Psychological and Behavioural Science

Cloud storage

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Abstract

Cloud storage has an environmental footprint comparable to the aviation industry, a fact many people are not aware of. Therefore, in this report we propose ways to reduce the unnecessary taking and storing of digital photos and raise awareness of the environmental and social impacts. To achieve this, the social-psychological reasons why end-users take and store unnecessary photos are discussed, and the theoretical tools that will be used to identify solutions (Installation Theory and Activity Theory) are introduced. A stakeholder analysis is presented, after which solutions are defined in full: technology interventions that aim to inform users of their behaviour and make deleting unnecessary photos easier; education initiatives that aim to bring awareness to the environmental and social impacts of taking/sharing photos; and media campaigns that aim to shape new social norms and collective behaviours around photo-taking and storage. A case study is used throughout to illustrate how these solutions could be effective in a specific context. Finally, the limitations of the proposals and areas for further research are discussed.

Introducing the Problem

According to a 2021 report by the Institution of Engineering and Technology (IET), the unnecessary storage of emails, pictures, clips and texts on servers across the globe is estimated to have the same ecological footprint as the aviation industry. 71% of people use cloud storage for photos (Armstrong, 2021), with the average adult in the UK taking 900 photos per year (IET, 2021). Many people are not aware (or perhaps do not care) that storing data on the “Cloud” is backed by gigantic data centres which are extremely energy-consuming. Even among those actively trying to reduce what they store on the cloud - only 16% cited environmental reasons in the IET report for deleting their duplicate or unwanted photos (IET, 2021).

To tackle the issue, we break it into two parts - the *taking* of photos and the *storage* of photos. Targeting solutions at both aspects will address both the existing number of photos stored on the cloud, and help to prevent the issue from getting increasingly worse.

Theoretical Analysis

Why do we take photos?

One of the most widely referenced findings of Prospect Theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1985) is that losses loom larger than gains. While the universal application of loss aversion is now being questioned (Gal & Rucker, 2018; Simonson & Kivetz, 2018), it has been suggested that it does apply for "protected goods" (Gal & Rucker, 2017a; 2017b) – things that cannot be replaced, such as memories. Since some digital photos will serve to facilitate important memories, and may even be considered as part of an individual's extended sense of self (Belk, 1988; 2013), we argue that loss aversion applies to taking photos. For example, people often take many photos and videos at concerts that invariably end up being low quality because the lights make it difficult to see the stage or the audio is compromised by their own attempt at singing. We know this to be the case, so why do we continue to do it? Because we fear that without that blurry photo, we will forget the experience. That is, we take photos to avoid the anticipated feeling of loss if we do not take them, even if we never look at them, because they cannot be replaced.

This is linked to the more modern phenomenon of FOMO (fear of missing out) where people overuse their electronic devices not for the pleasure of using them, but to avoid the feeling that they will miss something (Heitmayer, 2021). In relation to photo-taking, FOMO may manifest itself as many pictures being taken because people fear that they could miss the angle or lighting that best captures the experience, or because of the fear that someone else may capture it better. This is exacerbated by the intention to share photos: in a recent study of US adults, 48% of women and 53% of men reported to taking 2-5 selfies on average before they "found a winner", with 3% in each group reportedly taking over 26 selfies before they were satisfied (FHE Health, 2020). This propensity for maximising (rather than satisficing) behaviour has been linked to lower levels of happiness and higher levels of regret for decision-makers (Schwartz et. al., 2002).

Beyond the individual, social norms exist where taking and sharing many similar photos is acceptable behaviour. For example, it is increasingly the norm on social media platforms such as Instagram and Snapchat to share not only memorable moments, but also daily activities (e.g. getting coffee, exercising, having dinner etc.). These platforms are widely popularised and are seen as a tool to establish status and manage impressions (Schlosser, 2020). Overall, we propose that the ultimate motives for taking many photos are self-interest (building the extended sense of self) and status-seeking/competition (especially when there is an intention to share) (Griskevicius et al., 2012; Griskevicius & Kenrick, 2013).

Why do we store photos?

Another widely cited finding of Prospect Theory is status quo bias (Kahneman & Tversky, 1979; Tversky & Kahneman, 1985). Linked to the concept of inertia (Gal, 2006), this relates to individuals' general preference for, and unwillingness to change from, their current state. This is especially true in cases where the consequences of taking no action are not salient and the benefit to the ultimate self-interest motive is not clear (Griskevicius et al., 2012; van Vugt et al., 2014). Since there are few perceived consequences of storing photos (but perceived risks of deleting them i.e. loss aversion), this increases the propensity to store many photos, even if they are not used or even looked at again - in the selfie-taking example above, how many people would actively go back and delete the 26+ photos that they do not share?

