

Digital overload warnings - “the right amount of shame”?

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Abstract. Media is rife with articles regarding smartphone addiction and how digital overload may be harming the mental well-being of children and young adults. As a response to the negative backlash about digital overload, Apple and Google released ScreenTime and Digital Well-being on iOS and Android devices to help users make informed decisions about their smartphone app usage. However, we expect that reminding users about their digital overload may have a negative effect, especially in undergraduate students, who are avid users of smartphones, and maybe also struggling with mental health issues. We conducted a survey among 230 undergraduate students to understand whether they use the ScreenTime feature on their iOS devices to manage app usage and if so, how the tool affected their emotions. We discovered that ScreenTime was effective in changing smartphone usage behavior, but also triggered negative emotions in undergraduate students who are avid smartphone users and also struggle with mental health issues. We expect the tools can be improved by changing the way users are warned about increased phone usage, by incorporating positive mindfulness techniques. We also emphasize the need to have more studies, like ours, to understand the effectiveness of digital overload reminder tools.

Keywords: smart home, smartphones, tablets, children, privacy, trust, security, safety, family

1 Introduction

Smartphones have increasingly become an integral part in people’s daily lives, allowing them to manage activities [46], keep track of health and wellness [15] and also stay connected with family and friends [16]. However, the media is rife with articles regarding smartphone addiction and how *digital overload* may be harming users, especially young adults [43, 44]. In this paper, we use the term digital overload to indicate the phenomenon where people are constantly using their smartphones, computers and tablets to obtain immediate access to messages from their loved ones, news updates and information from hundreds of networked apps. Researchers have shown that digital overload can lead to stress, anxiety, depression and lack of sleep, especially in undergraduate students [6, 10].

As a response to the negative backlash about digital overload, Apple and Google released ScreenTime and Digital Wellbeing on iOS and Android devices to help users make informed decisions about their smartphone app usage [29]. For example, the ScreenTime app feature allows iOS users to set a specific allotted time of usage per app [49]. When the timer is up, iOS shows a warning and temporarily blocks the user from returning to the app. ScreenTime also presents weekly reports about the users' overall app usage including apps opened and websites visited while analyzing how they use their device.

Researchers have shown that nudging users about the time they spent on their devices helps them manage their smartphone use [34] so it is possible that ScreenTime may help users reduce their digital overload. However, we expect that reminding users about their digital overload may have a negative effect, especially in undergraduate students, who are avid users of smartphones [2] and may also be struggling with mental health issues such as anxiety and depression [1]. We wanted to understand whether digital overload warnings were effective in helping undergraduate students reduce their screen time, without adding to their mental health burden.

We conducted a survey among undergraduate students to understand whether they use the ScreenTime feature on their iOS devices to manage app usage and if so, how the tool affected their emotions; we chose to focus on iOS users who use ScreenTime to manage their iPhone usage because iPhones were more popular than Android phones on our campus.

In this paper, we provide the following contributions. We present the survey questionnaire and findings from the survey we conducted with 230 undergraduates to understand the effect of digital overload warnings on their smartphone app usage behavior. Our exploratory study revealed that participants mostly experienced negative emotions on receiving a warning they had exceeded the time allotted for an app and despite receiving the warning, most participants went back to the app. However, we also discovered that most participants felt content after viewing the summary of their daily app usage and believed that ScreenTime helped them understand and in some cases, alter their app usage behavior. We also present a discussion on why participants may ignore digital overload warnings, and provide design recommendations for nudging techniques to motivate users to reduce screen time.

2 Background and related work

It is important for users to learn to control their smartphone use as smartphone overuse distracts users while at work, in class, or while driving [13, 35, 28, 3]. On the other hand, researchers also discovered that vague examples of problematic smartphone use provided by popular media have influenced people's notions of smartphone overuse, causing them to be overcome by negative emotions such as guilt even when they used their smartphones for a useful task [25].

