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Short-Term Effects of Induced Mood on Smartphone Use

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Abstract

A large body of literature describes effects of smartphone use on mental wellbeing. However, few studies have investigated the opposite direction of effect: ways in which mood states might affect smartphone use (e.g., the applications with which people engage). This true experimental study therefore aimed to investigate whether, and how, different mood states affect smartphone use. We hypothesised that induction of positive mood would result in tendencies toward using social applications (e.g., Instagram), whereas induction of negative mood would result in tendencies toward using non-social applications (e.g., YouTube). Undergraduate volunteers were randomly assigned to either a neutral (n = 22), negative (n = 22), or positive (n = 23) mood induction condition. Post-induction, all participants were instructed to sit quietly at their desks until the experimenter allowed them to leave the room. At the outset of this 12.5-min observation period, they were implicitly encouraged to use their smartphones. At its conclusion, they were asked which application(s) they had used. Data from the Profile of Mood States (POMS-16) questionnaire, which was administered pre- and post-manipulation, suggested that the mood inductions were effective in the expected directions. However, our primary inferential analyses detected no significant between-condition differences in type of application (social / non-social) used during post-induction observation period; therefore, could not confirm our hypotheses. We conclude that our findings support one branch of the existing literature in indicating that the ways in which individuals use their smartphones is powerfully habitual and therefore not amenable to alteration by short-term, transient mood states.

Keywords: affect; mood; smartphone use; smartphone applications; social media.

Short-Term Effects of Induced Mood on Smartphone Use

Although telephonic communication has an extensive history, the smartphone has only recently become an essential part of human interaction. Current global estimates suggest the number of smartphone subscriptions surpasses six billion (Li et al., 2022). Over the past three decades, this digital device has become increasingly ubiquitous due to its ability to access the Internet, connect the user with others, and allow engagement in entertainment on-the-go (Twenge et al., 2018). However, as the number of smartphone users has increased, so has concern regarding effects of heavy use on mental health.

Problematic Smartphone Use

Because the amount of time individuals spend on smartphone-related activities has increased significantly over the past decade, excessive and time-consuming use has become the focal point of much research in the evolving field of cyberpsychology (see, e.g., Derevensky et al., 2019; Elhai et al., 2017). The term *problematic smartphone use* refers to compulsive use of the device that results in psychological, social, or physical harm (Yeh et al., 2020). Although cyber-psychological researchers tend to avoid using terms such as "smartphone addiction", the definition of problematic smartphone use given above meets the criteria set out by Kardefelt-Winther (2017) for behavioural addiction (i.e., an ongoing failure to control the addictive behaviour that results in functional impairment or distress). Such problematic behaviour related to smartphone use appears to have significant implications for the user's mental health and emotional state.

Effects of Problematic Smartphone Use on Mental Health and Mood

A general consensus emerging in the literature is that problematic smartphone use has non-negligible negative effects on mental health (see, e.g., Davey & Davey, 2014; Sohn et al., 2019). For instance, in a study examining correlates of problematic smartphone use in a North American university sample (N = 9449), Grant et al. (2019) found associations with

higher levels of alcohol use, anxiety, depression, posttraumatic stress disorder, and with poor academic performance. Associations between long-duration or problematic smartphone use and depressive symptoms are particularly universal, having been reported in studies from Japan (Ikeda & Nakamura, 2014), Spain (Sánchez-Martínez & Otero, 2009), and Austria (Augner & Hacker, 2012), among others.

However, smartphone use is not a unitary construct; the relationship between smartphone use and mood depends largely on the *type* of smartphone activity being measured (Marty-Dugas & Smilek, 2020). Passive or absent-minded use (a form of inattention and spontaneous mind-wandering), rather than general use (i.e., general smartphone-related behaviours, including how often participants use social media, send and receive text messages, and browse the web) tends to be associated with the appearance of depression, anxiety, stress, and negative affect (Marty-Dugas & Smilek, 2020).

Does Emotional State Affect Frequency and/or Type of Smartphone Use?

Digital technologies, such as smartphones, video games, and virtual reality experiences, influence emotions (Collins & Cox, 2014; Mehrotra et al., 2015; Valmaggia et al., 2016). However, there is limited research investigating an effect in the opposite direction; that is to say, whether a user's mood affects their smartphone-related behaviour. Of the handful of studies investigating that question, two are of particular interest here.

In the first of these studies, Mehrotra et al. (2015) gathered mood reports from participants (N = 28) for 20 consecutive days (one report every 3 hours between 9am and 11pm, resulting in 5118 unique reports across the sample). The researchers designed a mobile application to record participants' emotional states and their smartphone-related behaviour throughout the day. Reports about emotional state were organised into three categories: activeness (a state of arousal and being fit to respond), happiness (a state of positivity and jubilation), and stress levels (experiencing a sense of negativity and feeling of pressure as a

result of increased levels of coercion). Reports about smartphone-related behaviour included data on which specific applications were used, participants' communication patterns, and their reaction time (RT) to notifications. After examining correlations between emotional states and different aspects of smartphone use, Mehrotra et al. continued their research by investigating causality for those variables that showed significant correlation. They did this by ensuring that temporal precedence was confirmed between predictor and outcome variables. Ultimately, they concluded there was a causal link: Participants who reported higher stress levels were more attentive to their smartphones because they recorded more rapid RTs to the device's notifications.

The design, results, and conclusions of this study have several key implications. First, the research protocol provides convincing evidence that smartphone-based technology can be a source of emotional state assessment. Second, the observed data and the causal analysis make it clear that emotional state does indeed affect smartphone use. Mehrotra et al. suggest that these findings may guide the design of mobile systems; for instance, smartphone applications could become more effective in being 'emotion-aware', thereby being beneficial to individuals experiencing distinct emotional states. Finally, a major inference from the study is that raising awareness of how individuals' emotional states may be affected by smartphone use could allow researchers to estimate the optimal time for conveying specific types of information that can constructively aid the user to manage those states.

Another pertinent study investigating bidirectional relations between emotional state and smartphone use was conducted by Sarsenbayeva et al. (2020). They developed a piece of software to record the applications their participants were using at a particular moment. Another piece of software recorded users' emotions in similar momentary fashion by capturing facial expressions through the lens of the smartphone's camera. Over a 2-week period, the researchers captured 502,851 instances during which participants (N = 30, 15

women, 15 men; age range 20–45 years) reported which application they were using while their facial expressions were logged. The authors found that the more applications launched by participants, the more likely they were to be experiencing a wider range of emotions. However, for some participants, emotions appeared to drive the number of application launches. This finding was explained by the fact that people usually seek distractions and divert their attention when experiencing certain negative emotions. Therefore, while smartphone application use often drives emotions, there is reason to believe that this relationship is bidirectional.

This study demonstrates an ambiguous link between specific application use and the user's emotional state. On the one hand, the findings suggest that certain emotional states provoke the user to engage in activities on distinct types of applications. On the other hand, the findings also suggest that the use of certain applications provokes distinct emotional states. Despite this ambiguity, one clear implication of this set of findings is that an enhanced technology-mediated component can be built into mobile applications to contribute to emotion regulation.

Together, these two studies bring the field of cyberpsychology one step closer to understanding bidirectional relations between smartphone use and emotional state.

The Current Study: Rationale, Aim, and Hypotheses

Extensive research has examined causes and effects of the rapidly increasing engagement with smartphones over the past decade. In particular, numerous studies have investigated the potentially harmful effects of problematic smartphone use on mental health, specifically affect. Based on this literature, one may conclude that digital technologies have the potential to influence emotional states. However, the current study aimed to investigate a relationship in the opposite direction: the impact of emotional states on smartphone use. Previously, Mehrotra et al. (2015) and Sarsenbayeva et al. (2020) reported causal links

between user mood and smartphone-related behaviour (i.e., they found that stressed individuals are less likely to respond to notifications, and that the happier people are, the less likely they are to use their smartphones). The shortcomings of these studies, however, are that both (a) required participants to install specific software on their smartphones which resulted in them being aware that they were being monitored (i.e., demand characteristics), (b) were conducted in a natural setting thus lacking the control that is available when using experimental setting and (c) investigated the amount of time that participants spent on their smartphone and how quickly they engaged with their device opposed to analysing which applications they used and how they used their devices based on either a positive or negative mood.

The current research aimed to address this knowledge gap by recruiting three groups of healthy young adults; one group experienced a positive mood induction, the second a negative mood induction, and the third a neutral mood induction. We tested the hypotheses that those who experience a positive mood induction would tend to use social applications (e.g., WhatsApp), whereas those who experience a negative mood induction would avoid social applications but will tend to use those that provide entertainment (e.g., TikTok, YouTube). We proposed that these patterns of behaviour will manifest because when people are in a low mood, they tend to perceive social interactions negatively and consequently withdraw from them (Kashdan & Steger, 2006). In contrast, when people are in a more positive mood they tend to seek out and engage in more social interactions (Ryczkowska, 2022).

Method

Design and Setting

The study used a true experimental design. The independent variable (IV) was the participant's mood (i.e., their transient state of mind or emotion; Broome et al., 2015). The

operational definition of the IV was self-reported changes in mood after being exposed to a film clip manipulation (i.e., viewing either a positive, negative, or neutral video fragment). The dependent variable (DV) was smartphone use (i.e., the ways in which the participant used their phone). The operational definition of the DV was subjectively and objectively measured engagement in different types of smartphone activity during an observation period of 12.5-min.

The study setting was Meeting Room 3B within the University of Cape Town (UCT) Department of Psychology.

Participants

Recruitment

We used convenience sampling to recruit UCT undergraduate students *(N* = 67). An announcement was placed on the VULA Student Research Participation Programme (SRPP) site (see Appendix A) which contained a link to book a research slot (Appendix B). We used this method of recruitment because it was time-effective and allowed us to reach all students registered for a course in the Department of Psychology. The online booking software allowed participants to hide their names and all other identifying information, thus ensuring their right to confidentiality.

We customised the booking software to allow a maximum of five bookings per time slot (in other words, each experimental session could include a group of up to five participants). At the conclusion of data collection, we had run a total of 30 experimental sessions (10 featuring a negative mood induction, 10 a positive mood induction, and 10 a neutral condition), with an average of two participants per session (range = 1– 4). To reach our desired sample, we recruited participants throughout our study and randomly assigned them to an induction condition until an equal amount was reached.

Each participant who completed the study procedures was awarded 2 SRPP points.

Eligibility Criteria

We required that each participant be (a) a registered UCT student, (b) aged between 18 and 25 years, and (c) a fluent English speaker. Furthermore, all participants had to own and regularly use an iPhone with at least iOS10 installed.

We excluded from participation individuals with a history of either common mental disorders (e.g., generalised anxiety disorder, major depressive disorder) or serious psychological, psychiatric, or neurological disorders (e.g., any psychotic disorder, obsessive-compulsive disorder, epilepsy). We set this exclusion criterion in place because individuals experiencing mental illness are vulnerable to changes in emotion and cognition that could have affected the reliability of our mood induction.

There were no eligibility criteria related to sex, gender, race, or ethnicity.

