Freedom and Constraint in Digital Environments: Implications for the Self

Sanaz Talaifar & Brian S. Lowery

Stanford University

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Author Note

Sanaz Talaifar https://orcid.org/0000-0002-4918-9575

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Correspondence concerning this article should be addressed to Sanaz Talaifar. Email: stalaifar@gmail.com.

Abstract

We evaluate how features of the digital environment free or constrain the self. Our review of the empirical evidence suggests that modern technological features, like predictive algorithms and tracking tools, pose four potential obstacles to the freedom of the self: 1) lack of privacy and anonymity, 2) (dis)embodiment and entrenchment of social hierarchy, 3) changes to memory and cognition, 4) behavioral reinforcement coupled with reduced randomness. Comparing these constraints on the self to the freedom promised by earlier digital environments suggests that digital reality can be designed in more freeing ways. We describe how people reassert personal agency in the face of the digital environment's constraints, and provide avenues for future research regarding technology's influence on the self.

Keywords: digital technology, affordances, self, behavioral reinforcement, memory, cognition, autonomy, algorithmic bias, privacy, anonymity, echo chambers, prediction

The internet promised to expand our horizons, connecting us with diverse worlds we would have never encountered otherwise (McKenna & Bargh, 2000). In the process, we were freed to become anyone we might wish, to explore new ways of being that would upend traditional hierarchies. Somehow, this vision does not seem to have materialized. Today, going online can feel less like diving into a pool of unknown possibilities and more like entering an enclosed carnival house of mirrors. The elusiveness of freedom in the modern digital world is reflected in popular media headlines that ask "If AI Is Predicting Your Future, Are You Still Free?" or those that more definitively pronounce that "We Have Abandoned Every Principle of the Free and Open Internet" (Brandom, 2017; Véliz, 2021).

This paper considers the empirical evidence behind such claims. Specifically, we evaluate how features of the current digital environment free or constrain the selves that people can express, explore, escape, construct, destruct, and change. We do so by reviewing evidence related to four potential obstacles to freedom that the digital environment poses for the self: 1) lack of privacy and anonymity, 2) (dis)embodiment and entrenchment of social hierarchy, 3) changes to memory and cognition, and 4) behavioral reinforcement and reduced randomness. Drawing on research from across the social and computer sciences, our review highlights that the digital environment offers the self opportunities for both freedom and constraint. However, our thesis is that the digital environment is placing underappreciated constraints on the self and that better attending to these constraints opens new avenues for research. We compare the constraining forces of the current digital world to the freeing forces promised by the early internet to show that constraint is not inevitable and that digital reality can be designed in more freeing ways.

The strongest version of the claim that the modern digital environment is exerting a constraining force on the self can be described as follows. The uninhibited exploration promised by the anonymity of the early internet has given way to an erosion of privacy that "chills" riskier forms of self-expression and self-exploration. An internet that promised to free people from their marginalized identities through disembodiment reinforces existing status hierarchies through biased algorithms. Habit-forming devices that bombard people with notifications prevent the kind of reflection needed for self-insight and narrative identity development. The recording of every digitally mediated behavior is robbing people of the freedom to forget and be forgotten. And predictive algorithms that feed people content based on their past behaviors serve as reinforcement machines that impede people's ability to change. Although the existing evidence cannot yet support such strong claims, the evidence does invite legitimate doubts about whether the digital environment in fact offers the kinds of freedom people may want or expect it to.

What is clear is that the digital environment provides a new arena for an age-old psychological battle: a self striving for freedom and an environment imposing constraint. Indeed, research shows that in the face of the aforementioned threats to their freedom, people are developing strategies to reassert their agency online, but these effortful strategies often fall short in the face of the digital environment's constraining defaults. Our aim is to galvanize psychologists to pay greater attention to this unfolding battle, its new rules of engagement, and the ways in which freedom might be on the losing side. In articulating this perspective, we are responding to calls for greater theory development regarding digital technology's effects on individuals and society (Valkenburg, Peter, & Walther, 2016; Orben 2020; Wagner et al., 2021).

Theoretical Framework

Before reviewing the empirical evidence pertaining to how the digital environment may free or constrain the self, we will explain what we mean by self, freedom, and constraint. We will also describe the concept of "affordance," which offers a potential mechanism through which digital environments free or constrain the self. This background provides a theoretical framework for understanding the perspective we present in subsequent sections of the paper.

The self is a dynamic and multi-faceted mental representation of 'me'— "the entire set of beliefs, evaluations, perceptions, and thoughts that people have about themselves" (Swann & Bosson, 2010, p. 591). The self is multi-faceted in that different facets of the self are revealed in different environments. The self is dynamic in that it changes over time. The origins of the self are both intrapersonal and interpersonal. For instance, people can seek knowledge about the self *intrapersonally* through introspection or *interpersonally* through appraisals from others. Attending to interpersonal origins of the self shows how the self is socially constructed. People make sense of who they are in distinctly social environments—in the context of social norms, social roles, social hierarchies, and social relationships…"

At the same time, the self can select, alter, and defy its environment (Swann & Jetten, 2017). In exerting influence on its environment, digital or otherwise, the self can explore and construct new selves, and it can forget and destruct old selves. This agentic process allows the self to experience freedom. Philosophers define freedom as the ability to act without external interference and with enough power and resources to achieve one's goals (Christman, 2020). The ability to act without interference is considered *negative freedom* or "freedom from" (Berlin, 1969; Fromm, 1941). Environments and social structures (e.g., racism, sexism) constrain negative freedom to the extent that they interfere with a subset of selves' ability to act (e.g., to

vote, to open a bank account) The ability to achieve one's goals is considered *positive freedom* or "freedom to." Environments constrain positive freedom to the extent that they interfere with agency and autonomy to achieve desired ends like self-expression, self-mastery, and self-actualization. In our review, we consider how digital environments can constrain both negative and positive freedom. For instance, if the digital environment perpetuates social inequities that prevent some selves from acting, then it constrains these selves' negative freedom. If the digital environment prevents people from exploring or constructing a desired identity, then it constrains the self's positive freedom.

No environment provides complete freedom, but digital environments can offer more or less freedom depending on how their technological features enable or inhibit "possibilities for action." Such possibilities for action are called *affordances* and are an important mechanism through which technological features influence individuals (Gibson, 1979; Evans, Pearce, Vitak, & Treem, 2017). For example, technological features like text messaging and notifications afford the possibility of immediate availability, which may influence people's communication behavior (Karapanos, Teixeira, Gouveia, 2016). There are many features in the digital environment, and they create many affordances. We chose to analyze a few affordances thoroughly rather than many affordances superficially. Two criteria guided our selection of affordances. First, we focused on affordances that seem relatively pervasive across modern digital environments. Second, we focused on affordances that appeared most likely to influence the self's freedom—the ability to act without interference in expressing, exploring, escaping, constructing, destructing, and changing the self. Table 1 provides a summary of the affordances included in the paper, including their implications for the self and the technological features on which they

depend. Given our non-exhaustive approach, we urge researchers to consider how other affordances of the digital environment may free, constrain, or otherwise impact the self.

It may be tempting to think that for an affordance to influence an individual, the affordance must be *perceived* by the individual. For example, if anonymity (affordance) enabled by encryption (technological feature) prompts self-disclosure (freedom) it must be because a person is aware of the anonymity that technology provides. In support of this idea, research shows that perceptions of anonymity, rather than actual anonymity, predict willingness to post comments online (Wu & Atkin, 2018). Similarly, some might argue that for an affordance to constrain or free an individual, the individual must perceive themselves to be constrained or free. In the above-described example, the individual must experience the self-disclosure prompted by anonymity as freeing, and potentially more freeing that self-disclosure that occurs in a non-anonymous environment. In this view, it is the *perception* of freedom that matters more than actual freedom.

In contrast, we do not claim that it is necessary for an individual to perceive an affordance or its freeing/constraining influence on the self for such influence to exist. This perspective is in line with Gibson's original statement on affordances. He argued that an affordance "is not bestowed upon an object by a need of an observer and his act of perceiving it" but rather is inherent to the actual properties of an environment (Gibson, 1979, p. 139; Scarantino, 2003). Gibson's perspective is also consistent with one of social psychology's most fundamental tenets: People do not always know how the environment influences their cognition and behavior (Ross, 1977). Indeed, people may use digital devices with little conscious awareness, and research suggests that people may not have complete and accurate insight into how the digital environment influences them (Barr et al., 2015; Bastick, 2021; Bayer et al., 2016;

Epstein & Robertson, 2015; Fisher, Goddu, & Keil, 2015; Ward, 2021). Identifying the degree to which people are aware of the digital environment's freeing and constraining influences on the self is not a focus of our paper. However, this is an important and intriguing avenue for future research.

Our analysis recognizes that technological features and their affordances vary over [virtual] space and time. Just as living in Paris in 1968 may shape you differently than living in Manchester in 1988, so too may going on MySpace in 2005 shape you differently than going on Twitter in 2025. Acknowledging temporal context will allow us to compare whether digital environments promised to influenced the self in different, less constraining ways in the early years of the internet than they appear to now. Historical context is particularly important to the study of technology because digital environments evolve so quickly over time, rendering the idea of static digital media effects nonsensical. Moreover, this approach highlights how the number and kinds of people who can access digital environments has also evolved over time. The digital divide persists between and within countries, but the internet is no longer exclusively the province of wealthy Westerners (Li, 2021; Vogels, 2021).

One caution is warranted before we proceed. As is the case for all review articles, especially interdisciplinary review articles, our "conclusions can be no more valid than the evidence surveyed" (Baumeister, 1987, p. 164). If the claims in this paper are somewhat speculative, it is because there remain many gaps in the field's empirical knowledge of digital media's effects on the self. This lack of knowledge stands in contrast to the proliferation of psychological research on digital media's effects on well-being (see Kross et al., 2020 for a review). Despite the uneven empirical record, we have proceeded with our analysis because to do otherwise would exacerbate rather than correct the problem. Nevertheless, our focal theoretical

claim—that the modern digital environment is constraining the self—describes a general pattern rather than a universal truth. Such generality in a theory is desirable according to some philosophers of science because it yields greater empirical content and thus greater testability and falsifiability (Kruglanski, 2001). Indeed, as should already be clear, our hope is that this article spurs new and innovative research on the diverse psychological implications of technological developments.