Emotions have been defined as feelings, expressive behavior or a responsive state [19]. Scherer defined emotions as a sequence of events – feelings that a

person experiences, action taken as an immediate reaction to the feeling such as crying, an appraisal to evaluate events that caused the feeling, communicate our feelings through facial expressions such as a smile or a hug when we are happy, and finally, the physical response in our body, such as rush of blood flow when we are angry [41]. Plutchuk identified that every emotion also has an opposite emotion, so he presented eight primary emotions with varying intensity on a wheel with the opposite emotions represented on opposite sides of the wheel [37]. Stressors typically lead to increased negative emotions [11] and negative emotions have been shown to lead to problematic use of smartphones, especially in young adults [5, 4]. On the other hand, the Broaden-and-Build theory of positive emotion posits that when people are likely to broaden their thoughts and action and bring about change when they experience positive emotions, even if only for a moment [12]. So in our survey, we wanted to understand both the negative and positive emotions participants experienced when attempting to control digital overload.

Researchers identified social media and communication as the most addictive apps for undergraduate students [8]. Lee et al. discovered that college students who spent more time on their phones daily, especially immediately after receiving a push notification, were more likely to be addicted to their smartphones [27]. A survey of 612 participants showed that a lack of self control and low willpower also contributed to digital overload [24]. Prior research showed that college students are drawn to smartphones when they experience stress in their personal and academic lives [23, 47] and also when they have low self-esteem and high anxiety levels [21]. Researchers have shown that digital overload also can lead to stress, anxiety, depression and lack of sleep, especially in undergraduate students [6]. Prior research shows that smartphone use increased anxiety, stress, and feelings of impatience in college students, even when their phone was not with them [10]. Additionally, Toma discovered that self-comparison on social media sites such as Facebook led to depression, especially among people with psycho-social problems [45].

Tools that track a user's device usage can be very useful, since it has been shown that users are often unable to quantify the time they spend using apps on devices [26]. A study conducted with an app usage tracking tool called ScreenLife revealed that personal tracking of device use is desirable for increasing productivity, and controlling device use [40]. Prior research also shows that nudging users about the time they spent on their devices helps them control their device use [34]. However, is it enough to just track how long you spend on different applications to understand smartphone usage? Harwood et al. discovered that it was the nature of smartphone use, and not the extent of use, that affected stress and depression [20]. Mehrotra et al. conducted a study to understand the relationship between user's emotional state and their app usage [30]. Our survey is the first that we know of, that studies the effectiveness of digital overload warning tools and specifically, how they affect users' emotions.

3 Research Methods

We conducted a survey of 233 undergraduate students to understand whether they use the ScreenTime feature on their iOS devices to make informed decisions about their app usage and what emotions they experienced when using different aspects of the ScreenTime tool. In our work, we considered emotion as the first event in Scherer’s emotion model, i.e., the feeling that a person experiences. We addressed the following research questions:

- How many undergraduate students are aware of and use digital overload tools available on their phones?
- What time limits do they select for daily use of social media, entertainment and games; we have anecdotal evidence that students consider apps in these three categories to be most distracting.
- What emotions do they feel when they use an app for which they set a daily time limit?
- What emotions do they feel when they see the warning that they have exceeded the time set for an app?
- What action do they take as a response to the warning?
- How effective are digital overload warnings in changing users’ smartphone usage behavior?

The survey was administered using the Qualtrics software. The study was approved by the college’s institutional review board (IRB) and we recruited the participants through an email sent to all undergraduate students at our institution. All participants were incentivized with a \$5 Starbucks gift card for completing the survey, irrespective of whether they had used the ScreenTime tool on their phones. We only considered iOS users for the following reasons: iPhones were more popular on our campus than Android, and ScreenTime was available on all iPhones unlike Android’s Digital Wellbeing – we excluded the 2 Android users from the 233 participants who responded to the survey. It is unclear whether we excluded users from poor socio-economic background by only considering iOS users; we did not collect demographic information because it was not relevant to our research questions.

The survey included questions about the participants’ ScreenTime usage, emotions they felt when using ScreenTime, such as using an app with a time limit, when receiving a warning about exceeding time limit, and when reviewing daily smartphone usage summary, actions they took as a response to the time limit warnings, and any changes in their smartphone usage behavior. The questionnaire is included in the Appendix section at the end of this paper. The list of emotions included in the survey questions was compiled from public American Psychology Association test records and articles in psychology journals about emotions and moods [42, 14, 31].

4 Findings

We coded and grouped the qualitative data into themes that we present below, as well as analyzed the quantitative data using independent t-tests. We classified emotions as positive and negative using Plutchik’s wheel of emotions [37].

