptakes in adolescent aggression. A couple of years earlier, comic books were a similar political scapegoat for aggressive and antisocial behavior. In 1954, the

psychiatrist Fredric Wertham wrote that a comic book's "chronic stimulation, temptation and seduction . . . are contributing factors to many children's maladjustments" (p. 10). Society and politicians were receptive to this hypothesis about how comic books were the cause of recent rises in juvenile delinquency, even though such a trend could have also been explained by other societal or cultural issues. Yet such underlying causes would have been much more difficult to address. In a *New York Times* article, the sociologist C. Wright Mills (1954) lauded Wertham's book as "a most commendable use of the professional mind in the service of the public" (for criticism of Wertham's research methods, see Tilley, 2012). In the end, Wertham's work was instrumental to the passing of restrictive comic book legislation that was hoped to decrease adolescent aggression (Tilley, 2012). Although politicians used Wertham's thesis to limit comic book contents, adolescent aggression did not cease being a major problem. It is still a problem today. In recent years, however, this problem has been blamed not on comic books but on YouTube videos, video games, and aggressive music lyrics. Political intervention in moral panics by blaming new media for certain problems in society is therefore still a welcome tool to evade discussion about contemptuous or difficult political issues.

Although it is in the political interest to be seen to address technology panics, it has now become common to outsource the process of finding potential solutions to scientific research. In the past few decades, politics and parenting have increasingly turned to science as a guide for addressing difficult questions. Society now treats "scientists as experts, whose opinions are regularly sought on matters of importance and for most part accepted without question" (Okasha, 2002, p. 121). This gives science a place in society whereby its specialized knowledge is used to calm fears and concerns in the general population, providing "comfort and reassurance in the face of the crucial uncertainties of the world" (Ravetz, 1971, p. 386; see also Okasha, 2002). Said differently, an arising societal concern is therefore not just a political event but also a challenge to the relevant science (Ravetz, 1971). Outsourcing the technological panic to science by funding, commissioning, and referencing research therefore allows politicians and policymakers to calm and reassure the population, potentially putting the onus on academics to provide a sense of security through the production of tailored research.

On the one hand, such political outsourcing raises the profile of psychological science: Researching a technology implicated in a panic promises funding, prestige, and other outcomes aligned with current scientific incentives. In the industrialized age of science, in which researchers work in more precarious positions and need to find research funding to support their existence, policy's decision to fund science addressing the technological panic at hand promotes work in the area (Ravetz, 1971; Rubenstein, 1982). Furthermore, there is an attraction to investigating something society is inherently interested in, with the hope of ultimately helping vulnerable populations.

Psychologists therefore adopt the relatively novel position of providing the public with research into a societal concern, rooting their work in the solution of such a practical issue. Some argue that this causes certain problems insofar as it fosters dependence: Such a science must, independent of evidence, project and uphold an aura of crisis to legitimate that science is necessary to cure the problem at hand (Grimes et al., 2008). An in-depth consideration of this argument is out of the scope of this article, but I highlight further problems arising from the outsourcing of technological panics to science below. However, by providing resources, attention, and prestige, technology panics cater to both the needs of politicians and the psychological discipline. This builds a further dependency into the already existing network of dependence between the public, policy, and academia in the face of technological concerns.

3. Wheel reinvention

Although researching technologies has many positive consequences for researchers, there are also pronounced negatives when science becomes the provider of evidence to technological concerns. In particular, researchers have noted the distinct similarity of research conducted to address different technological panics over time (Wartella & Reeves, 1985). Nearly identical questions about addiction to emergent technologies have been raised for radio (Preston, 1941), comic books (Wertham, 1954), television (Lowery & DeFleur, 1988), video games (Bushman & Anderson, 2002), and social media (Twenge, 2018). Likewise, questions about social connection, violence, sex, and empathy are routinely found when reading psychological commentary on a range of new technologies (Greenfield, 2014; Wartella & Reeves, 1985). In none of these cases does evidence ameliorate society's concerns; rather, the focus of concerns shifts to a new technology as society simply moves on. It is therefore routinely overlooked that each novel technology shares more similarities than differences with its predecessors—even though it might look completely new at first glance (Seagoe, 1951).

Lack of theory. This reinventing of the research wheel might be a symptom of an area built on the existence of a practical problem rather than the existence of a universally accepted theoretical underpinning or research thread. Without an underlying paradigm or reliable conceptual

frame to guide research, each researcher is "forced to build his field anew from its foundations" (Kuhn, 1962, p. 13). Many, if not all (Lang, 2013), researchers agree therefore that the psychological discipline examining technological panics is in a Kuhnian preparadigmatic period of science (Kuhn, 1962; Potter, Cooper, & Dupagne, 1993). This idea is supported by metascientific work that has noted that research on media effects uses very little theory (Kamhawi & Weaver, 2003; Riffe & Freitag, 1997).

But are there theories that could at least be used to provide an initial basis for technology research? Although there are some common ideas about technologies, such as the displacement hypothesis (Dienlin, Masur, & Trepte, 2018; Ellul, 1980; Przybylski & Weinstein, 2017), these approaches are commonly used to explain findings without having a more influential role in shaping or progressing the research field. A welcome exception is the work on technological *affordances*, which allows for insights to be translated between different types of technologies by examining the activities that they allow users to perform (Evans, Pearce, Vitak, & Treem, 2017). Such an approach is promising because technologies are ever-evolving, and it is therefore not very useful to study separate technologies as separate entities or redesign theory for each new development (Ellul, 1980).