Table 1

Technological Features & Affordances with Constraining Implications for the Self

Technological Feature	Affordance / Mechanism	Implication for the Self
Tools for tracking/identifying people across websites, devices, services	Lack of anonymity & privacy	Less self-expression and exploration More socially desirable behavior
Tools for sharing/rewarding the visual Predictive algorithms from biased data	More salient social categorization	Entrenchment of social hierarchy
Ease, speed, scale, fidelity of data storage and retrieval Notifications, device portability	Persistence of information Impaired memory & cognition	Less malleable narrative identity Less self-insight
Predictive algorithms based on past behavior of self & similar others	Reduced randomness and choice Behavioral reinforcement	More stable self-views More homogeneity

Note. This table summarizes how features of the digital environment (left hand column) constrain the self (right hand column) through a variety of mechanisms (middle column). The top row corresponds to the section "Lack of Anonymity and Privacy: Implications for Self-Expression and Self-Exploration." The second row corresponds to the section "(Dis)Embodiment: Implications for the Self in Entrenched Social Hierarchies." The third row corresponds to the section "The Paradox of (In)Fallible Memory: Implications for Self-Insight and Narrative Identity." The bottom row corresponds to the section "Behavioral Reinforcement and Reduced Randomness: Implications for Identity Change and Heterogeneity." Technological features and their corresponding affordances should not be viewed in isolation; instead, features enable each other, and affordances work in concert to influence the self's freedom in mutually reinforcing ways.

Lack of Anonymity and Privacy:

Implications for Self-Expression and Self-Exploration

Communication and psychological theorists considered the anonymity afforded by the early internet to be revolutionary (Bargh & McKenna, 2004; Christopherson, 2007; Turkle, 1995). Instead of using their real identities, people could opt for creative usernames that were not necessarily tied to their everyday selves and social circles, a feat made easier by an internet that was less visually saturated than it is today. Although anonymity could encourage antisocial behavior (e.g., deception), researchers theorized it would also have freeing effects by encouraging self-disclosure and disinhibition (Suler, 2004; Walther, 1996), giving people "far greater play in identity construction than is conceivable in face-to-face encounters" (p. 62, McKenna & Bargh, 2000). People, especially adolescents, could experiment with new identities online (Valkenburg et al., 2005; Valkenburg & Peter, 2008). Feedback from online peer groups would support these new selves (Belk, 2013; Walther et al., 2011). In particular, anonymity and privacy would allow people to experiment with less socially sanctioned identities and groups, such as fringe political or sexual groups (McKenna & Bargh, 2000). Anonymity and privacy did not appear to be under threat, as technology monopolies did not yet capture and monetize the vast amounts of personal information that digital behaviors leave behind.

Anonymity (i.e., the degree to which the source of a message is "unknown and unspecified" [Scott, 1998])—is still available in some digital environments like 8chan. People who frequent these digital spaces likely experience the freedom of self-expression and self-exploration that the early internet seemed to promise. However, anonymity and its freeing effects do not seem to be core features of our current digital environment. Only 24% of American adults "agree" or "strongly agree" that it is easy to be anonymous online (Madden, 2014). One

explanation for this may be that ubiquitous tracking technologies do make true anonymity rare since every digitally-mediated behavior can, in theory, be recorded and connected to one's personal identity. Such tracking technologies are foundational to the business model of the handful of major technology platforms that have come to dominate a previously decentralized web (Helmond, 2015). For example, one study found that Google tracks people across more than 80% of the websites they visit (Libert, 2015). Anonymity has also declined because most people's email accounts and social media profiles are connected to their offline identities, encouraging connection with people they know in real life rather than exploration of novel personas and groups (Valkenburg & Peter, 2009). In fact, the most frequently cited reason for using social media is to stay in touch with current friends, while making new friends is one of the least commonly cited reasons (Smith, 2011). Likewise, another study found that Facebook use is not associated with a need for identity exploration and is instead associated with other motives like the need for self-continuity (Manzi et al., 2018).

Today, lack of anonymity seems to be accompanied by lack of privacy (i.e., "selective control of access to the self" [Altman, 1975]).[1] This is reflected in the privacy perceptions of Americans, 81% of whom say they have very little or no control over the data that companies collect about them (Auxier et al., 2020) and that they feel least secure when sharing personal information via social media as compared to other communication channels (Madden, 2014). Concerns about privacy also carry into work settings. A majority of workers in the U.S. and Australia report that their organization monitors their internet usage, and almost half say that their employer monitors the content of their email—surveillance activities that correspond to less trust in management among employees (AMA, 2007; Holland, Cooper, & Hecker, 2015). In

[1] Although Evans, Pearce, Vitak, & Treem (2017) argue that privacy is the consequence of other technological affordances rather than an affordance itself, we treat it as an affordance for the sake of simplicity.

knowingly or unknowingly sharing their personal information online, people do open themselves up to a variety of potential privacy violations (Wilson, Gosling, & Graham, 2012). The severity, scope, and frequency of privacy violations by technology companies—an accounting of which cannot be done justice here—are particularly troubling (e.g., Wakabayashi, 2020; Federal Trade Commission 2019, 2020). Researchers have sought to understand why people continue to reveal personal information online despite these privacy violations and their expressed privacy concerns (for reviews see Gerber, Gerber, & Volkamer, 2018; Kokolakis, 2017). Some scholars argue that people reveal personal information online because the perceived benefits of doing so outweigh the perceived costs (Bol et al., 2018; Dienlen & Metzger, 2016). Other scholars have a less optimistic take, arguing that digital environments exploit people's evolved psychological vulnerabilities through design choices that obfuscate the extent of privacy violations (Acquisti et al., 2020; Acquisiti, Brandimarte, & Hancock, 2022; Bösch et al., 2016; Shariff, Green, & Jettinghoff, 2021).

Lack of privacy and anonymity has important consequences for self-expression. People report expressing their personality traits less online than offline (Blumer & Döring, 2012; Bunker & Kwan, 2021), and self-disclosure is less frequent online than in face-to face interactions according to a meta-analysis of 31 studies (Ruppel et al., 2017). Moreover, the vast majority users on a social media site like Twitter are not expressing their views; they are simply lurking. Three-quarters of Twitter users produce only 3% of all tweets; all other tweets are produced by a minority of highly active users (McClain et al., 2021). People may be less willing to express themselves online because they do not perceive their disclosures in digital environments to be private or anonymous. Consistent with this idea, meta-analytic evidence from 14 studies finds that lack of anonymity is related to less self-disclosure online (Clark-Gordon et al., 2019).

Experimental studies have similarly provided causal evidence that lack of privacy reduces self-disclosure and the willingness to express personal opinions online (Joinson et al., 2010; Wu & Atkin, 2018). It is also possible that privacy erosion reduces self-expression more indirectly, For instance knowledge of privacy erosion among only a few people in a social network may change norms of disclosure in the broader community, affecting the behavior of those who are unaware of privacy erosion.

These findings are particularly relevant in adolescence, when the ability to experiment with new identities and views that one can leave behind is particularly important to development (Eichhorn, 2019; Nesi, Telzer, & Prinstein, 2020). Indeed, according to a recent systematic review self-disclosure online is less beneficial to adolescents' well-being than self-disclosure in face-to face interactions (Towner et al., 2022). Future research could investigate whether the reduced benefits of self-disclosure online can be explained in part by adolescents' concerns about privacy and the persistence of their digital traces. If so, digital environments that provide adolescents with greater control over access to the self (e.g., Snapchat) might alleviate such concerns and thus aid in identity development.

Survey and experimental evidence suggest that lack of privacy does not constrain all kinds of online speech and behavior equally; it specifically "chills" speech and behavior that is not socially sanctioned (Rainie & Madden, 2015; Penney, 2017; Stoycheff, 2016; Stoycheff et al., 2019; see Büchi, Festic, & Latzer, 2022 for a review). Before posting, more than 45% of American Twitter users consider factors like whether the post "portrays them in a positive light," "could be used against them in the future," and provides "potential for others to attack or harass them" (McClain et al. 2021). Presumably people would be less concerned with social approval in more private or anonymous environments. One small study showed that lack of privacy online

can even influence behavior offline; people behaved in a more socially desirable way in real life when they believe that their actions might be posted on social media (Marder et al., 2016). A more extreme example of how lack of privacy and anonymity can increase socially desirable behavior was documented in the wake of the U.S. National Security Agency's surveillance program. After the extent of the NSA's surveillance activities became publicly known, there was a large decline in web searches and visits to Wikipedia pages that were "privacy sensitive," such as those related to eco-terrorism and nuclear enrichment (Marthews & Tucker, 2017; Preibusch, 2015; Penney, 2016). The American Civil Liberties Union filed a lawsuit against the NSA on behalf of the Wikimedia Foundation and several other organizations out of concern that such surveillance would have a "chilling effect" on freedom writ large (Wales & Tretikov, 2015).

However, despite claims since the 1950s in case law and the legal literature about the chilling effects of lack of privacy on freedom both offline (Schauer, 1978) and online (Solove, 2006), the topic remains difficult to study empirically. People may become habituated to privacy violations, tempering the effects of chilling on their behavior (Fast & Jago, 2020; Oulasvirta et al., 2012a; Tsay-Vogel, Shanahan, Signorielli, 2018). Alternatively, feeling surveilled may incite reactance (Brehm & Brehm, 1981). In work contexts, for example, electronic surveillance by one's employer (and corresponding perceptions of privacy invasion) are associated with reactance in the form of greater anger and counterproductive work behaviors, as well as less creativity, organizational trust, and perceived autonomy (Alge et al., 2006; Jensen & Raver, 2012; Yost et al., 2019). In political contexts, resistance to digital surveillance may take the form of increased political participation among dissidents online (Krueger, 2005), though other studies find no such resistance (Stoycheff, 2016; Stoycheff, Burgess, & Martucci, 2020; Stoycheff et al. 2019). Moreover, demonstrating chilling effects is challenging methodologically

(Chen, 2021). "Chilled" behavior, like self-censorship, is characterized by an *absence* of behavior, and it is difficult to demonstrate the counterfactual—that a behavior would have occurred with greater privacy. As a result of these and other challenges, many questions about the scope and prevalence of chilling effects remain unanswered (Büchi et al., 2022).