Familiarity of ScreenTime. Out of the 228 participants we considered, 206 were familiar with ScreenTime functionality, but only 37 participants used the ScreenTime tool on their iPhones.

Time limits for social media, entertainment and games. In the survey, we asked participants to choose the time limits they set for three categories - social media, entertainment and games. Most participants were concerned more about the time they spent on social media than entertainment apps and games. Using independent t-tests, we discovered that participants who had chosen a time limit of less than or equal to 2 hours for daily social media app use were more likely to experience negative emotions when they saw a time out warning ($p < 0.05$).

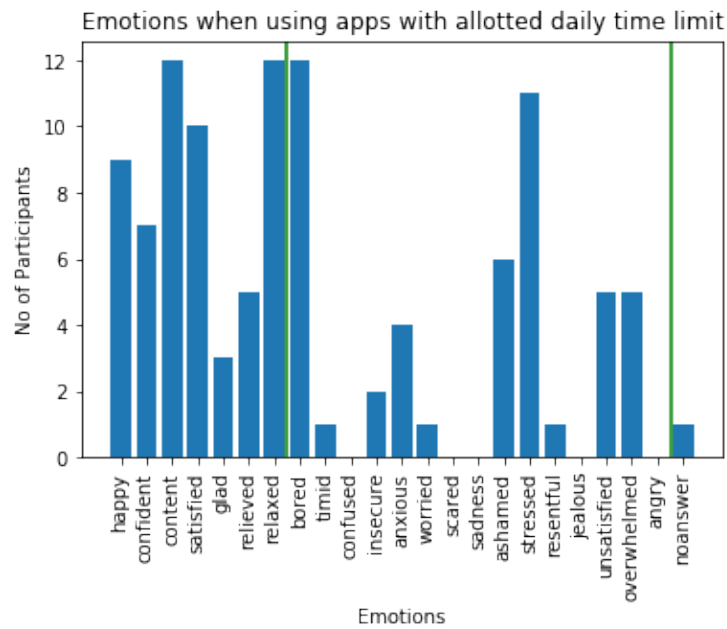
Out of the 37 participants, 34 had set time limits for social media use; the mean time was 4.5 hours, median time 2 hours, with an interquartile range (IQR) of 5 hours. 31 participants set time limits for games; the mean time was 4.13 hours, the median time 1.5 hours with an IQR of 3 hours. 29 participants set time limits for entertainment; the mean time limit was 3.93 hours, the median time was 1 hour with an IQR of 7 hours.

Reasons for using social media, entertainment and gaming apps. The participants used social media, entertainment and gaming apps when they were bored or as a way to relax when they were stressed or having a panic attack. For example, one participant said, “I distract myself from panic with games and humor.” while another said, “I use games and social media mainly as a distraction for when I’m bored or am kinda stressed [and] when [I] don’t want to do something.”

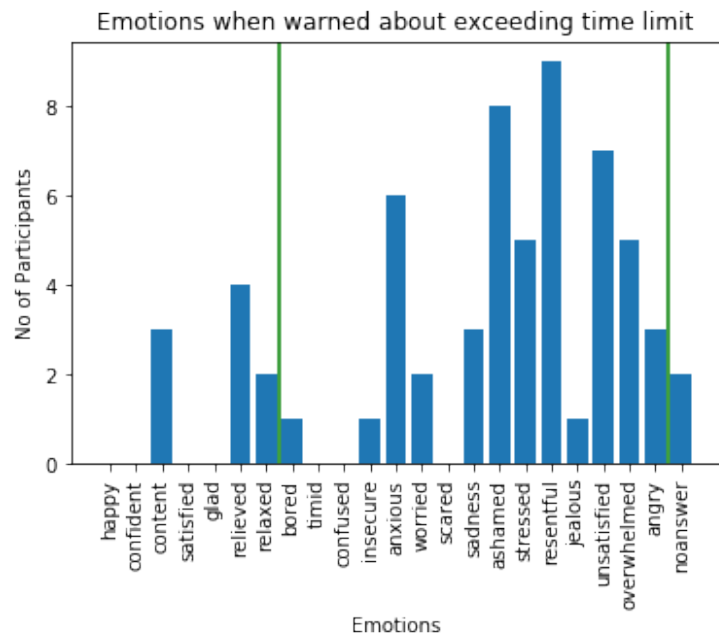
Participants associated negative and positive emotions with smartphone apps. One participant said, “When it comes to playing games I feel relaxed and happy to take my mind off of things but social media apps tend to make me happy but cause me lots of anxiety.” Another participant said “sometimes social media can be overwhelming and anxiety inducing.” Social media apps also invoked positive emotions, for example one participant found that Instagram, “[provided them] great inspiration for art and cooking and lifestyle habits”, while another found comfort in using social media apps.

