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A.R.E. Taylor

In September 2021, my iPhone suddenly stopped working. I had plugged it into the mains to charge overnight and in the morning the lock screen was unresponsive. I held down the power button to try turning the device off and on, but nothing happened. The screen was a black rectangle of fingerprint-stained glass. I had purchased the phone in early 2019 and had not experienced any technical issues with it until that moment. In fact, I had gone to considerable effort to protect the fragile device. To reduce the chance of the screen cracking, I had invested in a "scratch-resistant" tempered glass screen protector that could supposedly withstand a 22LB (10KG) impact. I had also tried to protect the phone from damage if it was dropped, by purchasing a "rugged" shock-resistant phone case that promised military-standard drop protection (MIL STD 810G-516.6). Despite these physical security measures, it looked like the unresponsive screen could be related to a failed software update, so I took the phone to my network provider's local store. After conducting some routine diagnostic tests, the technician could not identify the problem. He explained that the quickest and easiest solution would be to upgrade my phone because I had already completed my planned contract. They provided me with a new iPhone. Whilst still in the store, I inserted my SIM card into the new phone, turned it on and began to set it up. I logged into my Apple iCloud account, which I had used to automatically back up the files and system data on my defunct phone. Within a few minutes, my system settings, along with my photos and other data, had been downloaded and installed on my new phone.

In this chapter, I explore how cloud backup and recovery services like Apple's iCloud work to render the breakdown and failure of digital devices as non-disruptive as possible.[1] I argue that, while these services may provide valuable protection for our precious digital files, they facilitate and bolster a culture of routine device upgrading and electronic waste (e-waste) production. Digital technologies are prone to failure. Packed full of fragile microelectronics, the computers, smartphones, tablets and other electronics that surround us are not built to last. According to consumer research companies, the average lifespan of a smartphone ranges between two and three years (Statista 2022). Failure is often strategically built into digital devices. Battery degradation, software updates that slow down performance, and design logics based on planned obsolescence result in a rapid turnover of digital devices and sustain practices of perpetual upgrading, leading to ever-accelerating accumulations of e-waste (Parks 2007; LeBel 2012; Gabrys 2013;

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Little 2021). Restrictive device repair policies further exacerbate these issues, making it difficult for end users to extend the lifespan of their devices with the help of third-party tech repair outlets or through their own tinkering (Cangiano and Romano 2019).

Within the emerging interdisciplinary fields of discard studies and e-waste studies, the broken, outdated and discarded electronics of digital culture have provided openings for exploring the limitations of technological progress and for problematising the narratives of newness and innovation that underpin the development, design and marketing of digital technologies (Gabrys 2013; Alexander 2017; Little 2021; Liboiron and Lepawsky 2022). Discarded digital objects have also surfaced as valuable entry points for exploring contemporary configurations of capitalism (Mantz 2008; Burrell 2012). Commenting on the economic value of failure-ridden digital devices, Arjun Appadurai and Neta Alexander (2020, 23) have observed that "[t]echnological failures such as limited battery life, digital lags, or frozen, irresponsive screens effectively support a business model of upgrading." There are now ongoing consumer rights disputes about the unethical and unsustainable operating logics of a technology industry that capitalises on the failure of digital commodities (see for example the ever-shifting legislative landscape of the right to repair movement (Cangiano and Romano 2019)). Nevertheless, for the time being, rapid obsolescence and short lifespans appear to remain the default design logics among global technology manufacturers.

While discarded devices are now drawing significant scholarly attention, in this chapter I set out to approach the economy of techno-failure from a different vantage point. I focus on the cloud storage and backup market. At its most basic, "the cloud" refers to a form of online data storage. Users upload their files to an online cloud platform. Dropbox, Microsoft OneDrive and Google Drive are some of the most widely known brands. Through this process, users' files are transferred or duplicated onto servers located inside the cloud providers' data centres

Figure 16.1 Server cabinets in the "cloud"
Source: Photo by the author.

