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Type, Not Frequency, of Smartphone Use Predicts Life Satisfaction

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Abstract

Smartphones are an indispensable part of everyday life. Despite their functional benefits, numerous studies describe associations between more frequent smartphone use and adverse mental health outcomes. However, no previous research has investigated associations between particular *types* of smartphone use (e.g., social networking, gaming, productivity) and those outcomes. We used an iPhone software feature (the Battery Use Screenshot [BUS] report, which collates data on overall screen time as well as screen time per specific application) to test the hypothesis that type of smartphone use (categorized as either social networking or non-social networking) is a more significant predictor of mental wellbeing than simple frequency of use. Participants (N = 70, 18–25 years) completed self-report measures of depression, anxiety, and life satisfaction, and emailed a BUS report screenshot. Regression models suggested that neither average daily screen time nor screen time devoted to social networking significantly predicted scores on the mental health measures. Higher levels of non-social networking use did, however, significantly predict lower life satisfaction. These results suggest that type, rather than frequency, of smartphone use predicts life satisfaction, and that future studies should focus on specific online activity rather than simple estimates of overall use. These data were collected during national pandemic-related constraints on socialising, which encouraged increased smartphone use; hence, these findings may not be directly comparable to pre-COVID studies. Nonetheless, this research contributes to the literature focused on smartphone use and mental health outcomes and offers valuable insight to public policy conversations surrounding the promotion of healthy online engagement.

Keywords: anxiety, depression, life satisfaction, screen time, smartphone use, screen time

Over the past decade, the use of Internet-enabled mobile devices has increased exponentially, with no sign of abating. Recent estimates suggest that as of December 2020 there were 3.6 billion smartphone users worldwide; this number is predicted to rise to 4.3 billion by the beginning of 2022 (Statista, 2021). In South Africa, a 2017 estimate indicated that almost 90% of households use mobile phones as their sole means of digital communication (Statistics South Africa, 2020).

The ubiquity of smartphones is one marker of the shift into the Fourth Industrial Revolution (i.e., the use of modern Internet-based technology and artificial intelligence that allows the widespread automation of industrial operations and collaboration, thereby increasingly blurring lines between humans and machines; Ciman & Wac, 2016; Dombrowski & Wagner, 2014). In turn, one product of this revolution has been a boom in research on the human-smartphone interaction, particularly within the psychological sciences. Much of this research focuses on the consequences for mental and physical health of increasingly frequent smartphone use.

The Role of Smartphones in Our Daily Lives

Although smartphones are still used most commonly for communication (e.g., via calling, texting, or social networking sites such as Instagram), their range of application has expanded broadly in recent years. For instance, they are now used frequently in academic or educational settings, as health-monitoring devices, and as ways to improve the efficiency of everyday activities (Dombrowski & Wagner, 2014; Rather & Rather, 2019). Smartphones also allow access to the Internet, thus providing users with gateways to information, games, opportunities for remote employment, and much more (Dalombo, 2001; Rather & Rather, 2019).

Notwithstanding this increasing range of applications, social networking remains by far the most commonly used function of a smartphone. Indeed, the use of social media applications (i.e., forms of electronic communication through which users create virtual communities to share personal messages, information, and ideas; Merriam-Webster Dictionary, 2014) continues to grow exponentially (Anderson & Jiang, 2018; Bashir & Bhat, 2017; Saleh & Mukhtar, 2015).

Because of this key communicative role and their increasing multifunctionality, smartphones play a significant (and, in some ways, indispensable) role in contemporary society, and the human-smartphone relationship has a strong impact on individual lives. This impact is particularly powerful within the age groups that have the highest rates of use – adolescents (ages

13–18) and young adults (ages 18–25). Therefore, most cyberpsychological research on the human-smartphone interaction has focused on people within those age ranges (Sarwar & Soomro, 2013; Zilka, 2020).

One of the key research questions posed by cyberpsychologists is whether, and in which direction, smartphone use affects mental health. Two opposing schools of thought dominate this research landscape. The first of these is informed by a large group of studies describing associations between more frequent smartphone use and adverse mental health outcomes (see, e.g., Hussain et al., 2017; Kang et al., 2020) The most common of these outcomes are depression and anxiety, but others such as loneliness and poor-quality sleep are also observed (see, e.g., Boumosleh & Jaalouk, 2017; Cheever et al., 2014; Scott et al., 2019; Tams et al., 2018). Within this subset of studies, some have characterized excessive smartphone use, particularly among adolescents, as an addiction (Asante, 2019; Gower & Moreno, 2018).

Regarding possible associations between social media use and personal health, extant research suggests that the former has negative implications for the latter (Dhir et al., 2018; Oghuma et al., 2016). For instance, a small group of empirical studies reports links between social media use and anxiety, indicating that anxious users are more likely to use those applications to alleviate their undesirable emotions (see, e.g., Lepp et al., 2014; Saleh & Mukhtar, 2015). These studies conclude that, in terms of mental health outcomes, social media engagement may be one of the worst uses of screen time.

This purported association between heavy or frequent smartphone use and negative psychological outcomes is concerning because not only is use increasing generally, but it also appears to increase as people progress through adolescence and into adulthood (Parry et al., 2021; Statista, 2021). One report indicates that the average teenager (13–18 years) spends approximately 9 hours using a smartphone each day whereas for tweens (8–12 years) this number is roughly 6 hours (Dalombo, 2001). Relatedly, the COVID-19 pandemic has led to even greater use, with physical distancing leading to patterns of increased mobile-based communication and information seeking (Hodes & Thomas, 2021; Ohme et al., 2020).

The opposing school of cyberpsychological thought on the human-smartphone interaction proceeds from the assumption that individuals do not have single-focus relationships with their devices and that, therefore, some kinds of use can have positive effects on mental health. These benefits appear to arise primarily from the convenience that constant connectivity offers in terms

of everyday functioning (Dalombo, 2001; Dwivedi et al., 2018). For instance, smartphones allow people to stay connected with family and friends, to access information rapidly and effectively, and to improve the convenience of conducting navigational and financial transactions (Billieux, 2012; Karim et al., 2020). A study conducted in rural Uganda suggested that the ability to use mobile phones to connect with physically distant people might improve mental wellbeing (Pearson et al., 2017). Some research has also suggested that patterns of smartphone use could augment programs that monitor or track depression, social anxiety and isolation, emotional regulation, and general psychological well-being (Canzian & Musolesi, 2015; Chow et al., 2017; Elhai et al., 2018; Montag et al., 2019). Such monitoring or tracking can be especially helpful under circumstances (e.g., COVID-19 lockdowns) wherein social interaction is forcibly restricted.

Measuring Screen Time

Most studies investigating effects of screen time on mental wellness rely on subjective (and hence relatively imprecise) measures of digital engagement (e.g., Christensen et al., 2016; Loid et al., 2020; Orben & Przybylski, 2020). The most common of these subjective measures are self-report surveys (Gower & Moreno, 2018; Sewall et al., 2020). Inferences drawn from studies using such measures must be drawn cautiously because people often find it difficult to report accurately on their own behaviors, regardless of whether that report is on smoking, sleeping, or screen time (Lipinska & Thomas, 2017; Orben & Przybylski, 2020). Additionally, participants in cyberpsychological research may purposely underestimate their screen time to satisfy perceived social desirability requirements or to meet what they perceive as experimenter expectations (Blackwell et al., 2016). Hence, subjective estimates of screen time may be biased and unreliable (Gower & Moreno, 2018).