Participant emotions when using smartphones with ScreenTime enabled. As shown in Figure 1a, participants mostly feel positive emotions, though many participants also reported feeling stressed, ashamed, unsatisfied, overwhelmed and anxious when using apps for which they had chosen a daily usage time limit. Participants’ emotions were affected by their perception of their smartphone use.

Some participants were not worried about their smartphone use but wanted to track the time they spent using their phones; one participant said, “I set the



(a) Emotions when using apps with daily time limits. The first green line separates the emotions into positive and negative; the last bar shows the number of participants who did not answer the question. Participants mostly feel positive emotions, though many participants also report that they were stressed, ashamed, unsatisfied, overwhelmed and anxious.



(b) Emotions when receiving warning about exceeding time limit. The first green line separates the emotions into positive and negative; the last bar shows the number of participants who did not answer the question. Participants mostly feel negative emotions when receiving the warning.

limits, but I don't really care if I go over them. [It is] just a way for me to know how long I've spent on my phone."

Others were relieved after learning, from ScreenTime data, that they used their phone less than they expected; one participant said, "I feel more satisfied because I know that my free time is not wasted by using these apps and it feels relieving when I am spending less time attached to my device."

However, some participants considered their smartphone use as problematic and experienced emotions such as shame and guilt when they were on their phone. One participant said, "I enjoy using the apps I often limit, but I feel guilty about using them, or almost ashamed". Another said, "I know I should be doing better things with my time, but the allure of social media is often difficult to overcome."

Other participants were able to use the apps without experiencing negative emotions, until they exceeded the time limit. One participant said, "I generally like using the app I set a time limit for (Instagram), but I know I spend too much time on it which makes me feel a little ashamed."

Participant emotions about exceeding time limit warnings. As shown in Figure 1b, participants experienced mostly negative emotions when receiving the warning that they have exceeded the time allotted for an app. Participants experienced positive emotions when they had chosen a time limit that they were comfortable with, while others reported feeling resentful, ashamed, unsatisfied, anxious, stressed, overwhelmed, sad, angry and worried when they realized that they had spent a significant time on certain apps that they were trying to reduce use of.

Some participants felt guilty for exceeding the allotted time limit; they associated the warnings with negative traits such as being addicted to their smartphone, lacking self-control, procrastinating and being disconnected from their surroundings.

Some participants felt upset on seeing the warnings because they enjoyed using their smartphones. One participant said, "My phone and apps are a safety blanket and a distraction to what's going on around me and it gets upsetting that I don't have much to hide from." The other participant said, "I love being on my phone so when I get the notification I feel pretty sad."

Some participants experienced negative emotions based on the time of the day when they received the warnings, especially if the warnings appeared earlier in the day. One participant said, "I think I am always a bit surprised at what point in the day the timer alarms. Most days it is close to when I am going to bed, other days it is much earlier in the evening and that is when I feel a bit ashamed about how much I am on my phone." Another said, "I sometimes feel resentful that I have used all my time especially when it's early in the morning."

Some participants experienced positive emotions because they were able to stop using the phone when seeing the warning while others felt negative emotions for wanting to continue using the app despite the warning; one participant was "ashamed that I want to go over the limit". One participant said, "I feel content

because I know that I won't be using my phone as much as I used to". while the other said, "I feel better knowing I am consciously controlling my screentime."

Some participants felt negative emotions when receiving the time limit warnings but were able to reflect on the positive consequence of reducing smartphone use. One participant said, "I get annoyed sometimes BUT generally it's a good reminder to get the heck back to work" while another participant said, "The time warning makes me feel bad because it makes me aware of how much time I waste on the app. Ultimately I feel relieved though because I know that because of the time limit I am spending less time on the app." A third participant said, "I am sad because it shows that I've spent the day using the apps with all the time available to me, but I am glad that the timer helps me control the amount of time spent on my phone." Another participant was happy they did not have to monitor their own app usage, they said, "I'm vaguely resentful when the app locks because I want to keep using it, but I'm glad that the choice to use it has been (mostly) taken out of my hands, as I don't think my impulse control is very good."