Power Analysis

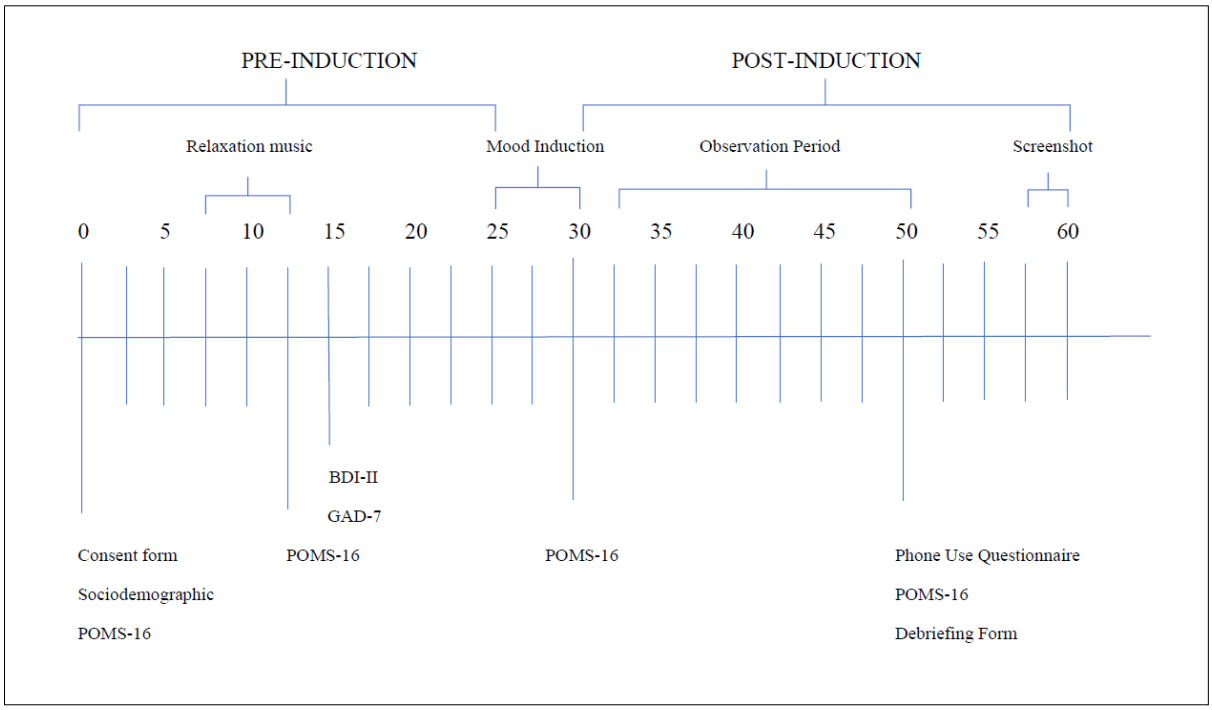
We used G*Power software (Erdfelder et al., 1996) to determine the appropriate sample size for our study. Using parameters of $\alpha = .05$ and an estimated effect size of medium magnitude, Cohen's $f^2 = .15$ (Pérez & Pericchi, 2014), the software determined that a sample size of 77 would be adequate to generate statistical power of $(1 - \beta) = .90$ when using one-way ANOVA to explore main effects.

Materials and Procedure

Figure 1 is a flowchart describing the experiment's sequence of events

Figure 1

Flowchart Describing the Study Procedure



Note. POMS-16 = Profile of Mood States Questionnaire (short version); BDI-II = Beck Depression Inventory-II; GAD-7 = General Anxiety Disorder. 0 = the point at which the participants began the procedures. Numbers indicate the minutes of the experiment.

Enrolment and Screening

Formal enrolment into the study began once the participant had booked a research slot using the online appointment system. Immediately after we received notification of that booking, we sent the participant a confirmation email detailing their selected time and date of participation.

On the day of the appointment, the participant arrived in the UCT Department of Psychology and was escorted (along with all the other participants who had booked the same slot) to a quiet research room that contained several desks and chairs, as well as a projector and a screen that would be used to display the experimental manipulation's film clips. As the participants entered the venue, they were asked to place all their belongings except their smartphone at the front of the room. Thereafter, each participant was seated at a desk where they found a copy of Research Booklet A and a black pen. They began by completing a

document capturing the date, their student number, and the course code to which they wanted their SRPP points allocated (see Appendix C). They were then asked to open Booklet A where, on the first two pages, they found a *consent form* (see Appendix D) followed by an *informed consent comprehension questionnaire* (see Appendix E). Once consent was received and it was clear that the participant had comprehended the contents of the consent document, the study commenced.

The participant was asked to turn the page in Booklet A and complete our study-specific *sociodemographic questionnaire* (see Appendix F). This questionnaire gathered information about the participant's sex/gender, year of initial registration at UCT, programme in which they were registered, current year of study, and relevant medical/psychiatric history. If information from the sociodemographic questionnaire confirmed that the participant was eligible to continue, we allowed them to continue to the next stage in the experimental protocol. Only one participant was excluded at this point – they self-reported a history of psychiatric illness. The participants had to answer the first Profile of Mood States questionnaire to capture the level of their mood at baseline.

Relaxation Period

We dimmed the room's lights and asked participants to relax by closing their eyes and listening to a calming audio track that was streamed from YouTube via Meeting Room 3B's desktop computer (see Appendix G). This relaxation period, which was designed to ensure all participants were in a similarly neutral and relaxed mood state prior to the onset of the experimental manipulation, concluded after 5 minutes.

To signal its conclusion, we returned the lights to their original brightness and then asked the participant to open Booklet A at page seven. They were instructed to complete the following three standardised self-report questionnaires: the *Beck Depression Inventory-II* (*BDI-II*; see Appendix H), the *General Anxiety Disorder-7* (*GAD-7*; see Appendix I), and the

second revised short screening version of the *Profile of Mood States* (*POMS-16*; see Appendix J). Upon completion, the participant was asked to close Booklet A and shift their gaze to the screen at the front of the room.

Experimental Manipulation: Mood Induction

Psychological literature describes several different laboratory-based mood induction methods. Each of these aim to provoke specific mood states within an individual who is participating in research (Van der Does, 2002). However, a recent meta-analysis indicated that the use of film clips is one of the most effective methods of mood induction (Martínez-Rodrigo et al., 2020). The authors reviewed 45 studies, each of which used a particular method to induce neutral, positive, or negative mood. They found that the film clip method is especially powerful in inducing negative mood states (Hedges' *g* for valence = -1.49 and for arousal = -1.77), and is also effective for inducing positive mood (Hedges' *g* for valence = -1.22 and for arousal = -1.34). Based on these findings, as well as the facts that film clips are often used to induce particular moods in psychological studies (see, e.g., Gross & Levenson, 1995; Schaefer et al., 2010) and that film as a method of mood induction has a relatively high degree of ecological validity (Uhrig et al., 2016), we decided to use film clips to induce negative and positive mood states. An audio soundtrack was used for the neutral mood comparison condition.

Each participant assigned to the negative mood induction condition viewed a 3-min scene from the film *The Champ* (see Appendix K). This clip is a mainstay of sadness induction in the field of affective science (Rottenberg et al., 2018). Participants assigned to the positive mood induction condition viewed a 4-min clip from the television show *Whose Line is it Anyway* (see Appendix L). This film stimulus has been validated by Rottenberg et al. (2018). Participants assigned to the neutral condition listened to the first 5 mins of an instrumental audio track titled. This track's YouTube description box describes it as being

"calm piano music with bird sounds for sleeping, relaxation and study" (https://www.youtube.com/watch?v=AKy6Jx59fis).

Post-Induction Observation Period

Immediately after the manipulation, participants were asked to turn to the back of Booklet A and complete the POMS-16 for a third time. Upon completion, they stayed seated at their desk and a researcher collected Booklet A from them. They were told, "We will now take a short break. Please remain seated, avoid speaking to anyone else but feel free to make use of your smartphone."

The researcher remained at the front of the room, in full view of the participants, and began using their smartphone to encourage conformity. A video camera placed in the corner of the room recorded the participant's behaviour for duration of the observation period (12.5 mins). We coded the footage formally using a coding key (see Appendix M), noting the time it took the participant to pick up and begin using their phone as well as the total amount of time they used their phone. An advantage of video-recording participants is that it provided us with the ability to replay and review participants' behaviour as well as control for observer fatigue (Haidet et al., 2009).

Gathering Screen Time Data

At the end of the observation period, participants were handed Research Booklet B. Page one of this booklet presented a study-specific *Phone Use Questionnaire* that gathered information regarding smartphone use over the 24 hours prior to study participation (see Appendix N). It asked, for instance, about the participant's typical smartphone activity on an average weekday at the time of study participation, their estimate of the average time spent on their smartphone throughout a typical day, and which mobile applications they used during the observation period. Thereafter, the researchers instructed the participant to complete the POMS-16 for the fourth and final time.

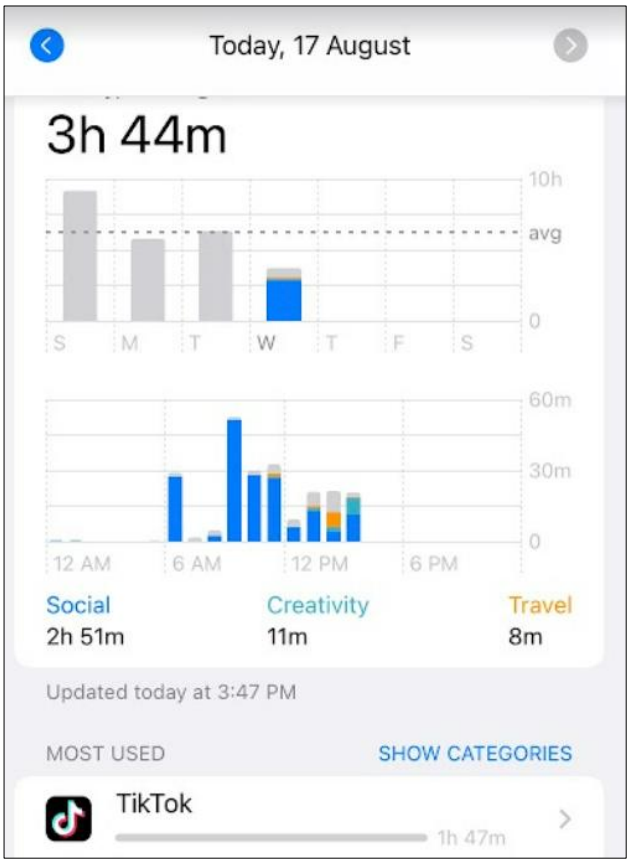
Conclusion and Debriefing

The participants were asked to turn to the final page of the Booklet B where they were able to read through a debriefing form (see Appendix O). When all participants had finished reading that form, we debriefed them verbally to ensured they were fully aware of the study's true purpose and aims and their right to withdraw their data.