Collections of photos may serve as an archive of important memories. Indeed, it has been shown that this is a motive for posting photos on social media (Chaudhari et al., 2019). It should be noted here that encouraging people to refrain from taking, storing or sharing important photos is not the aim of this paper. Instead, we aim to reduce the number of unnecessary photos (those that are duplicated, low quality or low in personal value) which are less likely to be considered as "protected goods" to individuals. Therefore, the interventions we suggest are less likely to compromise the ultimate motives of self-interest, building of the extended self or status competition, and are less likely to be perceived as infringing on individual freedoms.

Method

How do we break down behaviours and identify intervention points? Activity Theory (Leontiev, 1978) provides a conceptual framework for analysing purposeful behaviour. By identifying the subject of an activity and the objects they will use during that activity, the framework allows us to break down the steps involved in taking and storing photos and identify interventions that align with the subject's motives and end goals.

Once we better understand the activity, subjects and objects involved, how should interventions be targeted? Installation Theory (Lahlou, 2018) provides a framework for analysing how the subject's environment shapes their behaviour. By looking at their physical affordances, embodied competences and the social regulation they adhere to, we have identified ways to adjust their environment to encourage the desired behaviour (Figure 1).

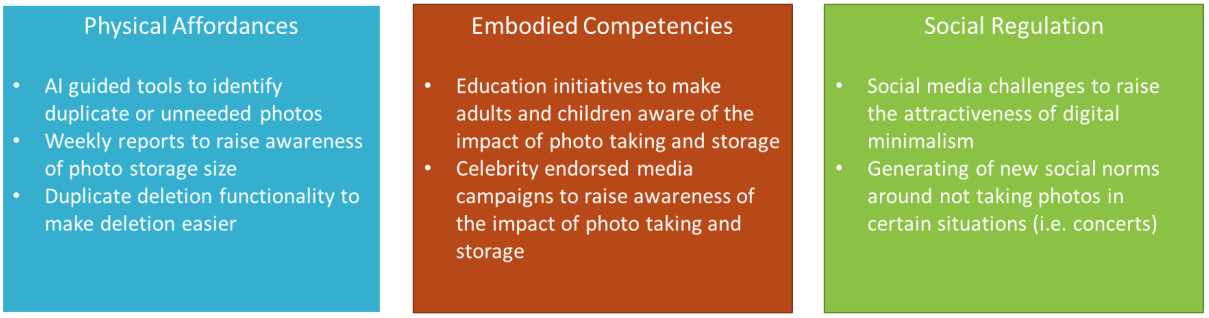

Figure 1: solutions broken down by installation theory framework

Stakeholder Analysis

An overview of the stakeholders who will be involved in our interventions to reduce the taking and storing of photos can be found in Table 1. Targeting the solutions to the problems that each of the stakeholders faces, while thinking about the motivations for their activity, will increase support for the interventions while increasing their effectiveness in changing behaviour.

Table 1: Stakeholder motives, problems and power-interest levels

Stakeholder	**Motives**	**Problem**	**Power-Interest** (Freeman, 1984)
Smartphone users	- Capture experiences (M1) - Retain memories (M2) - Demonstrate status (M3) - Feel good about oneself (M4) - Comply with norms (M5)	- Negative impact of photo-taking/sharing intentions on experiences - Negative impact of photo-taking/sharing on mental health	- Low power – limited control over designing physical affordances, increasing embodied competencies or invoking social regulations - Low interest – knowledge of the issue is currently low, and interest will remain low unless they feel that freedoms are restricted **= Monitor**

Social media users	- Share experiences (M6) - Retain memories (M2) - Demonstrate status (M3) - Feel good about oneself (M4) - Comply with norms (M5)	- Negative impact of photo-sharing intentions on experiences - Negative impact of social media use on mental health	- Low power – limited control over designing physical affordances, increasing embodied competencies or invoking social regulations - Low interest – knowledge of the issue is currently low, and interest will remain low unless they feel that freedoms are restricted **= Monitor**
Social media platforms	- Responsible and widespread use of platforms	- Negative impact on mental health of social media use	- High power – responsible for the design of the physical affordances and regulations of social media - High interest – by reducing photo-taking/sharing intentions, use of their platforms could reduce **= Manage Closely**
Smartphone and technology providers	- Responsible and widespread use of products	- Negative impact on the environment of cloud storage	- High power – responsible for the design of various technical physical affordances - High interest – reducing photo-taking/storing intentions has a significant impact on the usage of their products **= Manage Closely**