Despite the potential freeing effects of anonymity, it is important to recognize that, for many people, the extent of anonymity present in spaces like 8chan is a source of chaos, not freedom. Anonymity can foment antisocial behaviors like deception, harassment, and violence. In contexts where antisocial behaviors prevent others from acting (e.g., out of fear), then anonymity is a constraining rather than freeing force, at least for the targets of such behavior. One solution to this problem may be to think of anonymity on a continuum rather than as a binary. Design choices that increase levels of anonymity without providing total anonymity can increase the self's freedom while preventing a descent into chaos. For instance, the pseudonymity offered by sites like Reddit allows people to maintain a continuous identity across the site's forums and thus be held accountable by moderators for problematic behavior (Véliz, 2019). At the same time, pseudonymity protects people on Reddit from having their activity tied to their real life personal identities, allowing more unhindered self-expression and exploration.

In sum, privacy and anonymity afforded by digital environments promised to encourage self-expression and exploration with different, less socially sanctioned views and identities. However, the evidence suggests that technological features that track and identify people across digital environments have made privacy and anonymity rare. As a result, the digital environment seems to be constraining freedom of self-expression and self-experimentation online. Although complete anonymity across all digital environments is not the answer, greater privacy and pseudonymity may help restore some freeing properties of the internet.

(Dis)Embodiment:

Implications for the Self in Entrenched Social Hierarchies

Reduced prominence of visual identity cues was key to the belief that the internet would allow for anonymity and identity exploration (Castronova, 2008; McKenna & Bargh, 2000; Turkle 1995; cf. Hayles, 1999). Text-based, as compared to photo-based, platforms allowed people to be known for their personality or perspectives, rather than what they look like. The physical self also diminished in importance as the body became less essential to many tasks than it used to be. People can order groceries and check their bank statement with a few clicks, tasks which used to require movement of the entire body to a place where it could be judged (and discriminated against) by others. Indeed, many believed that in a disembodied world, the constraining expectations about what a person should be like based on their physical appearance would fall away, and the prejudices associated with physical bodies would become obsolete. For example, early research showed that status differences in group participation diminished online as compared to in face-to-face interactions (Dubrovsky, Kiesler, & Sethna, 1991; Siegel et al., 1986).

However, the obsolescence of the physical body and the evaporation of discrimination against certain bodies have failed to materialize (Marwick, 2013). Status differences only tend to be minimized in online communication when people are anonymous (Postmes & Spears, 2002). In the absence of anonymity, status differences can be even more pronounced in online interactions compared to face-to-face interactions (Boucher, Hancock, & Dunham, 2008). Features of the digital environment have reduced anonymity while simultaneously facilitating and rewarding sharing of photos and videos, a phenomenon that has been called the “breakout of the visual” (Bolter, 1996). When people and the social categories to which they belong can be so

easily identified, discrimination on the basis of those categories is likely to follow. Indeed, people of color and LGBTQ+ individuals receive more online harassment than white, heterosexual people (Vogels, 2021). A recent evaluation of social media's safety for LGBTQ+ individuals went so far as to say "the entire sector is effectively unsafe for LGBTQ users" (GLAAD, 2021, p. 7). Facial recognition technologies that automatically categorize people on the basis of their sexual orientation could be used to further discriminate against and harass LGBTQ+ individuals (Wang & Kosinski, 2018). Harassment has important constraining behavioral implications, incluuding self-censorship (Marwick, 2021; Nogrady, 2021).

Even if digital environments have not freed people from physical bodies and hierarchical structures via *disembodiment,* scholars believed perhaps *re-embodiment* via avatars could be freeing. In multi-player video games, for example, people have great flexibility in creating and selecting their avatars. Embodying avatars different from oneself can promote identity exploration and change if a person becomes more similar to their avatar (Yee, Bailenson, & Ducheneaut, 2009; Ratan et al., 2020). Embodying a person with a disability can also reduce social inequity by allowing people to take the perspective of and subsequently help people with a disability (Ahn, Le, & Bailensen., 2013). That said, identity exploration and perspective taking are not the only purposes avatars serve. Many people use them merely to represent their offline identity (Lin & Wang, 2014). Moreover, very few avatars are obese, elderly, or disabled, suggesting that when avatars are used for identity exploration or perspective taking, they are used to explore idealized or socially desirable selves (Bessière, Seay, & Kiesler, 2007; Dunn & Guadagno, 2012). Increasingly sophisticated tools allow people to convincingly alter their images on platforms like TikTok, but people use these tools to embody identities that they consider sexually desirable (and thus more monetizable) (Jennings, 2021). Even if people do

choose to use avatars to take the perspective of people with less socially desirable identities, such perspective taking will only improve intergroup attitudes in the absence of intergroup threat (Oh et al., 2016). In other words, re-embodiment is easier than ever, but it is unclear that it will reduce social inequities by improving dominant group members' understanding of people with marginalized identities (Chun, 2008; Talaifar et al., 2021).

Other evidence that the digital environment has not freed people from existing social hierarchies comes from research showing that marginalized groups often have less power online. For example, a large body of work has documented that Wikipedia editors are predominantly white men, and that they produce a gender-biased corpus of articles (e.g., a woman must be more notable to merit a Wikipedia article than a man) (Wagner et al., 2015; Wagner et al., 2016). Such gender disparities are particularly troubling given that Wikipedia links appear in 67-84% of desktop search engine results pages (Vincent & Hecht, 2021). In addition, Black and Asian people are underrepresented among users promoting Twitter trends (Chakraborty et al., 2017), women are less influential on Facebook and Twitter (Aral & Walker, 2012; Chakraborty et al., 2017), and TikTok has even suppressed content from physically unattractive, disabled, and poor people (Feldman, 2020). In these ways, the digital environment has failed to free people from the constraints imposed by their place in the social hierarchy (Cheney-Lippold, 2011).

Amidst the digital environment's hierarchy-enhancing constraints, people from historically marginalized communities are able to find some freedom, or at least perceptions of freedom. Black Americans are more likely than White Americans to say that social media provides an effective way to "help give a voice to underrepresented groups," "hold powerful people accountable," "change people's minds about political, social issues," and "create sustained social movements" (Auxier, 2020). Nevertheless, some activists have argued that low-

risk online activism, called "clicktivism" or "slacktivism," reduces the likelihood of actual social change by providing an illusion of change without any actual material concessions (White, 2010). Although research suggests that "slacktivism" can promote meaningful subsequent action (Lee & Hsieh, 2013), 76% of Americans believe that "social media make people think they are making a difference when they really aren't" (Auxier, 2020). Again, the potential disassociation between the illusion of freedom online and actual freedom online is relevant here. Observers have long noted that "providing citizens with the means to express themselves aesthetically without reforming their lives materially" maintains the status quo (Swanson, 2022, referencing Benjamin, 1935). Technological features like cameras and livestreaming that can be used to hold police and authorities accountable have the potential to increase the actual freedom of people from historically marginalized groups.

Of course, even in the absence of the "breakout of the visual," the idea that the internet would free people from bias was always overly naïve. As Marwick (2013, p. 357) describes, "sexism and racism are not solely based on appearance…Even if users couldn't see who they were talking to, their beliefs remained intact." Researchers are now documenting how such biased beliefs leave traces in and are reproduced by digital technology, particularly biased algorithms (O'Neil, 2016; Noble, 2018; Apprich et al., 2018). Algorithms learn biases against women and minorities from the human language and other data on which they are trained (Caliskan, Bryson, & Narayanan, 2017; Brayne, 2017). For example, Google is more likely to serve ads about incarceration in response to searches for names belonging to black than white people (Sweeney, 2013) and ads for high paying jobs to male users than female users (Datta, Tschantz, & Datta, 2014). Other studies have found that the gender and racial composition of image search results for common occupations underrepresent the actual representation of women

and minorities in these occupations (Metaxa et al., 2021). It is also important to remember that biased algorithms are increasingly applied *offline* in criminal justice, finance, employment, and healthcare (Dressel & Farid, 2018; Huang, Chen, & Wang, 2007; Moy, 2019; Raghavan et al., 2020). One algorithm applied to ~200 million patients reproduced racial health disparities by assigning equivalent risk scores to black patients who were less healthy than white patients, meaning that black patients had to be sicker than white patients to receive the same level of care (Obermeyer et al., 2019). Despite this accumulation of evidence, people assume that algorithms discriminate less than humans and therefore prefer being evaluated by an algorithm when they believe discrimination may be possible.

More generally, algorithms tend to exacerbate existing differences in power and status. Specifically, algorithms widen inequality by recommending popular accounts and content at higher rates than less popular accounts and content, creating a "rich get richer" effect (Fabbri et al., 2020; Fleder & Hosangar, 2009). For instance, YouTube's "up next" algorithm tends to recommend channels that already have more than 100,000 followers and videos that already have more than 1 million views (Matamoros-Fernandez et al., 2021). Another example of the ways in which algorithms differentially benefit those already at the top comes from Twitter. Its recommendation algorithm provided an almost 60% boost in the number of followers for Twitter accounts with 100K-1 million followers, but only a 10% boost in the number of followers for accounts with 10-99 followers (Su, Sharma, & Goel, 2016). And one study using a nationally representative sample in cross-sectional and experimental designs found that algorithmic sorting exacerbates the tendency to "like" news that conform to the dominant viewpoint (Shmargad & Klar, 2020). Research and theory on the "spiral of silence" would suggest that the more algorithms increase the majority view's perceived popularity, the less people will be willing to

express the minority view, further reducing the minority view's popularity (Stoycheff, 2016; Woong Yun & Park, 2011). These findings are especially problematic when popular accounts provide poor quality content or misinformation because people adapt their opinion to be in line with what they perceive to be the majority view (Winter, Remmelswaal, & Vos, 2021).