Finally, the researcher asked the participants to email a screenshot of their iOS screentime tracker (STT) reports to a study-specific address. The STT takes an average of the previous 7 days of use (see Figure 2 for an example). This objective measure provided us with an hour-by-hour account of the participants' smartphone activity. They were instructed to send that email prior to leaving the study venue to avoid any technical issues. Once we received their email, they were thanked for their participation and permitted to leave the venue.

Figure 2

Example of an iOS Screen Time Tracker



Note. The screenshot indicates the data as well as the amount of time that the user has spent on their phone during each of the past 7 days. Furthermore, the main app categories – which are decided upon by Apple – are reflected beneath the graph.

All study procedures were granted ethical approval by the UCT Department of Psychology Research Ethics Committee (see Appendix P).

Data Management and Statistical Analysis

Data Cleaning and Scoring

We captured the questionnaire data on Google Sheets (see Appendix Q) and uploaded SST screenshots and video footage of the observation session to Google Drive (see Appendix R). Then, we (a) scored the standardised questionnaires using conventional methods (Beck et al., 1996; Spitzer et al., 2006), (b) used the video footage and the schedule described above to calculated the amount of time each participant spent using their phone during the post-induction observation period, and (c) perused the Phone Use Questionnaire so that we could

categorise the applications participants used during the post-induction observation period, and during the analogous time on a usual weekday, into two categories: social use applications and non-social use applications (Appendix S). Previous studies in this literature used the same dichotomous classification of smartphone activity (see, e.g., Song et al., 2004; Van Deursen et al., 2015).

To calculate each participants' Observation Period Social Score, we noted which applications (up to a maximum of three) they reported using most heavily during the 12.5-min post-induction observation period. We then awarded a value of +1 to each social application used and a score of -1 to each non-social application used. So, for example, if a participant reported using only WhatsApp and Outlook during the observation period, their social score would be (+1) + (-1) = 0; as should be clear, higher scores indicate heavier use of social applications.

To calculate each participant's Usual Social Score, we noted which applications (up to a maximum of three) they reported using most heavily on a usual weekday at the time of their study participation. We then awarded a value of +1 to each social application used and a score of -1 to each non-social application used, in the same way as described above.

To calculate participants' STT-derived Social Score (i.e., a representation of how heavily biased their smartphone activity over the previous 7 days had been toward using social applications), we noted which application had been used most frequently over that period and awarded the application the same value as we did for the observation period Social Score. Because in this case we were evaluating only one application, the value of this variable could be either +1 or -1.

Finally, we completed cleaning and preparation of the data spreadsheet for analyses.

Primary Inferential Analyses

These analyses, and those described in the section immediately below, were conducted using R Studio, with the threshold for statistical significance set at $\alpha = .05$. Our initial sample size (i.e., the number of participants who completed the study protocol) was $N = 67$. We removed the data from four participants from our final analyses: one because they did not answer the questionnaires correctly and three because their BDI-II scores were > 30. Hence, the final N for data analysis was 63 (21 per condition). The primary analyses then proceeded across three discrete steps.

First, a series of one-way ANOVAs (for the continuous variables BDI-II total score, GAD-7 total score, and years of education completed successfully) and chi-squared tests (for the categorical variables sex and programme of registration) investigated the magnitude of between-condition differences for sample sociodemographic and clinical characteristics. At this step, we also computed a full set of descriptive statistics (e.g., measures of central tendency and dispersion) for each of the predictor and outcome variables. These descriptive statistics allowed some deeper insight into our dataset (e.g., indicated potentially problematic outliers) that might have been useful in considering the next analytic steps to take.

Second, two separate one-way ANOVAs investigated the success of the relaxation induction by analysing the magnitude of between-group differences in POMS-16 scores at baseline and then at the post-relaxation measurement point. Then, a series of paired-sample *t*-tests evaluated the success of our mood induction procedures by comparing, within each group, the POMS-16 score at the post-relaxation measurement point to that at the post-induction measurement point.

Third, a one-way ANOVA tested the study's major hypotheses by investigating the magnitude of between-group differences in post-induction observation period social scores.

Secondary Inferential Analyses

Two analyses examined whether smartphone activity immediately post-induction was different from participants' usual activity. First, a paired-samples *t*-test investigated the magnitude of difference between participants' Observation Period Social Score and Usual Social Score. Second, a Kendall's rank correlation test measured the association between Observation Period Social Score and STT-derived Social Score. We used this test because the latter variable could only take the value of -1 or +1 (Van Doorn et al., 2018).

Finally, we used the video footage data and one-way ANOVA to investigate between-group differences in the amount of time participants spent using their smartphones during the post-induction observation period.

Results

Sample Sociodemographic and Clinical Characteristics

Overall, the sample consisted of 12 men and 55 women; this ratio reflects the current demographics of the UCT Department of Psychology. By design, all participants were aged between 18 and 25 years and had successfully completed a minimum of 12 years of education (M = 14.75 SD = 1.08, range = 13–17). Most were registered for a Bachelor of Social Science (BSocSc) degree.

As Table 1 shows, the mood induction groups (negative, positive, neutral) were well matched for education, programme of registration, BDI-II score, and GAD-7 score. Regarding BDI-II score, the average for each group was in the range conventionally described as 'minimal depression' (Beck et al., 1996). Regarding GAD-7 score, the average for each group was in the range conventionally described as depicting 'mild anxiety symptoms' (Spitzer et al., 2006). The internal consistency of both the BDI-II and GAD-7 in the current sample was observed to be acceptable (Cronbach's α = .84 and .91, respectively).

As Table 1 also shows, analyses detected significant between-group differences with regard to sex distribution. Eight men were assigned to the positive mood induction group (38.10% of the total number assigned to that group), whereas only one man (4.76%) was assigned to the negative group and three (14.29%) to the neutral group.

Table 1

Sample Sociodemographic and Standardized Measures (N = 63)

	Mood Induction Condition						
	Negative	Positive	Neutral			95% CI	
Variable	(*n* = 21)	(*n* = 21)	(*n* = 21)	*p*	F/X²	LL	UL
Education [a]	15.05 (0.22)	14.76 (0.21)	14.43 (0.26)	0.18	1.78		
Females	20(95.24)	13(61.90)	18(58.71)	0.02*	8.03		
Programme [b]	19(90.48)	19(90.48)	19(90.48)	0.81	3.00	14.58	15.51
BDI-II	11.67 (1.75)	8.33 (1.13)	10.76 (1.78)	0.31	0.31	8.5	14.83
GAD-7	7.90 (1.1)	6.43 (0.84)	6.29 (1.12)	0.47	0.47	5.86	9.95

Note. For the variables *Age*, *Education*, *BDI-II*, and *GAD-7*, means are presented with standard deviations in parentheses. For the variables *Females* and *Programme*, frequencies (raw numbers) are presented with percentages in parentheses. BDI-II = Beck Depression Inventory-II; GAD-7 = General Anxiety Disorder-7; ESE = effect size estimate (for *F*, eta squared; for χ^2, Cramer's *V*); CI = confidence interval; LL = lower limit; UL = upper limit.

[a] Years completed successfully.

[b] Number of participants registered for the Bachelor of Social Science degree.

*$p < .05$.

Manipulation Check

The purpose of the relaxation period was to ensure that all participants were in a similar mood state before undergoing the mood induction manipulation. Analyses detected significant between-group differences in POMS-16 scores at baseline (i.e., before the participants were exposed to the relaxation period), $F(2, 60) = 3.80$, $p = .028$, $\eta^2 = .11$. There were, however, no such differences in POMS-16 scores at the post-relaxation measurement point, $F(2, 60) = 2.83$, $p = .067$, $\eta^2 = .09$. Hence, we can conclude that the relaxation period was successful in ensuring that participants, regardless of group assignment, were in generally the same mood state immediately before entering the induction manipulation.

Upon emerging from the relaxation period the sample's average POMS-16 score was -7.92 ± 8.84. This score indicates that, on average, participants were in a reasonably positive mood state. Note, however, that the high value of the standard deviation indicates great dispersion of scores.

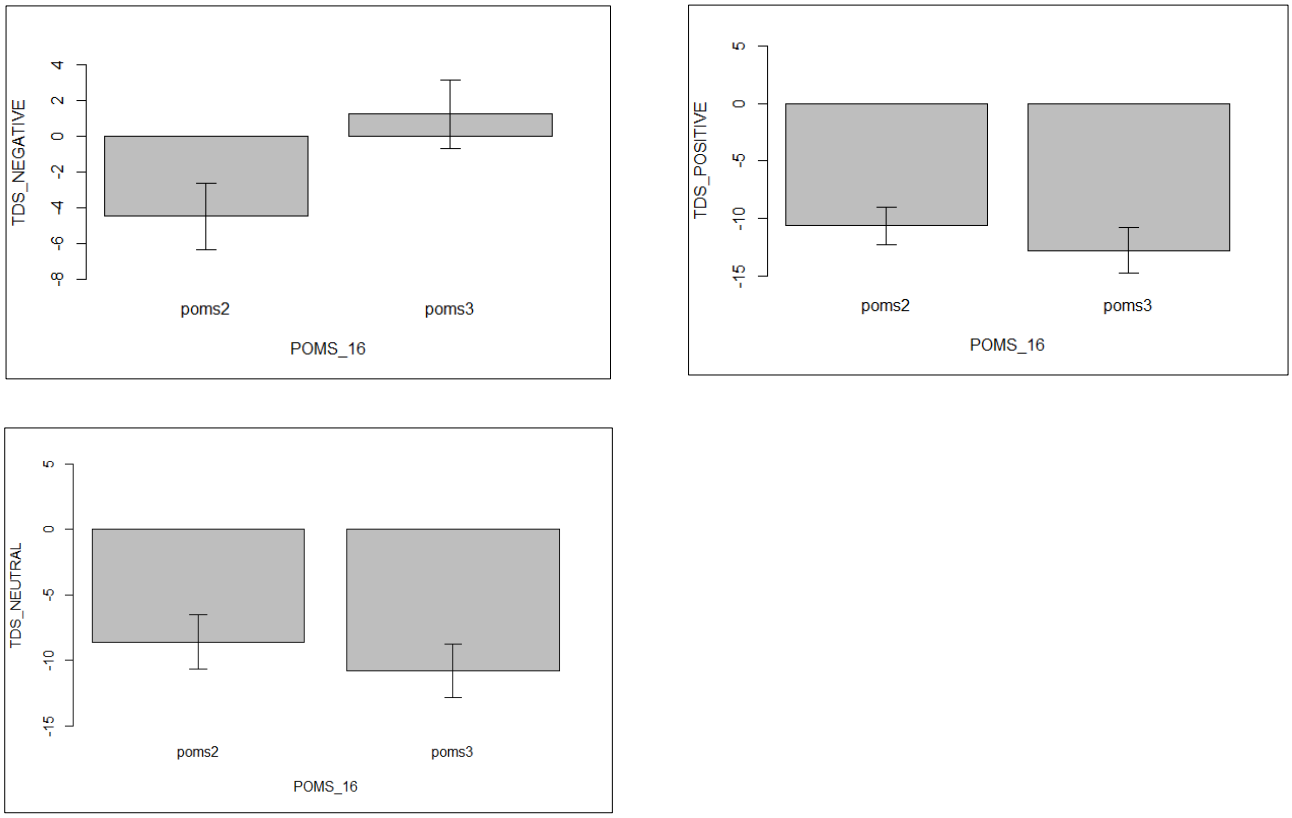
Analysis confirmed that both the positive, negative, and neutral mood inductions delivered the expected outcomes (see Figure 3). On average, participants assigned to the positive condition showed a significant reduction in Total Disturbance Score (TDS) from the post-relaxation / pre-induction measurement point ($M \pm SD$ = -10.67 ± 1.66) to the post-induction measurement point (-12.81 ± 1.97), p = .013, Cohen's d = 1.59. That is to say, mood in these participants was significantly better after the induction than before.