Participants also liked the flexibility that ScreenTime provided, by not restricting their access to apps even after exceeding usage time limit. One participant realized that they could set high time limits to avoid seeing the digital overload warning. This participant said, "I feel positive feelings because the time limits I set are so high that it discourages me from getting anywhere close to that amount of time." Another participant also felt happy that ScreenTime did not lock them out of the app when they exceeded the time limit; this participant said, "I picked 'content' because the setting does not permanently lock me out of the app, so I do not worry when I can extend the time if needed."

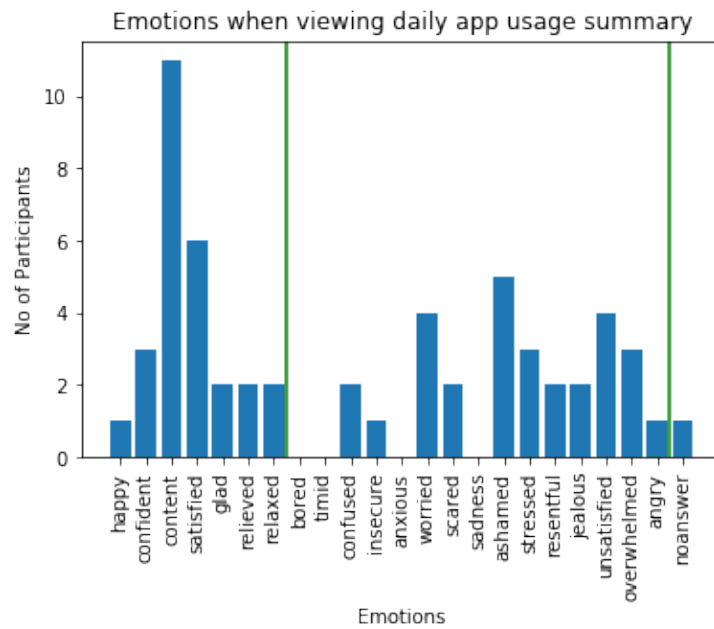
Actions taken by participants as a response to the time limit warning. Only 3 participants reported that they rarely went back to the app after seeing the warning. 13 participants said that they sometimes went back, 10 often went back and 4 always went back.

One participant felt better that ScreenTime made them consciously reduce the time spent on smartphone apps, but felt that they were missing out on the benefits provided by the apps, which made them want to use the app; this participant said, "It makes me feel better to know I'm spending less time on my phone, but I am still always wondering if someone has messaged me on one of the blocked apps and sometimes I ignore the time limit".

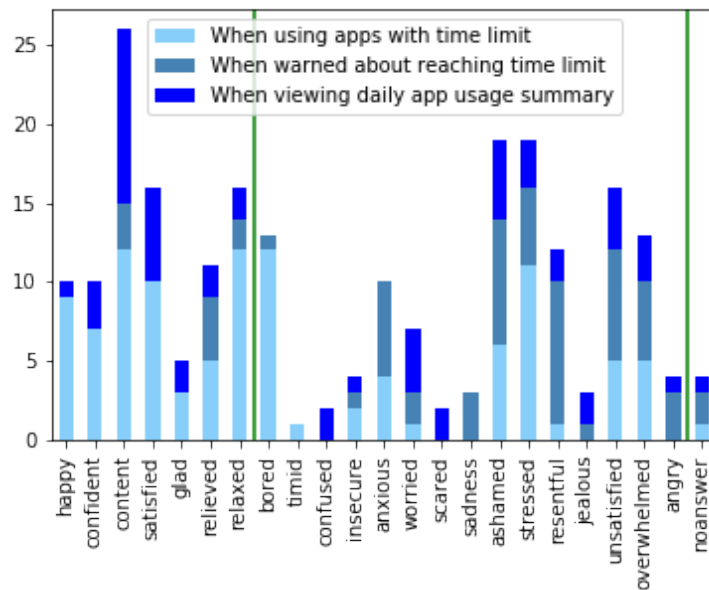
Some participants were unhappy that they continued using the apps despite getting the warning of exceeding the time limit; one participant said, "I picked 'stressed' because I feel like I extend the time too often."