The harmful consequences of inequity-perpetuating algorithms extend beyond the countries, like the U.S., from which most of these technologies originate. As more and more of the world population goes online, the harms of biased technologies may affect even more people. This is especially true because investments in the fairness and safety of online content are often distributed unequally to different populations (e.g., non-English language markets). For instance, an internal Facebook report found that its hate detection systems only flagged 6% of Arabic hate speech, including speech targeting LGBTQ people and other minority groups (Cushing, 2022; Scott, 2021). At the same time, algorithms meant to detect terrorism in the Middle East incorrectly removed non-violent Arabic content 77% of the time, infringing on the legitimate self-expression of Arabic-speaking people (Scott, 2021). If algorithms are applied unequally within countries and between countries, then they also have the potential to exacerbate inequality within and between countries. An entire field of research on fairness in artificial intelligence is now tackling these problems (e.g., Mehrabi et al., 2019). In fact, techno-optimists often argue that correcting biased algorithmic decision-making may be more tractable than correcting biased human decision making. That said, algorithmic fixes are often too little too late; in many cases, thousands of people are seriously harmed before a problematic algorithm is identified and corrected (Obermeyer et al., 2019.

In sum, when we consider whether digital environments are freeing or constraining, we must ask for whom are they freeing and for whom are they constraining? Dis-embodiment and

re-embodiment offer potential freedom by allowing people to reduce the salience of their own identity cues and to take the perspective of people with different identities. However, potential freedom from dis-embodiment and re-embodiment seem to be overshadowed by the constraints presented by pervasive algorithms that provide marginalized people with less influence online and that perpetuate discrimination and inequality. Put differently, the evidence suggests that hierarchy-enhancing forces in the digital environment outweigh hierarchy attenuating-forces. In the process, the digital environment provides more constraint and less freedom for all but those with the most privileged identities.

The Paradox of (In)Fallible Memory:

Implications for Self-Insight and Narrative Identity

For centuries, memory and cognition have been central to theories of the self (Conway, 2005). As John Locke posited, memory is what connects the self of the present moment to the self of the previous moment, and to the self of the distant past (Gordon-Roth, 2019). David Hume similarly believed that the cognitive reconstruction of remembered events is central to our notions of ourselves (Kihlstrom, Beer, & Klein, 2003). Likewise, more recent work suggests that constructing a narrative identity requires cognitive resources to engage in mental time travel and to interpret the meaning of life events (McAdams, 2013; Addis & Tippett, 2008). A person's memories are unique to them and no one else, an individuating force that distinguishes each person's sense of self from that of another person. Therefore, if technological features influence memory and cognition, they are also likely to influence our unique mental self-representations and our capacity to construct them.

Technological features have increased the ease, speed, scale, and fidelity of data storage and retrieval in ways that have important consequences for human memory and cognition. The

sheer volume of information that can now be stored on our digital devices and in the cloud far surpasses what was possible a few decades ago. Every day, people send 500 million tweets, 294 billion emails, 65 billion WhatsApp messages, and conduct 5 billion searches (Desjardins, 2019). Because information stored digitally can be more quickly, reliably, and accurately recalled than information stored in a human brain, technology is a critical memory aid in the modern world. In fact, the need for digital memory aids has been exacerbated by the increasing amount of information made available by technological developments, creating chronic cognitive overload (Cialdini, 2009). In other words, technological features that increase memory capacity create both the problem (too much information) and the solution (the ability to offload information storage).

The ability to offload memory to the internet might have positive consequences, such as freeing up mental capacity for other cognitive tasks like creative problem solving (Sparrow & Chatman, 2013; Cecutti, Chemero, & Lee, 2021) or even developing self-insight and a coherent narrative identity. Recent work also shows that "offloading" autobiographical memories to social media might improve later recall of those memories (Wang, Lee, & Hou, 2017; Johnson & Morley, 2021), potentially helping people use these memories for narrative identity construction. The ability to strategically choose which tasks and memories to offload in service of one's identity-related goals and values could be considered freeing (Cecutti, Chemero, & Lee, 2021). In this view, technology used as a memory aid is a useful tool in the construction of an evolving self. This perspective forms the basis of the "quantified self" movement in which people use self-tracking tools (e.g., Fitbits) with the goal of amassing self-relevant data to be dissected in service of self-optimization (Lupton, 2016).

However, qualitative evidence provides mixed evidence for the idea that self-tracking tools help people improve self-insight and construct desired selves. A review of 24 studies found that self-tracking seems to lead to newfound self-insight for some participants, but often these participants did not find the insight to be actionable (Kersten-van Dijk et al., 2017). Other participants in these studies reported that self-tracking did not yield any new insights. Moreover, it is important to recognize that using technology as a memory aid produces qualitative differences in how memory is encoded, stored, and recalled (Whitworth & Ryu, 2012; Jacobsen & Beer, 2021). Digitally stored information can persist indefinitely and is the same regardless of how many times and under what conditions it is retrieved. Thus, digital "memory" comprises a fairly complete record of our past that is immune to updating, selective remembering, and selective forgetting. For example, Facebook's "year in review" feature has been criticized for providing some people with a parade of tragic memories that they would rather forget (Chowdhry, 2014). In contrast, human memory is highly dynamic, discarding and changing memories in response to subsequent retrievals of information and the social contexts in which retrieval occurs (Kim et al., 2020; Coman, Manier, & Hirst, 2009; Wang, 2021; Hirst & Echterhoff, 2012).

The fallibility of human memory may seem disconcerting, but it is this very fallibility that gives people the freedom to update their sense of self. In years past, when every event was not so faithfully recorded online, you might not have realized the discrepancy between memory and reality, allowing greater freedom to construct your own narrative of the past. Alternatively, consider a flattering memory of your 21st birthday that is shattered five years later by Facebook's flashback to actual photos of the event and its corresponding comments. If you are trying to become a responsible 26-year-old adult, it may be harder to construct a past consistent with that

new identity when social media keeps reminding you—and your social circle—that you really were a wild child. Although you may *believe* that your memories are faithful recordings of the past, traces of your past selves in the digital environment expose the revisions you have made to your life narrative. Thus, the persistence of static digitally mediated memories may constrain the narrative identities people are able to construct, especially in critical periods of identity development (Eichhorn, 2019). Perhaps this is why cross-sectional and longitudinal evidence suggests that the intensity of one's Facebook and internet use is associated with lower self-concept clarity (Appel et al., 2018; Petre, 2021).

To be a freeing force, the digital environment should affirm rather than undermine selves people seek to forge. People do have agency in constructing social media profiles that reflect who they are now and who they are becoming, instead of cataloguing all the selves they used to be. This is especially true on platforms like Snapchat where the ephemerality of posts eliminates the persistence of old selves (Nesi, Telzer, & Prinstein, 2020). Even in digital environments that afford persistence like Instagram and Facebook, people can curate traces of their past selves to serve current identity-related goals. This may explain why viewing one's social media profile is self-affirming, increasing feelings of self-worth and self-integrity, and offering refuge in the face of threats to the self (Toma & Hancock, 2013). At the same time, the technological tools that are meant to return freedom to the self—untagging photos, deleting posts and messaging histories—may never truly imitate the natural and unconscious pruning of human memory that has aided the self's evolution in the past.

One cannot successfully forge an identity in isolation; the self requires verification from others to be sustained (Swann, 1987). Such self-verification should not be hard to find online. Social feedback about the self is afforded to an unprecedented degree by virtually all digital

environments (Nesi, Telzer, & Prinstein, 2020). At the same time, the pervasiveness of social feedback online may result in performing a self that garners social approval rather than cultivating an authentic self in line with one's own values. Moreover, technology may hinder the social relationships that sustain the self *offline.* A growing body of evidence suggests that diverting attention to digital devices negatively affects social interactions and conversation quality (Dwyer, Kushlev, & Dunn, 2018; McDaniel & Coyne, 2016; David & Roberts, 2017; Przybylski & Weinstein, 2013), which are the building blocks of relationships. In fact, many people use their phones to avoid social interaction altogether (Smith, 2015; Kim & Sung, 2021). It is often in interaction with others that we discover new things about ourselves, find new aspirations, consider different ways of construing our past, or have life-changing experiences. It is worth considering in what ways we limit our selves when are not engaged in full communion with others.

One way digital environments disrupt social connection is through distraction. It is easy to forget that the first clunky mobile phones used to only "notify" the user of incoming calls. Today, the average American receives 73 smartphone notifications and checks their phones 96 times a day **(**Goode, 2019; Asurion, 2019). Not only do our devices distract us via a variable reward schedule of calls, texts, and notifications, but the portability of these devices means that they are always with us (Toh et al., 2021; Schrock, 2015). As a result, we cannot help but be distracted from our everyday experiences **(**Dwyer, Kushlev & Dunn, 2018; Smith, 2015). For example, people randomly assigned to enable notifications on their phone exhibit higher levels of inattention and hyperactivity than those who disable notifications (Kushlev, Proulx, & Dunn, 2016; Stothart, Mitchu, & Yehnert, 2015), and people who use social media or take photos during an in-person experiences have worse memories of those experiences (Soares & Sharifian,

Zaheed, & Zahodne, 2021; Storm, 2018; Tamir et al., 2018). Even when our phones are not buzzing and pinging in our ears, they can still decrease working memory and fluid intelligence because we have to suppress the temptation to check them (Ward et al., 2017). As people spend more time on their phones than laptops, their online behavior is becoming more "bursty" (Peng, Zhou, & Zhu, 2020) and thus may produce even weaker memories. Doing the cognitive work of constructing an insightful and coherent narrative identity seems like it would challenging amidst all of this distraction.

Digital environments are not just distracting; they encouraging reflexive rather than reflective cognition. Perhaps the best evidence for this comes from an increasing number of studies showing that our devices and social media platforms are habit forming (Bayer & Campbell, 2012; Oulasvirta et al., 2012b; Limayem & Cheung, 2008; Limayem et al., 2007; see Anderson & Wood, 2021 for a review). Economists estimate that if people's social media use were more intentional and less habitual, people would spend 42 minutes less per day on social media than they actual do (Allcott, Gentzkow, & Song, 2021). Other evidence suggesting that people are not particularly reflective in online settings comes from research showing that they choose links that are highly ranked in Google search results even when those links are not particularly relevant to their query (Pan et al., 2007). This study joins others showing that people outsource thinking to Google (e.g., Ward, 2021). If the modern-day digital environment impairs memory and reflective cognition, then it also has the potential to constrain the richness of our cognitive self-representations (Hixon & Swann, 1993). The introspection and self-insight needed to notice, recall, or initiate changes in oneself are less likely to occur if moments of reflection have been replaced by sessions of Candy Crush. There is a reason why people are asked to silence their phones in therapy and in church, places we go to reflect and change for the better.