Government agencies	- Protect the environment - Protect public health - Encourage investment in technology sector	- Impact on the environment of excess cloud storage - Impact on public mental health of excess social media use	- High power – ability to impact embodied competencies and social regulations of the general public - Low interest – reducing photo-taking and storage is unlikely to be a government priority **= Keep Satisfied**
Performers and the arts sector	- Share performances/ art with fans through great experiences at concerts/ exhibitions - Protect intellectual property	- Fan experience and intention to share negatively impacted by excessive phone use/photo-taking - Intellectual property compromised by photo-taking	- Low power – while they have some influence over social regulation (i.e. influencers) they have limited impact outwith the context of performance venues - High interest – Fan experience and protecting intellectual property are key to their livelihoods **= Keep Informed**

(See appendix for Power-Interest grid visualisation)

User Motives and End Goals

Motives drive behaviour towards end goals (Jagers et al., 2017; Leontiev, 1978; Maslow, 1943). Linking to the proximate motives described in the stakeholder analysis and the ultimate motives described above, we argue that the end goals for smartphone and social media users are:

- Capturing moments that are not necessarily important but might lead to higher social status (M1, M2, M3, M5, M6)
- Capturing important moments in one's life to later look back on as part of building their extended self (M1, M2, M4)

We argue that the end goals for storing photos are:

- Store photos for as long as possible, even ones that are duplicates or unimportant, due to the possibility or fear of losing them (M2, M4)
- Store photos of important moments that can be looked back on later to solidify the sense of self (M1, M2, M4)

Case Study

To demonstrate how interventions can be employed to minimise photo-taking and storage, a case study using the example of a concert has been modelled, as it is a venue where photography is common. Concerts nowadays are spaces where data creation runs rampant – individuals want to document their experience by taking pictures and videos of the event, inhibiting their own enjoyment, the enjoyment of others around them and infringing on the intellectual property of the artist. With the rise of social media, content from events is often taken with the purpose of being shared.

Some psychologists have noted that filming a concert feels like a momento that triggers a neural network of memories through the various components of the video such as sound and images (Diehl et al., 2016). However, studies have shown that filming diminishes the experience and leads to increased anxiety, due to higher self-presentational concerns with individuals focusing their attention on how their peers and followers will react to their curated content (Barasch et al., 2018). Social situations have long been linked to increased concerns about how the self is presented to others with social media increasing these concerns past the immediate context (Scott & Schlenker, 1981). Moreover, hyper-focusing on taking the right photo or video has been shown to impact the auditory experience of a concert, diminishing the experience itself (Barasch et al., 2018). Therefore, the negative psychological impact that filming a concert has on an individual's experience, paired with the high number of low-quality photos taken, means that concerts are ideal situations to model interventions aimed at decreasing photo-taking and storage.

By leveraging various points within the activity theory schema and then applying interventions from the three elements of installation theory, a map of the process of changing behaviour can be created. The process of attending and documenting a concert is outlined in Figure 2, with three intervention points labelled – before the event during the advertisement period, at the event when triggered to take a picture, and after the event when reviewing the

data. The following section will examine solutions structured around installation theory, as well as their application to the modelled case study example.

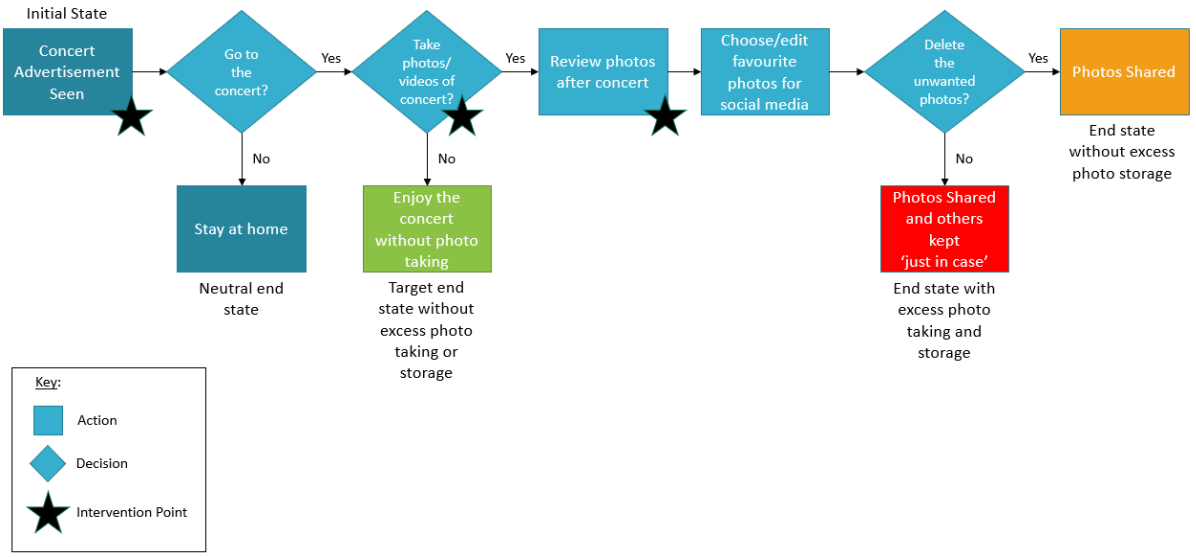

Figure 2: Activity theory of going to a concert with the intention to take and share photos