A few recent studies have showcased measures that might help overcome the problems inherent to, and arising from, subjective estimates of screen time. One of these measures is the iPhone's battery use screenshot (BUS) feature. The BUS indicates which specific applications contributed to battery usage over a specific time period (e.g., the previous 24 hours, or the previous 10 days), and how much each contributed to it. This screen time data is gathered even if the application is running in the background, providing a comprehensive overview of use (Gower & Moreno, 2018).

Measures such as the BUS give unbiased and reliable insight into ways in which screen time reflects individuals' daily routines and lifestyles, and may also be used as means for monitoring behavior (Nahum-Shani et al., 2015; Prociow & Crowe, 2010). For instance, Hodes and Thomas (2021, N = 267 university students) used the BUS to (a) compare objective and subjective data on screen time during COVID-19, (b) compare smartphone use during weekdays with that over the weekend, and (c) examine smartphone attachment as a mediator of the relationship between affective outcomes and smartphone use.

Rationale, Aim, and Hypothesis

Smartphones are an increasingly indispensable part of everyday life. Their functions enhance daily living experiences by simplifying tasks and making personal communications simpler and more immediate. These communicative functions, particularly, have become increasingly significant in the time of COVID-19, with individuals' physical movements and in-person social interactions restricted.

Although an almost decade-long literature has investigated associations between smartphone use / screen time (as they are broadly defined) and mental health outcomes (e.g., symptoms of depression and anxiety), few published studies have investigated associations between the use of particular smartphone-based applications and the same mental health outcomes.

This study aimed to address this knowledge gap. Specifically, we investigated relations between type of smartphone use (social networking versus other [education, business/work, productivity, health and fitness, games and entertainment] use) and symptoms of depression and anxiety, as well as overall life satisfaction. We focused on depression and anxiety because they are the mental health difficulties most frequently identified by previous smartphone use studies (Elhai et al., 2017; World Health Organization, 2017). We used the iPhone BUS feature to track how frequently, and for how long, each installed smartphone application was used by the participant over a 10-day period. We tested the specific hypothesis that the type of smartphone use is a better predictor of subjective wellness (i.e., symptoms of depression, symptoms of anxiety, overall life satisfaction,) than average daily smartphone use.

Method

Design and Setting

The study used a correlational-observational design. The iPhone's BUS feature allowed us to collect objective data on overall screen time and app-specific use over a period of 10 consecutive days. We also collected self-report data on depression, anxiety, and overall life satisfaction.

Because of pandemic-related restrictions on in-person research during the data collection period (16 August–11 October 2021), we used digital (online) methods to collect data. The use of such methods in psychology has increased in recent years (even before the spread of COVID-19), particularly because they are time- and cost-efficient in giving access to larger and more diverse samples. Reports suggest that online survey results are as reliable and valid as those derived from in-person methods (Neophytou et al., 2019; Sanchez, 2020).

Participants

Recruitment

We used convenience sampling to recruit 70 healthy young adults (16 men and 54 women). The invitation to participate (Appendix A) was sent to undergraduate students using the University of Cape Town's Vula platform.

Eligibility Criteria

Participants were required to (a) be aged between 18 and 25 years, (b) be currently enrolled as a university student, and (c) own an iPhone with iOS 10 or later software. Individuals with a history of serious psychological, psychiatric, or neurological disorders (e.g., any psychotic disorder, obsessive-compulsive disorder, epilepsy) were excluded from participation. Those with a history of common mental disorders (e.g., generalized anxiety disorder, major depressive disorder) were not.

Materials and Procedures

Enrolment

Formal enrolment into the study commenced after volunteers expressed interest in the study by following a hyperlink in the research invitation. This link led them to an online survey whose first page was an informed consent document (Appendix B) that described the role of participants, stated what would be expected of them, encouraged them to ask questions regarding any aspect of the research process, and provided contact details for the research team. If, after

reading the consent form and having had their questions answered, an individual agreed to participate, they clicked "Agree" and were then required to type their full name at the bottom of the form. The survey then proceeded to the next page, where a short questionnaire (Appendix C) assessed their understanding of the consent form. The formal screening process then commenced.

Screening

Participants completed a study-specific online questionnaire (Appendix D). This questionnaire collected information on psychiatric history as well as sociodemographic data (e.g., gender, year of study, educational background). It also asked whether the participant owned a smartphone and, if so, what type of device and what the currently installed operating system was.

Primary Measures: Depression, Anxiety, Life Satisfaction, and Screen Time

The measures described below captured aspects of the participant's behavior and mental state over the 10–14 days prior to reporting. They were required to complete these measures on any Monday or Tuesday during the data collection period. This ensured that data would include two weekends for each participant.

Beck Depression Inventory-II (BDI-II). The BDI-II (Beck et al., 1996; Appendix E) is the most widely used self-report instrument for the assessment of depressive symptoms. Its 21 items, which take roughly 10 minutes to complete, evaluate the frequency and severity of depressive symptoms as they were experienced over the previous 2 weeks. Each item has four response options, with each option indicating either (a) no symptom presence (allocated score = 0); (b) symptom presence and mild intensity (allocated score = 1); (c) symptom present and moderate intensity (allocated score = 2); or (d) symptom present and severe intensity (allocated score = 3). Hence, a respondent's total score can range from 0 to 63; higher scores indicate a likelihood of greater depressive symptomatology. According to the developers, scores of 0–13 indicate minimal depression; 14–19, mild depression; 20–28, moderate-severe depression; and 29–63, severe depression (Beck et al., 1996).

The BDI-II has excellent psychometric properties in both clinical and non-clinical populations. Internal consistency ranges from .73 to .92, with a mean of .86 (Beck et al., 1996). A recent meta-analysis found good convergent validity, with large effect sizes, between the BDI-

II and 43 other measures of depression (including screening tools and gold standard clinical diagnostic interviews; Erford et al., 2016).

The BDI-II is used commonly in South African clinical and research settings, where it appears to retain the same strong psychometric properties described above (Mall et al., 2018; Rousseau et al., 2021). For example, Makhubela and Mashegoane (2016, N = 919 university student, M_{age} = 21.7 years) reported that it showed high levels of internal consistency reliability (Cronbach's α = .84) in a study conducted at the Universities of Limpopo and Pretoria.

Generalised Anxiety Disorder 7-item (GAD-7) Survey. The GAD-7 (Spitzer et al., 2006; Appendix F) is one of the most commonly used self-report instruments for assessing symptoms of anxiety disorders. This easily administered tool, which takes approximately 2–3 minutes to complete, asks the respondent to reflect on the degree to which they experienced different symptoms of anxiety over the previous 2 weeks (Beard & Björgvinsson, 2014). Each of the instrument's items has four response options (0 = *not at all*; 1 = *several days*; 2 = *more than half the days*; 3 = *nearly every day*). Hence, the total score can range from 0–21; higher scores indicate higher levels of generalized anxiety. According to the developers, scores of 0–4 indicate minimal anxiety; 5–9, mild anxiety; 10–14, moderate anxiety; and 15–21, severe anxiety.

The GAD-7 has good sensitivity (72%) and specificity (80%) at a cut point of 10 for diagnosing GAD (Spitzer et al., 2006). At that cut point, it is also moderately good at screening for three other common anxiety disorders: panic disorder (sensitivity 74%, specificity 81%), social anxiety disorder (sensitivity 72%, specificity 80%), and posttraumatic stress disorder (sensitivity 66%, specificity 81%; Kroenke et al., 2007). Kageyama et al. (2021) reported that the GAD-7 had high internal consistency (Cronbach's α = 0.90–0.92) when tested on a Japanese sample of 32 undergraduates with subthreshold depression.

The GAD-7 appears well suited for use in South African clinical and research settings. A systematic review by Mughal et al. (2020) reported that it had consistent specificities (72–79%) with a range of sensitivities (38–86%) across low- or middle-income countries (e.g., South Africa, Lesotho, Botswana).