On average, participants assigned to the negative condition showed a significant increase in Total Disturbance Score (TDS) from the post-relaxation / pre-induction measurement point ($M \pm SD$ = -4.78 ± 1.86) to the post-induction measurement point (1.24 ± 1.90), $p < .001$, Cohen's d = -3.20. That is to say, mood in these participants was significantly worse after the induction than before.

On average, participants assigned to the neutral condition showed a significant reduction in Total Disturbance Score (TDS) from the post-relaxation / pre-induction measurement point ($M \pm SD$ = - 8.62 ± 2.09) to the post-induction measurement point (-10.81 ± 2.05), p = .027, Cohen's d = 1.06. That is to say, mood in these participants was significantly better after the induction than before (note, however, that the mean difference here is smaller than that in the positive mood induction condition).

Figure 3

Mood Induction Results: Change in POMS-16 Scores from Pre- to Post-Induction (N = 63)



Note. The upper left panel presents data from participants in the negative mood induction condition (*n* = 21). The upper right panel of the figure presents data from participants in the positive mood induction condition (*n* = 21). The lower left panel of the figure presents data from participants in the neutral mood induction condition (*n* = 21). TDS = Total Disturbance Score on the Profile of Mood States-16 (POMS-16; higher scores represent greater mood disturbance, i.e., more negative mood); poms2 = average score on the POMS-16 at the pre-induction / post-relaxation measurement point; poms3 = average score on the POMS-16 at the post-induction point. Error bars represent the upper and lower limit of the 95% confidence interval.

Primary Analyses

On average, participants in both the negative and positive mood induction conditions had similar Observation Period Social Scores; their scores were notably higher than those of participants in the neutral condition (see Table 2 and Figure 4). The omnibus ANOVA detected no significant between-group differences, however, and therefore no further pairwise comparisons were conducted.

Perusal of the descriptive data presented in Table 2 (specifically, the high standard deviation in comparison with the mean) indicates that the data were relatively widely

scattered around the mean. Figure 4 presents visual elaboration on these findings; of particular note there is that the error bars from the negative and positive induction conditions overlap substantially.

Table 2

Smartphone Activity Type During the Post-Induction Observation Period: Descriptive Statistics and Between-Group Comparisons (N = 63)

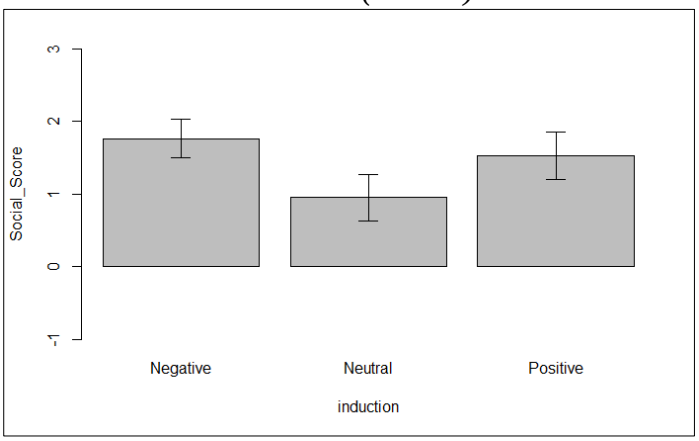
	Mood Induction Condition							
	Negative	Positive	Neutral				95% CI	
Social Score [a]	(*n* = 21)	(*n* = 21)	(*n* = 21)	*F*	*p*	ESE	LL	UL
Mean	1.76	1.52	0.95	1.85	.167	.06	1.15	2.37
Standard Deviation	0.27	0.33	0.31					
Range	-2–3	-3–3	-2–3					

Note. ESE = effect size estimate (in this case, partial eta squared); CI = confidence interval; LL = lower limit; UL = upper limit.

[a] To calculate this score, we noted which applications (up to a maximum of three) were reportedly used most heavily during the post-induction observation period. We then awarded a value of +1 to each social application (e.g., WhatsApp and Instagram) used and a score of -1 to each non-social application (e.g,. Vula and Ebook) used. So, for example, if a participant reported using only WhatsApp and Outlook during the observation period, their social score would be (+1) + (-1) = 0. Hence, higher scores indicate heavier use of social applications.

Figure 4

Smartphone Activity Type During the Post-Induction Observation Period: Data for Three Mood Induction Conditions (N = 63)



Note. There were 21 participants in each induction condition. To calculate the Social Score, we noted which applications (up to a maximum of three) were reportedly used most heavily during the post-induction observation period. We then awarded a value of +1 to each social application (e.g., WhatsApp and Instagram) used and a score of -1 to each non-social application (e.g,. Vula and Ebook) used. So, for example, if a participant reported using only WhatsApp and Outlook during the observation period, their social score would be (+1) + (-1) = 0. Hence, higher scores indicate heavier use of social applications. Error bars represent the upper and lower limit of the 95% confidence interval.

Because there was an uneven sex distribution across the three induction conditions, we re-ran the analyses after removing all male datasets. This sensitivity analyses also detected no significant between-group differences, $p = .149$ (see Appendix T).

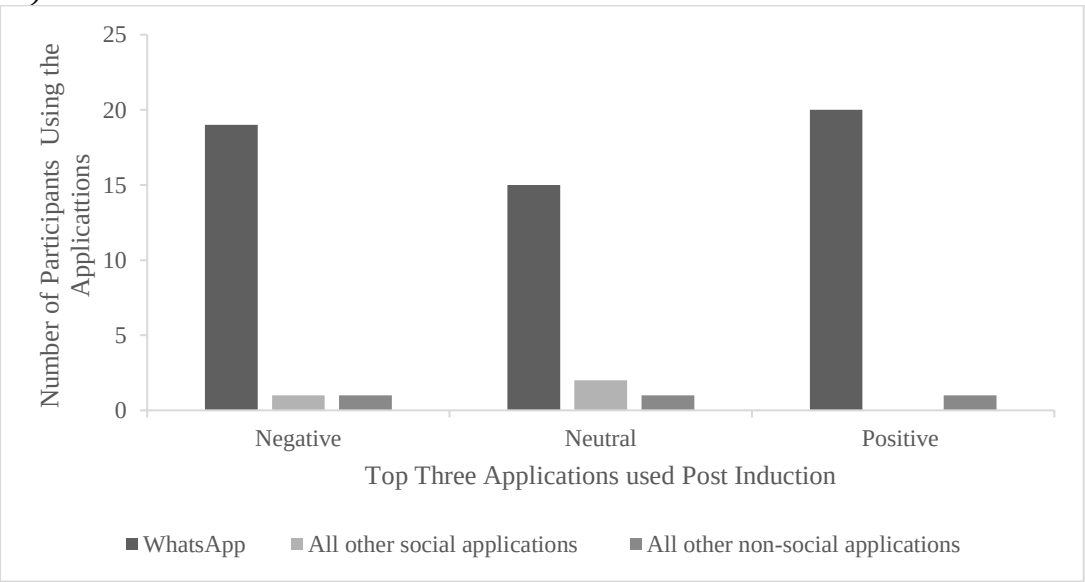
In summary, these findings indicate that we cannot reject the null hypothesis and therefore cannot confirm that either (a) a positive mood state leads to more use of social applications, or (b) a negative mood state leads to more use of non-social applications.

Secondary Analyses

Figure 5 presents within-group data regarding the applications used most heavily during the post-induction observation period. Clearly, the social application WhatsApp was used most frequently by participants in all groups.

Figure 5

Smartphone Activity During the Post-Induction Observation Period: Self-Report Data Regarding Most Frequently Used Applications for Three Mood Induction Conditions (N = 63)



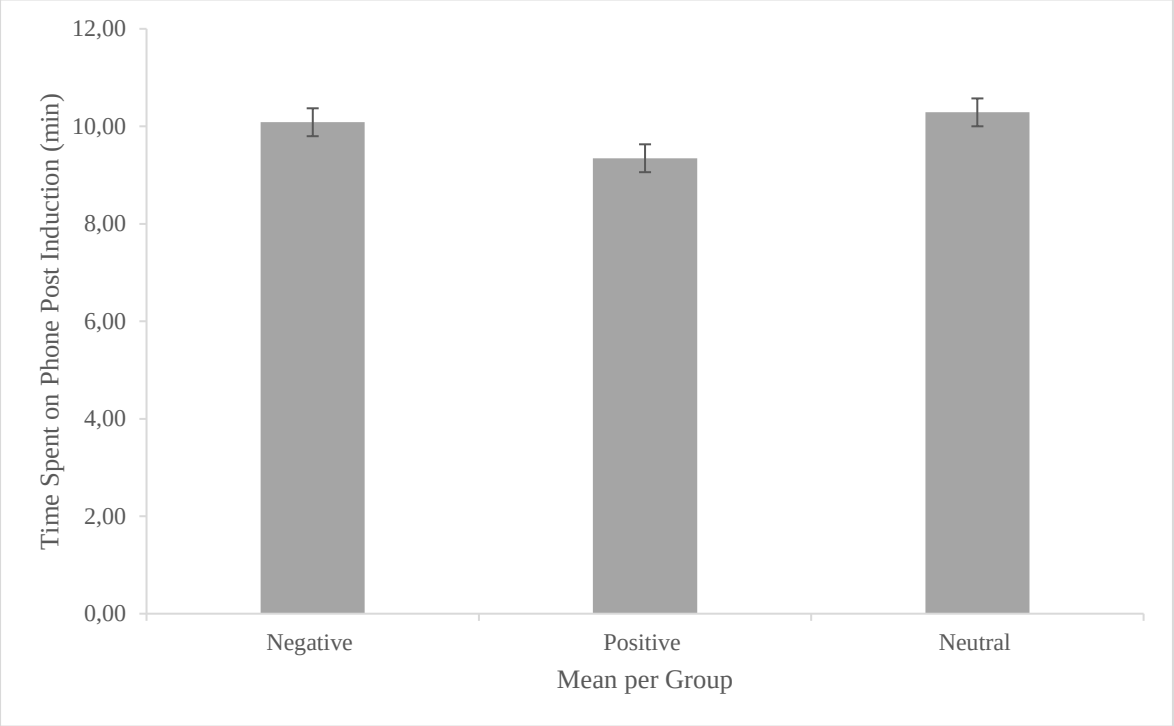
Note. Data are for raw numbers of participants who reported using the particular application/ category of application. Total observation time was 12.5 mins. Sample sizes for each induction condition were $n_{negative} = n_{positive} = n_{neutral} = 21$.