But such an approach is extremely difficult. The philosopher Ellul (1980) noted that an integrative study of technologies would be very complex because technologies form a complicated network. Other researchers agree that although people are very proficient at developing technological changes, it is a lot more difficult to determine whether these changes might influence our complex social system: "It is this huge disparity between our technical competence and our understanding of how the fruits of this competence affect human society which has given rise to the widespread hostility to technology" (Collingridge, 1980, p. 15). Possibly because of this difficulty, integrative approaches to technologies are not the norm, especially in research that examines novel technologies. It is still the case that once a new technology is studied, previous understanding developed by studying an older technology often ceases to be considered because it was not integrated into a more overarching theory. The research field therefore seemingly restarts, and research questions are recycled.

Similar progression. Without theory to guide progress, research investigating a new technology often answers the same basic questions previous researchers had already addressed when examining previous technologies. Wartella and Reeves (1985) argued that researchers often go through the same progression of research questions when researching a novel technology (Pecora, 2006; Wartella & Reeves, 1985). Such a realization is not new; even in 1951, researchers were complaining that for each new technological concern, "we seem to go through the same stages" (Seagoe, 1951; for critique, see Meadowcroft & McDonald, 1986).

It is remarkable that research conducted in response to different technological panics proceeds along parallel courses while at the same time lacking an overarching theoretical paradigm. In retrospect, this similarity has been explained in terms of researchers' consistent adherence to a shared set of basic structures of psychological thinking and argumentation (Grimes et al., 2008). When initially researching a new technology, both the new technology itself and its audience are often broadly defined: Researchers treat the technology as a unitary entity (e.g., smartphones) and consider it in terms of a general audience (e.g., all children). They try to link the technology to the outcome that is causing concern (e.g., violence or depression). This generalization directs the early literature toward a causationist standpoint. This view assumes that all members of the audience considered are affected by the new technology in the same way and that this technology is sufficient to cause long-term change (Grimes et al., 2008). This causationist standpoint has had many incarnations and follows a consistent pattern over the past century: Listening to the radio causes anxiety (Preston, 1941), reading comic books causes childhood maladjustment (Wertham, 1954), video games cause aggression (Bushman & Anderson, 2002), and smartphones and social media cause depression (Twenge, 2018; Twenge, Joiner, Rogers, & Martin, 2017).

The argument, however, is difficult to uphold because its framing requires accepting tenuous assumptions such as that children react in exactly the same way to a certain stimulus (Grimes et al., 2008; Himmelweit et al., 1961). Furthermore, the causationist standpoint assumes that the technology of interest has a substantive influence on the outcome of interest that is practically significant and on equal footing to other aspects of a child's life (Grimes et al., 2008). These kinds of assumptions are seldom directly tested and are themselves difficult to comport with widespread scientific evidence that has established how common individual differences in the environment can substantially change a person's cognitive structures and reaction to stimuli (DiPietro, 2000; Kolb & Gibb, 2011).

A natural progression for research in this area is therefore to move away from the causationist standpoint and instead examine more specific audience types. Subgroup analysis, segmentation, and moderation analysis provide useful alternative pathways for inquiry. A report by Herzog published in 1941 (as cited in Wartella & Reeves, 1985), for example, considered how age determines whether children are affected by

radio. The 1933 Payne Fund studies set to investigate the extent to which effects of films depended on gender, age, past experience, and predispositions (Wartella & Reeves, 1985). In addition to individual differences, research also progresses by taking into account the different contents that can be consumed when using the same technology (e.g., Blumer & Hauser, 1970).

When research progresses to consider the cues and justifications for a technology's use, it adopts a multiprocess approach (Huesmann, Lagerspetz, & Eron, 1984). This is especially the case once researchers start considering the bidirectionality of relationships between technology use and cognitive factors or even examine caregiver mediation strategies. The standard approach to investigating a new technology therefore opens up a natural progression of scientific thinking (Grimes et al., 2008). Research starts by taking a causationist standpoint but then moves on to more complex, multidimensional, and bidirectional approaches. Yet instead of this process leading to long-lasting accrual of knowledge, it restarts whenever a new technology is introduced, and research thus fails to consider the technological research progression that came before.

Lack of consensus. Research on new technologies therefore lacks overarching theory, but its standard approach to problems lets it progress in a similar fashion. There has been a lot of thought about how a field that investigates a problem without an overarching theoretical framework or an underlying basis for scientific understanding should look like. It has been argued that such a preparadigmatic field should be "marked by frequent and deep debates over legitimate methods, problems, and standards of solution, though these serve rather to define schools than to produce agreement" (Kuhn, 1962, p. 48).

This conflict about methodology and scientific standards has been very evident in research on technological panics. There are clear divisions in the scientific debate about violence in video games (Elson & Ferguson, 2014) and the current discussion about smartphone use (Ophir, Lipshits-Braziler, & Rosenberg, 2019). The lack of an underlying theory lets different camps emerge that are in scientific disagreement with each other, which leaves the quality of scientific output relatively uncontrolled (Kuhn, 1962). This problem is compounded, or possibly illustrated, by the isolated nature of the field of research on media effects in children, which is often made up of "isolated, uncoordinated studies" without a long-term or collaborative focus (Craig, 1999; Pecora, 2006, p. 1).

In preparadigmatic fields such as research on new technologies, the wheel is therefore routinely reinvented, and little progress is made because of the lack of theoretical anchors for scientific investigation and quality control. The Sisyphean cycle of technology panics thus restricts the researchers to addressing practical problems and internal debate rather than building a long-lasting theoretical understanding that can shape science in the long term.

4. No progress; new panic

The researchers trying to investigate a technological panic therefore lack the essential conceptual and methodological tools to produce evidence quickly and effectively. The funding provided by politicians and policymakers thus does little to provide concrete evidence for informing policy interventions, and what evidence is useful cannot inform the reaction to the next panic. This leaves policymakers in a difficult situation. In this section, I discuss how policymakers can react when facing this lack of evidence, whether it is even worthwhile, and how the introduction of a new technology often helps put an end to such problems.