Participant emotions about their smartphone use, based on ScreenTime data. As shown in Figure 2a, participants experienced a mix of both positive and negative emotions (most participants felt content) when viewing a summary of their daily app usage, while others were unaffected by daily app usage summary; one participant said, "I don't care how long I spent in the apps".

Some participants noticed a decrease in their screen time and believed that the ScreenTime was indeed helping them reduce their smartphone usage. One



(a) Emotions when viewing the app usage summary. Participants felt a mix of positive and negative emotions, though most participants felt content when viewing a summary of their daily app usage.



(b) Summary of emotions participants experienced in three different situations when using ScreenTime. The first green line separates the emotions into positive and negative; the last bar shows the number of participants who did not answer the question. The figure clearly shows that participants felt strong negative emotions when viewing the warning about exceeding time limit, both positive and negative emotions when using apps with allotted time limits and mostly positive emotions when viewing the daily app usage summary.

participant said, "My time spent on my phone is slowly being reduced". Another participant found it useful that the ScreenTime allowed them to track the change in their smartphone app usage; they said, "I see that either improvements have been made or it shows what I need to work on". One participant said the daily app usage summary helped them realize how they used their smartphone during their leisure time; this participant said, "It makes me realize how much time I spent on my phone when I have a lot of free time in my day."

Participants experienced positive emotions when their smartphone app usage was low. One participant said, "When I see that I used it far less than average that day, I feel good that I focused on my school work and did not get distracted." Another participant was surprised by what the summary showed them, because it did not match their expectations of their own digital usage. "I'm content with how much I've used social media and since I didn't use it as much as I thought I did."

On the other hand, participants experienced negative emotions when they realized their smartphone usage was high. One participant said, "When it shows how much time you spend on your phone it seems sad." Two participants were angry at themselves after seeing the amount of time they spend on the phone; one participant said, "I don't want to be on my phone as much as I am" while the other participant said, "I get mad at myself for going over my limit.". One participant felt unsatisfied with how unproductive they were, "due to how much time I mindlessly spent on my phone."

Participants' change in smartphone usage behavior. 23 participants said their app usage behavior changed since they started using ScreenTime, while 5 said it had not changed.

Some participants were able to reduce the overall time they used their phone. Some were able to control the urge to use their phone when it was not required, "I am not tempted to check my phone or pick it up every 20 minutes of the day" and another said, "I use my phone less when I am just waiting around". Some participants became more conscious about how often they would be distracted by their phone; one participant said, "Before using the screentime/ downtime feature I often got distracted because I would go to answer a text, but then autopilot to a time wasting app - the limit prevents me from continuing to spend time distracted." while another participant said, "[I am] more conscious of picking up the phone when I'm bored so I am able to put it down and find something else to do."

For some participants, their change in smartphone use was specific to social media apps. For example, one participant said, "I actually stopped being on social media for so many hours and now it has lessened to one or sometimes two." One participant deleted social media apps once they realized they spent a lot of time on them.

However, for most participants, their change in behavior came at the cost of negative emotions. One participant used their phone less on purpose because they were worried about seeing time limit warnings. Another participant experienced negative emotions when they used an app after seeing the warning, they said,

“I still override the lock from time to time, and I don’t use my locked apps too much less, I just feel worse when I do use them.” Another participant said that ScreenTime made them realize how much time they were “wasting” on using smartphones, when they could “put [that time] to better use”.

On the other hand, some participants ended up using their smartphone more than they wanted to because they had not reached the time limit. One participant said, “Sometimes I am happy I didnt use all the screen time but sometimes i want to use more so when i get the notification it stresses me out or makes me annoyed that i used so much.”

Overall, participants became aware of their app usage behavior better after using ScreenTime; one participant said, “I have become more conscious of how much mindless scrolling I do on Instagram and opening random things on Snapchat for example (I think most college kids can relate to this)”.

Participants experience mixed emotions about the data provided by ScreenTime. One participant felt overwhelmed with the data while others found the data helpful in understanding their device usage behavior. One participant said, “I notice that when I’m more stressed, I use it more, and vice versa.”

One participant was satisfied with the amount of information provided by ScreenTime; this participant said, “I think more information would just make me feel worse honestly, this is about the right amount of shame.”