Solutions

Physical affordances

As part of our aim to decrease unnecessary photo-taking and storage, we propose tools that facilitate deletion while also creating awareness about one's behaviour. Tools already exist that use Artificial Intelligence to detect both duplicates and "quasi"-duplicates (i.e. nearly identical photos). An example is PictureEcho (Figures 3 and 4), which scans your files for "exact" and "similar" matches, which are then shown to the user to be considered for deletion.

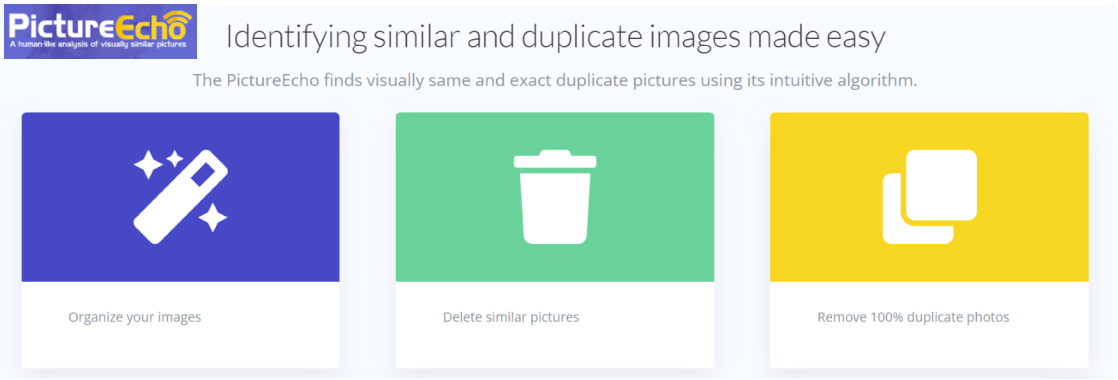

Figure 3: Solutions provided by PictureEcho

The issue however is that these tools (i) require active action (i.e. the tool does not scan automatically at regular intervals), and (ii) the interface is not user-friendly (Figure 4).