The difficult decision of the policymaker. In addressing new technologies, there is an understandable pressure placed on policymakers and politicians to act to alleviate the cause of a technological panic. Although one could argue that only the specific use of a technology determines whether it has good or bad repercussions, many disagree and believe that technologies can be harmful (or beneficial) by design: "The barrel of a gun can, if one insists, be used to stir one's tea. It is, however, better at killing and will primarily be used certainly for that purpose" (Hamelink, 1998, p. 62). Many policy interventions are therefore based on the instrumentalist assumption that policy management is integral to harnessing technology's constructive forces (Hamelink, 1998). From that perspective, policymakers not only face a public expectation to address whether technological panics are justified or to drive meaningful legislation but also should act to ensure the public good.

But how can policymakers inform their interventions for new technologies? In his book about technological policy, Hamelink (1998) proposed five types of evaluation. Policymakers could do *retrospective* work, learning from the past, or *formative* work, in which they test technological products when they emerge into the market. The retrospective approach is problematic because the past is often too different from the future to accurately predict the effects of new technologies. Furthermore, the formative approach is limited severely because technological innovation is so fast that it is often impossible to evaluate it in a timely manner on release. Other options for policymakers are calculating *risk* using probabilistic judgments and cost-benefit analysis, but technological events cannot be that well

estimated, or working *prospectively* and therefore trying to forecast technologies, which is known to be extremely difficult and inaccurate. All these options are therefore not viable to inform widespread public-policy approaches to new technologies. The only other option is *summative* evaluation, whereby researchers or policymakers examine the impact of a technology on certain groups as quickly as possible. This is currently the go-to method for informing policy. But as noted earlier, research progress when examining new technologies is complex, slow, and outpaced by technological change: "By the time the gap [in societies' understanding of the technology] is closed, a new gap has emerged" (Hamelink, 1998, p. 79).

More recently, vocal contributors to technology panics have argued that policymakers should therefore use the precautionary principle, implementing restrictive technology policy out of an abundance of caution to head off potential harm. This reverses the onus of proof so that the actor or technology provider needs to show that the activity is harmless instead of vice versa (Kriebel et al., 2001). Wertham (1954) provided a gripping analogy of this in his book:

> Gardening consists largely in protecting plants from blight and weeds, and the same is true of attending to the growth of children. If a plant fails to grow properly because attacked by a pest, only a poor gardener would look for the cause in that plant alone. The good gardener will think immediately in terms of general precaution and spray the whole field. But with children we act like the bad gardener. We often fail to carry out elementary preventative measures, and we look for the causes in the individual child. (p. 2)

Yet it is still a key pillar of public policy that interventions should at least be *evidence-focused* even if they cannot be completely *evidence-based*. The precautionary principle seems like a very extreme and laborsome solution that could hinder important beneficial technological progress. Furthermore, it often fails to take into account the benefits of certain technologies because it is preoccupied with the harms. When acknowledging the inability to completely base policy decisions on evidence (i.e., making them evidence-focused instead), people will have to learn to live with the understanding that there will never be enough information available to make truly informed technology policy. People's reactions to technologies might inherently be gambles (Hamelink, 1998). To consider whether this is a good trade-off, one needs to consider the work of other researchers, such as Collingridge, who have written compellingly about whether technological intervention might even have the power to deliver the desired effects.

Why acting fast might never be fast enough. Many philosophers and researchers believe that technological innovations and change is rapid and seems unstoppable: "No one can foresee the radical changes to come. But technological advance will move faster and faster and can never be stopped" (Heidegger, 1966, p. 51). Forecasting technological change is therefore "just impossible" because it is driven by complex interactions and is extremely rapid (Collingridge, 1980, p. 15; Ellul, 1980). This makes it difficult to develop controls that do not seem arbitrary when first proposed. But more importantly, the speed of technological entrenchment means that "by the time a technology is sufficiently well developed and diffused for its unwanted social consequences to become apparent, it is no longer easily controlled. Control may still be possible, but it has become very difficult, expensive and slow" (Collingridge, 1980, pp. 17–18).

This can be seen in current British attempts to block online pornography access for children via age verification, a move that means databases of incredibly sensitive information and personal identities will have to be constructed. At this stage of Internet adoption, such intervention is both risky and limits the broad personal freedom of the whole population. This is because once adoption has surpassed a certain level,

> society and the rest of its technology gradually adjust to the new technology, so that when it is fully developed any major change in the new technology requires change in many other technologies and social and economic institutions, making its control very disruptive and expensive. (Collingridge, 1980, pp. 17–18)

Collingridge therefore agrees with Hamelink that people's reactions to technologies might need to be gambles not just because the appropriate evidence for evidence-based policy will never be available but also because waiting for the necessary evidence to be established is not possible. Waiting would mean that the technology would already be so entrenched in everyday life that it would be impossible to rectify even if there were strong evidence that this is needed. Evidence-based policy is therefore out of reach, and policy should instead endeavor to ensure that society maintains the ability to change and adapt a technology even after it has spread in the population (Collingridge, 1980). Such adaptive policymaking might rest in regulating the need for flexibility in a technological product or preferring diverse technologies over monopolies even if that is more costly. In other words, technology

development options that are "highly flexible, insensitive to error, and easy to correct should, therefore, be favored" (Collingridge, 1980, p. 194). Given that this adaptive and evidence-focused approach is not the predominant approach taken currently, people are likely to fail in appropriately addressing technological change at the necessary speed.