Some participants wanted more detailed information about their app usage. For example, one participant said, “I wish you could breakdown the usage on specific apps, and how long the individual durations of use are per day.”. Other participants wanted “a countdown [timer] and usage per app”, “what times of the day I use them” and “what app I click on the most”.

Two participants also had suggestions that were not related to time spent on apps; they wanted to know “how many times the phone is picked up” and “how much battery [the phone] uses and what that equates to in energy costs and environmental impacts.”

5 Discussion

The goal of the ScreenTime feature was to help people make informed decisions about their digital overload, not to prevent people from going back to apps. But digital overload tools are expected to help people understand their smartphone app usage behavior and learn to reduce their screen time. Our survey revealed that users go back to the app despite getting a warning that they had exceeded the time limit, and that the warnings may make them feel negative emotions such as stress, dissatisfaction, shame and guilt. In this section, we discuss why people go back to apps even though they feel guilty when doing so, and explore design techniques could be used in order to encourage users to reduce their screen time, without inducing negative emotions.

5.1 Reasons for going back to apps

Many users reported feeling “addicted” to their devices causing them to feel insecure, stressed and anxious. This addiction could be the result of an *attachment* created between the individual and their smartphone, given how much users rely on their smartphones now. Kim et al. studied whether avoidant attachment could predict smartphone addiction and concluded that avoidant attachment may lead to low self-esteem and anxiety in college students, which in turn may lead to smartphone addiction [21]. We plan to work with psychologists to explore attachment theory further to understand why users go back to using their smartphones despite feeling negative emotions such as guilt and shame on being warned about digital overuse.

Some participants also mentioned that they used smartphones to escape from the stress in the “real world”. This could be the result of social phobia among users. For example, Ding et al. discovered that social and communication apps are considered most addictive among college students [8]. Yen et al. showed that people with social phobia prefer to communicate with others via the Internet than in person [50]. It is important to take into consideration users struggling with social phobia when designing tools for digital overload; for example, users with social phobia will not benefit from tools that force users to interact with each other and not use their phones when in the presence of others, such as Lock n’ LoL [22].

Another reason for digital overload could be the phenomenon called Fear of Missing Out (FoMo). Przybylski et al. define FoMo as the constant fear that others might be having rewarding experiences from which one is absent, which makes people stay continually connected with what others are doing [38]. In our study, many participants reportedly went back to their apps even after receiving a warning that they exceeded the time limit allotted for the app, due to the fear of “missing out” on something while not using their phones. Digital overload tools such as ScreenTime are supposed to help reduce users’ tendency to overuse apps but our survey revealed that reminders to stop using the app are only causing users to feel left out, making users go right back to the app. Pielot et al. demonstrated that users felt connected with others if they respond quickly to app notifications [36]. Designers might want to use positive reinforcement techniques that help users feel connected with others without being tempted to open an app, in order to help them reduce their screen time.

5.2 Techniques for behavior change

Digital overload tools, such as ScreenTime, are designed to help a user make informed decisions about the app usage. ScreenTime allows a user to choose a daily time limit for popular apps, and then warns the user when they exceed the time limit. ScreenTime does not force a user to stop using the app, but merely shows a warning screen, which a user can easily bypass to go back to the app if needed.

Some participants also pointed out how they were unaware of how long they had been using an app during the day; Okeke et al. developed a feedback mechanism that allowed a user to see how long they used the app during the day and how many times they opened the app [34]. This nudging technique also “primes” a user for the warning once they exceed the time limit, and could potentially also reduce the negative emotions a user may experience when suddenly being shown the warning screen [32].

Instead of using a negative reinforcement technique by warning users to stop using apps when they exceed their time limits, digital overload tools could use a positive reinforcement technique such as rewarding a user for not using the app beyond the time limit; one participant said they went back to apps despite warnings because they were not rewarded for quitting the app. Providing users with rewards, such as badges, have been shown to help change their behavior; for example, in mobile health apps, badges encouraged users to adopt a healthy lifestyle [39, 9].

Designers can also re-frame the warning message to provide a message that encourages the user to stop using the app. For example, the warning message could suggest other activities the user could do, such as take a walk, meditate, or listen to music, instead of going back to the app.