Satisfaction With Life Scale (SWLS). This 5-item instrument (Diener et al., 1985; Appendix H) assesses general life satisfaction. It is widely used because it is cost- and time-effective (taking 2 minutes to complete) and measures global cognitive judgments of life satisfaction (such as economic stability and sociodemographic factors) rather than simply

positive or negative affect (Veenhoven, 1996). Respondents indicate levels of agreement on each item using a 7-point Likert-type scale, with response options ranging from *strongly agree* (7) to *strongly disagree* (1). Hence, the total score can range from 5–35, with higher scores indicating higher levels of life satisfaction. According to the developers, scores of 5–9 indicate the respondent is extremely dissatisfied with their life; 10–14, dissatisfied; 15–19, slightly dissatisfied; 20, neutral; 21–25, slightly satisfied; 26–30, satisfied; and 31–35, extremely satisfied.

The SWLS has good internal consistency and correlates well with other measures of subjective well-being (Dirzyte et al., 2021; Pavot & Diener, 2009). It has been used successfully in a variety of countries with different cultural contexts, including South Africa. For instance, Geldenhuys and Henn (2017) reported that the instrument showed high levels of internal consistency (Cronbach's $\alpha = .88$) when tested on a sample of 540 South African adults.

Screen Time. Participants were instructed that, on one Monday during the data collection period, they should email a screenshot of their BUS report to the study's dedicated email address. We stressed that they should select 'Last 10 Days' when retrieving this information, and that they should enable 'Show Activity' before capturing the screenshot, as this displays screen time for each application, as well as information on background compared to active use. Figure 1 presents an example of such a screenshot.

If the participant completed all the above questionnaires but then neglected to email a BUS screenshot, they were immediately emailed a reminder to do so. This reminder email included specific instructions on how to access the correct version of the BUS screen time report. To allow us to follow up on these tardy participants and to give us an opportunity to include their data, we extended the data collection window by 24 hours for them.

Ethical Considerations

As the prevalence of online methodology for psychological research grows, so does the awareness that online data collection brings its own ethical challenges (Sugiura et al., 2017). Although there are currently no ethical requirements specific to online research, general standards as outlined by the ethics codes of the American Psychological Association and the Health Professions Council of South Africa are applicable (American Psychological Association, 2016; Psychological Society of South Africa, 2021). Hence, this study was conducted in accordance with those codes and with the guidelines specified by UCT's Codes for Research

Involving Human Participants. Formal ethical approval was granted by the UCT Department of Psychology Research Ethics Committee (Appendix I).

Consent and Confidentiality

There are several potential challenges in relation to obtaining informed consent when using online data collection (Barrera et al., 2016). For instance, the lack of in-person interaction between researcher and participant may undermine the latter's understanding of the data collection process or increase the likelihood of the participant failing to read the consent form properly (Theiss et al., 2014; Whitehead, 2007). To address these challenges, we ensured participants were led to an online consent form that gave a full explanation of the data collection process. Their understanding of that process, and of their involvement in the research more generally, was confirmed by asking them to complete a short questionnaire prior to enrollment; research suggests that requiring participants to indicate understanding results in greater concentration on comprehension of informed consent documents (Perrault & Keating, 2018). After they completed the short questionnaire, we encouraged participants to ask questions about the research process and emphasized their right to withdraw from the study at any time during data collection without negative consequences.

Because sharing a screenshot of screen time could possibly expose sensitive information, it was crucial that confidentiality was explained to the participant. Internet research has the advantage of affording a greater degree of anonymity than face-to-face research methods (Gosling & Mason, 2015). In this study, individual anonymity was ensured by holding personal details and associated data confidential (i.e., by randomly assigning a number to each participant, and keeping the key to number-participant pairs in a separate password-protected spreadsheet to which only the researchers have access). To further protect the privacy of potential participants, we collected only the minimal information necessary for screening.

Data Security

Ethical concerns about data security in online research may be related especially to privacy and to secure storage (i.e., prevention of hacking or external access; Emery, 2014; Eynon et al., 2009). We used a Secure Sockets Layer (SSL) Certificate External on our landing page to prevent external access to research data by spyware, thus going some way toward ensuring data privacy and protection of our data. SSL prevents third-party interventions into what may be an otherwise insecure network by using encryption to ensure secure connection between web server

and browser (Norton LifeLock Inc, 2021). We further ensured data security by using password-protected computers. Moreover, all communication (including the reports of screenshots of screen time) was conducted via a dedicated email address (cyberpsychresearch21@gmail.com), which required two-step verification to access.

Risks and Benefits

Participation in the study posed no risk of physical, psychological, or social harm. To incentivize participation, we offered two Student Research Participation Program (SRPP) points.

Debriefing

Another area of concern for online research is the potential for insufficient debriefing (Hoerger & Currell, 2012). To allay such concerns in this study, we sent participants a detailed debriefing form (Appendix H) after data collection was complete. This document informed participants of the previously unstated true purpose of the study (i.e., that mental health outcomes were being investigated in relation to type of screen time use) and reminded them that they may withdraw their information at any time. Additionally, this form again encouraged them to approach us with any questions about the research and provided contact details for that purpose.

Data Management and Statistical Analyses

We conducted all statistical analyses using R Studio, with the threshold for statistical significance of inferential tests set at $\alpha = .05$.

The analytic process proceeded across eight steps. First, we scored participants' BDI-II, GAD-7, and SWLS responses using conventional manualized methods. We entered total scores and scores for each individual item into an MSExcel spreadsheet. Second, we calculated internal consistency reliability (estimated using Cronbach's α coefficient) for those three measures. Third, we entered participants' BUS data (overall 10-day screen time as well as 10-day screen time for applications manually grouped into these seven categories: social networking, education, business/work, productivity, health and fitness, games and entertainment, and other) into an MSExcel spreadsheet. Perusal of those data indicated that most participants (55 of 70) had social networking as their most used category. Hence, we decided to re-classify the BUS data into two categories of total use (in minutes) over the 10-day data collection period: *social networking use* and *non-social networking use*, where the latter category contained all use from the six categories other than social networking. Fourth, we created a complete set of descriptive

statistics for the predictor and outcome variables. These statistics allowed us to identify possible outliers that could affect subsequent inferential analyses and their interpretation, and to check assumptions underlying those analyses. Fifth, a series of bivariate correlational analyses assessed the magnitude of association between, on the one hand, average daily screen time, screen time for social networking use, and screen time for non-social networking use, and on the other, a mental health outcome (BDI-II total score, GAD-7 total score, SWLS total score). Sixth, a series of linear regression analyses sought to determine the predictive power of average daily screen time over the 10-day data collection period in predicting, respectively, depression (as measured by BDI-II total score), anxiety (as measured by GAD-7 total score), and life satisfaction (as measured by SWLS total score). Seventh, a second series of three linear regression analyses sought to determine the whether the two types of screen time were significant predictors of each of these mental health outcomes. Finally, three one-way analyses of variance (ANOVAs) assessed magnitude of differences between the predictive power of the regression models for each outcome measure.

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Results

Sample Sociodemographic and Smartphone Use Characteristics

The sample consisted of 70 healthy undergraduates (54 women and 16 men; this split reflects the demographics of the UCT Department of Psychology). By design, all were aged between 18 and 25 years. They had all completed at least 12 years of education (M = 13.0, SD = 1.02, range = 12–15).