In sum, the points we have made in this section are somewhat paradoxical. On the one hand, identity development requires rich memories and cognitive resources in the context of meaningful relationships, all of which can be impoverished by the presence of distracting, habit-forming devices in daily life. On the other hand, technology can allow new forms of social feedback while enhancing the capacity and fidelity of memory far beyond the human brain's own capabilities. In making forgetting and being forgotten more difficult, technology offers up a less human memory whose infallibility may aid in narrative identity construction or may make revisions to the self more difficult. Put differently, people are both more distracted and more objective historians of their past selves. In these ways, the digital environment both constrains and frees the selves we can construct and destruct.

Behavioral Reinforcement and Reduced Randomness: Implications for Identity Change and Heterogeneity

Randomness can be freeing, helping us break out of the predictable to explore new ways of being. The course of many people's lives has been changed by stumbling upon a random person, book, or lifechanging event. Our existence would be dull without this element of surprise. Yet people tend to underestimate the influence of random events in their lives (Janoff-Bulman & Yopyk, 2004; Kahneman, Sibony, & Sunstein, 2021). A bedrock feature of modern digital environments—the predictive algorithm—functions to reduce randomness (Pariser, 2011).

Google began personalizing search results in 2009 (Pariser, 2011). But even before the rise of predictive algorithms, neither online nor offline environments were totally random or unpredictable. People have always shaped their environments in identity congruent ways. For example, media diets have long been curated by people themselves, their social contacts, advertisers, and other gatekeepers (Lazarsfeld, Berelson, & Gaudet, 1948; Thorson & Wells,

2016). People also move to neighborhoods and cities to be closer to people with views similar to their own (Brown & Enos, 2021) and even avoid commuting routes that bring them in contact with people unlike themselves (Anicich et al., 2021). Indeed, computer simulations show that echo chambers can emerge online in the absence of technological features like algorithms, merely as a function of these normal psychological processes (Geschke, Lorenz, & Holz, 2019). It is also important to point out that predictions and their potential constraining influence are not new. People, including researchers, have always made predictions about others and their future behaviors, with implications for the targets' freedom. As Gergen (1973) writes:

> "To the extent that an individual's behavior is predictable, he places himself in a position of vulnerability. Others can alter environmental conditions or their behavior toward him to obtain maximal rewards at minimal costs to themselves. In the same way that a military strategist lays himself open to defeat when his actions become predictable, an organizational official can be taken advantage of by his inferiors... Knowledge thus becomes power in the hands of others." (pp. 313-314)

What has changed is the source and pervasiveness of predictions, as well as the extent to which these predictions are revealed to and used by the target of predictions. As a result, predictive algorithms have afforded identity congruent ecological niches to an unprecedented degree. To provide a sense of the scale of algorithmic influence, consider that 70% of the 1 billion hours of YouTube content watched each day is recommended by the site's algorithms (Solsman, 2018). Another analysis found that 11.7% of Google search results are personalized to the user (Hannak et al., 2013), a percentage that could have large effects when one considers that Google processes about 12 billion searchers per month (Johnson, 2021), and that Google search results ranking can influence important outcomes like voting preferences (Epstein & Robertson, 2015). Rather than leave one's encounters with the world up to chance, the digital environment is

modified as a function of our past digitally mediated behavior (Pariser, 2011). Algorithms automatically remake the digital environment for a given individual without their prompting, serving up search terms, search results, ads, newsfeed content, movies, music, friends, and followers. Instead of watching whatever news the rest of the country is watching, your feed serves up news similar to what you have read in the past. In a sense, these algorithms may be giving people what they want. In one survey, people said they prefer algorithms that recommend news content that is similar to what they consumed in the past over news that is dissimilar to what they normally consume (Joris et al., 2021). Other work suggests people sometimes prefer algorithmic judgment over human judgment (Logg, Minson, & Moore, 2019).

In our view, predictive algorithms are not anodyne personalization tools; they provide continuous behavioral reinforcement. In fact, today, you would have to go out of your way to choose a digital environment that does not reinforce what you have already liked. An early study that asked about participants to provide thousands of movie ratings shows how recommendation algorithms provide behavioral reinforcement (Cosley et al., 2003). Compared to those were not randomly assigned to see a recommendation system's prediction of their movie rating, people who saw the recommended prediction were more likely to provide the same movie rating that they had provided previously. One interpretation of these results is that the recommendation system is "actually influencing people's beliefs, convincing them to rate at the prediction shown by the system" (Cosley et al., 2003). This interpretation is especially fitting because the authors also found that artificially inflated predictions influenced people's subsequent ratings in the expected direction. When the prediction shown was altered to be higher than the recommender system's "accurate" prediction, participants subsequently rated movies higher.

Consider a hypothetical example of how such algorithmic behavioral reinforcement can also produce *self*-reinforcement. If you are vegan, a digital environment characterized by algorithms that serve vegan ads, accounts, videos, and books will reinforce vegan choices. By observing yourself clicking on a vegan item that was suggested by an algorithm, you may then infer that that behavior is indicative of who you are (Bem, 1972; Gonzales & Hancock, 2008). Others who observe your online choices may also infer that your vegan choice is indicative of your identity without considering the contextual constraints influencing your behavior (Ross, 1977). These people may treat you in a way consistent with that perception, further reinforcing your identity (Swann, 1987). Through this chain reaction, algorithms do not predict the future so much as tell you who you should be based on your past. This is why people who want to create a new online identity must start from scratch—deleting their old accounts and creating brand-new profiles and social networks. Even then, their past selves may follow into corners of their new digital world.

It is not merely that algorithms may provide self-reinforcement via behavioral reinforcement; algorithms also have the power to constrain the self by reducing autonomy, or our ability to "choose otherwise" (Kane, 2011; Cheney-Lippold, 2011). Obviously, the more algorithms show you content that aligns with what you are already like, the less they will show you content that is not aligned with what you are already like—even things that you *would* like if given the chance. For instance, Facebook's algorithm is less likely to show conservatives posts from liberal outlets, and vice versa (Levy, 2021). As a result, conservatives have less of an opportunity to choose information that might change their political identity than if they were in an environment that did not expressly rearrange itself to suit their previously expressed interests. This is true even if, in theory, they are open to defying expectations or changing their opinion. In

this way, the internet provides the illusion of an abundance of choice, yet in actuality it often presents us with a limited choice set that is determined by who we have been in the past. For example, algorithms tend to recommend items with a great deal of historic data rather than more novel items with less historic data (Fleder & Hosangar, 2009), and algorithmic expose people to a narrower set of items over time (Nguyen et al., 2014). This is another case of technology providing both the problem (overabundance of people, products, and information) and the solution (a narrow set of personalized options).

Thus far we have focused on the implications of predictive algorithms based on one's own previous behavior. However, algorithms also serve content based on the prior behavior of similar others or people in general (Tkalčič et al., 2009; Aggarwal, 2016; DiResta, 2020; Ricci, Rokach, & Shapira, 2011). For example, an in-depth analysis of Google search results suggests that they are both tailored to one's own prior search history as well as the search history of other users with a similar profile (Feuz, Fuller, & Stalder, 2011). Thus, algorithms may both influence people to remain like their past selves and to become more like similar others. For instance, even though recommender systems can push each individual towards new content, these systems also simultaneously push groups of people to the same content (Fleder & Hosangar, 2009; Yu, Lakshmanan, & Amer-Yahia, 2009). Algorithms may also influence people to become more like similar others not by recommending content but by recommending similar people to friend and follow (Santos, Lelkes, & Levin, 2021).

The potential homogenizing effects of similarity-based predictive algorithms seem reminiscent of the effects of the invention of the printing press. Instead of speaking and thinking like local villagers, scholars believe that the printing press caused people to speak and think more like others in a much larger imagined community of readers by homogenizing language across

larger swaths of the population (Anderson, 1983). Although scholars of the early internet believed that the internet would usher in a similar era of homogenization that includes the entire world (McLuhan & Fiore, 1968), the internet instead seems to be homogenizing people into polarized niches (Geschke, Lorenz, & Holtz, 2019; Sîrbu et al., 2019). For example, the introduction of 3G in the United States increased Democrats' liberal leanings and Republicans' conservative leanings (Melnikov, 2021). A systematic review of digital media's relationship with democracy around the world found that most papers find detrimental associations between digital media use and political polarization (Lorenz-Spreen et al., 2021). This is consistent with other research showing that the introduction of mobile internet reduces national identification by 5-7% by exposing people to greater polarization online (Choi, Laughlin, & Schultz, 2021).

Nevertheless, in some influential academic circles it has become unpopular to attribute political polarization to online algorithms and echo chambers. Political scientists who advocate "avoiding the echo chamber about echo chambers" cite evidence showing that only a minority of users occupy online political echo chambers and online social networks can expose people to counter-attitudinal political views they would not encounter offline (Guess et al., 2018). This view also emphasizes that people's own choices online have a larger effect than algorithms do on the diversity of political content that people see (Bakshy et al., 2015). The existing evidence suggests all of this is true.

However, our view is that it is premature to discount the influence of algorithms and their constraining influence on identity change and homogeneity more broadly. Comparing the large of effect of people's own choices to the small effect of algorithms on online content diversity does not account for the fact that people's choice's may have been shaped by algorithmic recommendations in the first place (Narayanan, 2021). Rather than relying on snapshots of a

single point in time, analyses of algorithmic effects must consider small but potentially recursive effects that accumulate over weeks, months, and years (Götz, Gosling, & Rentfrow, 2020). This is especially important because small algorithmic effects at the individual level can have profound effects at the societal level (Wagner et al., 2021). Moreover, comparing algorithmic effects to human choice means comparing algorithmic effects to an inherently biased target. As previously mentioned, people structure their environments in identity congruent ways, regardless of whether the environment is digital or analog. If algorithms structure digital environments in somewhat less identity congruent ways than people do, this is not a great achievement. Instead, the effects of a digital environment *with* algorithms should be compared to the effects of the same digital environment *without* algorithms. This is a more appropriate comparison to make, but studies typically do not make such comparisons because they cannot control or suspend platforms' algorithms at will. Simulation studies can overcome some of these limitations but compromise ecological validity in the process.