Analyses detected (a) significant difference between Observation Period Social Score and Usual Social Score, $t(62) = 2.06$, $p = .044$, Cohen's $d = .32$ and (b) no significant

association between Observation Period Social Score and STT-derived Social Score, Kendall's $\tau = .1.49$, $p = .136$. Analyses also detected no significant between-group differences in the time participants spent using their smartphones during the post-induction observation period, $F(2, 60) = 0.29$, $p = .749$, $\eta^2 = .01$. As Figure 6 shows, on average participants in all three groups spent approximately 10 minutes of the 12.5-minute observation period using their smartphone (overall, for the sample, $M \pm SD = 9.95 \pm 2.67$ mins).

Figure 6

Total Time Spent Using Smartphone During the Post-Induction Observation Period: Data for Three Mood Induction Conditions (N = 63)



Note. Total observation time was 12.5 mins Error bars represent the upper and lower limit of the error and is an indication of statistical significance. For the negative mood induction condition ($n = 21$), $M \pm SD = 10.08 \pm 2.52$ mins; for the positive condition ($n = 21$), 9.34 ± 2.87; for the neutral condition ($n = 21$), 10.29 ± 2.91.

Discussion

Our study's primary objective was to investigate the impact of mood states on smartphone use. We hypothesised that laboratory-based induction of positive mood (via a film clip)

would result in tendencies toward using social applications (e.g., Instagram), whereas similar induction of negative mood would result in tendencies toward using non-social applications (e.g., YouTube). To test these hypotheses, we recruited a sample of healthy undergraduate psychology students (N = 63; age range 18–25) and randomly assigned one-third of them to a positive mood induction condition, another third to a negative mood induction group, and the rest to a neutral mood induction condition. After the induction, all participants were exposed to a 12.5-min waiting period at the beginning of which they were implicitly encouraged to use their smartphones. During this waiting period, we observed their behaviour in real time and also videotaped them. We used a self-report questionnaire (the Profile of Mood States-16 [POMS-16]; Petrowski et al., 2021) to track participants' mood state from pre- to post-induction, and a study-specific smartphone use questionnaire to enquire about which applications they had used during the waiting/observation period.

Analyses of the sample's sociodemographic and clinical characteristics suggested that the three condition-based groups were well matched on education, degree programme, and current mental health. Although there was an unequal distribution of men and women across groups (eight men were assigned to the positive mood induction condition, whereas only one and three were assigned to the negative and neutral conditions, respectively), sensitivity analyses that removed all male data from the sample indicated that the overall results from our hypothesis tests remained the same as when those data were included. Furthermore, data from the Beck Depression Inventory-II (BDI-II) and the General Anxiety Disorder-7 (GAD-7) questionnaires indicated that, on average, participants in all three groups reported minimal levels of depression and anxiety symptomatology. Hence, we are confident that our findings and interpretations were not confounded by either (a) between-group differences in sociodemographic and clinical characteristics or (b) severe psychological distress within the sample.

Manipulation Check

Analyses indicated that both the positive and negative mood induction conditions were effective in the expected directions (i.e., those assigned to the former condition reported significantly more positive mood post-induction compared to pre-induction, whereas those assigned to the latter condition reported significantly more negative mood post-induction compared to pre-induction). Of note, however, is that the effect was stronger for the negative condition. This finding is consistent with those reported in previous studies in the psychological literature (see Valenti et al., 2021; Westermann et al., 1996).

Although we therefore expected this discrepancy in the effects of the negative versus the positive mood induction, we attempted to minimize it by using a consistent instructional dialogue across conditions so as to reduce demand characteristics; these are known to be a modulating factor in mood induction procedures (Falkenberg et al., 2012). Specifically, we avoided asking participants to achieve a certain mood: Prior to screening the film clips, we gave each group identical instructions and exposed them to as identical as possible environmental conditions. This approach is well established in the literature and recommended as a possible way to control for the confound of demand characteristics that might increase discrepancies between the effects of negative and positive mood inductions (Westermann et al., 1996)

Tests of the Major Hypotheses

As noted above, our primary hypotheses were that induction of positive mood would result in tendencies toward using social applications (e.g., Instagram), whereas induction of negative mood would result in tendencies toward using non-social applications (e.g., YouTube). To test that hypothesis, we used a distinction provided by van Deursen and

colleagues (2015) to categorise smartphone applications as being either social or non-social in nature. Within this framework, social applications are platforms providing a service that allows for social networking (Lopez-Fernandez et al., 2013); examples of such applications are WhatsApp, Instagram, and Twitter. In contrast, non-social applications do not encourage interaction, but instead support the creation, curation, consumption, and/or sharing of visual or audio material; examples of such applications are Pinterest, Apple Podcasts, or Spotify. Using this distinction allowed us to create a variable (Observation Period Social Score) reflecting the degree of social / non-social application use during the post-induction observation period.

Subsequent analyses of those data indicated there were no significant between-group differences with regard to social score (i.e., participants, regardless of the experimental condition to which they had been assigned, used similar kinds of applications). Hence, we did not confirm either of our primary hypotheses.

During the post-induction observation period, and for participants in all three groups, WhatsApp was the most frequently used smartphone application. This was confirmed by our subjective measure (the self-report Phone Use Questionnaire) which provided an account of the most used applications during the study's observation period as well as the objective (the iOS screentime tracker [STT]) which reported on the three most frequently engaged applications over the past 24 hours. This finding is consistent with nationwide statistics indicating that WhatsApp is the most popular smartphone application in South Africa (Galal, 2022). However, although the participants' subjective reports regarding their smartphone activity during the observation period (and even the objective data recorded by the iOS screentime tracker) can inform us *which* smartphone applications were used, they do not allow us to determine *what* they were doing when using the applications.

Smartphone behaviour is nuanced. Although an application such as WhatsApp may be primarily social in nature, one can interact on it in a non-social way (e.g., by passively watching WhatsApp stories as opposed to actively messaging). Some studies have explored this active-passive distinction with regard to Facebook, finding that passive Facebook reduces levels of subjective well-being (Verduyn et al., 2015) whereas 10 minutes of active Facebook use left participants feeling the same or better than before (Kross et al., 2015).

However, not many studies have followed this lead. We suggest that a focus for future research on what exactly participants do *within* a smartphone application will provide a richer understanding of how smartphone use affects, and is affected by, emotional states.

We also speculate that our non-significant finding (i.e., no significant between-group differences in smartphone activity during the post-induction observation period) might be attributed to the fact that smartphones are often used by individuals to relieve pain or escape reality (Huisman et al., 2000), and that such regular and repetitive behaviour – even unconsciously – may then result in habitual use (Park et al., 2021). Habitual smartphone use (e.g., automatically unlocking one's device to look for notifications) occurs without self-instruction (Oulasvirta et al., 2011), and (notably given the current results) develops even faster when the device is used for social purposes (Wickord & Quaiser-Pohl, 2022).

Habitual use is further strengthened by the range of activities offered by the smartphone. Smartphone use meets the need for information (i.e., learning or seeking advice), the need for entertainment (i.e., escapism or relaxation), the need for personal identity (i.e., seeking models of behaviour), and the need for integration (i.e., a substitute for conversation or sociability) (Van Deursen, 2015). When these needs are met regularly, the individual's neuronal reward pathways are activated, thus strengthening the habit (Rush, 2011).

Habitual smartphone use has a positive social feature in that it allows for automatised action, but it can also become maladaptive when it interferes with other acts e.g., inappropriate use of a smartphone during a meeting and lecture.

Additional Analyses

Secondary analyses of our data (i.e., analyses not related specifically to the hypotheses of primary interest) examined whether smartphone activity during the post-induction observation period differed from participants' usual smartphone activity. The analyses indicated that there was significant difference between participants' Observation Period Social Score and the Usual Social Score (derived from their subjective report, Phone Use Questionnaire). Whilst not significant, the social score post-induction reflected that participants tended to engage more social applications during the observation period than usually would on another day.

The finding of a significant discrepancy in these two social scores might be explained by participants finding it difficult to accurately recall behaviour from previous days, while recalling more accurately behaviour from just a few minutes before. This may be due to time-based degradation of memory traces which, according to the temporal decay hypothesis, occurs with the passage of time and results in forgetfulness (Brown, 1958). In particular, memories with little emotional valence – such as smartphone behaviour – are at an even higher risk of memory decay as they lack a subjective vividness; it is a heightened emotional response which enables individuals to recall past events with great detail i.e., 'flashbulb memory' (Kensinger, 2009).

Finally, participants spent an average of 9.57-min of the total 12.5-min post-induction observation period using their smartphone. Sixty of the 63 participants engaged with a social application for at least part of this time. Here again we return to the speculation that

smartphone use may be deeply engrained in habit which would make it exceptionally challenging to alter their usage behaviour via a short-term mood induction.

Limitations and Directions for Future Research

The following limitations might constrain the inferences one might draw from the study's findings. First, the sample was not evenly distributed in terms of sex/gender: More than 80% of our participants were women. Although previous literature suggests there should not be significant sex differences in terms of the effects of mood induction, and although sensitivity analyses indicated that our pattern of results held when male data were excluded, future studies in this field should endeavour to recruit equal numbers of men and women; this suggestion stems from the fact that there are significant associations between sex and mood (e.g., women are more likely to be diagnosed with generalised anxiety disorder, social anxiety disorder and post-traumatic stress disorder, whereas men more often diagnosed with major depressive disorder (Rainville & Hodes, 2018), therefore recruiting an equal amount of men and women would ensure that the strength of the observed effects are not confounded by sex differences in response to the induction (Seney, 2014).

Second, there was no objective marker of *what* participants did on their smartphone during the observation period. The iOS STT was able to provide information about (a) participants' true screentime over the past 24 hours and (b) the most frequently engaged smartphone application during this period, but it was not capable of delivering details about what participants did within these applications (e.g., whether they were engaging with previously posted content, posting original content, or simply scrolling). Future studies in this field should develop an objective measure to describe the types of activities (at the broadest level, active versus passive) in which participants engage on their smartphones; simply giving the names of the applications and the category (social, entertainment, productivity and

finance) into which they might fall is no longer sufficient. Although these categories are both necessary and helpful, a deeper account is required to truly understand smartphone behaviour and its relationship with mood.

Summary and Conclusion

The manipulation check indicated that both the negative and positive mood induction conditions were statistically successful in altering our participants' mood. However, primary inferential analyses revealed that, on average, participants in both of these induction conditions used social and non-social applications similarly; therefore, we failed to reject the null hypothesis. These findings suggest that altering smartphone behaviour in the short-term is challenging because smartphone use tends to be habitual. This use can become maladaptive and can, unintentionally, have adverse effects on both online and offline behaviour. However, although habitual smartphone behaviour might be excessive and impulsive in nature, it differs from addictive smartphone behaviour in that it can be altered. Ludwig et al. (2020) note that self-awareness is a driver of behaviour change, and hence on implication of this study's findings is that they turn the attention of future research to (a) describing how prevalent habitual smartphone use is, (b) examining how such use develops, and, ultimately, (c) designing interventions that might combat such use and thus ensure a healthier relationship between the smartphone user, the applications with which they engage, and their broader online and offline environments. Finally, future research should endeavour to investigate *what* participants do within smartphone applications to allow for a deeper, more nuanced understanding of smartphone behaviour.