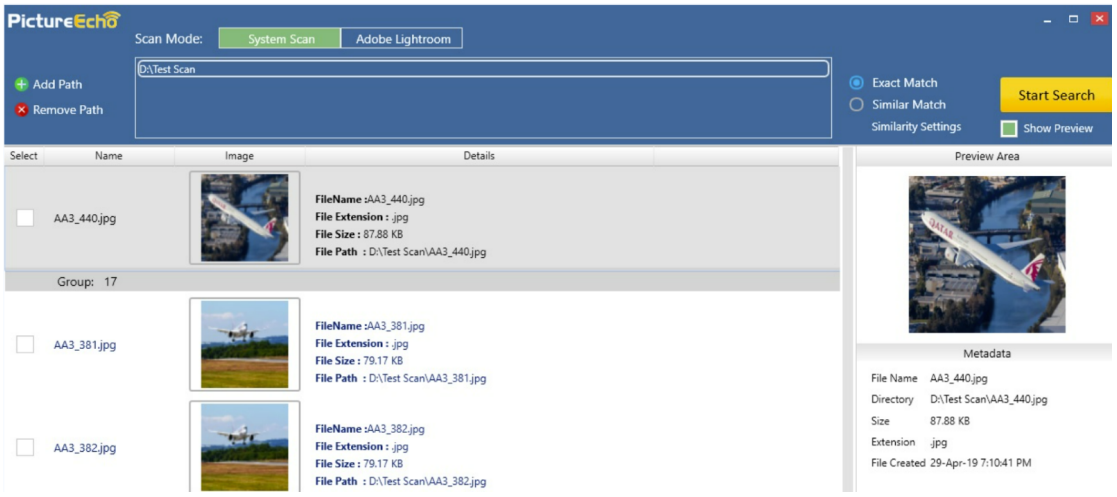

Figure 4: PictureEcho's User Interface

We argue that these AI tool providers should pair with smartphone providers to present users with weekly or monthly *automatic* scans via push notifications which are then translated into user reports (similar to Apple's "Screen time" reports, see Figure 5). Simplification techniques can be applied, such as using a duplicates "thermometer" and using colour schemes to symbolise where current behaviour is in relation to that of others. Furthermore, additional information or prompt messages should be included in these reports to further encourage actual deletion, such as the CO_2 impact and (evolving) social norms. Making these tools as easy to use and accessible as possible is key to overcoming inertia, while raising awareness of the impact that storing many photos can have. While reducing the amount of data that users store on iCloud, for example, goes against Apple's profit motives, demonstrating social and environmental responsibility can be advantageous for companies (Chernev & Blair, 2021), and as such this poses a worthwhile initiative to pursue.

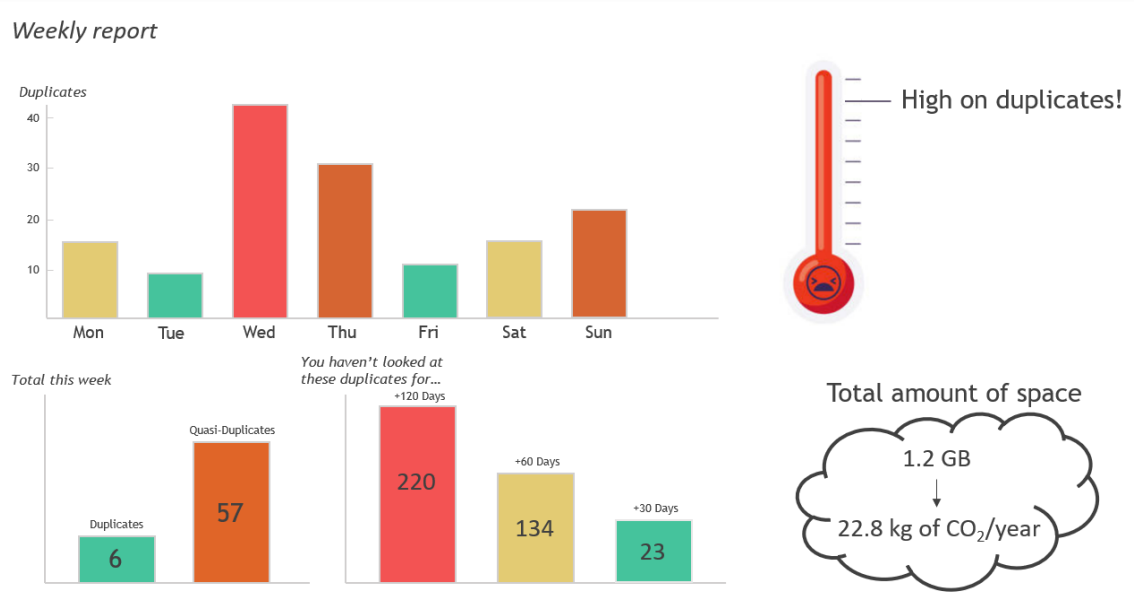

Figure 5: Outline of the weekly photo report and duplicates thermometer

Figure 6 shows how the application of these tools would be effective in guiding behaviour through our case study. Once the concert has finished, the duplicate/quasi-duplicate deletion tools can be employed to sift through photos that have been taken, with push notifications used to nudge users to delete their unnecessary or unwanted photos. Moreover, photos that are blurry or of bad quality can also be marked as potential photos to be removed.