New panic. Because slow scientific progress in addressing technologies makes policy interventions difficult or impossible, evidence-based or evidence-focused policy is currently virtually impossible to achieve in this area. This raises the question of how most panics about technologies end up being addressed. The answer is rather simple. Most often, sooner or later, the current technological panic will subside because of the introduction of a new technology (Dennis, 1998). From the historical perspective, it is clear that once a new technology is introduced, interest and concern about older technologies decrease substantially (Wartella & Reeves, 1985). Although some researchers believe the interest decreases very quickly or subsides completely (Wartella & Reeves, 1985), others think that it takes a while longer to peter out (Meadowcroft & McDonald, 1986).

Somewhat ironically, however, the introduction of a new technology does serve to reduce the pressure on politicians and policy to intervene to regulate older technologies that had been the target of previous apprehensions. This is especially the case once the concern for the new technology eclipses the concern for the old technology, which has ultimately become an uneventful part of everyday life. Indeed, few 21st-century politicos or health professionals are expected to act to rein in the influence of true-crime stories, radios, or comic books. Rather, public and political attention turns to the new technology, restarting the Sisyphean cycle of technology panics, while leaving behind a debate that potentially contributed little to knowledge creation and could not be addressed by effective and timely policy interventions. The research completed and debates held will be largely forgotten, clearing the field for a new generation of researchers, politicians, and policymakers to reinvent the wheel again for a new technology recently introduced into society.

Looking Ahead

After elaborating the network of dependencies that drives the Sisyphean cycle of technology panics, it becomes clear that action to address this cycle needs to be taken. Because it cannot be assumed that technologies are designed for the public good, academics and policy makers need to better their ability to understand and control technological development. Only when this is successful can it be ensured that potentially harmful technologies will be spotted quickly and curtailed effectively (Hamelink, 1998). Although such harmful technologies might not yet be invented, in an age of technological innovation, it is just a matter of time until they are.

However, some might argue that psychologists fare rather well out of the Sisyphean cycle of technology panics: Investigating a new technology almost guarantees funding, societal importance, and public attention. These, in turn, are increasingly important for supporting scientific careers (Ravetz, 1971). Academics could thus be discouraged from questioning the effectiveness of their research about new technologies given that such work helps them win funding, media coverage, and prestige. As in Albert Camus's *The Myth of Sisyphus* (1955), they might therefore be content with their fate in contributing to a futile and cyclic research task, just as Sisyphus might be content with his task of pushing a boulder up a hill for eternity. This highlights how current incentives for forging a successful career in academia diverge sharply from the motivators necessary to support good science. Yet this is no excuse for overlooking the negative impact of the Sisyphean cycle of technology panics, especially with much of the relevant research funded out of the public purse. With technological change and adoption accelerating, the importance of ensuring effective steering of new technologies and efficient research production is also only going to increase in future. Forgoing rigorous practices and theory creation now might have profound opportunity costs later.

In the previous section, I covered some aspects of policymaking that could be adapted to better address new technological developments. The main focus was on moving from an evidence-based-policy to a more evidence-focused-policy approach that is not overly reliant on the provision of slow and laborsome scientific consensus. This is because a delay in policy response might make it impossible to intervene in a technological development that has become increasingly entrenched. Possible additional policy approaches to accelerate the production of policy recommendations could include implementing a science court that hears arguments and then makes an informed decision (Collingridge, 1980). Such a science court would be made up of academic and stakeholder experts on a specific new development; the court is called to judge the current evidence and recommend policies even if there is not yet enough evidence to label their proposed policies "evidence-based." This system would forgo the need to achieve ultimate scientific consensus, forcing policy change at earlier stages of scientific research.

Such a system of forced decision-making could be combined with mandating the continual monitoring of a preemptive policy decision after it has been made to rapidly spot whether it is in need of correction (Collingridge, 1980). In this model, policy decisions would not be made as point decisions but would instead be considered a continual process that is to be monitored and adapted (Collingridge, 1980). Researchers would therefore have a different job than they do currently: Certain groups of them would recommend policy changes early, which others would then monitor and continually evaluate. Society could therefore start homing in on a workable and effective policy solution without waiting for the scientific evidence to be complete.

Such structural change to policymaking, however, is hard to come by. For the rest of this article, I will therefore focus on what researchers could do to mitigate the effects of the Sisyphean cycle of technology panics. Although I do not present ultimate solutions, my two main suggestions will hopefully stimulate debate and conversation about what can be done to improve research on technologies. First, scientists could try to break the Sisyphean cycle by letting future research build on past research to create a more linear and less circular progression of knowledge. Second, they could aim to accelerate the production of scientific evidence so that it can help build policy in a more efficient and effective way.

Breaking the cycle

One possible approach to stop the cyclic nature of panics would entail the development of better theories and theoretical approaches that would make it possible to integrate research on older technologies into more current research considering recent technological developments. New technologies would challenge previous theories, requiring them to be revised but not replaced with a whole new theoretical framework. The article has presented some theoretical approaches that potentially allow for a more continuous study of technologies, even if they would not completely break the Sisyphean cycle of technology panics. Some researchers have focused on technological affordances, examining the activities that each new technology affords the user and their similarities and differences (Evans et al., 2017). Others have examined the time that technology displaces and how that might drive certain well-being outcomes (Dienlin et al., 2018; Przybylski & Weinstein, 2017). More recently, researchers have begun to put forward developmental frameworks that examine technologies through the lens of adolescent identity development or integrative frameworks that examine multiple different media types (Taylor & Bazarova, 2018).