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Appendix A

Invitation to Participate in the Study

Subject: Get 2 SRPP points for your participation in a cyberpsychology study.

Organizers: Jess Henn and Morgane Vercruysse

We are two students currently completing Honours degrees in the UCT Department of Psychology. Our research investigates different types of smartphones use among young adults. We hope we can motivate you to participate in this exciting project.

To participate in this study, you need to:

(a) be a registered UCT student
(b) have no history of either common mental disorders (e.g., generalised anxiety disorder, major depressive disorder) or serious psychological, psychiatric, or neurological disorders (e.g., any psychotic disorder, obsessive-compulsive disorder, epilepsy)
(c) own an iPhone with software update iOS10 or later

If you meet the above criteria and would like to participate in our study, please email us at cyberpsychresearch22@gmail.com. If we determine that you are eligible for the study, we will contact you to discuss the experiment and what you can expect. This experiment will be as follows.

- We will send you an email where you can decide which slot you would like to participate in (you will be able to choose between eight different hour-long time slots).
- You will be invited to a research laboratory within the Department of Psychology and will be asked to remain with us to complete the study procedures.
- During the experiment, we will ask you to complete a few questionnaires and to view some film clips.

If you have any questions, please feel free to email us at cyberpsychresearch22@gmail.com.

All the best and looking forward to meeting you.

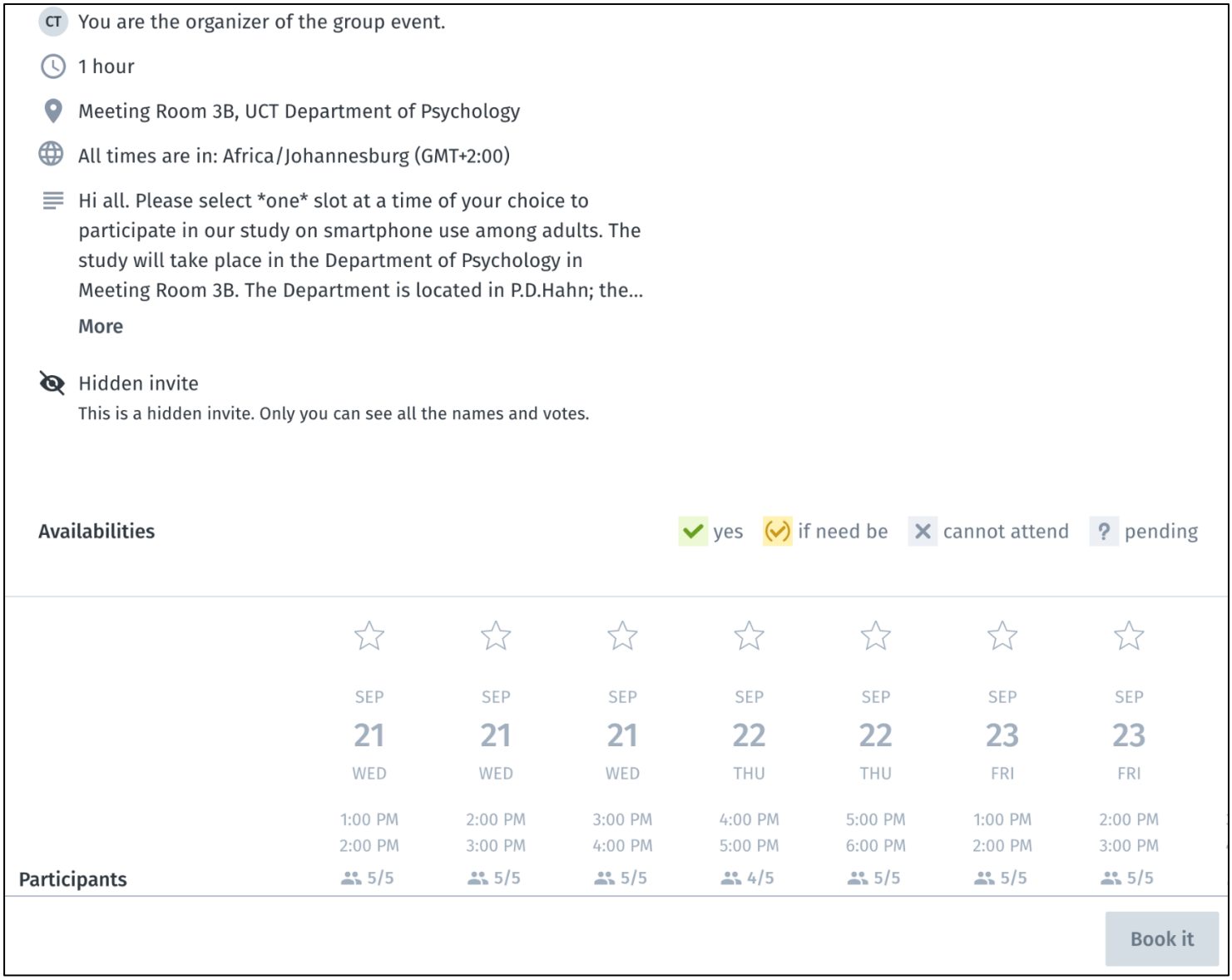
Jessica and Morgane

Psychology Honours Students

****

Appendix B

Example of Doodle Booking Sheet



Appendix C

Document for SRPP points

Smartphone Use Study: Participant List

Student number:	Date:	Course code:	Signature:	Uploaded:

Appendix D

Consent Form

Study title: Personality Traits Among UCT Students.

What is this study about?

We aim to investigate specific personality traits which exist among university students. This study is conducted by a research team at the University of Cape Town (UCT).

Who can participate in this study?

To participate in this study, you need to:

(a) be a registered UCT student

(b) have no history of either common mental disorders (e.g., generalised anxiety disorder, major depressive disorder) or serious psychological, psychiatric, or neurological disorders (e.g., any psychotic disorder, obsessive-compulsive disorder, epilepsy)

(c) own an iPhone with software update iOS10 or later

What will happen if you participate in this study?

Should you agree to participate in this project, you will receive an email listing eight possible laboratory session slots. Once you have selected your slot, you will be invited to one of the research laboratories located in the UCT Department of Psychology. In the laboratory, you will be asked to respond to a few questionnaires pertaining to the aims of the study. The study procedures will take approximately 1 hour to complete. At the end of the experiment, you will be debriefed.

What will happen to the information you give us?

The information that is shared will always be kept confidential. To guarantee anonymity, neither names nor contact details will be recorded. Instead, your identification will be documented using your UCT student number. Once you have completed study participation, your information will be assigned to a random participation ID number. This information will only be accessible by the research team and will be secured online with two-factor authentication.

Are there any costs or benefits involved in participation?

There aren't any costs involved to participate in this study nor will participation involve any social, physical, or psychological risk. At the completion of the experiment, you will receive 2 Student Research Participation Program (SRPP) points.

Do you have to participate in this study?

Participation in this study is not compulsory. If you choose to participate, you will be invited to the Department to be involved in the experiment. Only after signing the consent form will the experiment commence. If you wish to withdraw at any stage of this study, you are free to do so without providing any reason. At this point, you can decide whether we may keep the information provided to that point or not. Should you withdraw from this study prematurely, no SRPP points will be awarded.

What if you have questions about the study?

Should you have any questions regarding this study, please email us at cyberpsychologyhonours22@gmail.com. You may also contact the supervising researcher, Prof. Kevin Thomas, at kevin.thomas@uct.ac.za. Finally, if you wish to contact a representative of UCT's Department of Psychology, please telephone or email Ms Rosalind Adams (021 650 3417; rosalind.adams@uct.ac.za).

Appendix E

Informed Consent Comprehension Questionnaire

Do you understand what the experiment will entail?.....YES/NO

Do you understand your role and responsibilities during the experiment and data collection procedure?.....YES/NO

Do you understand that your data and identification will be kept confidential and anonymous?.....YES/NO

Do you have any other question regarding the research process, the experiment, the data collection?.....

Do you have any questions regarding the informed consent?.....

Do you understand that participation in this project is voluntary and that you have the right to withdraw from the research process at any given point without negative consequences or justification?.....YES/NO

Participant signature and date

.....

Appendix F

Sociodemographic Questionnaire

Instructions : Please fill in

1. Sex/gender? .....
2. Year of first registration at UCT? .....
3. What program are you enrolled in at UCT?.....
4. Which year of your degree are you currently in? .....
5. Have you ever been diagnosed with a psychological, psychiatric, neurological, or learning disorder?.....
    a. If yes, which one?.....

Appendix G

Link to Relaxation and Neutral Mood Induction Audio Track

https://www.youtube.com/watch?v=AKy6Jx59fis

Appendix H

Beck Depression Inventory-II (BDI-II)

This 21-item self-report questionnaire (Beck et al., 1996) was developed to measure the intensity and depth of depressive symptoms experienced by the reporting individual over the previous 2 weeks. Each item's response is awarded a score of 0, 1, 2, or 3; higher numbers reflect greater intensity and/or depth of the responding individual's symptom severity. Hence, total score can range from 0–63, with interpretation as follows: scores from 0–9 indicate no or minimal depression; 10–18 indicate mild-to-moderate depression; 19–29 indicate moderate-to-severe depression; and scores ≥30 indicate severe depression (Beck et al., 1996).

Regarding basic psychometric properties, the BDI-II has high internal consistency reliability, ranging from .73 to .92 with a mean of .86, among both psychiatric and non-psychiatric populations (Beck et al., 1996). Furthermore, test-retest reliability ranges from .73 to .96 (Wang & Gorenstein, 2013).

Regarding cross-cultural use, the BDI-II has been translated into 17 languages and is used globally (Wang & Gorenstein, 2013). Makhubela and Mashegoane (2016) concluded that the BDI-II is a reliable (Cronbach's $\alpha = .84$) and valid measure of depressive symptomatology among South African university students.

Beck Depression Inventory-II (BDI-II)

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully. And then pick out the one statement in each group that best describes the way you have been feeling during the past two weeks, including today. Circle the number beside the statement you have picked.

1. 0 I do not feel sad.
   1 I feel sad.
   2 I am sad all the time and I can't snap out of it.
   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 discouraged about the future.
   2 I feel I have nothing to look forward to.
   3 I feel the future is hopeless and that things cannot improve.

3. 0 I do not feel like a failure.
   1 I feel I have failed more than the average person.
   2 As I look back on my life, all I can see is a lot of failures.
   3 I feel I am a complete failure as a person.

4. 0 I get as much satisfaction out of things as I used to.
   1 I don't enjoy things the way I used to.
   2 I don't get real satisfaction out of anything anymore.
   3 I am dissatisfied or bored with everything.