As Figure 1 shows, the most common use of screen time was for social networking. More than 78% of participants (n = 55) had social networking as their primary use category. Hence, as noted previously, we decided to create two overarching categories of smartphone use: social networking use and non-social networking use, with the latter category a simple sum of all uses other than social networking. This division is consistent with previous studies' dichotomous classification of Internet and smartphone activity into either social or process (including entertainment and productivity) uses (see, e.g., Song et al., 2004; Van Deursen et al., 2015).

Key Variables: Descriptive statistics and internal consistency

Table 2 presents descriptive data for the predictor variables (average daily screen time, social networking use, and non-social networking use), as well as descriptive and psychometric data for the outcome variables (BDI-II, GAD-7, and SWLS). Internal consistency reliability of those mental health measures was good.

Regarding the distributional characteristics of these six variables, four were normally distributed: average daily screen time, non-social networking use, BDI-II scores, and SWLS scores. Social networking use and GAD-7 scores were positively skewed.

We identified an extreme outlier in the distribution of social networking use data. One person's BUS report indicated that, over the 10-day data collection period, they had spent 8763 minutes (more than 14.5 hours per day) using social networking platforms. This piece of data is 6.25 *SD* above the sample mean. We confirmed that this individual did not use social media in any professional capacity, and thus we could not exclude their data on that basis. Nonetheless, because the data point was so extreme, we decided to use a winsorizing procedure (i.e., replace it with the next-highest value) so as limit its influence on the overall findings.

Independent-sample *t*-tests detected no statistically significant differences between male and female participants regarding outcomes on the BDI-II, GAD-7 and SWLS (*ps* > .19). Hence, we did not have to control for participant sex in subsequent analyses.

Bivariate Correlations

As Table 2 shows, analyses detected weak and non-significant positive correlations were between each smartphone use variable and (a) BDI-II scores (*p*s > .16), and (b) GAD-7 scores (*p*s > .39). Similarly, average daily screen time and total social networking use were both weakly and non-significantly associated with SWLS scores (*p*s > .15). However, analyses detected a highly significant negative correlation between non-social networking use and SWLS scores (*p*=.008), suggesting that higher levels of such smartphone use are associated with lower levels of life satisfaction.

As might be expected, scores on the BDI-II and the other two mental health measures were significantly associated (*p*s < .001), indicating that higher levels of depression were correlated with higher levels of anxiety and lower levels of life satisfaction. Although higher levels of anxiety were associated with lower levels of life satisfaction, this correlation was not statistically significant, $p = .36$.

Linear Regression Models

A series of three separate linear regression models sought to describe the strength of average daily screen time in predicting, respectively, symptoms of depression (as measured by BDI-II score), symptoms of anxiety (as measured by GAD-7 score), and overall life satisfaction (as measured by SWLS score).

As Table 3 shows, Model 1 (predictor: average daily screen time) was statistically non-significant for each of the BDI-II, GAD-7, and SWLS total scores, p = .42, -.92, and .16, respectively. Together, these data indicate that average daily screen time was not a significant predictor of mental health outcomes.

Regarding the assumptions underlying those three models, plots of standardized residuals versus predicted residuals confirmed that in each case the assumption of homoscedasticity was upheld. Additionally, the residual plots for each model revealed that the scores follow a normal-shaped distribution, although with some deviation at the very top and bottom of the dataset. The GAD-7 data were the most skewed, being only roughly normally distributed.

A second series of three separate linear regression models sought to describe the relative strength of the two types of smartphone use (social networking use and non-social networking use) in predicting, respectively, symptoms of depression (as measured by BDI-II score), symptoms of anxiety (as measured by GAD-7 score), and overall life satisfaction (as measured by SWLS score). Data were centred before use in the models in order to have predictors with a mean of 0 to allow for greater ease of interpretation.

As Table 3 shows, the final overall models for BDI-II and GAD-7 scores were both statistically non-significant (p = .33 and p = .64 respectively), indicating that neither social networking use nor non-social networking use were significant predictors of depression and anxiety. However, the pattern of data for the SWLS model was quite different. There, although the overall model explained only a small proportion of the variance in the outcome, it was statistically significant, p = .03 More specifically, the analysis detected a statistically non-significant association between social networking use and life satisfaction (p = .97), but a highly significant association between non-social networking use and life satisfaction, p = .01.

Regarding the assumptions underlying this latter set of three models, the VIF scores of the predictors were all just over 1, indicating that there was no significant risk of multicollinearity.

ANOVA Comparing Predictive Values of Each Regression Model

To determine whether there were statistically significant differences in the strength of an overall measure of screen time (average daily screen time) versus that of a dichotomized measure (social networking use, non-social networking use) in predicting each mental health outcome, we ran three separate one-way ANOVAs comparing the two models.

As Table 4 shows, analyses detected no significant differences between the two BDI-II models or between the two GAD-7 models. In contrast, analyses of the SWLS models detected a significant difference in predictive power between the model comprised of average daily screen time and that comprised of the two types of smartphone use. These results indicate that type of smartphone use is not a significantly better predictor of depression or anxiety symptoms than average daily screen time, but that it is significantly better predictor of overall life satisfaction.

Discussion

The main aim of this research was to add to the literature investigating associations between smartphone use and mental health. We tested the hypothesis that *type of use* (categorized as either social networking or non-social networking) will be a stronger predictor of depression, anxiety, and overall life satisfaction than *amount of use*. To do so, we gathered objective screen time data and subjective mental health data from a sample of 70 healthy volunteers (54 women; age range 18–25 years).

Mental Health Outcomes Across the Sample

Together with sample's sex distribution and relatively restricted age range, scores on the mental health measures indicated that our data were sampled from a typical undergraduate population. Our sample's mean BDI-II score is similar to that reported by Rousseau et al. (2021), whose longitudinal study analyzed data collected at UCT over the period 2016–2019. Furthermore, this study's SWLS data are consistent with those reported by Patel et al. (2009), who also collected life satisfaction data from South African undergraduates. Although no published studies have used the GAD-7 to screen South Africans, our observed data are consistent with scores collected in a recent cross-national study of university students (Ochnik et al., 2021).

This consistency of the current data with those from similar previous studies suggests that our sample is typical of the population of South African university students, and that therefore the inferences we draw from our results are, at least, generalisable to that population.

Smartphone Use in the Sample

BUS-reported screen time varied widely over the 10-day data collection period, with daily averages ranging from 1 hour 16 minutes to 17 hours 16 minutes. On average, however, our participants appeared to spend unusually large amounts of time using their devices: Where previous research (e.g., Neophytou et al., 2019; Przybylski et al., 2020) classifies excessive

screen time as being 2–5 hours of use per day, and where recent studies on daily smartphone use in students have reported averages of under 5 hours (e.g., Atas & Çelik, 2019; Rozgonjuk et al., 2020; Shaw et al., 2020), in our sample the daily average was 6 hours 43 minutes with 7 participants (10% of the sample) averaging >10 hours.

One possible explanation for this apparent discrepancy between the current study and previous research is that many of those studies collected self-reported screen time data, which recent studies suggest is quite unreliable (see, e.g., Hodes & Thomas, 2021). Another possible explanation is that relatively high levels of screen time may result from COVID-19 restrictions on face-to-face social interactions (Qin et al., 2020).

Analysis of screen time by type clearly demonstrated that participants used social networking applications more frequently than all other types of application combined. This finding is consistent with those reported in previous studies examining differences between social and process (i.e., all non-social) smartphone uses (Song et al., 2004; Van Deursen et al., 2015).