Because these approaches are not widespread and universally used, they do not yet have the power to stop the Sisyphean cycle of technology panics. They are, however, important examples of potential avenues that could be taken to build a more integrative approach to technology that would substantially lessen the repetitive nature of technology research. Remember, however, that it would be a momentous task to reverse-engineer a complete theoretical framework for an established research area. Furthermore, because research into technological innovations is mainly funded to solve a concrete practical problem, finding the necessary political and academic backing for such a long-term theoretical task will be difficult (Grimes et al., 2008).

Accelerating scientific evidence

The other approach that researchers could take is to accelerate the production of scientific evidence. Especially in a time in which technological change and adoption is accelerating, this might be crucial to ensure important evidence is delivered in time: whether that is to inform or evaluate policy. To do so, the research field should endeavor to streamline and focus current psychological research from the outset instead of going through certain research stages that are relatively ineffective but are currently repeated for every new technology studied. One example of such ineffective research stages is the initial causationist approach to a new technology in which researchers examine the effects of the technology as a whole, which is far too broad to merit robust conclusions (Grimes et al., 2008).

Work done to investigate emergent technologies should therefore entail enough nuance to provide cohesive and replicable outcomes from the start. What could such an approach for improved and more efficient psychological technology research look like? The UnITED Framework for Technology Research outlined below describes five aspects that, if addressed in future research, could improve the accrual of evidence about emergent technologies.

1. *Unique use*: Researchers should not investigate the effects of a technology as a whole (e.g., digital-technology use or social-media use) but should focus instead on a unique use that sets the specific technology of interest apart. They should also consider the mechanisms necessary for this unique use to affect the outcome of interest. For example, if interested in social-media use's effect on well-being, researchers should focus on an aspect or feature of social-media use that makes it unique (e.g., the nondirect nature of communication; Altman & Taylor, 1973).

2. *Individual*: Researchers should specify a specific population when making claims about emergent technology effects. Furthermore, their work should clearly demarcate whether it is examining within-person or between-person effects. In the process, researchers should highlight how they attempted to control for other individual factors that could affect both the technology-use measure and the outcome of interest.
3. *Time frame*: In a longitudinal study, the time frame of the effects measured should be specified, and the theoretical impact should be discussed. Researchers should clearly communicate whether, for example, they examined the changes predicted by social media 1 min after use rather than 1 year after use and why such a time scale was theoretically plausible.
4. *Effect size*: Researchers should report the size of the effect or association that they investigated and provide an interpretation of what the size means for stakeholders. The key question is, statistical significance aside, why should I believe this effect is important?
5. *Direction*: Researchers who do cross-sectional studies on emergent technologies should acknowledge that media effects are inherently bidirectional and that correlational work is unable to decipher which direction the effects of interest are in. Researchers who do longitudinal work should interpret and highlight the bidirectional paths of the effects of interest.

If implemented, this framework could improve the quality of research and substantiate the depth of understanding about new technology effects. Crucially, it could also accelerate the production of much-needed evidence, especially if paired with open scientific principles such as open data, shared code, and preregistration (Munafò et al., 2017; Vazire, 2018). By sharing data and materials, progress could be accelerated because researchers can easily build on (and check) others' work (Crüwell et al., 2019). Furthermore, by implementing preregistration and Registered Reports, false-positive rates and publication biases can be better controlled (Chambers, 2013; Wagenmakers, Wetzels, Borsboom, van der Maas & Kievit, 2012).

The adoption of open scientific principles could also extend to the promotion of large-scale and diverse-team science. Recent examples of large team-based scientific ventures such as the Psychological Science Accelerator or the Many Labs projects provide encouraging examples of how diverse researchers with varying areas of expertise can work together to provide key insights into pertinent research questions (Klein et al., 2018; Moshontz et al., 2018). Similar team-based scientific approaches could be applied to the research of new technologies to ultimately accelerate the production of high-quality evidence in the area.

Such an accelerated technology research procedure would ensure that work is produced at the highest possible standard and that the research area learns from the issues that have hindered progress in the past. Although such acceleration will not solve the Sisyphean cycle of technology panics, it will provide a first step to managing and mitigating its negative effects on the psychological discipline and improve society's understanding of new technologies.

Conclusion

Digital technologies are presently shaping and reshaping people's lives and how they live them; their power to do so will likely increase in the foreseeable future. High-quality scientific evidence considered within a broader historic context is needed to understand how these changes will affect people and society. It will help ensure stakeholders, such as governments, regulators, designers, programmers, parents, and digital technology users, are equipped with the tools and information necessary to make informed decisions in caregiving, policy, and personal arenas.

With that understood, there is little reason to assume future research investigating new technologies will escape the Sisyphean cycle of technology panics without a substantial shift in conceptual and empirical approach. The lack of a linear approach in this research area—created on the basis of a societal problem, not a scientific theory—means that panics are reincarnated for every new technology that becomes popular in society. Scientific progress is slow, and the research output produced is routinely conflicting and intensely wasteful. This stymies actionable science communication and policymaking. Furthermore, technology quickly embeds itself in society, which makes it difficult to change or adapt, meaning that evidence provision needs to be as fast as possible. It is apparent from examining past technology panics that research in the area routinely fails to efficiently deliver answers to important and divisive research questions.

Being realistic, there is little impetus for the field to reflect about its own methodology and its place in the network of political, academic, and public spheres that drive this inefficient cycle. To ensure that psychology does not become an accomplice to a never-ending Sisyphean cycle of technology panics, the research area has to acknowledge the need for radical change. Psychologists need to recognize the increasingly prominent role they play in facilitating cycles of technology panics

and consider whether what they are doing is bringing a net benefit to society and academia. Psychological scientists need to encourage debate about how policy can be built in a time of accelerating technological change but slow research progress. Furthermore, research practices should be adapted so that the research process does not restart when a new technology gets introduced and that evidence is provided quickly. Reflecting, discussing, and adapting the field to address the Sisyphean cycle of technology panics can ultimately empower psychology to steer predictable public concerns about emergent technologies into a more productive and efficient future.