Figure 16.2 Some of the service providers that operate in the increasingly busy cloud backup market

Source: Image produced by the author.

(Figure 16.1). For this reason, data centres are often imagined as sites where "the cloud touches the ground" (Holt and Vonderau 2015, 75).

The cloud is often promoted as a multipurpose tool with which users can expand their data storage, synchronise and share files between devices, and automatically back up data and system settings. A range of service providers have now emerged that specifically focus on cloud backup and recovery solutions (Figure 16.2). In this chapter I concentrate predominantly on cloud backup providers for consumer mobile devices, with a focus on Apple's iCloud. For Apple users, the default cloud backup solution is iCloud Backup and Restore. For Android users, Google provides the default cloud backup service. In addition to iCloud and Google, there is now an entire economy of apps in the smartphone data backup, restore and recovery marketplace. Sync, pCloud, Autosync by MetaCtrl, Swift Backup and Buggy Backup Pro are just some of the other cloud-based backup providers who promise to provide users with quick, easy and infinitely scalable data backups, for a monthly subscription fee.[2] On mobile devices, these backup services can duplicate a range of data in the cloud, including call history, contacts, system settings, SMS and MMS messages, photos and videos, and app data (such as chat histories from third-party messaging platforms like WhatsApp).

Backing up off-cloud to a storage device such as an external hard drive can be a time-consuming task that users often defer. The iPhone, for example, must be connected to a computer

via a USB/USB-C cable or Wi-Fi connection and then synchronised with iTunes. This is not difficult to do, but it requires users to remember to back up their device and is a task that is easily put off to another day. In their marketing materials, cloud service providers promise to make the process of backing-up simple, easy and hassle free. Cloud-based backup solutions have the advantage of requiring little to no action on the user's part. Most cloud backup services automate the backup process, carrying out backups at a designated time of day, providing there is a Wi-Fi connection. This is nicely captured by a "how-to" guide on cloud backups: "backing up is now easier than ever: the new wave of cloud storage services can do the job for you in the background while you work" (Nield 2015).

Cloud storage is increasingly the default file storage option on many portable electronics. Indeed, the internal storage capacity of consumer electronics is shrinking as more and more of our computing needs are implemented as web services. External storage options are also being stripped away, with SD card slots, CD and DVD players and other expandable memory ports no longer considered a design necessity, now that movies, music, apps and software can be downloaded or accessed "as a service" via the internet. As powerful as our devices are, their main task today is to act as portals to the cloud – and taking a device off-cloud can sometimes be a difficult process that is often made deliberately confusing by technology companies (Taylor 2018). Of course, users do not have to back up their devices into the cloud. A range of non-cloud backup options exist. As previously mentioned, users can plug their phones into their laptop or desktop computers to back them up (or use Wi-Fi syncing to wirelessly connect their phones to their computers). However, cloud-based backups appear to be growing in popularity, according to survey data collected over a period of 13 years by the cloud backup service provider Backblaze (2021), as part of their annual backup awareness month (June). In Backblaze's (2021) most recent survey, conducted in collaboration with the US-based market research and analytics company The Harris Poll, 61% of those surveyed now use the cloud as their primary backup method.

The cloud provides users with a secure online repository that is safely removed from the fragile materiality of failure-prone digital gadgets. The idea is that, no matter what should happen to a users' device, their data will be readily available to be instantly accessed or re-downloaded on another device. Whereas the failure or breakdown of a digital device may once have resulted in a disruptive and potentially devastating data loss event, cloud backup and recovery services now aim to ensure that device failure does not result in data loss or entail significant disruption or delay to users' digital lives. Shannon Mattern (2018) has observed that, for techno-dependent citizens of the global north, "a cracked screen can mean death." Certainly, for those who have not backed up their data or are without the means to quickly access a replacement device, the malfunction of a phone or laptop can be a devastating experience. However, with cloud backup services built into more and more digital devices, a cracked screen (for those privileged users who can easily replace a broken device) is perhaps increasingly just as likely to be greeted with a shrug of the shoulders as much as a scream of despair. Experiences of device breakdown thus unfold across a range of disruptive horizons, with individuals from lower socioeconomic backgrounds most likely to be disproportionally affected.