In sum, empirical evidence about algorithm's effects remains incomplete. However, the existing evidence is suggestive that algorithms in digital environments may constrain within-person variability across time while also constraining between-person variability across space. Put differently, personalized algorithms may be pushing people into highly tailored ecological niches at the same time that popularity-based algorithms and hyperconnectivity push people to become more similar to like-minded others. Both serve similarly constraining ends, making it less likely for a person to change their self-view over time even as the way in which they define and enact the self conforms more to similar others' selves. A digital world without algorithms may be more random, but it may also be more free.

The Self Attempts to Reassert Agency Over the Digital Environment

In highlighting the influence of the digital environment on the self, we do not intend to diminish the influence of the self on the digital environment. People are not spineless entities who succumb to the power of the situation (Swann & Jetten, 2017). They actively shape their offline and online environments, even as these environments shape them (Buss, 1987; Yoo, Ng, Johnson, 2018; Ashokkumar et al., 2020; Stachl, et al., 2020; Boutyline & Willer, 2017**;** Mosleh et al., 2021; Gosling et al., 2011). Decades of research shows that when people are deprived of their freedom, they react in ways to restore the freedoms that were lost or threatened (Brehm & Brehm, 1981; Rosenberg & Siegel, 2018).

We have already described some of the ways in which people reassert their agency when they feel constrained by digital environments (e.g., when they feel surveilled), but this topic deserves further attention. Individual agency is apparent when people use virtual private networks (VPNs); download adblocking and other tracking protection tools (e.g., Ghostery); and create fake social media accounts with smaller audiences to recapture the freeing effects of online privacy and anonymity (Englehardt & Narayanan, 2016; Amaral, 2021; Taber & Whittaker, 2020; Acquisti, Brandimarte, & Loewenstein 2020; Garimella, Kostakis, & Mathioudakis, 2017). Individual agency is also apparent when people erase browser, location, calling and text messaging histories; delete and untag pictures of themselves; and block old friends to take control over the construction of their narrative identity. Individual agency is on display when people opt out of algorithmically driven services entirely, try to trick algorithms by misrepresenting themselves, or create new social media accounts to avoid the limits imposed by recommendations based on previously recorded preferences (Eiband et al., 2019). People can also choose to frequent digital environments characterized by “old” freeing affordances, which

remain fully intact in some corners of the internet (e.g., Craigslist, Wikipedia, 8chan) (Lingel, 2020). They even try to prevent the constraining influence of digital environments from impinging on freer *offline* environments, as evidenced by nightclubs that have banned phones (Gray, 2013).

In addition to these strategies to exert agency in the face of constraint, people can use digital media in thoughtful ways to advance personal and societal goals. One effective strategy for counteracting the spread of misinformation online is to remind people to be more reflective about the accuracy of what they are sharing (Pennycook et al., 2021; Perez, 2021). Likewise, some people use their social media accounts to engage as a form of self-reflective journaling (Vitak & Kim, 2014). Eichhorn (2019) has even argued that children today have *greater* control over their narrative identity than they used to because recording childhood is no longer exclusively relegated to the adults. Perhaps most importantly, activists and minority groups consciously use digital media to advance equity and justice (Fox & Warber, 2015), and encrypted messaging apps that enable anonymity have been critical to the pro-democracy movements (Shao, 2019).

However, there are at least two reasons why the personal agency may falter against the power of the digital environment's constraints. First, exerting agency is exhausting (Brey, 2005). It requires people to override their automatic, effortless responses with more conscious, effortful responses. When people were explicitly instructed to exert agency over their digital environment—to prevent an artificial intelligence chatbot from gleaning information about their private attributes in an online interaction—they had limited success and found tricking the AI to be tiring (Völkel et al., 2020). Most people do not have the time, resources, or knowledge to reject all of the digital environment's constraining default options in favor of alternatives like

VPNs and adblocking tools (assuming these tools are effective in the first place). For instance, even if people were motivated to understand privacy risks online, doing so may not be cognitively possible since reading the privacy policies of all the websites one visits in a year would take 200+ hours (McDonald & Cranor, 2008). In fact, an analysis of more than 130,000 showed that privacy policies have doubled in length over the past 20 years while still underreporting tracking technologies they use (Amos et al., 2020). Technology companies can make overriding default features even more effortful by employing "dark patterns" that subtly discourage people from exerting agency over their digital environment in ways that would hurt their bottom line (Bösch et al., 2016; Chromik et al., 2019; Gray et al., 2018; Mathur et al., 2018, 2019). For example, companies may attempt to subtly nudge people away from disabling cookies if enabling cookies helps effectively target ads. The idea that people will have the cognitive resources resist dark patterns and other manipulative features of the digital environment is inconsistent with evidence that people are "cognitive misers" who will outsource the effort of thinking when the opportunity presents itself (Fiske & Taylor, 1991). In fact, people who are low on analytic thinking, the most "miserly," are particularly likely to offload thinking to their smartphones (Barr et al., 2015).

Second, the idea that the self can overcome the constraints of its environment overlooks the fact that our digital selves are socially constructed. Even if an individual chooses to opt out of using digital technology or attempts to misrepresent themselves online in an effort to retain freedom, their social circle's behavior can give them away. For example, if a person does not post pictures of themselves online, their friends and family can still do so without their permission, revealing the individual's private attributes to entities that use facial recognition technologies **(**Wang & Kosinksi, 2018). Similarly, a woman can misrepresent her gender online

to avoid ads targeted to women, but her "real" gender can be easily inferred through the pronouns that her friends use to address her on social media or in emails (Slavkovik et al., 2021). And as previously mentioned, algorithms serve content both on the basis of one's own behavior and on the basis of the behavior of similar others. If a person represents themselves as a man but continues to behave similarly to how women typically behave online, then algorithms may still classify the person as a woman. Because technology companies compile data from so many sources, and because all individuals are embedded in a larger social context, no individual can fully escape the constraints of the digital world. That there are few jobs, services, and tasks that can be done without access to the internet only reinforces this point. Going about life without a digital presence is becoming increasingly difficult, if not impossible. The inability to abstain from digital environments altogether to live a completely analog life may potentially constitute the greatest unaccounted loss of freedom. There is no opting out.

Designing Digital Environments to Fulfill Diverse Needs

Individual agency may not be particularly effective in counteracting the digital environment's constraints on the self, but the digital environment still has the potential to be less constraining than it is now. To design a digital environment that provides the self greater freedom, it is important to understand ask why constraint has become the default in the first place. However, before committing to greater freedom online, it is also important to ask whether a freer digital environment is even desirable. In this section, we consider some answers to these questions.

Four possible interconnected factors explain why the digital environment has evolved to constrain the self, following Lessig's (2009) analysis of architecture, norms, laws, and markets as the four regulators of any given system. First, regarding the influence of architecture,

technology has produced problems that more technology is expected to solve. As previously mentioned, technological features produced the problem of too much information and connections for the brain to handle, which then required a solution: technological features that categorize, rank, and manage this profusion of information and connections. Second, regarding the influence of norms, the societies in which digital technologies were developed value speed, efficiency, and convenience. Freedom and exploration, while attractive in theory, are inefficient and thus may not be particularly desirable in societies that prioritize productivity. Third, regarding the influence of laws, with the exception of intellectual property law, governments have left digital environments largely unregulated, especially in the United States. In the context of little government intervention, market forces constitute the fourth and most influential contributor to digital constraint.

The modern-day digital environment is designed to make money (Bak-Coleman et al., 2021), not to maximize individual autonomy, identity development, self-insight, or self-exploration. Therefore, technological affordances that generate more revenue will survive at higher rates than those that produce less revenue, and constraining affordances appear to be more lucrative than freeing affordances. To illustrate, although anonymity has long been known to be psychologically freeing, it is no longer the coin of the digital realm because verifying people's identities makes online financial transactions more secure (Marwick, 2013). Similarly, although many people believe that surveillance violates fundamental human freedoms, privacy compromising tracking technologies allow companies to build sophisticated customer profiles that can improve the effectiveness of their targeted ads (Nissenbaum, 2010; Zuboff, 2015). Likewise, predictive algorithms that target ads and other content may limit people's autonomy by limiting their choices (Wertenbroch et al., 2020), but such ads are more likely to be effective

(Matz et al., 2017). Targeting content may even be more effective when people's traits and preferences are stable over time and contexts because stable customer profiles retain their predictive validity, and thus their value.

One perspective would argue that if the digital environment has evolved to become more constraining, this is because the internet that has been supplied is the internet that consumers have demanded. However, this perspective overlooks the ways in which the market has in fact failed to meet consumer demand. In the realm of privacy, for example, economists have recently argued that "even if consumers were infinitely savvy, they would still find desired …as well as desirable…levels of privacy nearly unattainable" (Acquisiti, Brandimarte, & Loewenstein, 2020, p. 744). They go further, saying that "approaches to privacy management that rely purely on market forces and consumer responsibilization have failed" (p. 753). These economists attribute the market failure in the domain of privacy to a number of causes, including monopolistic practices, information asymmetries between consumers and companies, and consumers' inability to comprehend complex privacy policies.

Consumer demand for freedom in the form of novelty, autonomy, and experimentation may also be undersupplied. Research on Spotify's recommendation algorithms can provide a concrete example of how companies may be underestimating people's desire for freedom in their pursuit of short-term user engagement. When people use algorithmically created playlists on Spotify, their listening time increases in the short-term even though the variety of music they listen to decreases (Anderson et al., 2020; Holtz et al., 2020). One might say it is therefore in Spotify's interest to encourage people to use recommendation algorithms. After all, more listening time means more ads or perhaps a higher likelihood of subscribing to premium features. However, the same study showed that less musical diversity hurts *long-term* outcomes like

customer retention (Anderson et al., 2020). This suggests that although constraining algorithmic tools may be financially beneficial in the short-term, they may be detrimental in the long-term if they curb the variety of people's experiences.