Transparency

Action Editor: Laura A. King
Editor: Laura A. King
Declaration of Conflicting Interests
The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.
Funding
This work was supported by Barnardo's UK and Emmanuel College, University of Cambridge.

ORCID iD

Amy Orben https://orcid.org/0000-0002-2937-4183

Acknowledgments

I thank Jerome Ravetz for the coffees we shared during the conceptualization of this article: Our conversations gave me the confidence to start putting my own ideas to paper. Furthermore, I thank Diane Coyle, Sally Davies, Tim Dalgleish, and Andrew Przybylski, who all provided me with ideas from their respective fields to make this article better. I am also grateful for the MediaPsychology Conference 2019 in Chemnitz, where I presented preliminary ideas and received much encouragement and feedback. Tobias Dienlin and Andrew Przybylski gave valuable input on late versions of this article.

References

Altman, I., & Taylor, D. A. (1973). *Social penetration: The development of interpersonal relationships*. New York, NY: Holt, Rinehart and Winston.

Anderson, J. A. (2008). The production of media violence and aggression research: A cultural analysis. *American Behavioral Scientist*, *51*, 1260–1279. doi:10.1177/0002764207312019

Anderson, M., & Jiang, J. (2018 May 31). *Teens, social media & technology 2018*. Pew Research Center. Retrieved from https://www.pewresearch.org/internet/2018/05/31/teens-social-media-technology-2018/

Bell, V., Bishop, D. V. M., & Przybylski, A. K. (2015). The debate over digital technology and young people. *The BMJ*, *351*, Article h3064. doi:10.1136/bmj.h3064

Blakemore, S.-J. (2019). Adolescence and mental health. *The Lancet*, *393*, 2030–2031. doi:10.1016/S0140-6736(19)31013-X

Blumer, H., & Hauser, P. M. (1970). *Movies, delinquency, and crime*. New York, NY: Arno Press.

Boyd, D. (2014). *It's complicated: The social lives of networked teens*. New Haven, CT: Yale University Press.

Bushman, B. J., & Anderson, C. A. (2002). Violent video games and hostile expectations: A test of the general aggression model. *Personality and Social Psychology Bulletin*, *28*, 1679–1686. doi:10.1177/014616702237649

Camus, A. (1955). *The myth of Sisyphus and other essays* (J. O'Brien, Trans.). New York, NY: Alfred A. Knopf.

Chambers, C. D. (2013). Registered Reports: A new publishing initiative at Cortex. *Cortex*, *49*, 609–610. doi:10.1016/J.CORTEX.2012.12.016

Choi, J., Cho, H., Lee, S., Kim, J., & Park, E.-C. (2018). Effect of the online game shutdown policy on internet use, internet addiction, and sleeping hours in Korean adolescents. *The Journal of Adolescent Health*, *62*, 548–555. doi:10.1016/j.jadohealth.2017.11.291

Cohen, S. (1972). *Folk devils and moral panics: The creation of the mods and rockers*. London, England: MacGibbon & Kee.

Collingridge, D. (1980). *The social control of technology*. London, England: Frances Pinter.

Craig, R. T. (1999). Communication theory as a field. *Communication Theory*, *9*, 119–161. doi:10.1111/j.1468-2885.1999.tb00355.x

Crüwell, S., Doorn, J., van Etz, A., Makel, M. C., Moshontz, H., Niebaum, J. C., . . . Schulte-Mecklenbeck, M. (2019). Seven easy steps to open science. *Zeitschrift Für Psychologie*, *227*, 237–248. doi:10.1027/2151-2604/a000387

Davies, S. C., Atherton, F., Calderwood, C., & McBride, M. (2019). *United Kingdom Chief Medical Officers' commentary on 'Screen-based activities and children and young people's mental health and psychosocial wellbeing: A systematic map of reviews.'* Department of Health and Social Care. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/777026/UK_CMO_commentary_on_screentime_and_social_media_map_of_reviews.pdf

Dennis, P. M. (1998). Chills and thrills: Does radio harm our children? The controversy over program violence during the age of radio. *Journal of the History of the Behavioural Sciences*, *34*, 33–50.

Department for Digital, Culture, Media and Sport & Secretary of State for the Home Department. (2019). *Online harms white paper*. London, England: HM Government. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/793360/Online_Harms_White_Paper.pdf

Dienlin, T., Masur, P. K., & Trepte, S. (2018, May). *A longitudinal analysis of the privacy paradox using RI-CLPM*. Paper presented at the 68th annual conference of the International Communication Association, Prague, Czech Republic.

DiPietro, J. A. (2000). Baby and the brain: Advances in child development. *Annual Review of Public Health*, *21*(1), 455–471. doi:10.1146/annurev.publhealth.21.1.455

Ellul, J. (1980). *The technological system*. New York, NY: Continuum.

Elson, M., & Ferguson, C. J. (2014). Twenty-five years of research on violence in digital games and aggression: Empirical evidence, perspectives, and a debate gone astray. *European Psychologist*, *19*(1), 33–46. doi:10.1027/1016-9040/a000147

Evans, S. K., Pearce, K. E., Vitak, J., & Treem, J. W. (2017). Explicating affordances: A conceptual framework for understanding affordances in communication research. *Journal of Computer-Mediated Communication*, *22*, 35–52. doi:10.1111/jcc4.12180

France, A. (2007). *Understanding youth in late modernity*. Maidenhead, England: Open University Press.