In what follows, I explore how the cloud acts as a buffer against device failure. I suggest that cloud backup and restore services work to transform device failure from a disruptive data loss event into an easily manageable and barely noticeable "non-event." This has implications for theories of failure that are based on the premise that breakdown or failure are disruptive events. The first section of this chapter briefly situates this analysis within a larger body of scholarship investigating the relationship between technology and failure. I then move on to examine how cloud-based backup products strive to anticipate and accommodate the failure of digital devices, with the aim of ensuring breakdowns or malfunctions are as non-disruptive as possible. This

chapter closes by embedding cloud backup services within a larger economy of techno-failure, reflecting on how cloud backup services enable technology corporations to extract value from users' anticipations of device failure.

Failure Studies Beyond the Event

It has long been a commonplace in analyses of human–machine relations that the failure of technological systems or tools is a disruptive, even world-shattering event. Stephen Graham and Nigel Thrift (2007) have traced this line of thinking back to Heidegger's (1962) philosophy of technology. When technologies break down or malfunction, it has been understood that they shift status from being "invisible" tools that facilitate work into stubborn and unruly objects that disrupt routines or habits (Verbeek 2004, 79; Harman 2009). As Graham and Thrift (2007, 2) summarise: "human beings do not focus on a tool or a piece of equipment but on the work in which they have become engaged." The tool employed to conduct a specific task – whether that is a hammer being used to hit nails into a piece of wood or a computer being used to write an article – "disappears" into the background of the working process and only comes to our attention if it fails. When this moment of malfunction arises, "the tool suddenly demands attention for itself" (Verbeek 2004, 79). Peter-Paul Verbeek applies this to digital tools:

> Someone sits at a word processor focused on the text at hand and all of a sudden the computer freezes. The trustworthy world that developed around the computer – the open book, the keyboard, the screen, the cup of coffee; in short, the entire mutually referring network that Heidegger calls a world – is abruptly destroyed.
>
> *Verbeek 2004, 79*

If technologies, from hammers to computer systems to large-scale infrastructures, are designed to disappear into the background of everyday life, upon breakdown, they forcefully reappear. Indeed, technologies, it is often stated, become visible upon breakdown or malfunction. In her oft-cited essay on information system infrastructure, anthropologist Susan Leigh Star (1999, 380) noted that such infrastructure, when operating smoothly, "is by definition invisible, part of the background for other kinds of work." However, when infrastructure systems fail, they become visible: "The normally invisible quality of working infrastructure becomes visible when it breaks: the server is down, the bridge washes out, there is a power blackout" (Star 1999, 382). This moment of appearance via breakdown has been of great interest to social theorists because it provides an opening onto complex and fragile relations between people, technology and the industries that design and provision them – relations that are concealed or go unnoticed when a system is working smoothly. As Steven J. Jackson (2014, 230) has noted, "breakdown disturbs and sets in motion worlds of possibility that disappear under the stable or accomplished form of the artefact." From this perspective, failure and breakdown are valuable revelatory moments (and valuable analytical opportunities) precisely because they are understood as exceptional, disruptive events rather than normal operating states, through which we can therefore learn something new about our world. This line of thinking has perhaps been most prominent in disaster studies scholarship, in which disasters are valuable precisely because they are not the norm but "messy times when norms […] fail" and which therefore provide a momentary window through which we can "analytically denaturalise and examine these practices that create norms" (Petersen cited in Guggenheim 2014, 7).