Given the above-mentioned market failures, we echo Acquisti, Brandimarte, & Loewenstein (2020) in our belief that market solutions will not provide the primary impetus for a shift to a more freeing virtual digital world. Given how difficult it is for the self to assert its agency in the modern digital environment, individual consumers can produce only small shift away from constraining digital environments. We also believe that not all problems created by technology can be solved with more technology (e.g., Brandimarte, Acquisiti, & Loewenstein, 2013; Gorwa, Binns, Katzenbach, 2020). Rather, the larger sociopolitical and cultural context in which the creation of digital technology is embedded would need to change to achieve a non-incremental shift to a more freeing digital environment. In other words, citizens must decide that they value freedom in this digitally mediated world and must advocate for change through collective action that influences the legal and other structures regulating technology companies.

Of course, people may not believe that digital environments *should* be designed to free the self. This normative question is more complicated than it may first appear. Digital media is used by billions of people with diverse needs and value systems but is largely designed by an elite and homogenous cadre of American developers who may not realize the specificity of their value system to their time, place, and position in the global power hierarchy (Mansell, 2017). To design digital environments without considering human variation in desired end states is both psychologically unsound and a display of hegemonic ignorance on the part of the powerful.

People have a fundamental need for freedom, but they also have a countervailing need for structure, predictability, and coherence in themselves and in others (Neuberg & Newsom, 1993;

Swann, Rentfrow, & Guinn, 2003). Even if someone hopes to be a different kind of person, they may find greater comfort in the known than the unknown. Change can be jarring, which may explain why people engage in a wide variety of strategies to negotiate stable selves in their relationships both online and offline (Ashokkumar et al., 2020; Swann, 1987). Too much freedom and choice in digital environments may be especially uncomfortable for certain segments of the population, such as those low on openness to experience (Botti & Iyengar, 2006; Perry & Sibley, 2013; Matz, 2021**)**. From their perspective, digital environments should provide structure and stability, not greater freedom. In fact, too much freedom online could have negative political implications. One foundational theory of authoritarianism argues that freedom can be aversive, causing people to latch on to authoritarian leaders (Fromm, 1941).

That said, and as previously argued, the supply of freeing digital environments is likely not currently meeting demand. If that is the case, technology may be thwarting one of the most fundamental human needs (Fromm, 1941; Weinstein and Platt, 1969). Pursuing freedom for its own sake has been a cornerstone of many post-Enlightenment political movements and remains a highly regarded value around the world (Welzel & Inglehart, 2005). From this perspective, digital environments should be designed to maximize freedom and minimize constraint of any kind, even if minimizing constraint produces less socially desirable, non-normative behavior. Research suggests that increasing perceptions of freedom can have positive effects, like making people feel less self-alienated, more aware of their true self, and that their life has meaning (Seto & Hicks, 2016; Seto et al., 2015). To increase perceptions of freedom in service of these goals, technological features could be designed to increase privacy while reducing behavioral reinforcement and the salience of social categories.

Having freedom could also be a means to desired ends. Psychologists have long encouraged people to change the self in "healthy" directions (e.g., Allport 1955; Fromm, 1955; Rogers, 1961) and have even advocated for public policy that can foster healthy personalities (Bleidorn et al., 2019). From this perspective, digital environments should not just maximize freedom; they should specifically aid in the development of healthy, prosocial identities. However, the belief that the self should always be growing and improving is a unique concern of modern neoliberal culture (Adams et al., 2019). Moreover, the desirability of a given identity depends on the immediate environment and broader sociocultural context in which the individual is embedded (Denissen et al., 2018; Heine & Hamamura, 2007).

Conclusion and Future Directions

Around the world, billions of people spend hours a day on their computers and phones (Clement, 2020; Zenith Media, 2019). Given the primacy of technology in our lives, psychologists interested in how contexts shape the self must confront a new class of digitally mediated environmental influences. The research we reviewed across numerous domains and disciplines converges on a central theme: The digital environment constrains the self even as it offers opportunities for freedom. Put differently, the digital environment introduces inertia that may make it more difficult for the self to evolve towards new selves and away from past selves, similar others, or one's place in the social hierarchy. Constraints on the self are a function of technological features that produce a variety of affordances—lack of privacy and anonymity, salience of social categories, changes to memory and cognition, and behavioral reinforcement. In response to these constraining forces, the self attempts to reassert its agency in the digital environment. However, its ability to do so is limited by the effort agency requires.

Our theoretical account aimed to sensitize readers to the freeing and constraining possibilities of a wide variety of digital environments (Gergen, 1973; Sullivan, 2020). In so doing, we join a growing chorus of voices emphasizing the need to move beyond examining the effects of "screen time" to understand the mechanisms through which digital media effects operate (Orben, 2020; Kross et al., 2020). In some cases, technological affordances have magnified normal psychological processes. In other cases, technological affordances have disrupted normal psychological processes, changing them qualitatively. People's folk theories about digital media effects (French & Hancock, 2017; DeVito et al., 2018) may or may not reflect the constraining reality of modern digital environments that we have described. As mentioned previously, the digital environment can influence the self outside of conscious awareness (Fisher, Goddu, & Keil, 2015; Ward, 2021; Bastick, 2021), and folk theories that the digital environment is freeing may blind people to the ways in which the digital environment is constraining.

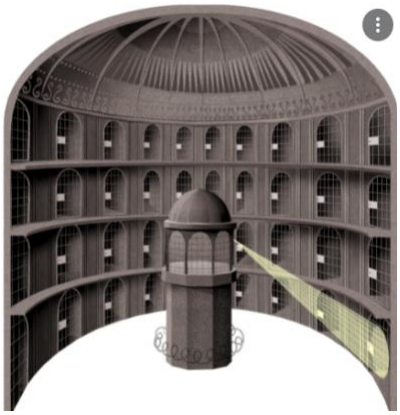
The digital environment may fall short of the freedom that the early internet (and early internet scholarship) promised, but this does not mean that modern technology offers less freedom for the self than no technology. Rather, our aim is to help people imagine what a freer digital environment might look like, and to consider whether that is a digital environment they would want. Digital environments can be designed in any number of ways, depending on the features of a given environment and the affordances these features enable. Addressing the factors, like market forces, that favor a constraining feature set may help people design different digital environments. This is an optimistic outlook in that our technological future is neither predetermined nor homogenous. Rather than viewing new technology with reflexive suspicion and fear (Orben, 2020), we should consider how different platforms can support different needs

and values, and how different people in different societies in different eras will imagine different ideal virtual worlds. In some ways, we have revealed our own values by describing how the digital environment provides “freedom and constraint” rather than “chaos and stability” (Gergen, 1973).

However, perhaps the most interesting possibility is the that the very *ambiguity* surrounding how digital infrastructure works lies at the center of technology’s constraining influence. In Jeremy Bentham’s vision of the panopticon (Figure 1), a cylindrical prison is controlled by the omniscience of a single guard tower positioned at the center of the prison (Foucault, 1975). Critically, inmates cannot actually see into the guard tower to determine whether it is occupied, so it is the *possibility* of being surveilled that controls their behavior. As Chun (2008) writes in her analysis of the panopticon, “power had to be visible, yet unverifiable.” When Google allows people to erase their search history, people have no way to verify that these traces of their past behavior are truly erased. When a smartphone app allows people to disable location tracking, people have no way to verify that their whereabouts are truly unknown. Ultimately, control of digital selves lies elsewhere: in opaque corporations (Slavkovik et al., 2021). The state of uncertainty and paranoia that emerges, even in the absence of any actual lack of privacy, anonymity, or tracking, may be the true force behind technological control and the decline of freedom.

Figure 1

Jeremy Bentham's Panopticon



Note. Bentham's panopticon controls behavior even though surveillance is unverifiable. Illustration by Adam Simpson for the *New York Times*.

We drew clear causal links between a given technological feature, the affordance it enables, and the constraining implications of that affordance for the self, but this remains an oversimplification. For one thing, technological features buttress each other. Predictive algorithms only work if tracking technologies gather enough valid user data, habit-forming notifications keep the user engaged enough to produce more data, and data storage capabilities can handle the volume of data that is produced. Similarly, sharing and rewarding of visual images is possible because of device portability, data storage capabilities, and notifications about images that are posted or liked. Therefore, any given affordance is the product of multiple interdependent technological features.

Affordances are not only multicausal (i.e., produced by multiple features), they are also multifinal (i.e., have diverse consequences for the self). For example, predictive algorithms not only reinforce people's idiosyncratic preferences, they also reinforce the social categories to which people belong. Habitual device use not only disrupts self-related cognition, it also influences how much personal information people disclose online (Fernandes & Pereira, 2021).

Lack of privacy not only "chills" non-normative behavior, it also disproportionately penalizes marginalized people (e.g., sex workers) who engage in non-normative behavior (Blue, 2020). Historically marginalized people may also bear the brunt of the constraining consequences of persisting digital memories, for example when people transitioning to another gender have more difficulty leaving behind a previous gender identity recorded online (Eichhorn, 2019). Therefore, rather than working in isolation, technological features and affordances function as part of a mutually enforcing network that constrains the self.

The shift away from freedom online may seem inconsequential, but in many parts of the world, technology's role in limiting freedom is literal. Authoritarian governments use the technological features and affordances we reviewed, like distraction and invasions of privacy, to suppress democratic movements, control minority groups, and enforce social order (Zhuravskaya, Petrova, & Enikolopov, 2020; Ribeiro et al., 2019, King, Pan, & Roberts, 2017; Pan & Xu, 2020). Authoritarian governments' ability to use technology to impose control on their population depends on the extent to which they control technology firms operating in the country (Pan, 2017). And just as technological features can support authoritarian control from the top-down, they may also influence key political outcomes like populism and far-right voting from the bottom-up (Lorenz-Spreen et al., 2021). Thus, although this paper examined the influence of recent technological developments on the freedom of the *individual*, our work has obvious implications for freedom at the societal level.