Furedi, F. (2015). The media's first moral panic. *History Today*, *65*(11). Retrieved from https://www.historytoday.com/archive/media%E2%80%99s-first-moral-panic.

Garland, D. (2008). On the concept of moral panic. *Crime, Media, Culture: An International Journal*, *4*, 9–30. doi:10.1177/1741659007087270

Greenfield, S. (2014). *Mind change: How digital technologies are leaving their mark on our brains*. New York, NY: Random House.

Grimes, T., Anderson, J. A., & Bergen, L. (2008). *Media violence and aggression: Science and ideology*. Thousand Oaks, CA: Sage.

Gruenberg, S. M. (1935). Radio and the child. *The Annals of the American Academy of Political and Social Science*, *177*(1), 123–128. doi:10.1177/000271623517700118

Hamelink, C. J. (1998). *The technology gamble*. Norwood, NJ: Ablex Publishing.

Heidegger, M. (1966). *Discourse on thinking*. New York, NY: Harper & Row.

Herzog, H. (1941). *Children and their leisure time listening to the radio*. New York, NY: Radio Council on Children's Radio Programs.

Himmelweit, H. T., Oppenheim, A. N., & Vince, P. (1961). *Television and the child: An empirical study of the effect of television on the young*. Oxford, England: Oxford University Press.

House of Commons Science and Technology Select Committee. (2019). *Impact of social media and screen-use on young people's health* (pp. 1–92). London, England: House of Commons. Retrieved from https://publications.parliament.uk/pa/cm201719/cmselect/cmsctech/822/822.pdf

Huesmann, L. R., Lagerspetz, K., & Eron, L. D. (1984). Intervening variables in the TV violence-aggression relation: Evidence from two countries. *Developmental Psychology*, *20*, 746–775. doi:10.1037/0012-1649.20.5.746

Kamhawi, R., & Weaver, D. (2003). Mass communication research trends from 1980 to 1999. *Journalism & Mass Communication Quarterly*, *80*, 7–27. doi:10.1177/107769900308000102

Klein, R. A., Vianello, M., Hasselman, F., Adams, B. G., Reginald, B., Adams, J., . . . Nosek, B. A. (2018). Many labs 2: Investigating variation in replicability across samples and settings. *Advances in Methods and Practices in Psychological Science*, *1*, 443–490. doi:10.1177/2515245918810225

Kolb, B., & Gibb, R. (2011). Brain plasticity and behaviour in the developing brain. *Journal of the Canadian Academy of Child and Adolescent Psychiatry*, *20*, 265–276.

Kriebel, D., Tickner, J., Epstein, P., Lemons, J., Levins, R., Loechler, E. L., . . . Stoto, M. (2001). The precautionary principle in environmental science. *Environmental Health Perspectives*, *109*, 871–876. doi:10.1289/ehp.01109871

Kuhn, T. S. (1962). *The structure of scientific revolutions*. London, England: The University of Chicago Press.

Lang, A. (2013). Discipline in crisis? The shifting paradigm of mass communication research. *Communication Theory*, *23*, 10–24. doi:10.1111/comt.12000

Leonardi, P. M. (2012). *Car crashes without cars: Lessons about simulation technology and organizational change from automotive design*. Cambridge, MA: MIT Press.

Livingstone, S. M., Mascheroni, G., & Staksrud, E. (2018). European research on children's internet use: Assessing the past and anticipating the future. *New Media & Society*, *20*, 1103–1122. doi:10.1177/1461444816685930

Lowery, S., & DeFleur, M. L. (1988). Violence and media: The turbulent sixties. In S. Lowery & M. L. DeFleur (Eds.), *Milestones in mass communication research*. New York, NY: Longman Publishers.

Meadowcroft, J. M., & McDonald, D. G. (1986). Meta-analysis of research on children and the media: Atypical development? *Journalism Quarterly*, *63*, 474–480. Retrieved from https://eric.ed.gov/?id=EJ346973

Moshontz, H., Campbell, L., Ebersole, C. R., IJzerman, H., Urry, H. L., Forscher, P. S., . . . Chartier, C. R. (2018). The psychological science accelerator: Advancing psychology through a distributed collaborative network. *Advances in Methods and Practices in Psychological Science*, *1*, 501–515. doi:10.1177/2515245918797607

Munafò, M. R., Nosek, B. A., Bishop, D. V. M., Button, K. S., Chambers, C. D., Percie, du, Sert, N., & Ioannidis, J. P. A. (2017). A manifesto for reproducible science. *Nature Human Behaviour*, *1*(1), 1–21. doi:10.1038/s41562-016-0021

Murali, V., & George, S. (2007). Lost online: An overview of internet addiction. *Advances in Psychiatric Treatment*, *13*(1), 24–30. doi:10.1192/apt.bp.106.002907

Neuman, W. R., & Guggenheim, L. (2011). The evolution of media effects theory: A six-stage model of cumulative research. *Communication Theory*, *21*, 169–196. doi:10.1111/j.1468-2885.2011.01381.x

Ofcom. (2019). *Children and parents: Media use and attitudes report 2018*. Retrieved from https://www.ofcom.org.uk/research-and-data/media-literacy-research/childrens/children-and-parents-media-use-and-attitudes-report-2018

Okasha, S. (2002). *Philosophy of science: A very short introduction*. Oxford, England: Oxford University Press.

Ophir, Y., Lipshits-Braziler, Y., & Rosenberg, H. (2019). New-media screen time is not (necessarily) linked to depression: Comments on Twenge, Joiner, Rogers, and Martin (2018). *Clinical Psychological Science*, *8*, 374–378. doi:10.1177/2167702619849412

Pecora, N. O. (2006). The changing nature of children's television: Fifty years of research. In N. O. Pecora, J. Murray, & E. Wartella (Eds.), *LEA's communication series. Children*

and television: Fifty years of research (pp. 1–40). Mahwah, NJ: Erlbaum.