Bivariate Correlational Associations

Unsurprisingly, scores on the three mental health measures were all highly correlated. Analyses detected a significant positive correlation between BDI-II and GAD-7 scores, a finding consistent with research indicating high levels of comorbidity between depression and anxiety and suggesting that they may measure the same underlying mood disorder construct (Primack et al., 2017; Riehm et al., 2019; Sigdel et al., 2020). Both BDI-II and GAD-7 scores were negatively correlated with SWLS scores, although only the former association was statistically significant. This finding suggests that depression may be more strongly linked than anxiety to lower life satisfaction. Again, this pattern of association is consistent with previously published research (Guney et al., 2010; Røysamb et al., 2018).

In contrast to previous findings (e.g., Matar Boumosleh & Jaalouk, 2017; Elhai et al., 2017), neither average daily screen time, nor social networking use, nor non-social networking use were significantly correlated with either self-reported depression or self-reported anxiety. Findings regarding life satisfaction were similar, with one notable exception: amount of non-social networking use was significantly negatively correlated with SWLS scores (i.e., more such use was associated with lower levels of life satisfaction). Interpretation of these patterns of association follow in the next section.

Does Quantity or Type of Screen Time Influence Mental Health Outcomes?

Linear regression models tested, separately, the influence of smartphone use quantity and smartphone use type on mental health outcomes. Consistent with the correlations described above, these analyses indicated that none of daily use, social use, or non-social use were significant predictors of self-reported depression or anxiety, and that amount of social networking use was not a significant predictor of life satisfaction. This set of results stands in contrast to a body of research describing (a) significant positive associations between daily smartphone use and depression / anxiety (see, e.g., Boumosleh & Jaalouk., 2017; Demirci et al., 2015; Dhir et al., 2018; Elhai et al., 2017; Lepp et al., 2014; Woods & Scott, 2016), and (b) social media use as, of all smartphone applications, the strongest contributor to adverse mental health outcomes (see, e.g., Cleary et al., 2020; Saleh & Mukhtar, 2015; Winkler et al., 2020).

Most of those previous studies were, however, conducted prior to the COVID-19 pandemic and ensuing changes to global social reality. Although a few studies published in pre-COVID times reported no significant association between objectively measured screen time and mental health outcomes in adolescents and young adults (see, e.g., Babic et al., 2017; Harwood et al., 2014;), literature on the non-significance of this association has increased significantly over the past 18 months as researchers explore ways in which smartphones and social media platforms bridge the enforced social divisions. For instance, Rozgonjuk et al. (2020) found that frequency of the use of Instagram (one of the most commonly used social media applications within our sample) was not significantly associated with symptoms of either depression or anxiety (N = 355 young adults, M_{age} = 23.61). Thus, changes in social conditions may be linked to shifts in relations between smartphone use and mental health.

The linear regression model describing associations between type of smartphone use and SWLS scores revealed that amount of screen time spent on non-social networking applications was a significant predictor of lower life satisfaction (p = .01). In contrast, average daily screen time and amount of time spent on social networking applications were not significantly associated with life satisfaction. Unsurprisingly, this set of results is consistent with a finding from the correlational analyses described above.

This is the first study to separately examine the influence of screen time quantity and type on life satisfaction. Previous studies examining life satisfaction in the context of overall screen time (e.g., minutes of use per day) have produced mixed results, with some reporting a negative

association (see, e.g., Hale et al., 2020; Lepp et al., 2014; Samaha & Hawi, 2016) and others reporting a positive association (see, e.g., Kim et al., 2020; Rotondi et al., 2017). Studies examining life satisfaction in the context of social networking use, specifically, have suggested that such use is a positive predictor of life satisfaction (see, e.g., Chui, 2015; Doğan, 2016). The current study is therefore consistent with some elements of the existing literature in finding that neither overall screen time nor social use are significantly associated with worse life satisfaction. A possible reason for the absence of a negative relationship between social use and life satisfaction may thus be that life satisfaction is obtained through positive experiences of connection gained from social networking. It may be that the inconsistency in the previous literature regarding the association between overall screen time and life satisfaction is rooted, at least in part, by not sufficiently parsing out the negative effects of specific non-social use. This possible confound emphasizes the importance of separating social and non-social use, as one type may have a positive and one may have a negative impact on life satisfaction. Collapsing the types into one variable may, therefore, give an inaccurate depiction of the relationship between smartphone use and life satisfaction.

Our result showing that more use of non-social networking applications is related to lower levels of life satisfaction is, however, consistent with some extant research. Studies examining the effects of social and process smartphone/Internet use on mental health report that the latter type of use is likely to be more strongly associated with negative mental health outcomes such as stress, depression, and anxiety (Rozgonjuk et al., 2020; Woo et al., 2021). For instance, Elhai et al. (2020) reported that, in their sample of 316 undergraduates, process use was more strongly associated than social use with higher rates of depression and anxiety.

Taken together, the current set of results suggests that the influence of smartphone use on mental health may not be as negative as suggested by many previous studies. Additionally, they suggest that future research in this field should focus more closely on type of use (and particularly, on process or non-social networking uses), rather than examining variables as gross as total screen time per day.

Influence of COVID-19 Restrictions on Current Results

Contextual factors related to the COVID-19 pandemic must be considered when interpreting the current results. During our data collection phase (16 August–11 October 2021), South Africa transitioned between adjusted alert level 3 (26 July–12 September), adjusted alert

level 2 (13–30 September), and adjusted alert level 1 (1 October onward). These levels-imposed restrictions of various stringencies on people's abilities to socialise as they generally would. For instance, national curfews of, respectively, 22:00–04;00, 23:00–04:00, and 00:00–04:00 were imposed during these alert levels (South African Government, 2021). Additionally, people were discouraged from attending large social events and gatherings. UCT students were additionally affected by university-mandated restrictions: Most courses were conducted online, and very little learning happened face-to-face. What all of this means is that, like members of the general population, members of the current sample would have been relying more than usual on their smartphones for social connectivity, for work, and for educational purposes. Recent studies confirm that, across the world, there have been reports of a drastic increase in social media use following pandemic-enforced physical and social distancing (Boursier et al., 2020; Ohme et al., 2020). A separate strand of research suggests that isolation reinforces subjective experiences of loneliness in both older and younger individuals, which strengthens their need to be part of a virtual community (Boursier et al., 2020).

The necessary isolation bought about by the pandemic has, therefore, created a context wherein virtual communities constitute a significant proportion of many individuals' social connectivity. This shift in context may have changed the ways in which smartphone use influences mental wellbeing. Studies conducted in pre-COVID times (e.g., Kwak et al., 2018; Turkle, 2017) indicated that increased smartphone use resulted in people neglecting their immediate and close personal relationships, with such neglect being linked to adverse mental health outcomes (Mahapatra, 2019; Nayak, 2018). However, after COVID-19 lockdown restrictions were imposed, smartphone-based interaction (particularly that related to social networking) allowed people to maintain interpersonal relationships to at least some healthy degree, and to give and receive social support (Abbas et al., 2021; David & Roberts, 2021). Such relationship maintenance and socially supportive interactions contribute to reduced loneliness and anxiety, increased self-efficacy and self-esteem, and, ultimately, improved overall wellbeing and life satisfaction (Hunt et al., 2018; Rotondi et al., 2017; Twenge et al., 2019). In short, the opportunity offered by social networking platforms to stay connected with other individuals during the pandemic may counteract previously reported negative effects of social media use (Goel & Gupta, 2020).

The fact that social networking use itself was not a significant predictor of better life satisfaction is worth reflecting on. It may be that, although the context in which social media is consumed has changed, those aspects of social networking that may have negative effects on mental wellbeing (such as comparison, which is associated with decreased self-esteem, which is linked to worse life satisfaction; Marengo et al., 2021; Samaha & Hawi, 2016) have not.