Future Directions for Research

Each topic reviewed in this paper is ripe for further research. Table 2 summarizes a few concrete avenues for research that can begin to address existing gaps in knowledge to lay the groundwork for researchers interested in the self-related implications of privacy erosion,

predictive algorithms, and impaired cognition. This research will require new methodological tools and collaborations. At the same time, researchers must go beyond studying the digital environment as it currently exists by staying attuned to and anticipating new technological developments that might affect the self.

First, more research is needed to understand the psychological implications of lack of privacy. The causes, nature, and extent of privacy violations are well-documented, as are the reasons why people nevertheless continue to share their personal information online (i.e., the privacy paradox; see Gerber, Gerber & Volkamer, 2018 for a review). Less research has examined the psychological effects of privacy erosion. For example, we know little about how declines in actual privacy track changes in privacy norms or perceived privacy (Brough & Martin, 2020). Psychologists should study privacy norms longitudinally in much the same way they have studied changes in other social norms over time (Tankard & Paluck, 2016). Future research should additionally examine the extent to which eroding digital privacy "chills" behavior online *and* offline. Research examining "chilling" effects tends to focus on the consequences of high-profile instances of government surveillance rather than the more general threat of losing control of our personal information and records. That said, future research must also go beyond pointing out privacy violations and their effects by offering solutions that can help effectively preserve privacy. This is particularly important because interventions to improve privacy (e.g., giving people control over privacy settings) can have paradoxical effects (e.g., causing them to reveal more information than they would otherwise) (Brandimarte, Acquisiti, & Loewenstein, 2013; Martínez, 2021).

Second, the field must shift its thinking about predictive algorithms. They are not merely tools for personalization; they create a new kind of environment structured on the basis of our

own or others' similar past behavior (Feuz et al., 2011; Haim et al., 2018; Wagner et al., 2021). People are interacting with many algorithms throughout their days for years on end. It is this continuous and long-term exposure to algorithms that can affect something as stable as people self-views and stereotypes (Pariser, 2011; Cheney-Lippold, 2011). Researchers who use machine learning algorithms to "predict" personality and other aspects of the self must recognize that they may be implicated in creating the reality that they seek to predict.

That said, although many studies have shown that predictive algorithms can reduce the diversity of content people encounter **(**e.g., Bakshy et al., 2015; Fleder & Hosangar, 2009; Nguyen et al., 2014), no studies to our knowledge have examined how this influences the stability or homogeneity of people's self-views over time. Similarly, although many studies have documented that predictive algorithms serve biased results against women and minorities, only a small handful studies (e.g., French, 2018) have examined the effects of such algorithms on stereotype development, maintenance, and strength. Moreover, most research on algorithmic influence tends to focus on political identity and polarization when algorithms have the potential to influence many other aspects of self and identity. Similar to the need for research that actually *alleviates* privacy erosion, research must move beyond pointing out that algorithmic bias exists to developing and deploying algorithms that mitigate bias at scale. Researchers in industry and academia have long identified lack of diversity and novelty provided by predictive algorithms as a potential problem (e.g., Li, Fang, & Sheng, 2018; Terveen & McDonald, 2005; Vargas & Castells, 2011; Yu et al., 2009). One solution that engineers have used to meet consumer demand for heterogeneity and novelty is to program algorithms to occasionally recommend random or serendipitous content (Kotkov, Wang, & Veijalainen, 2016; Smets et al., 2021).

Third, although psychologists have devoted a great deal of attention to technology's impact on memory and cognition, how such impairments may be influencing other psychological phenomena, like the construction of our narrative identity, remains understudied. Quantifying the impact of technological features on cognition can be difficult due to the paradoxical nature of the effects: technology both enables and disturbs cognitive functioning. This may clarify why empirical research on technology and cognition has sometimes produced inconsistent results (e.g., Mueller & Oppenheimer et al., 2014; Backes & Cowan, 2019; cf. Morehead, Dunosky, & Rawson, 2019; Urry et al., 2021). One potential solution is to move away from studying technology's influence on people's *ability* to remember and move towards studying the *way* people remember. When it comes to identity processes, documenting how features of the digital environment are changing the very nature of memory—what gets remembered, how, and why—may be critical (Jacobsen & Beer, 2021; Wang, Lee, & Hou, 2017**;** Johnson & Morley, 2021**)**.

Table 2

Opportunities for Future Research on the Digital Environment's Constraining Effects

Research Objective	Research Question	Possible Methodological Approach
Understand psychological effects of privacy	● How do privacy perceptions change over time? ● How do privacy-related current events (e.g., media coverage, laws) influence privacy norms and self-relevant behaviors (e.g., self-disclosure)? ● Does uncertainty about the likelihood of online surveillance cause paranoia and socially desirable behavior?	● Large, longitudinal panel studies ● Naturalistic quasi-experiments ● Lab-based experiments
Improve privacy	● What factors increase the adoption of adblocking and other privacy protecting tools? ● How can activists increase collective action in favor of privacy regulation?	● Ecologically valid interventions ● Applied studies with community engagement
Understand psychological effects of algorithms	● Does algorithmically served content increase the stability of people's self-views over time? ● Do attitudes in a social network with recommender algorithms converge faster over time than attitudes in networks without algorithms?	● Event-triggered experience sampling ● Social network analyses
Reduce social inequities	● Do improvements in algorithmic fairness reduce implicit bias? ● Do changes in popularity-based ranking systems increase the influence of online content from underrepresented groups?	● Field studies in collaborations with technology companies, using behavioral and linguistic measures of bias
Understand psychological effects of tech-enhanced memory/cognition	● Do experiences that were posted on social media feature more prominently in people's narrative identities than similar unposted memories? ● Do notifications prevent self-insight by increasing distraction?	● Life story interviews ● Smartphone-based cognitive load manipulations

Note. Illustrative examples of research objectives, questions, and methodologies that can begin to address identified gaps in the existing literature.

The future directions described here are far from exhaustive. Researchers should think generatively about how other recent digital affordances may be influencing the self more broadly. For example, newly established reputation scores based on one's digital footprint may cause socially desirable behavior on a scale not previously witnessed (e.g., Fertik & Thompson, 2015). Facial recognition technologies might make being anonymous in public impossible, even in our offline lives. Developments in artificial intelligence might provide people with social interaction partners explicitly programmed to fulfill their most unique preferences and needs. Augmented reality and virtual reality technologies may make shared experiences with dissimilar others in real life a rare occurrence, further pushing us into idiosyncratic ecological niches. And smart homes, smart cars, and other forms of ambient technology that rely on the technologies discussed in this paper may constrain the self in more and more places (Brey, 2005). Characteristic of all these technological developments is the increasing fusion of people's offline and online environments. We need a better understanding of how constraints in the latter bleed into the former. For example, foreign travel has historically offered the self a great deal of freedom—to try new identities, lifestyles, and friends. However, with a smartphone in your pocket, it is much harder to "lose" yourself both physically and metaphorically. Your physical context may change, but your social context and the self it supports may not. You carry your old life in your pocket, with the self you embody back home on display for any new acquaintances who care to Google you to see.

Critically, researchers should try to predict technological developments so as to anticipate their consequences *before* they irreversibly impact human life. In a rapidly changing world, research focused only on the present quickly loses its relevance (Gergen, 1973). Early scholars of the internet who hypothesized that the digital environment would foster freedom were not

wrong; they just did not foresee the variety of technological affordances that could emerge over time. Of course, a major difficulty in predicting technological developments and their effects is that knowledge of even the current state is incomplete. In this way, the study of technology's effects on human behavior is no different from any other "crisis discipline" (e.g., climate science) that must anticipate the effects of changes to a system even before all components of the system are known (Bak-Coleman et al., 2021).

Indeed, researchers may currently lack the data and methodological tools needed to study these topics at scale. We hope that by identifying gaps in the field's knowledge, we have also helped identify the kinds of data and methods needed to fill these gaps. For instance, it is difficult to quantify the effects of algorithms on the self when we do not know how many algorithms an individual encounters in a given day, month, or year, let alone how each algorithm works (Wagner et al., 2021). Simulating a counterfactual world characterized by an entirely different set of freeing technological features and affordances is even more challenging. One ambitious but potentially fruitful avenue for future research would be to compile a database of digital maps that depict the "topography" of digital environments over time and virtual space. To investigate whether living in a mountainous region influences aspects of the self (Götz et al., 2021), one must know where there are mountains. Similarly, to know where and when digital environments may free or constrain the self, one needs a map that depicts the technological features and affordances available in various digital environments over time and virtual space. Such maps can be overlaid with new "census" datasets that document the number and characteristics of people occupying different digital environments over time. Together, maps and census data about the digital world will help improve the precision and generality of conclusions researchers can draw about digital media's changing effects. Documenting the digital

environment's evolution is especially important because virtual places can become quickly defunct, in some cases disappearing without a trace (Dowling, 2019).

Coda

In divining what the digital revolution will mean for the human psyche, it is helpful to look to another major communication revolution: the invention of the printing press in the 15th century and the subsequent rise of print capitalism (Dewar, 1998). Many people are aware of the role of the printing press in transforming the European political and religious landscape (Eisenstein, 1980), but few realize that the press also contributed to a fundamental psychological shift in how people thought of themselves. Historians believe that for most of human history national identity did not exist (Gellner, 1983; Hobsbawm, 1990).[2] People thought of themselves as resident of village A, brother of B, customer of C, and a worshipper of deity D, but *not* as a citizen of any nation-state (Anderson, 1983). Voluntary self-sacrifice occurred in the name of these close ties or God; otherwise, self-sacrifice was reserved for mercenaries. But a few centuries after the invention of the printing press, national identity had become so important that people were willing to voluntarily fight and die for their nation—an imagined community of people they would never meet. The fifth most cited book in the social sciences points to the rise of print capitalism as the cause of this shift (Breuilly, 2016). By homogenizing and stabilizing previously discrete local languages, print capitalism made it "possible for rapidly growing numbers of people to think about themselves, and to relate themselves to others, in profoundly new ways" (Anderson, 1983, p. 36). If our current communications revolution is as transformative, it will change how people think of themselves on a massive scale. Although the

[2] If you are surprised by this fact, you are not alone. Historians have puzzled over laypeople's subjective sense of the antiquity of national identity given its objective modernity in historical time (Anderson, 1983).

nature of that shift in the self may not be known for many years to come, it is naïve to think that the change is not already underway.

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