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 don't feel disappointed in myself.
   1 I am disappointed in myself.
   2 I am disgusted with myself.
   3 I hate myself.

8. 0 I don’t feel I am any worse than anybody else.
   1 I am critical of myself for my weaknesses or mistakes.
   2 I blame myself all the time for 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 all the time now.
   3 I used to be able to cry, but now I can't cry even though I want to.

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 can work about as well as before.
   1 It takes an extra effort to get started at doing something.
   2 I have to push myself very hard to do anything.
   3 I can’t do any work at all.

16. 0 I can sleep as well as usual.
   1 I don’t sleep as well as I used to.
   2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
   3 I wake up several hours earlier than I used to and cannot get back to sleep.

17. 0 I don’t get more tired than usual.
1 I get tired more easily than I used to.
2 I get tired from doing almost anything.
3 I am too tired to do anything.

18. 0 My appetite is no worse than usual.
1 My appetite is not as good as it used to be.
2 My appetite is much worse now.
3 I have no appetite at all anymore.

19. 0 I haven’t lost much weight, if any, lately.
1 I have lost more than 2.5 kg.
2 I have lost more than 5kg.
3 I have lost more than 7.5kg.

20. 0 I am no more worried about my health than usual.
1 I am worried about physical problems like aches, pains, upset stomach, or constipation.
2 I am very worried about physical problems and it's hard to think of much else.
3 I am so worried about my physical problems that I cannot think of anything else.

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 have almost no interest in sex.
3 I have lost interest in sex completely.

Appendix I

Generalised Anxiety Disorder 7-item Survey

This self-report questionnaire is a rapid screen for symptoms of generalised anxiety disorder (GAD; Spitzer et al., 2006). It asks respondents to reflect on the degree to which they have experienced particular symptoms of anxiety over the previous 2 weeks. Response options are 'not at all', 'several days', 'more than half the days', and 'nearly every day', with a score of 0, 1, 2, or 3 assigned, respectively. Total score for the seven questions is summed and interpreted as follows: 0–4, minimal anxiety; 5–9, mild anxiety; 10–14, moderate anxiety; and 15–21, severe anxiety. Any individual reporting severe anxiety will be excluded from participation.

The GAD-7 has robust psychometric properties. Using a threshold score of 10, it has a sensitivity of 89% and a specificity of 82% for GAD. It also performs quite well at screening for three additional anxiety disorders: panic disorder (sensitivity 74%, specificity 81%), social anxiety disorder (sensitivity 72%, specificity 80%), and post-traumatic stress disorder (sensitivity 66%, specificity 81%; Kroenke et al., 2007).

The GAD-7 has been used successfully in a number of different countries. For instance, Kageyama et al. (2021) reported that it had a high internal consistency (Cronbach's $\alpha = 0.90$–0.92) when used in a Japanese sample of 32 undergraduate students. In South Africa, Bezuidenhout (2018) used exploratory and confirmatory factor analyses to investigate the validity of the GAD-7 in a sample of 644 healthy employed adults and concluded that the instrument has great promise in measuring GAD in the South African working population.

Generalised Anxiety Disorder 7-item Survey

Instructions: Over the last few weeks, how often have you been bothered by the following problems? Circle the number beside the statement you have picked.

1. Feeling nervous, anxious or on edge

0 Not at all
1 Several days
2 More than half the days
3 Nearly every day

2. Not being able to stop or control worrying
   0 Not at all
   1 Several days
   2 More than half the days
   3 Nearly every day

3. Worrying too much about different things
   0 Not at all
   1 Several days
   2 More than half the days
   3 Nearly every day

4. Trouble relaxing
   0 Not at all
   1 Several days
   2 More than half the days
   3 Nearly every day

5. Being so restless that it is hard to sit still
   0 Not at all
   1 Several days
   2 More than half the days
   3 Nearly every day

6. Becoming easily annoyed or irritable
   0 Not at all
   1 Several days
   2 More than half the days
   3 Nearly every day
7. Feeling afraid as if something awful might happen
   0 Not at all
   1 Several days
   2 More than half the days
   3 Nearly every day

Appendix J

Profile of Mood States Questionnaire

This standardised self-report questionnaire is widely used in psychological research to measure the current mood state(s) of participants. The original version of the POMS is a 65-item inventory that measures six elements of the mood construct (viz., Tension or Anxiety, Anger or Hostility, Vigor or Activity, Fatigue or Inertia, Depression or Dejection, Confusion or Bewilderment; Terry et al., 2003) using a 5-point Likert scale, with response options ranging from 0 ("not at all") to 4 ("extremely"). A Total Mood Disturbance (TMD) score is then calculated by summing the totals for the negative subscales (viz., tension, depression, fatigue, confusion, and anger) and then subtracting the totals for the positive subscales (viz., vigour and esteem-related affect).

Regarding psychometric properties, the measure has been shown to have a high reliability (Cronbach's $\alpha = .80$) (Grove & Prapavessis, 1992). Regarding cross-cultural use, the POMS has been translated into a number of languages, including Spanish, German, Arabic, Japanese, and Korean. Studies of those translated versions report values for internal consistency reliability, and for criterion and content validity, that are similar to one another and to the development studies (van Wijk, 2011).

Notably, researchers have, for many years, expressed concern about the length of the POMS. Consequently, efforts have been made to shorten it while maintaining its validity and usefulness (van Wijk, 2011). Therefore, in the current study, we will use a recently validated 16-item version (Petrowski et al., 2021). This abbreviated instrument is, like several other abbreviated forms, suitable for research administration in studies that require investigation of short-term psychological states. Its psychometric properties, including comparison to a previously developed 35-item version, were piloted on a sample of 977 community-dwelling German adults.

Profile of Mood States, Abbreviated Version (POMS-16)

Below is a list of words that describe feelings people have. Please circle the number that best describes how you feel right now.

	Not at all	A little	Moderately	Quite a lot	Extremely
Tense	0	1	2	3	4
Angry	0	1	2	3	4
Fatigued	0	1	2	3	4
Unhappy	0	1	2	3	4
Confused	0	1	2	3	4
Sad	0	1	2	3	4
On-edge	0	1	2	3	4
Ashamed	0	1	2	3	4

	Not at all	A little	Moderately	Quite a lot	Extremely
Proud	0	1	2	3	4
Lively	0	1	2	3	4
Energetic	0	1	2	3	4
Competed	0	1	2	3	4
Confident	0	1	2	3	4
Full of Pep	0	1	2	3	4
Well rested	0	1	2	3	4
Content	0	1	2	3	4

Appendix K

Link to Negative Mood Induction Clip

https://www.youtube.com/watch?v=WuH__IGnovA&t=3s

Appendix L

Link to Positive Mood Induction Clip

https://www.youtube.com/watch?v=RXzs9FzN-Jg

Appendix M

Behavioural Coding Key

Category	Behaviour
Time to phone (Measured in minutes)	How long it takes the participant to start using their phone?
Phone Use (Measured in minutes)	Actively using phone, engage in behaviours such as: - Scrolling - Typing - Watching screen - Taking pictures
Non-phone Use (Measured in minutes)	Engage in behaviours such as: - Looking around - Swinging on chair - Fidgeting with pen - Looking through the questionnaire booklet - Resting/sleeping - Staring blankly - Drinking a beverage

Appendix N

Phone Use Questionnaire

It is now _____ (record current time) on _____ (record day)

1. What do you usually do on your phone at this time of day on a normal weekday?

   .....

2. How many hours on average do you use your phone each day?

   .....

3. During the last 20 minutes, how many minutes did you spend on your phone? Please circle the appropriate number on the timeline below.

   0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 min

4. During the last 20 minutes, which applications did you use? You may tick as many boxes as necessary.
   - o WhatsApp
   - o Instagram
   - o Facebook
   - o TikTok
   - o Twitter
   - o Emails
   - o YouTube
   - o Other: _____

Appendix O

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. Please feel free to ask me any questions that you have as you read the form. 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 complete, 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 will provide you with email and telephone contact details should any of those questions arise after your participation is concluded. 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

This study is being conducted in pursuit of a better understanding of how one's mood state impacts smartphone use. We used a film clip to induce a particular mood state to observe whether you deviate from your usual smartphone behaviour. Should we yield significant findings, we hope to use this to inform health and wellness applications and interventions.

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. 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.

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 accurate. 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 the researchers at **cyberpsychresearch22@gmail.com,** or you may contact 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 Department of Psychology's 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.

_____

Participant Name

_____ _____

Participant Signature Date

Appendix P

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

19 July 2022

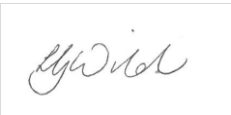
Jessica Henn and Morgane Vercruysse
Department of Psychology
University of Cape Town
Rondebosch 7701

Dear Jessica and Morgane

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, *Short-Term Effects of Induced Mood on Smartphone Use*. The reference number is PSY2022-026.

I wish you all the best for your study.