Finally, contextual factors may also have influenced the significance of the association between higher levels of non-social networking use and lower levels of life satisfaction. Under pandemic conditions, the benefits offered to mental wellbeing by increased use of social networking applications may not be provided by analogously increased use of non-social application. In fact, there are data suggesting that increased engagement with the latter has negative effects. For instance, Kingsbury et al. (2021) found that university students operating under COVID-19 restrictions often used non-social networking applications in conjunction with their academic work or to engage with recent news events. Both these forms of use may increase self-perceived stress and anxiety, which are predictors of decreased life satisfaction (e.g., Extremera et al., 2009; Matheny et al., 2008).

Limitations and Directions for Future Research

Inferences one might draw from the research may be limited by the relatively small sample size. We conducted a post-hoc power analysis using G*Power software (Erdfelder et al., 1996). Entering parameters of linear multiple regression with 2 predictors, effect size (Cohen's *f*) = .30, $\alpha = .05$, and $N = 70$, revealed that we achieved statistical power of $(1 - \beta) = .74$. Hence, the study was slightly underpowered, largely as a consequence of the usual time constraints imposed on data collection during the Honours year.

Another methodological limitation is that the sample was socioeconomically homogenous and participation was restricted to iPhone users. Mitigating factors here are that (a) previous South African research suggests there is no significant 'digital divide' across socioeconomic classes (Hodes & Thomas, 2021; Swanepoel & Thomas, 2012), and (b) Android smartphones lack a standardized screen time reporting feature.

A third, and similar, methodological limitation is that the sample's age range was quite restricted (18–25 years) and participants were all students at an urban South African university. This limitation exists because recruitment through university channels allowed us to obtain an adequate sample in a relatively short data collection window. A mitigating factor here is that this

age range is the demographic group that engages the most with their smartphones and is therefore the most relevant portion of the population for this research (Sarwar & Soomro, 2013; Zilka, 2020).

Conclusion

Given that smartphones are incorporated into almost every aspect of modern life, it is essential to understand the impact different types of smartphone use have on mental wellbeing. This study is among the first to investigate the difference in predictive power between type and amount of smartphone use (both measured objectively) and mental health outcomes. Our findings suggest there is no significant relationship between average daily use or type of use and major mental health outcomes (depression and anxiety). Non-social networking use was, however, significantly predictive of lower levels of life satisfaction. The study therefore suggests that smartphone use is not necessarily synonymous with adverse mental health outcomes, but rather that such outcomes are more likely to arise from types of use that do not aim to facilitate social connection. This finding is consistent with a small but growing pool of literature, a fact that might reflect shifting relations between smartphone use and mental health as a consequence of the COVID-19 pandemic.

Overall, this research contributes to the cyberpsychological literature focused on smartphone use and mental health outcomes. It also opens new and important avenues of research that may be crucial in shaping a safer form of smartphone navigation and offers valuable insight to public policy conversations surrounding the promotion of healthy smartphone engagement on both individual and societal levels.

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Tables

Table 1

Descriptive and Psychometric Statistics: Smartphone Use and Mental Health Outcomes (N = 70)

Variable	*M*	*SD*	Range	Cronbach's α
Predictor				
Average daily screen time (mins) [a]	396.00	179.95	76–875	
Social networking use [b]	1897.00	1097.39	132–4337	
Non-social networking use [b]	1885.00	1111.41	351–5481	
Outcome				
BDI-II	17.73	9.53	3–45	.90
GAD-7	7.63	5.09	0–20	.90
SWLS	19.49	6.77	5–33	.82

Note. BDI-II = Beck Depression Inventory-II; GAD-7 = Generalized Anxiety Disorder-7 item Survey; SWLS = Satisfaction with Life Scale.

[a] Average over the 10-day data collection period.

[b] 10-day total, in minutes.

Table 2

Correlation Matrix: Associations between Smartphone Use Variables and Mental Health Outcomes (N = 70)

Measure	1	2	3	4	5	6
1. BDI-II		**.55*****	**-.41*****	.09	.10	.16
2. GAD-7	**.55*****		.17	.01	.02	.10
3. SWLS	**-.41*****	.17		.16	-.06	**-.31****
4. Average daily time screen time [a]	.09	.01	.16		**.62*****	**.64**
5. Social networking use [b]	.10	.02	-.06	**.62*****		.22
6. Non-social networking use [b]	.16	.10	**-.31****	**.64*****	.22	

Note. Data presented are Pearson's *r* correlation coefficients. BDI-II = Beck Depression Inventory-II; GAD-7 = Generalized Anxiety Disorder-7 item Survey; SWLS = Satisfaction with Life Scale.

[a] Average (in minutes) over the 10-day data collection period.

[b] 10-day total, in minutes.

****p* < .001. ***p* < .01. **p* < .05.

Table 3

Linear Regression Models: Relations between Smartphone Use and Mental Health Outcomes (N = 70)

Outcome / Predictor	*B*	*SE*	sr^2	R^2	β	*F*	*df*	*p*
BDI-II								
Model 1: Average daily screen	.005	.006	.01	.005	9.56	.65	1,68	.42
Model 2								
Overall				.002	9.52	1.09	2,67	.33
Social networking use [b]			<.001		0.06			.57
Non-social networking use [b]			.02		0.15			.22
GAD-7								
Model 1: Average daily screen	.000	.003	.00	.01	5.13	.008	1,68	.92
Model 2								
Overall	7.62	.61		.01	5.13	.44	2,67	.64
Social networking use [b]	.000	.33	<.001		0.03			.66
Non-social networking use [b]	-	.0005	.01		-0.11			.36
SWLS								
Model 1: Average daily screen	.006	.004	.03	.01	6.72	1.98	1,68	.16
Model 2								
Overall				.07	6.52	3.64	2,67	.03*
Social networking use [b]			<.001		-0.00			.97
Non-social networking use [b]			.09		-0.31			.01*

Note. sr^2 = semi partial correlation; BDI-II = Beck Depression Inventory-II; GAD-7 = Generalized Anxiety Disorder-7 item Survey; SWLS = Satisfaction with Life Scale.

[a] Average (in minutes) over the 10-day data collection period.

[b] 10-day total, in minutes.

***$p < .001$. **$p < .01$. *$p < .05$.

Table 4

ANOVA results for mental health outcomes and smartphone use (N = 70)

Dependent Variable	Type III SS	*Df*	Mean Square	*F*	*p*	Eta^2
BDI-II	129.84	68	6218.00	1.42	.23	.35
GAD-7	19.67	68	1792.10	0.74	.39	.05
SWLS	220.81	68	3075.70	5.18	.02*	.59

Note. SS = sums of squares; BDI-II = Beck Depression Inventory-II; GAD-7 = Generalized Anxiety Disorder-7 item Survey; SWLS = Satisfaction with Life Scale.

*$p < .05$.