Participants often felt guilty and ashamed for spending a lot of time on popular apps, especially social media, because they believed the time they spent on these apps exceeded social expectations. Digital overload tools can provide actual data on how others use the app; for example, the tools could give feedback based on the average time the users’ friends, or people in their town, state or country spent on the app every day. However, as our survey showed, this could make users feel positive or negative depending on whether they spent less or more time on the apps than others.

Participants often enjoyed using their smartphones; in some cases, participants considered smartphones as an escape from their stressful lives. These participants often experienced negative emotions when they saw the digital overload warnings. To prevent users from spiraling into negative emotions, designers can incorporate context-sensing to determine whether a user is already stressed or experiencing some negative emotion and take the outcome of the learning algorithm into account when deciding whether to warn users about digital overload; researchers have used smartphone data such as a user’s app usage, call and sms statistics, and location traces to determine a user’s mood and mental health state [48, 30, 18, 17].

6 Limitations

We conducted a survey to understand what emotions undergraduate students experience when using digital overload tools. We are aware that survey responses may not reflect the actual emotions participants may feel when using the tool, but given our study was exploratory, our goal was to get a sense of the range of emotions participants may experience when using digital overload tools. In our

future studies, we plan to incorporate ecological momentary assessment (EMA) techniques to learn about users' actual emotions when using digital overload tools as well as conduct post-study interviews to better understand the reasons behind the emotions.

In our survey, we did not collect any personal information about the participants such as gender or age because they were not pertinent to our research questions. Other researchers have studied how age and gender affect digital overuse [7, 8, 33].

Our survey results are specific to the ScreenTime tool. We chose an existing digital overload tool instead of developing a new tool for the study because we did not want the users to experience additional negative emotions due to a steep learning curve.

Finally, it is possible that participants' responses were affected by factors external to the study such as academic or relationship stress.

7 Summary

In this paper, we presented the findings from a survey conducted among undergraduate students to understand the effect of digital overload reminder tools. Our analysis revealed that participants mostly experienced negative emotions such as resentment, shame, and anxiety when the phone warned them that they had exceeded the time allotted for an app and most participants went back to the app despite receiving the warning. However, most participants were happy with their daily app usage and also found that ScreenTime had changed their app usage behavior. We also presented a discussion on why participants may ignore digital overload warnings to continue using apps, and provide design recommendations for nudging techniques to reduce screen time.

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Survey questionnaire

1. Do you use an iPhone every day?
 - (a) Yes
 - (b) No
2. Are you familiar with the ScreenTime functionality on your phone?
 - (a) Yes, I want to continue with the survey.
 - (b) No. I wish to quit the survey.
3. Have you set any time limits for apps using ScreenTime?
 - (a) Yes
 - (b) No
 - (c) I do not wish to answer
4. Choose the time limits (in hours) that you set in ScreenTime. Go to Settings-¿ScreenTime-¿App Limits on your phone to view the time limits you have set.

5. Choose from below, the emotions you feel when you use an app for which you set a time limit
 - (a) Happy
 - (b) Confident
 - (c) Content
 - (d) Satisfied
 - (e) Glad
 - (f) Relieved
 - (g) Relaxed
 - (h) Bored
 - (i) Timid
 - (j) Confused
 - (k) Insecure
 - (l) Anxious
 - (m) Worried
 - (n) Scared
 - (o) Sadness
 - (p) Ashamed
 - (q) Stressed
 - (r) Resentful
 - (s) Jealous
 - (t) Unsatisfied
 - (u) Overwhelmed
 - (v) Angry
 - (w) I do not wish to answer
6. In one or two sentences, explain why you selected the emotions in the previous question?
7. Choose from below, the emotions you feel when your phone warns you that your time is up? [Same list as 5]
8. In one or two sentences, explain why you selected the emotions in the previous question?
9. Typically, when the time is up, how often do you go back to the app using the snooze option?
 - (a) Rarely go back to app
 - (b) Sometimes go back to the app
 - (c) Often go back to app
 - (d) Always go back to app
 - (e) I do not wish to answer
10. Choose from below, the emotions you feel when you look at your summary for today [Same list as 5].
11. In one or two sentences, explain why you selected the emotions in the previous question?
12. Have you changed your behavior since you started using ScreenTime?
 - (a) Yes
 - (b) No
 - (c) I do not wish to answer
13. In a few words, explain how your behavior has changed?
14. What additional information do you want about your app usage?