But what happens when failure becomes the norm? What happens when failure "fails" to disrupt, to produce new knowledge or to register as an "event"? A growing body of work has begun

to move analyses of technological failure beyond the "invisible until breakdown" and "failure-as-event" paradigms. Ethnographic work in social contexts (primarily in the global south) where malfunction is a regular companion of infrastructure and technology service provision has demonstrated that perceptions that infrastructures are "hidden" or "invisible" until breakdown are unable to adequately capture the "range of visibilities" (Larkin 2013, 336) that shape different social groups' experiences of technology failure or service interruptions (Harvey and Knox 2015; Trovalla and Trovolla 2015; Boyer 2018). Mattern (2016) thus observes that, "[t]he presumption that infrastructures are 'hidden' […] signals great privilege." For people whose work involves maintaining and repairing technology or infrastructure services, for example, malfunction is often particularly visible, and significant energy and labour are invested in trying to conceal these malfunctions from service end users (Taylor 2020; 2021). David Ribes and Thomas A. Finholt (2009, 378) have thus succinctly summarised that "one person's infrastructure is another person's daily routine of upkeep." As a sphere of work, maintenance has been historically undervalued in cultures obsessed with technological novelty and "innovation" (Russell and Vinsel 2018; 2020). Scholarly interest in practices of maintenance and repair has drawn attention to the shifting layers of (in)visibility through which failure can be experienced (Henke 1999; Graham and Thrift 2007; Denis and Pontille 2014; 2015; Carroll et al. 2017; Russell and Vinsel 2018; Mattern 2018; Graziano and Trogal 2019; Taylor 2021). Others have drawn attention to the privileged position of the visual and the persistent metaphors of (in)visibility that structure ways of thinking about the relationship between knowledge, failure and power (Carmi 2020, 5).

Failure-as-norm rather than exception has been widely theorised as one of the key operating conditions of neoliberal capitalism, under which experiences of insecurity and crises have become enfolded into the everyday (Harvey 2005; Klein 2007; Berlant 2011; Alexander 2017). This is something that Appadurai and Alexander (2020) have discussed in relation to the technology sector.[3] In *Failure* (2020), they argue that the regularity of digital device breakdown serves as a vital mechanism of capital accumulation by fuelling a culture of constant upgrading. They also suggest that the frequency with which digital devices break or malfunction challenges the relation between failure and epistemology. Distinguishing between the recurrent failure of digital devices and the less-regular failure of predigital tools, they ask: "is not the failure of the smartphone simply the failure of the iron hammer as the wooden handle breaks?" They answer in the negative, suggesting that the regularity with which digital technologies freeze, crash and break means that their failure does not so easily afford the same revelatory window onto social complexity. "[O]ur technological failures," they argue, "do not teach us something new about our world; their repeated breakdowns do nothing more than further obstruct the underlying logic and hidden infrastructures that sustain them" (Appadurai and Alexander 2020, 120). When it comes to digital technologies, the relationship between failure and knowledge production itself begins to breakdown.

In what follows, I develop a different line of analysis. I do not explore the relationship between failure, visibility and invisibility that has preoccupied disaster studies and infrastructure studies scholarship. Instead, I examine how the regularity of device breakdown generates new mechanisms and infrastructures that respond to and absorb failure. Failure is both destructive and "inherently productive" (Buchli 2017, 198), leading to seemingly endless broken devices but also to the development of an entire infrastructure designed to anticipate and accommodate device malfunction. I approach the relationship between material break*down* and epistemological break*through* by focusing less on whether the regularity of device breakdown renders failure ordinary, and more on whether the cloud renders failure uneventful, and, by extension, non-revelatory. In doing so, this chapter continues to advance theories of failure beyond the "failure-as-event" paradigm.

The Infrastructure of Anticipation

Paul Virilio famously suggested that with the invention of every new technology also comes the invention of its failure:

> When you invent the ship, you also invent the shipwreck; when you invent the plane you also invent the plane crash […] Every technology carries its own negativity, which is invented at the same time as technical progress.
>
> *Virilio 1999, 89*

If new technologies produce new opportunities for technological failure, as Virilio claims, in doing so, they also open up new opportunities to capitalise on failure. Cloud backup and recovery services transform the anticipation of digital failure into a commercial opportunity. Underpinning the growing adoption of cloud-based backup solutions is an awareness of the anytime–anywhere potential of digital devices to crash or break, coupled with the need to ensure continued access to the data stored on these devices that could fail at any moment. Cloud backup and restore services are thus driven by a form of "broken world thinking" (Jackson 2014, 221), which assumes that technology failure is inevitable and requires anticipatory investments from end users if they want to ensure that their data will endure after their device breaks down.

These services are the latest instantiation of a long-standing industry of IT backup and disaster recovery products that has steadily emerged since the late twentieth century. As computers became permanent fixtures in organisational environments in the 1960s and 1970s, the failure of IT systems or the loss of digital records was increasingly understood by disaster management practitioners as a major operational risk (Taylor 2021). This presented new opportunities for profit, with a commercial IT disaster recovery industry emerging, consisting of companies such as Cisco Systems and Sungard Availability Services. These companies provided data backup, restoration and salvage services, as well as dedicated emergency recovery sites. The aim was to ensure that the failure of an organisation's computer systems would not result in a disruption to their operations or loss of data. From the 1980s onwards, as microcomputers and portable digital gadgets began to disperse throughout the social field, the failure of digital devices became a concern not only for organisations but for individual end users. New mass markets for data backup products emerged, dominated by data storage corporations like Western Digital and Seagate Technology. From the mid-2000s, cloud storage providers began to target this new market of personal consumers, providing them with access to automated backup services and scalable online data storage in dedicated data centres that had previously only been available for industrial-scale storage operations. Today, cloud-based backup solutions are key technologies with which individuals and organisations strive to anticipate and avoid data loss (Taylor 2021; Forthcoming). For a monthly subscription fee, cloud providers promise users that their data will remain safe and accessible online in the event that a personal device or office computer system should fail. As Apple (2022a) states on its iCloud support web pages: "When you back up your iPhone, iPad, or iPod Touch to iCloud, you'll have a copy of your data if your device is ever replaced, lost, or damaged."

Cloud backup and restore is a two-stage process. The backup stage involves the transferring or duplicating of data that is stored locally on a device onto servers in a cloud provider's data centre (Figure 16.3). This data is usually uploaded over the internet. For large organisations or wealthy individuals with a large amount of data to transfer, cloud providers will often securely deliver a hard drive to the client, onto which their data can be transferred and then shipped

Figure 16.3 Inside the "cloud"
Source: Photo by the author.

back with a courier to the provider's data centre. If a user's device should break down, their data should be available in the cloud to be quickly retrieved and re-downloaded onto another device, providing an internet connection is available. This is the "restore" stage of the process. The aim is to reduce the disruptive impact of device failure and to facilitate the continued smooth running of users' digital lives. This is captured on Apple's (2022a) iCloud web pages, where it states: "You can restore your iPhone, iPad, or iPod Touch from an iCloud backup to pick up right where you left off."

By striving to make it quick and easy for users to reinstall their data on new devices, cloud backup and restore services are key tools through which device failure is transformed from a shocking or rupturing event into a permissible and (relatively) non-disruptive event. Indeed, a key goal of the cloud is to produce a world in which device malfunction, obsolescence or upgrades are barely experienced as disruptions because clients can simply access their data from another device or quickly re-install their data on new systems. As Apple's iCloud web pages highlight:

> iCloud makes moving your settings, photos, apps and documents to a new device seamless. Just sign in to iCloud when you set up your new device, and you'll be ready to go in minutes.
>
> *Apple 2022b; see Figure 16.4*

Working to ensure that device failure does not result in downtime or data loss, cloud backup and restore services strive to reconfigure breakdowns and malfunctions into uneventful and forgettable moments, rather than traumatic or catastrophic data loss events. That is to say, by providing