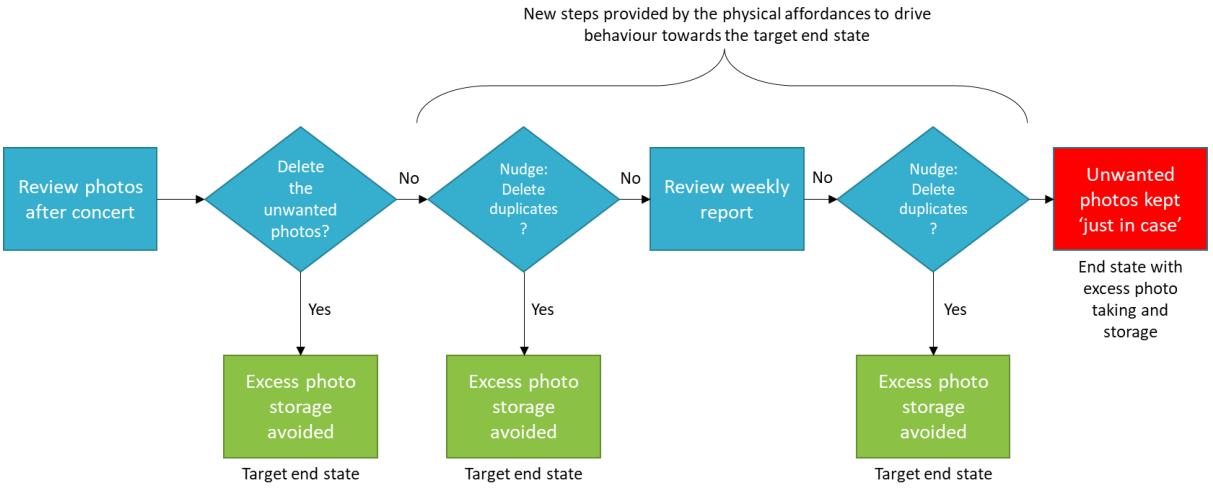

Figure 6: Activity Theory post-concert where the physical affordances provide extra guidance towards the target end state.

However, while these solutions make it easier to delete photos and prompt users to overcome inertia, it is unlikely that these physical affordances on their own will lead to a radical mindset shift and drive long-term change. The ultimate motives of status competition

and self-interest still present a barrier among end-users, because if others take, share and store many photos, users will be motivated to comply with the norm to avoid FOMO. As such, we need to extend our solutions to embodied competencies and social regulation.

Embodied competences

With the physical affordances in place to review and delete photos, we shift the focus to embodied competencies to reduce the number of photos taken in the first place, by making the environmental and mental health issues associated with the issue salient.

To raise awareness amongst adults on the impact of their excessive photo-taking habits, it is crucial to make the educational process convenient. Reaching adults in their most-frequented environments and in an interactive way can aid in the adoption of more sustainable habits (Monroe et al., 2008). For example, government agencies and the various technology stakeholders could set up stalls at university and neighbourhood fairs, providing a structured yet interactive way for people to learn while socialising in their own community (Andrews et al., 2002). Booths, workshops, guest speakers and challenges would provide people with interactive ways to digest information on topics like photo-taking/sharing's carbon footprint or mental health impact. Widespread, practical education will be key to improving the public understanding of cloud storage.

Advertisements and celebrity endorsements are another way to shed light on an issue that might be widely perceived to be a non-issue. Approaches to these ads could simulate the successful *Got Milk?* campaigns (Figure 7) that began in 1993 and are still used to change people's perceptions on milk and increase consumption. While we intend to *decrease* photo-taking and storage, the lighthearted approach used in the *Got Milk?* ads combined with the charisma of adult's and children's role models are worth emulating - while celebrities are not 'normal' members of society, their trustworthy nature allows them to normalise certain behaviours and thus encourage the average person to mimic them (Griskevicius et al, 2012; Tabor, 2021). Showing celebrities putting their phones away and enjoying the moment will thus bring reduced photo-taking in line with the ultimate motive of status-seeking by framing it as a desirable behaviour.

Figure 7: “Got Milk” campaign examples showed the impact of celebrity endorsements on raising awareness and changing behaviour in a public health context

Social media can also be a powerful tool to raise awareness and spread information quickly and broadly. Social media campaigns launched by government agencies, technology companies or even the platforms themselves, could discourage the use of filters, which are damaging not only to the environment but also to self-esteem (Kisilaslan, 2021), and photo-taking during social gatherings to promote mindfulness or ‘being in the moment’, which can actually aid memory recall (Suttie, 2018). Given that people are motivated to take and hold on to their photos to preserve memories (M2), making people conscious of this fact through campaigns from sources they trust could change behaviour.

Children’s embodied competences should also be strengthened through awareness initiatives, as the age at which we become attached to electronic devices keeps decreasing (Auxier et al., 2020). Government-organised school events have the benefit of taking place in an environment already designed for learning, and have been effective in teaching kids about the privacy and mental health consequences of sexting (UK Council for Internet Safety, 2020), so a similar approach could be applied here. No-phone challenges could also be employed in classrooms or during lunch breaks. Challenges would be seen as less restrictive or ‘threatening’ to children and young adults than strict no-phone policies, increasing the chance of receptibility, while inducing the motive of status-competition. However, when children see their parents behave in a certain way, especially from a young age, they internalise it and mimic their behaviour (Griskevicius et al, 2012). Therefore, getting parents on board is fundamental, reinforcing the need for the adult education initiatives discussed above.

By leveraging the power of government education agencies and the wide reach of social media platforms to spread awareness of these issues in engaging and interactive ways, people will better understand the impact of their behaviour and healthier habits can be formed in the younger generations. However, FOMO and status-competition could still present a barrier to behaviour change unless this increased awareness is translated into collective action.