Figures

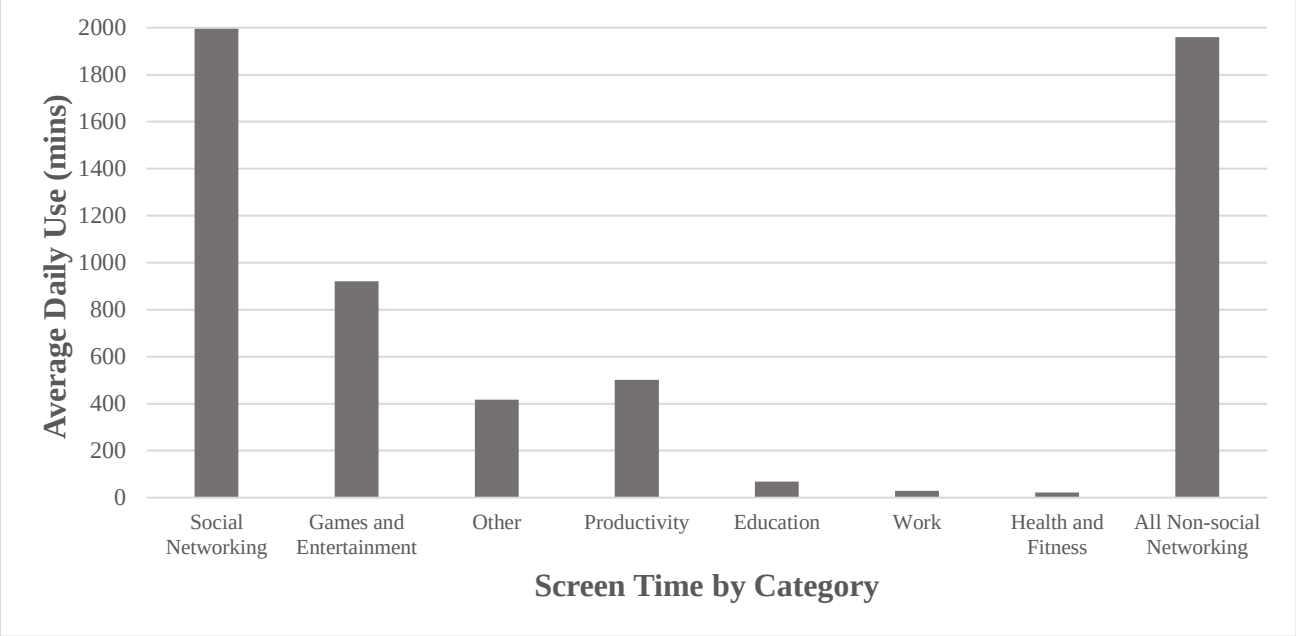
Figure 1

iOS Battery Use (BUS) Report

Note: An example of an iPhone battery use (BUS) report, revealing data regarding both total screen time and that associated with the most-used applications, as well as active use and background activity for these applications.

Figure 2

Average Daily Smartphone Use by Category (N=70)



Appendix A

Invitation to Participate

The following message will be placed on the VULA site for each undergraduate course in the UCT Department of Psychology.

Subject: Get 2 SRPP points for this semester from an exciting cyberpsychology study!
Organisers: Raine Gess and Malikah Du Toit
Hi everyone,
We are two Honours students in the UCT Department of Psychology. Our research study investigates how the use of specific smartphone apps might be associated with mood states and personality. It is one of the first studies to research this topic. We hope it will be of interest to you!
To participate in this study, you need to:

a. **Be a student at UCT.**
b. **Be between 18 and 25 years of age.**
c. **Own an iPhone with software update iOS10 or later.**
d. **Have no history of serious psychological, psychiatric, or neurological illness (e.g., OCD, a psychotic disorder). Please note that diagnosis of an anxiety or depressive disorder does NOT exclude you from this study.**

If you meet the above criteria, and would like to participate in our study, please answer a few background s questions by clicking on this link: [SurveyMonkey - Choose Collector].
If we determine that you are eligible for the study, we will contact you to discuss the research and what you can expect. You will then be asked to fill out 3 online questionnaires. These will ask about your recent mood states and aspects of your recent experiences, as well as your general life satisfaction. In total, the survey should take no longer than 30 minutes to complete, and for its completion you will receive **1 SRPP point.**
After completing the survey, you will be asked to take a screenshot of your iPhone screen battery report and email that screenshot to us at cyberpsychresearch21@gmail.com. For this, you will receive a **second SRPP point.**

If you have any questions, please feel free to email us at cyberpsychresearch21@gmail.com.

Looking forward to working with you!

All the best,

Raine Gess and Malikah Du Toit

Psychology Honours students

Appendix B

Consent Form

Study Title: Use of Smartphone Apps and Associated Mood States and Personality

What is this study about?

This study, which is being conducted by a research team in the University of Cape Town (UCT) Department of Psychology, aims to learn more about ways in which different people use their smartphones.

Who can participate in this study?

This study is open to students (aged 18–25 years) enrolled at UCT. Participants must own an iPhone with iOS software update 10 or higher. People who have been diagnosed with or treated for a severe psychiatric illness (e.g., a psychotic disorder), a neurological disorder (e.g., epilepsy), or an endocrinological condition (e.g., Addison's disease) will not be able to participate. The study is, however, open to people diagnosed with common mental disorders such as depression or an anxiety disorder.

What will happen if you take part in this study?

If you agree to take part, you will be asked to fill out three short questionnaires about your moods, feelings, and overall wellbeing. These should take about 30 minutes to complete. Please answer these honestly; there are no right or wrong answers. After filling out these questionnaires, you will be asked to take a screenshot of your battery screen time data for the previous10 days and email it to the researchers. Before taking this screenshot, please ensure that

you select the ‘Last 10 Days’ battery report, and that you click the ‘Show Activity’ instruction to generate a full report.

What will happen to the information you give us?

All personal information you share with us will be kept confidential. No personal information (e.g., names, contact details) will be shared with anyone outside the research team. Your information will be assigned a unique random number for use in the research process. All the collected information will be stored electronically. It will be accessible only through a password-protected dedicated email address, which is set up using a two-step verification process. All correspondence between you and the research team will be via this email address. The information you share with us is thus very secure and accessible only to the research team.

Are there any costs or benefits involved in participation?

There are no costs involved in participating. There are also no known risks of social, physical, or psychological harm associated with participation. You will be awarded two Student Research Participation Program (SRPP) points after you have completed your participation in the study: the first for completing the survey, and the second for emailing the screen time screenshots. If you would like, we will send you a summary of our finding after the research is complete.

Do you have to participate in this study?

Participation is not compulsory. If you choose to participate after reading this document, please click on ‘I agree to the informed consent form’ below. If you agree to participate, and then later wish to withdraw from the study, you may do so at any stage of the data collection process by informing one of researchers. You do not have to give reasons for withdrawing from the study, and it is up to you as to whether or not information you have provided up to that point is included in the research study.

Unfortunately, withdrawal from the study before you have completed the requirements means you will not be awarded SRPP points for the study.

What if you have questions about the study?

If you have any questions about this study, please contact the research team at *cyberpsychresearch21@gmail.com* or our supervisor, Dr. Kevin Thomas, at *kevin.thomas@uct.ac.za*. If you wish to be in contact with a representative of UCT's Department of Psychology, please telephone or email Ms Rosalind Adams (021 650 3417; *rosalind.adams@uct.ac.za*).

Appendix C

Informed Consent Questionnaire

Please answer the following:

Student Number

Do you agree with the informed consent?

Do you understand what the data collection process will entail?

Do you understand that you have the right to withdraw from the research at any given point without negative consequences?

Do you have any other questions regarding the informed consent?

Do you have any other questions regarding the research process?

Do you understand that your data will be kept confidential?

Do you understand your role and responsibilities in the data collection process?

Appendix D

Sociodemographic Questionnaire

Please answer the following:

How old are you?

What is you gender?

What is your current academic year of study?

What is your major at UCT?

Was your high school in an urban or rural setting?

Was it public or private?

Have you ever been or are you currently diagnosed with psychological, psychiatric, neurological or learning disorder? If yes, please specify.

Do you own a smartphone?

If you own an iPhone, what software are you using? You can find this by going to "Settings", "General" and "About" where you will be able to see the software version for your phone.

Would you like a copy of the report?

Appendix E

Beck Depression Inventory-II (BDI-II)

Instructions: Below are twenty-one questions using a scale of 0-3 indicating how you have been feeling over the past two weeks. Please select the number that you agree the most with.