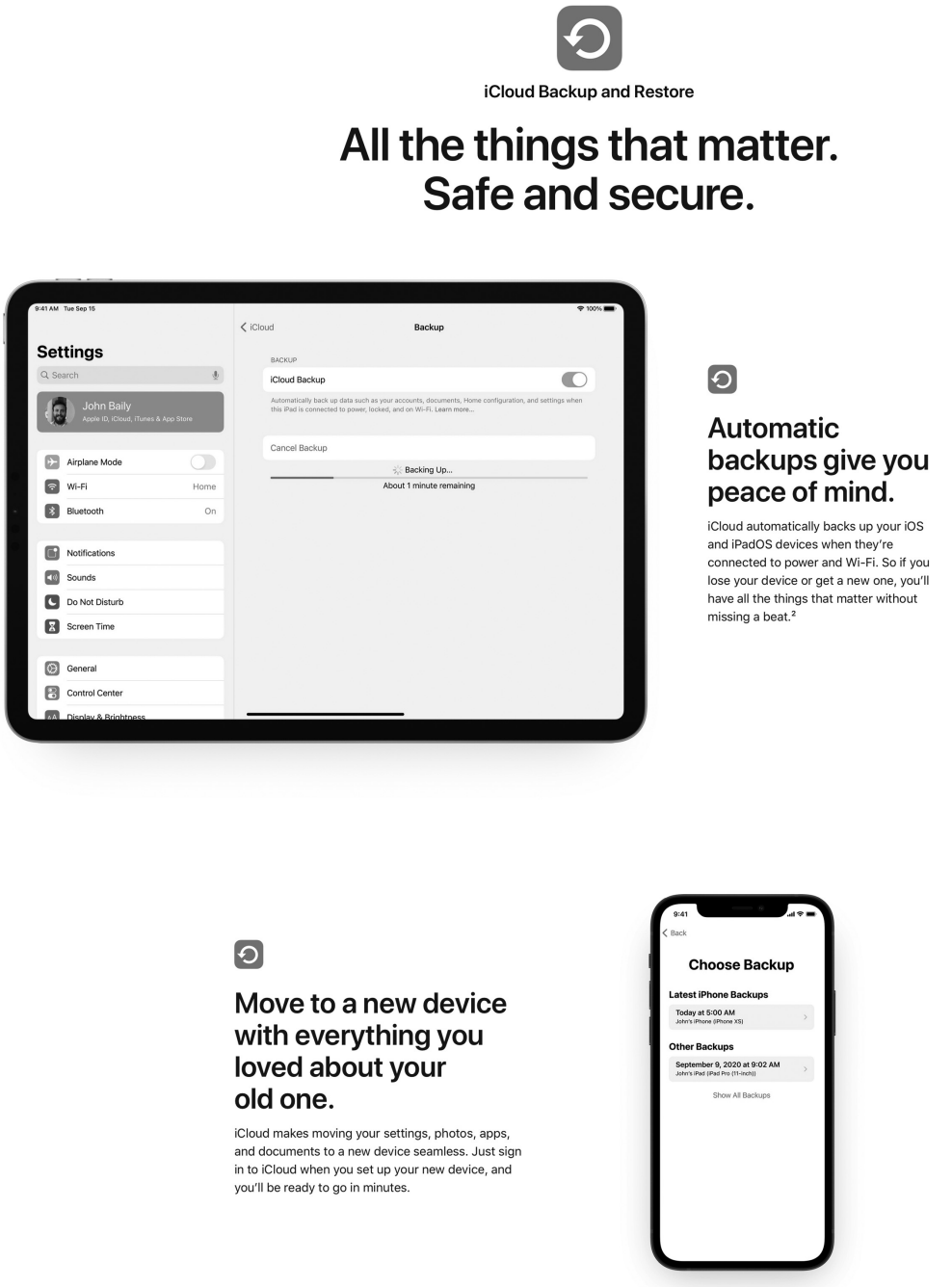

Figure 16.4 Some of the benefits of Apple's iCloud Backup and Restore service, as highlighted on their website

Source: Apple 2022b; screenshot by the author.

users with a tool to anticipate device failure, cloud services promise to produce a "world without events" (Masco 2014, 31).