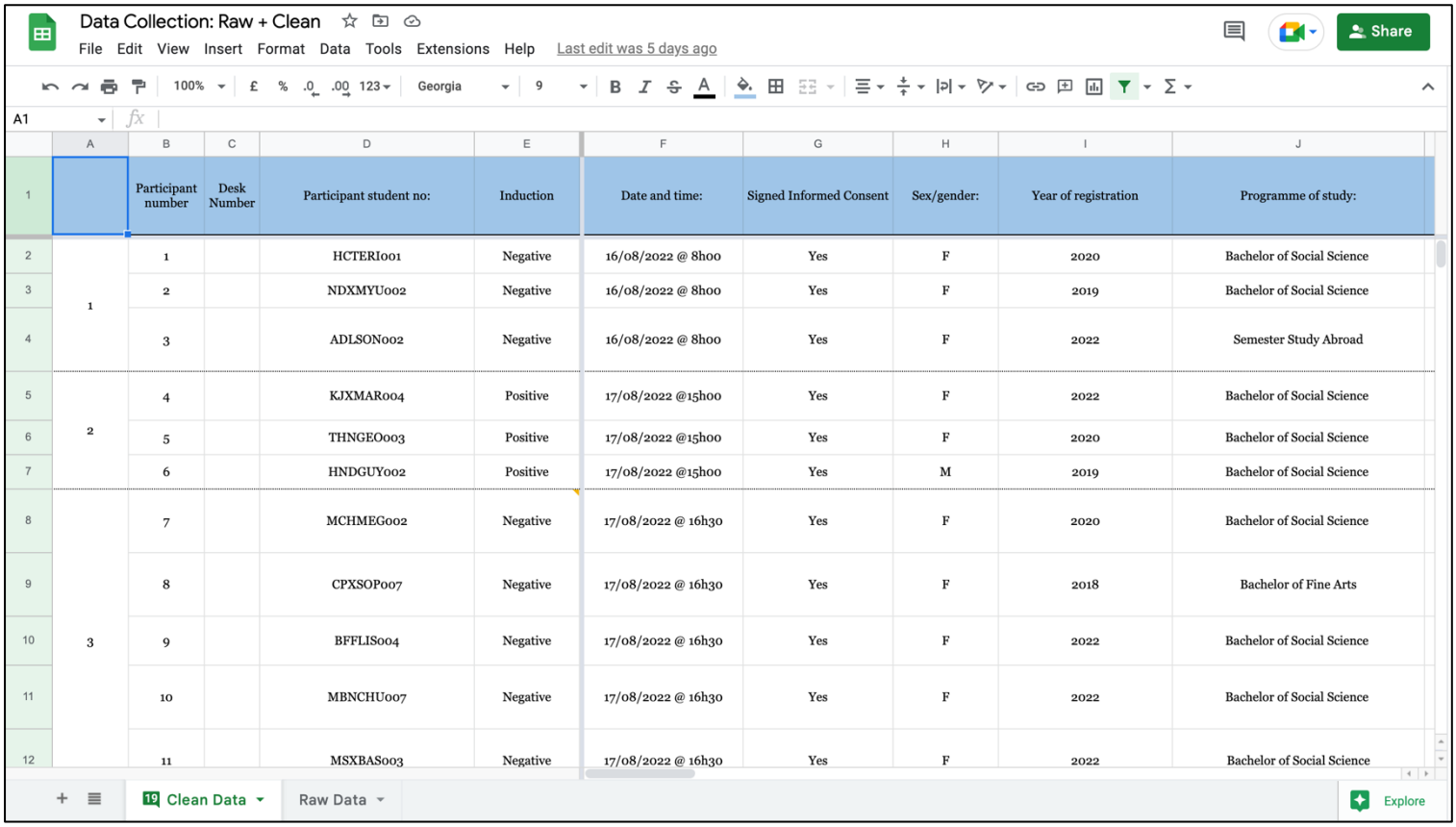
Yours sincerely



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

Appendix Q

Screenshot of Google Sheet Used to Capture Questionnaire Data



Data Collection: Raw + Clean

File Edit View Insert Format Data Tools Extensions Help Last edit was 5 days ago

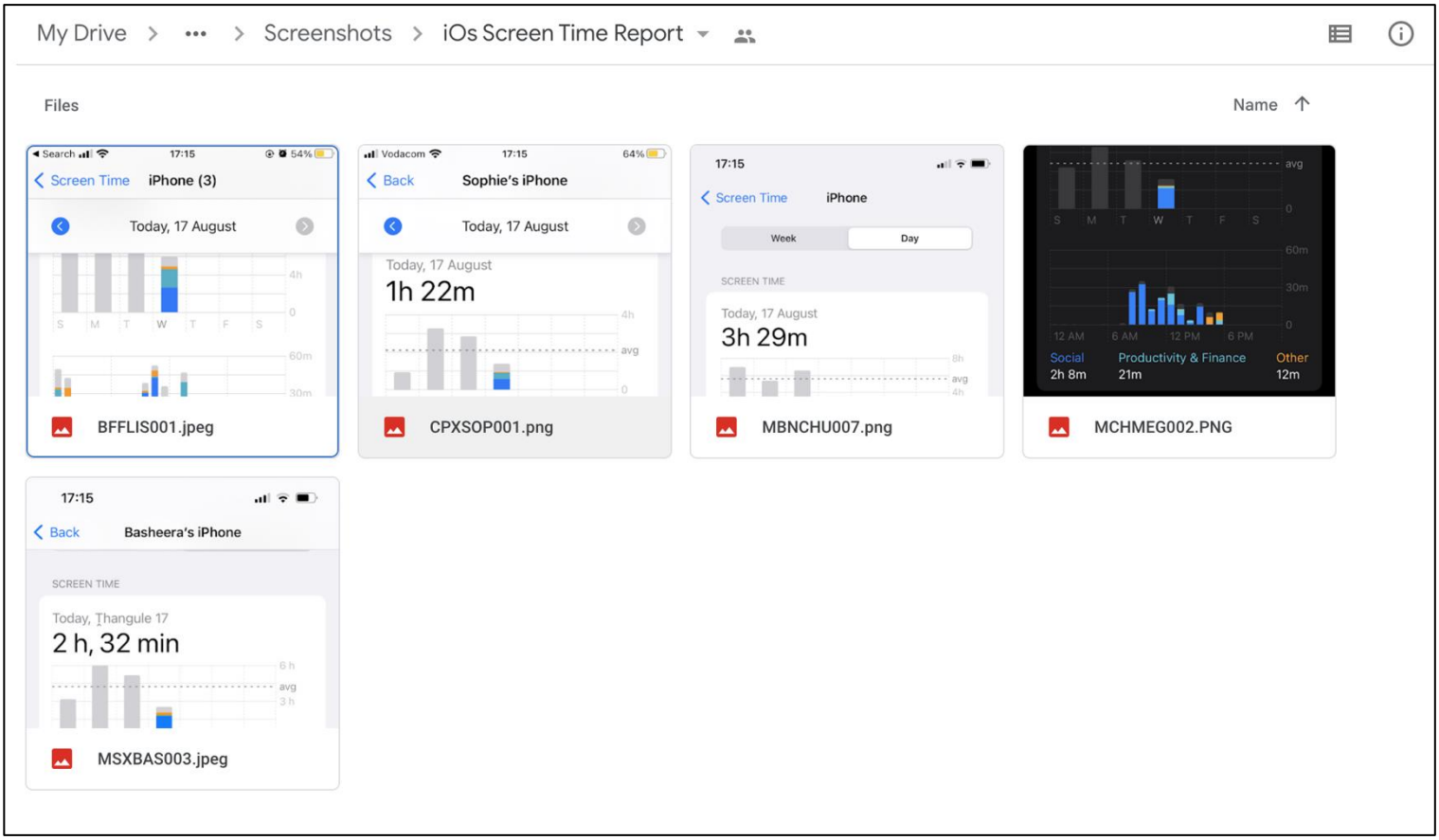
Share

		Participant number	Desk Number	Participant student no:	Induction	Date and time:	Signed Informed Consent	Sex/gender:	Year of registration	Programme of study:
2	1	1		HCTERI001	Negative	16/08/2022 @ 8h00	Yes	F	2020	Bachelor of Social Science
3		2		NDXMYU002	Negative	16/08/2022 @ 8h00	Yes	F	2019	Bachelor of Social Science
4		3		ADLSON002	Negative	16/08/2022 @ 8h00	Yes	F	2022	Semester Study Abroad
5	2	4		KJXMAR004	Positive	17/08/2022 @15h00	Yes	F	2022	Bachelor of Social Science
6		5		THNGEO003	Positive	17/08/2022 @15h00	Yes	F	2020	Bachelor of Social Science
7		6		HNDGUY002	Positive	17/08/2022 @15h00	Yes	M	2019	Bachelor of Social Science
8	3	7		MCHMEG002	Negative	17/08/2022 @ 16h30	Yes	F	2020	Bachelor of Social Science
9		8		CPXSOP007	Negative	17/08/2022 @ 16h30	Yes	F	2018	Bachelor of Fine Arts
10		9		BFFLIS004	Negative	17/08/2022 @ 16h30	Yes	F	2022	Bachelor of Social Science
11		10		MBNCHU007	Negative	17/08/2022 @ 16h30	Yes	F	2022	Bachelor of Social Science
12		11		MSXBAS003	Negative	17/08/2022 @ 16h30	Yes	F	2022	Bachelor of Social Science

Clean Data | Raw Data | Explore

Appendix R

Example Of Participants' Data Stored on Google Drive



Appendix S

Social Applications and Non-Social Smartphone Applications

Table S1

Examples of Social and Non-Social Smartphone Applications

Social Applications	Non-Social Applications
Instagram	Email (e.g., via MSOutlook)
WhatsApp	Pinterest
Facebook	Sudoku
Twitter	Notes
Social Media	Online shopping (e.g., Checkers60)
BeReal	Pictures
	Vula
	Ebook
	Gaming
	Podcast
	Music

Appendix T

Sensitivity Analysis: Examining the Data from Females Only

Table T1

Smartphone Activity Type During the Post-Induction Observation Period: Descriptive Statistics and Between-Group Comparisons for Females Only (N = 51)

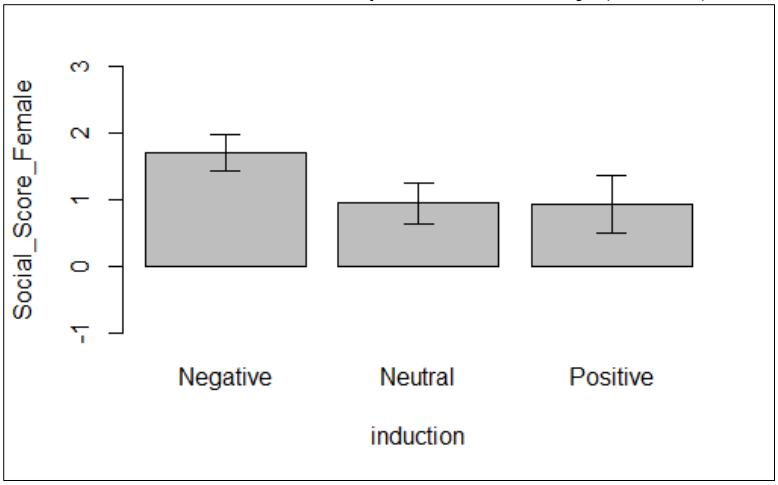
	Mood Induction Condition							
	Negative	Positive	Neutral				95% CI	
Social Score [a]	(*n* = 20)	(*n* = 13)	(*n* = 18)	*F*	*p*	ESE	LL	UL
Mean	1.70	0.92	0.95	1.98	.149	.07	1.10	2.30
Standard Deviation	0.27	0.43	0.31					
Range	-2–3	-3–3	-1–3					

Note. ESE = effect size estimate (in this case, partial eta squared); CI = confidence interval; LL = lower limit; UL = upper limit.

[a] To calculate this score, we noted which applications (up to a maximum of three) were reportedly used most heavily during the post-induction observation period. We then awarded a value of +1 to each social application (e.g., WhatsApp and Instagram) used and a score of -1 to each non-social application (e.g,. Vula and Ebook) used. So, for example, if a participant reported using only WhatsApp and Outlook during the observation period, their social score would be (+1) + (-1) = 0. Hence, higher scores indicate heavier use of social applications.

Figure T1

Smartphone Activity Type During the Post-Induction Observation Period: Data for Three Mood Induction Conditions, for Females Only (N = 51)



Note. Sample sizes for each induction condition were $n_{negative}$ = 20; $n_{positive}$ = 13; $n_{neutral}$ = 18. To calculate the Social Score, we noted which applications (up to a maximum of three) were reportedly used most heavily during the post-induction observation period. We then awarded a value of +1 to each social application (e.g., WhatsApp and Instagram) used and a score of -1 to each non-social application (e.g., Vula and Ebook) used. So, for example, if a participant reported using only WhatsApp and Outlook during the observation period, their social score would be (+1) + (-1) = 0. Hence, higher scores indicate heavier use of social applications. Error bars represent the upper and lower limit of the error, in our case a 95% confidence interval.