Potter, W. J., Cooper, R., & Dupagne, M. (1993). The three paradigms of mass media research in mainstream communication journals. *Communication Theory*, *3*, 317–335. doi:10.1111/j.1468-2885.1993.tb00077.x

Preston, M. I. (1941). Children's reactions to movie horrors and radiocrime. *The Journal of Pediatrics*, *19*, 147–168. doi:10.1016/S0022-3476(41)80059-6

Przybylski, A. K., & Orben, A. (2017, June 18). Social media is nothing like drugs, despite all the horror stories. *The Conversation*. Retrieved from http://theconversation.com/social-media-is-nothing-like-drugs-despite-all-the-horror-stories-79382

Przybylski, A. K., & Weinstein, N. (2017). A large-scale test of the Goldilocks hypothesis: Quantifying the relations between digital-screen use and the mental well-being of adolescents. *Psychological Science*, *28*, 204–215. doi:10.1177/0956797616678438

Ramey, C. R. (1994). In the battle over TV violence, the communications act should be cheered, not changed! *Federal Communications Law Journal*, *42*, 349–355.

Ravetz, J. R. (1971). *Scientific knowledge and its social problems*. London, England: Oxford University Press.

Riffe, D., & Freitag, A. (1997). A content analysis of content analyses: Twenty-five years of journalism quarterly. *Journalism & Mass Communication Quarterly*, *74*, 873–882. doi:10.1177/107769909707400414

Royal Society of Public Health. (2017). *#StatusOfMind*. Retrieved from https://www.rsph.org.uk/our-work/campaigns/status-of-mind.html

Rubenstein, E. A. (1982). Introductory comments. In D. Pearl, L. Bouthilet, & J. Lazar (Eds.), *Television and behavior: Ten years of scientific progress and implications for the eighties* (pp. 104–107). Rockville, MD: National Institute of Mental Health.

Sanbonmatsu, D. M., & Johnston, W. A. (2019). Redefining science: The impact of complexity on theory development in social and behavioral research. *Perspectives on Psychological Science*, *14*, 672–690. doi:10.1177/1745691619848688

Seagoe, M. V. (1951). Children's television habits and preferences. *The Quarterly of Film Radio and Television*, *6*, 143–153. doi:10.2307/1209900

Strasburger, V. C. (1989). Children, adolescents, and television—1989: II. The role of pediatricians. *Pediatrics*, *83*, 446–448.

Taylor, S. H., & Bazarova, N. N. (2018). Revisiting media multiplexity: A longitudinal analysis of media use in romantic relationships. *Journal of Communication*, *68*, 1104–1126. doi:10.1093/joc/jqy055

Tilley, C. L. (2012). Seducing the innocent: Fredric Wertham and the falsifications that helped condemn comics. *Information & Culture: A Journal of History*, *47*, 383–413. doi:10.1353/lac.2012.0024

Twenge, J. M. (2018). *iGen: Why today's super-connected kids are growing up less rebellious, more tolerant, less happy—and completely unprepared for adulthood*. New York, NY: Atria Books.

Twenge, J. M., Joiner, T. E., Rogers, M. L., & Martin, G. N. (2017). Increases in depressive symptoms, suicide-related outcomes, and suicide rates among U.S. adolescents after 2010 and links to increased new media screen time. *Clinical Psychological Science*, *6*, 3–17. doi:10.1177/2167702617723376

Varghese, S. (2018, October 2). Matt Hancock has a plan to curb social media use. It's a bad plan. *Wired*. Retrieved from https://www.wired.co.uk/article/social-media-guidelines-matt-hancock

Vazire, S. (2018). Implications of the credibility revolution for productivity, creativity, and progress. *Perspectives on Psychological Science*, *13*, 411–417. doi:10.1177/1745691617751884

Viner, R., Davie, M., & Firth, A. (2019). *The health impacts of screen time: A guide for clinicians and parents*. Royal College of Paediatrics and Child Health. Retrieved from https://www.rcpch.ac.uk/resources/health-impacts-screen-time-guide-clinicians-parents

Wagenmakers, E.-J., Wetzels, R., Borsboom, D., van der Maas, H. L. J., & Kievit, R. A. (2012). An agenda for purely confirmatory research. *Perspectives on Psychological Science*, *7*, 632–638. doi:10.1177/1745691612463078

Wait Until 8th. (2018). *Wait until 8th*. Available from https://www.waituntil8th.org

Wartella, E., & Reeves, B. (1985). Historical trends in research on children and the media: 1900–1960. *Journal of Communication*, *35*, 118–133. doi:10.1111/j.1460-2466.1985.tb02238.x

Wartella, E., & Robb, M. (2008). Historical and recurring concerns about children's use of the mass media. In S. L. Calvert & B. J. Wilson (Eds.), *The handbook of children, media, and development* (pp. 5–26). Oxford, England: Blackwell. doi:10.1002/9781444302752

Wartella, E. A., & Jennings, N. (2000). Children and computers: New technology. Old concerns. *The Future of Children*, *10*(2), 31–43. doi:10.2307/1602688

Wellman, B. (2004). The three ages of internet studies: Ten, five and zero years ago. *New Media & Society*, *6*, 123–129. doi:10.1177/1461444804040633

Wertham, F. (1954). *Seduction of the innocent*. New York, NY: Rinehart & Company.

Wright Mills, C. (1954, April 25). Nothing to laugh at. *The New York Times*, p. BR20.