Conclusion: Towards Long-Term Cloud Futures

Failure often works to bolster or strengthen an existing norm or order. As Dimitris Dalakoglou (2017, xii) observes, "All failures ensure the sustainability of their systems as they allow them to reconfigure constituent elements, reflect, revise and restart." Technology corporations like Apple and Google have developed a range of backup subscription services that aim to reduce the disruptive impact of device failure rather than reduce device failure itself. As such, cloud backup and restore services help maintain and sustain a technology market based on the continuous failure, obsolescence and upgrading of devices. With the cloud's promise to ensure data is safe and instantly retrievable, and by making it quick and easy for users to simply re-download their system data to a new phone or tablet, device failure becomes manageable, even tolerable. By extension, the cloud facilitates the smooth and rapid turnover of digital electronics.

Beyond the purchasing of replacement devices, cloud backup services provide technology corporations with new horizons from which further value can be extracted from device failure. Indeed, users increasingly incur the costs not only of having to regularly replace their broken devices, but also of monthly fees for cloud subscriptions in anticipation of device malfunction. Failure is thus rendered doubly profitable, both at the point of device replacement after failure, and at the point prior to malfunction, through anticipative investments in cloud subscriptions. Today, for technology behemoths like Apple and Google, cloud storage is a key strategic avenue for revenue growth (Zucker 2018; Gartenberg 2019). As users generate increasingly large volumes of data through their devices, their cloud storage needs for these ever-accumulating personal digital archives will continue to grow over their lifetimes, as will the payments for more and more cloud storage space. While a few gigabytes of introductory cloud storage are often provided for free, the costs for additional storage can quickly become expensive. In their online marketing, Apple actively encourage consumers to "take all the photos you want without worrying about space on your devices" (Figure 16.5). While users may not need to worry about storage space on their device, Apple does not foreground the incremental costs for additional cloud storage space that all of these photos will require.

Different temporal scales are at work here. If digital commodities are defined by their rapid obsolescence, the cloud offers a longer-term temporality that transcends the lifespan of the device. Cloud backup products are thus valuable tools with which technology companies can convert consumers of time-limited devices into potentially lifelong customers within tightly integrated cloud ecosystems. And yet, while big tech corporations are increasingly aware of the long-term value of their cloud storage offerings, many consumers are not adopting a long-term perspective when it comes to the cloud. We often opt for the cloud backup solution that is pre-installed on our device, settling for a well-known provider like iCloud, Google or even Dropbox. But these are often the most expensive services (and sometimes the least secure) in terms of price per gigabyte after their free storage capacity has been reached. At the time of writing this chapter, it is a laborious process for individuals to transfer their data from one cloud provider to another. Currently there is no simple "switching service" that enables users to quickly and easily move files between cloud providers that may offer better rates. Going forward, as we continue to produce more and more digital files, it will be important to adopt a longer-term perspective on our cloud storage needs. Indeed, unlike our digital devices, the cloud potentially involves a much longer temporal commitment.

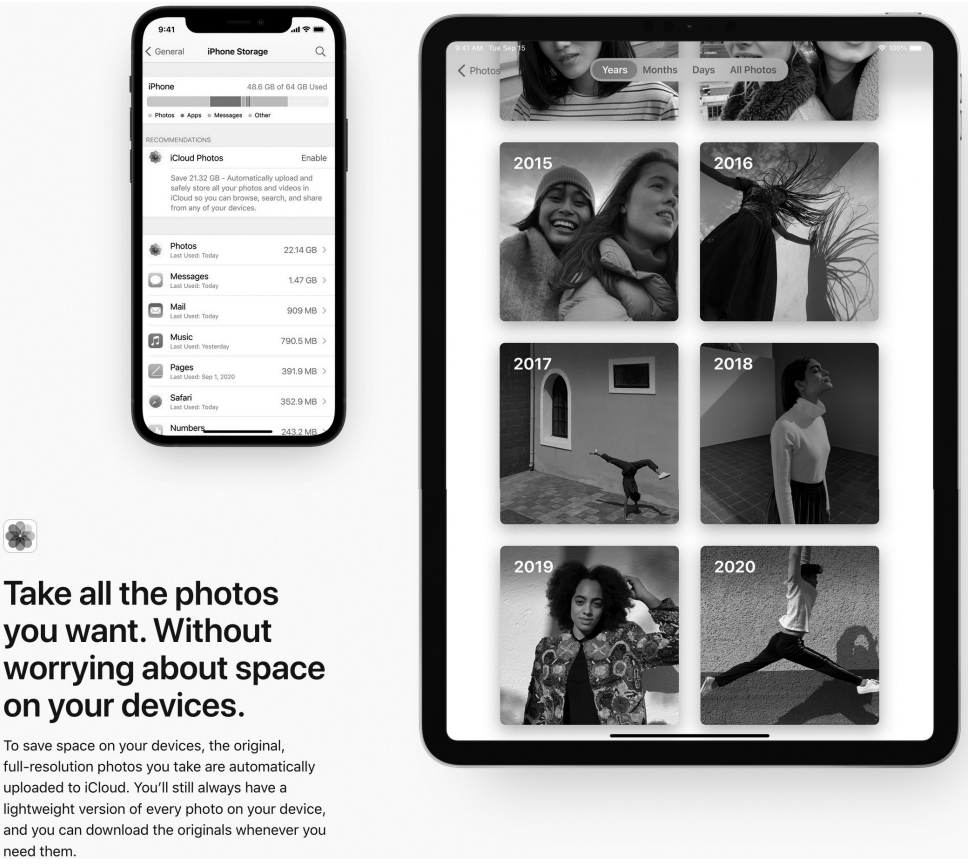

Figure 16.5 Apple promoting the unlimited data storage affordances of iCloud
Source: Apple 2022b; screenshot by the author.

The broken digital device and the cloud must thus be seen as two mutually reinforcing components within an economy of techno-failure. If failure is tolerated as an inevitable future for our digital devices, this is partly because an entire infrastructure of backup and repair has arisen to render device failure as non-disruptive and painless as possible by ensuring that the data contained on these technologies is not lost along with them. Rather than focus on the eventful failure of infrastructure, in this chapter I have thus focused on the infrastructure that has itself arisen in order to absorb failure. Cloud backup services are useful tools in a world where digital technologies are not built to last. But all too often these tools appear to provide technology corporations with a means to avoid ensuring the longevity of the devices they produce, facilitating the continuation of unethical and unsustainable business and design models based on logics of planned obsolescence and perpetual upgrading.

Notes

1 This chapter is an expanded version of a Twitter thread that was originally developed for the Discard Studies Twitter Conference that took place between 16 and 17 November 2020. I am grateful to the conference organisers, Max Liboiron and Josh Lepawsky, as well as the conference attendees, for their

insightful and supportive comments on the thread. The original thread can be viewed here: https://twitter.com/alexretaylor/status/1328722317162188800. This chapter also adapts ideas presented in Taylor (2020; 2021). Data Access Statement: The research data supporting this chapter are provided within this chapter.

2 There are also a range of cloud-based file sharing products that are not explicitly designed for backing up data, such as Dropbox, Microsoft OneDrive and Google Drive, but are nevertheless often used for this purpose.

3 See also Chun's work *Updating to Remain the Same: Habitual New Media* (2016) which, although not overtly discussing the failure and breakdown of digital devices, provides a useful entry point for exploring how practices of constant updating in digital culture relate to the perpetual production of crises under conditions of neoliberal capitalism.

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