1.
0 I do not feel sad.
1 I feel sad much of the time.
2 I am sad all the time.
3 I am so sad and unhappy that I can't stand it.

2.
0 I am not particularly discouraged about the future.
1 I feel more discouraged about the future than I used to be.
2 I do not expect thing to work out for me.
3 I feel my future is hopeless and will only get worse.

3.
0 I do not feel like a failure.
1 I have failed more than I should have.
2 As I look back, I see is a lot of failures.
3 I feel I am a total failure as a person.

4.
0 I get as much pleasure as I ever did from the things I enjoy.
1 I don't enjoy things the way I used to.
2 I get very little pleasure from the things I used to enjoy.
3 I can't get any pleasure from the things I used to enjoy.

5.
0 I don't feel particularly guilty.
1 I feel guilty a good part of the time.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

6.
0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

7.

0 I feel the same about myself as ever.
1 I have lost confidence in myself.
2 I am disappointed in myself.
3 I dislike myself.

8.

0 I don't criticize or blame myself more than usual.
1 I am more critical of myself than I used to be.
2 I criticize myself for all of my faults.
3 I blame myself for everything bad that happens.

9.

0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10.

0 I don't cry any more than usual.
1 I cry more now than I used to.
2 I cry over every little thing.
3 I feel like crying, but I can't.

11.

0 I am no more irritated by things than I ever was.
1 I am slightly more irritated now than usual.
2 I am quite annoyed or irritated a good deal of the time.
3 I feel irritated all the time.

12.

0 I have not lost interest in other people.
1 I am less interested in other people than I used to be.
2 I have lost most of my interest in other people.
3 I have lost all of my interest in other people.

13.

0 I make decisions about as well as I ever could.
1 I put off making decisions more than I used to.
2 I have greater difficulty in making decisions more than I used to.
3 I can't make decisions at all anymore.

14.

0 I don't feel that I look any worse than I used to.
1 I am worried that I am looking old or unattractive.
2 I feel there are permanent changes in my appearance that make me look unattractive.

3 I believe that I look ugly.

15.

0 I have as much energy as ever.
1 I have less energy than I used to have.
2 I don't have energy to do very much.
3 I don't have energy to do anything.

16.

0 I have not experienced any change in my sleeping pattern.
1a I sleep somewhat more than usual.
1b I sleep somewhat less than usual
2a I sleep a lot more than usual.
2b I sleep a lot less than usual.
3a I sleep most of the day
3b I wake up 1-2 hours early and can't get back to sleep.

17.

0 I am no more irritable than usual.
1 I am more irritable than usual.
2 I am much more irritable than usual.
3 I am irritable all the time.

18.

0 I have not experienced any change in my appetite.
1a My appetite is somewhat less than usual.
1b My appetite is somewhat greater than usual.
2a My appetite is much less than before.
2b My appetite is much greater than before.
3a I have no appetite at all.
3b I crave food all the time

19.

0 I can concentrate as well as ever.
1 I can't concentrate as well as usual.
2 Its hard to keep my mind on anything for very long.
3 I find I can't concentrate on anything.

20.

0 I am no more tired or fatigued as usual.
1 I get more tired or fatigued more easily than usual.
2 I am too tired or fatigued to do a lot of the things I used to do.
3 I am too tired or fatigued to do most of the things I used to do.

21

0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.

Appendix F

Generalized Anxiety Disorder 7-item (GAD-7) Survey

Over the last two weeks, how often have you been bothered by the following problems? Please use the following response options:

0 = Not at all

1 = Several days

2 = More than half the days

3 = Nearly every day

1. Feeling nervous, anxious, or on edge

0 1 2 3

2. Not being able to stop or control worrying

0 1 2 3

3. Worrying too much about different things

0 1 2 3

4. Trouble relaxing

0 1 2 3

5. Being so restless that it is hard to sit still

0 1 2 3

6. Becoming easily annoyed or irritable

0 1 2 3

7. Feeling afraid, as if something awful might happen

0 1 2 3

If you checked any problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people? Please circle one of the below options.

Not difficult at all Somewhat difficult Very difficult Extremely difficult

Appendix G

Satisfaction With Life Scale (SWLS)

Scale: Instructions: Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your response.

- 7 - Strongly agree
- 6 - Agree
- 5 - Slightly agree
- 4 - Neither agree nor disagree
- 3 - Slightly disagree
- 2 - Disagree
- 1 - Strongly disagree

____ In most ways my life is close to my ideal.

____ The conditions of my life are excellent.

____ I am satisfied with my life.

____ So far I have gotten the important things I want in life.

____ If I could live my life over, I would change almost nothing.

Appendix H
Debriefing Form

Thank you for taking part in our research on cyberpsychology!

Please read the material on this form carefully to learn more information about this study and ask me any questions that you have. After this debriefing, you may choose to have information about you removed from this research study if you so wish.

For this study, it was important that we withheld some information about the true purpose of the study from you. Now that your participation is completed, we will describe what precisely we were measuring, and why this information was withheld from you. We will also remind you of our willingness to answer any of your questions and provide you with contact details in order to do so. Finally, we will give you the opportunity to decide whether you would like to have your data included in this study or removed from it.

What You Should Know About This Study

Before you started participating in this research, you were told that the purpose of the study was to examine the relationship between use of specific smartphone apps, mood states, and personality. However, the actual purpose of the study was to study whether there is a relationship between type of smartphone use (e.g., whether it is primarily used for social media, for gaming, or for some other purpose) and symptoms of depression / anxiety. We did not tell you the true purpose of the study as it was important that your responses were not influenced by having this information.

Your Right to Withdraw Data

Now that you know the true purpose of this research study, you may decide whether you still wish to have your data included in the study or not. If you choose to have your data removed, please email us your request. All information regarding your answers to the questionnaires and screen time will then be deleted from our records, and excluded from the data analysis. There

will be no penalties or negative consequences for you if you withdraw from the study, although you will not receive your 2 SRPP points if you do.

Before making your decision, please feel free to contact the research team with any questions you have.

Confidentiality

Whether you allow your data to be used in this study or not, please remember that the integrity of this research depends on not disclosing the full purpose of the study. Therefore, it is important that you do not tell anyone else about the details of this study until our data collection process with other participants is complete.

Although the full purpose of this study was not originally explained to you, everything else on the consent form is correct. We will ensure complete confidentiality in any information you give us, including your decision about whether or not to withdraw from the study.

If You Have Any Questions or Concerns

If you have any questions or concerns about this study and the research procedures used, you may contact us, Raine and Malikah, at *cyberpsychresearch21@gmail.com*, or our supervisor Professor Kevin Thomas at *kevin.thomas@uct.ac.za*.

If you have any questions regarding your rights as a research participant in this study, please contact the postgraduate administrator Ms Rosalind Adams on 021 650 3417 or *rosalind.adams@uct.ac.za*. If you experience any adverse effects as a result of participating in this study, please contact us or our supervisor (above).

Appendix I
Letter of Ethical Approval

UNIVERSITY OF CAPE TOWN

Department of Psychology

University of Cape Town Rondebosch 7701 South Africa
Telephone (021) 650 3417
Fax No. (021) 650 4104

05 August 2021

Raine Gess and Malikah Du Toit
Department of Psychology
University of Cape Town
Rondebosch 7701

Dear Raine and Malikah

I am pleased to inform you that ethical clearance has been given by an Ethics Review Committee of the Faculty of Humanities for your study, *Investigating Associations between the Use of Different Smartphone Applications and Specific Mental Health Outcomes*. The reference number is PSY2021-040.

I wish you all the best for your study.

Yours sincerely

Lauren Wild (PhD)
Associate Professor
Chair: Ethics Review Committee