Social Regulation

In line with the idea that we mimic the behaviour of people we want to emulate or fit in with, it is necessary to create a new norm and emphasise the concept of 'less is more' when it comes to photos, in line with recent digital minimalism trends (Newport, 2019). Similar to the economic scarcity principle (Chen, 2020), our social regulation interventions aim to make fewer photos seem desirable or like a luxury (low supply, high demand), like a diamond or a sports car but accounting for emotive value (i.e. the concept of the "protected good") more so than monetary value. This will be partially achieved through celebrity endorsements.

Building a sense of community and accountability is necessary to ensure long-term change. Social media is once again a great way to do so, with challenges that can make this added sense of responsibility fun. For example, social media campaigns can involve 60 days (the average length of time needed to break a habit (Lally et al., 2009)) of no photo-taking, where friends can track and compare each other's progress and generate a sense of competitiveness or pressure to belong and conform to such trends (Franken & Brown, 1995). Social media users can also act as 'Change Ambassadors' and help further spread awareness and promote attendance to the community education events mentioned previously. Therefore, leveraging the power of social media to support the idea that digital minimalism is a desirable new norm can result in collective behavioural change.

Building upon our case study, we can see how education and constructing new social norms are an effective way to curb photo-taking at a concert by targeting the pre-concert intervention point through advertising. Advertising can utilise the celebrity influence of performers, allowing for the artists themselves to reinforce the social norm of not filming at concerts. Analogies of photo-taking to stealing may inspire similar feelings in individuals' as when attending a movie theatre or a play, where no one takes photos. Performers can reinforce the norm through advertising on their own social media platforms that their show will be "phone-free", as well as using tickets with a logo of a "phone-free show" to spread the word (Figure 8).

Figure 8: Concert ticket with the “no photo-taking policy enforced” symbol

Figure 9 utilises activity theory to map out how pre-concert embodied competencies and social regulation strategies will guide individuals to limit photo-taking and subsequent storage. By tapping into the motives M3 (Demonstrating Status), M4 (Feeling Good About Oneself) and M5 (Complying with Social Norms), shifting what behaviour is observed and understood to be socially accepted via our interventions will lead to less photo-taking. Norms can also be reinforced through signing virtual honour codes. These honour codes can reiterate “phone-free” shows and have been shown to limit antisocial behaviour, and in this case will also demonstrate others’ adherence to norms (McCabe, Trevino & Butterfield, 2010). In the case where an individual still wants to take a photo for a memento (M1 (Capture Experiences), M2 (Retain Memories) other strategies could be employed. For example, in line with trying to make scarcity feel like a luxury, more creative physical tickets or specific photo-worthy locations could be set up within the venue to limit the number of photos taken during the concert itself, while increasing the quality of the end product. Venues can also install photo-booths or employ a concert photographer to photograph attendees, which similarly would discourage photo-taking and supply better quality images to individuals. These additional strategies would also be in line with the motive of the performers to give fans a memorable experience while protecting their intellectual property.

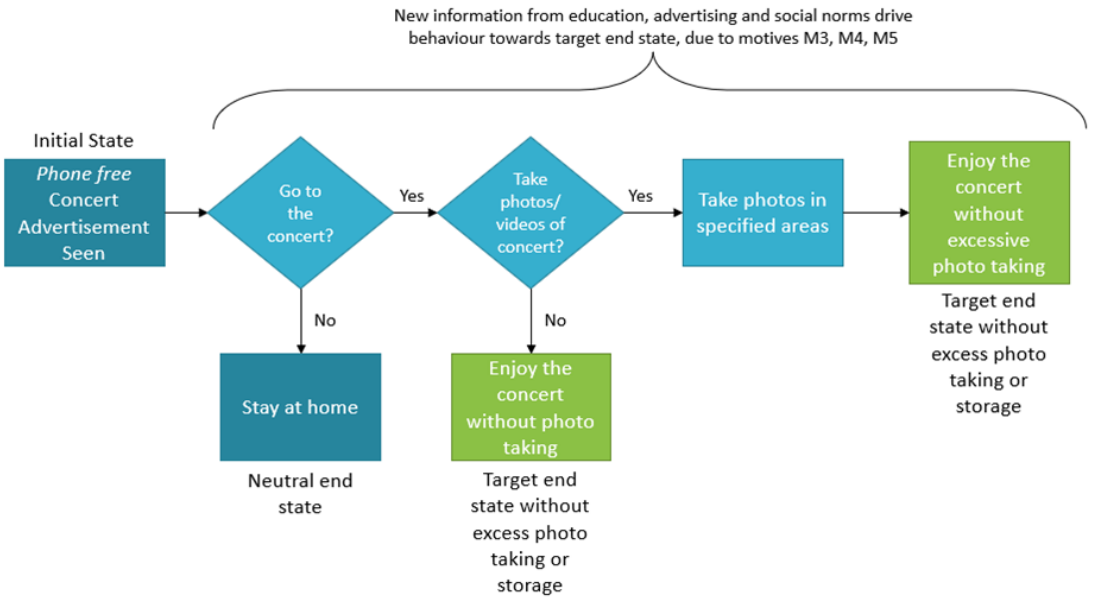

Figure 9: Activity Theory of going to a concert where the motives to take photos and subsequent environmental cues guide behaviour towards the target end state.

Discussion and Limitations

This essay examines causes of and solutions to unnecessary photo-taking and storage, employing installation theory and activity theory as guides to understanding and deconstructing the problem. Despite challenges to inhibiting individuals' technology use at a time when it is such an ingrained part of everyday life, the solutions presented here address the various motivations for taking and storing unnecessary photos, and look at how they can be minimised through physical affordances, embodied competencies and social regulation.

There are several limitations to the proposed solutions. Firstly, the impact of cloud storage on the environment is hard to quantify and interest is low - individuals may find it hard to understand or imagine how their actions (i.e. deleting a single file or photo) can help to solve the climate crisis (Olson, 1965), and while the education initiatives aim to raise awareness, this will take time to become common knowledge. Secondly, while we have attempted to align the solutions to the motives of influential stakeholders, we assume that they would support our interventions. For example, performers might be reluctant to support phone-free concerts since this could reduce publicity or shares on social media. We could also expect resistance from cloud storage providers (e.g. Apple), whose services rely on economies of scale. However, being perceived as a socially conscious business can be advantageous for big firms (Chernev & Blair, 2021), and demonstrating that they are willing to promote

environmental behaviours over profit-maximising ones would be a way to show this. Further investigation into the motives and goals of the stakeholders discussed is therefore recommended.

Promoting digital minimalism in an age with a growing number of smartphone users also presents a challenge, as the social pressures and motives that may preclude people from completely decluttering their devices are numerous and varied. FOMO and the pressures of social media create a desire to fit into current trends, with their influence continuing to grow with new platforms and trends emerging constantly. While some of our interventions aim to take advantage of the power of social media campaigns to reverse these norms, the impact may be short-term, as “trending” online is a fleeting phenomenon (Neuman, 1990; Wang & Huberman, 2012). Further research on the long-term persuasiveness of such campaigns should be investigated. It is also important to mention that social pressures will differ across countries with this report taking a Westernised view - culture and economic development between countries heavily impact technology and social media usage (Venkatesh et al., 2003).

A reason that was not explored to explain end-users photo-taking habits is that as people are increasingly living in urban areas (United Nations, 2019), they are less likely to find themselves in a natural environment and thus take more photos in those situations, perhaps as a means of “reconnecting” with nature (Abson et al., 2017). We deem this a kind of biophilic paradox, where people see the natural environment as a “protected good”, but actively (although likely unconsciously) harm it. Indeed, the environmental and social impacts of “insta-tourism” are an increasing area of research (Molinas & Victòria, 2020; Eltayeb, 2021). For example, thousands hike to Roy’s Peak in New Zealand every year before queuing to take pictures in one spot, impacting the path and wildlife (BBC, 2018). Therefore, further research on how Activity and Installation Theory could be applied to different case studies is recommended.

Our initiatives also remain limited in the sense that they are not immediate mitigators of climate change. Indeed, it takes time for habits and social norms to change (Goldstein & Cialdini, 2009; Lally et al., 2009), and it is without doubt that additional solutions with more immediate results have to be implemented. For example, France has banned several intra-country flights (BBC, 2021), which showcases the power of top-down solutions for quick results. Our solutions have a very narrow focus and many applications beyond our scope could be sources for further research. In terms of physical affordances, many useful tools exist, such as photo compressors (e.g. Kraken.io, n.d.), automatic deletion date setters (e.g.

Google Smart Storage, n.d.), and phone lockers for use at concert venues (e.g. Yondr, n.d.). Our solutions could also be extended to areas beyond pictures, such as emails, documents and datasets.

Regardless of these limitations, we hope to have convinced the reader of the pressing issue of cloud storage and its implications on our lives, as well as the potential of the various solutions proposed. By facilitating review and deletion through physical affordances, raising embodied competencies through awareness campaigns, and creating new social norms, we aim to drive long-term change in how we approach digital data creation and storage, which is increasingly becoming central to many aspects of society.

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Appendix

Visual Power Interest Grid (Freeman, 1984) - Stakeholder analysis: