Digital Detox: The effect of smartphone abstinence on mood, anxiety, and craving

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Abstract

Whether behavioural addictions should be conceptualised using a similar framework to substance-related addictions remains a topic of considerable debate. Previous literature has developed criteria, which allows any new behavioural addiction to be considered analogous to substance-related addictions. These imply that abstinence from a related object (e.g. smartphones for heavy smartphone users) would lead to mood fluctuations alongside increased levels of anxiety and craving. In a sample of smartphone users, we measured three variables (mood, anxiety, and craving) on four occasions, which included a 24-hour period of smartphone abstinence. Only craving was affected following a short period of abstinence. The results suggest that heavy smartphone usage does not fulfil the criteria required to be considered an addiction. This may have implications for other behavioural addictions.

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Behavioural addiction is defined by the DSM-V as an addictive disorder that does not involve the ingestion of a psychoactive substance (APA, 2013). However, Kardefelt-Winther et al (2017) have recently argued that research concerning behavioural addictions has not yet clarified whether sufferers become functionally impaired, experience psychological distress, or demonstrate any separation from normative behaviour. Failure to meet these criteria may indicate that an addiction is not present. Symptoms associated with substance addiction include mood modification, tolerance, and withdrawal (Griffiths, 2005). Therefore, we would also expect to see these symptoms in behavioural addictions, however, their measurement is often problematic. For example, how would one quantify tolerance within internet addiction? Further, with behavioural addictions in digital domains, it is difficult to appreciate where a line might be drawn between typical, excessive and problematic usage (see Ellis et al., 2018). Problematic usage should impair normal functioning and cause distress. For example, abstinence from addiction-related behaviours (e.g. drinking for heavy drinkers), leads to changes in mood, anxiety, and craving (cf. Kardefelt-Winther et al, 2017). If abstinence results in changes across all three measures, then this might reveal analogous symptoms necessary for a new phenomenon to be considered a genuine behavioural addiction.

In recent years, a growing body of research has focused on the potential problems associated with excessive smartphone use (e.g. Pan, et al., 2019; Kimm, et al., 2019; Lee, et al., 2019; Wilcockson, et al., 2018). However, Billieux et al (2015) argues that very little evidence supports the notion that smartphone use can be considered a form of behavioural addiction. Related research has focused specifically on social media. For example, Stiegel and Lewetz (2018) observed that social media abstinence led to an increase in craving for social media, but anxiety and mood were unaffected. Another study by Vanman and colleagues (2018) however, observed that people who gave-up Facebook reported lower levels of wellbeing. However, comparatively little research has considered the psychological changes that occur as people experience smartphone abstinence, which are primarily used to access to these services. Such research could support or refute the current literature base concerning the potential psychological consequences of smartphone addiction. Previously, Clayton, Leshner, and Almond (2015) reported that smartphone separation led to negative affect if a participant was prevented from answering their phone while it rang in another room. But this separation anxiety may not necessarily reflect addiction-like anxiety, which would be the result of prolonged functional impairment and distress and not simply event-based (cf. Kardefelt-Winther et al, 2017). To date, no study has examined smartphone abstinence over a 24-hour period. The aim of this project is therefore to examine the effect on mood, anxiety, and craving when participants stop using their smartphone for 24-hours.

Participants attended the lab on four occasions and completed a battery of tasks. The first session took place a week before the abstinence task, with the second session occurring immediately before abstinence. A third session took place immediately after a 24-hour smartphone abstinence, with the final session taking

place the following day. We expected no differences between responses on sessions 1 and 4, however, we predicted that changes would likely occur immediately before and after the abstinence task (sessions 2 and 3). Specifically, before the abstinence task people may be concerned about giving-up their device for 24 hours. Conversely, people are likely to be relieved after any period of abstinence is over.

Method

Participants

There were 45 participants who started the study (33% male; average age = 22.4), however, nine participants did not complete all four lab sessions (see Figure 1). Participants were recruited from the Psychology subject-pool at Lancaster University and by advertising the study across campus using posters. Recruitment was blind to any current levels of smartphone usage however, previous research demonstrates that younger participants spend more time on their smartphone than older adults (Christensen et al., 2016; Ellis et al., 2018). They were reimbursed £15 for their time. Full ethical approval was obtained prior to the study and all participants provided written informed consent.

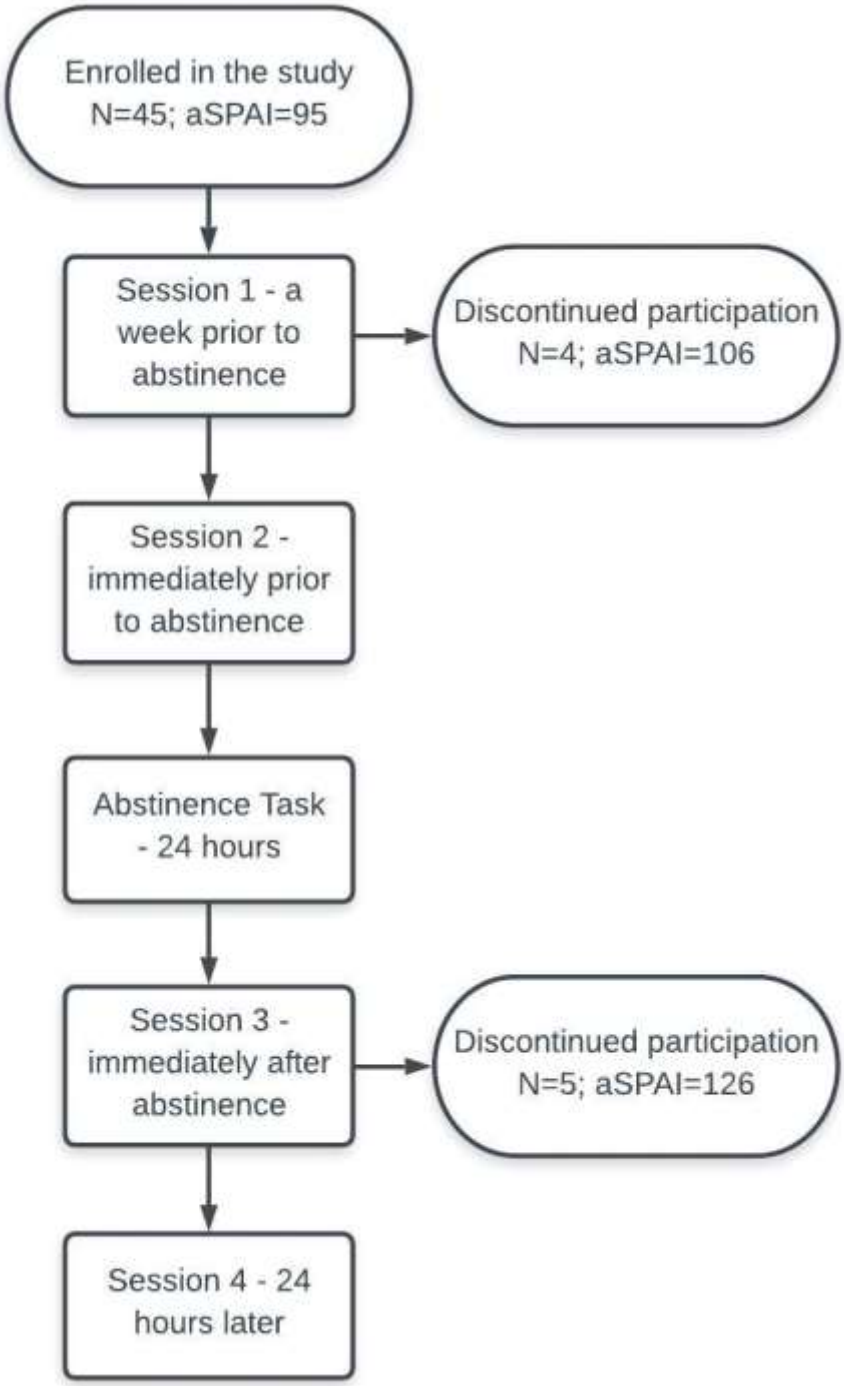

Figure 1. Flow diagram of procedure and participation discontinuation at each stage. Session 1 occurred a week prior to the abstinence task, Session 2 occurred immediately before abstinence. The Abstinence Task lasted 24 hours with Session 3 taking place immediately after. Session 4 occurred a further 24 hours later. This diagram also reports average Smartphone Addiction Inventory (aSPAI) scores for participants who left the study. Note, average SPAI scores for participants who discontinued was higher than the mean e.g. Session 3 drop-out aSPAI scores were 126 on average compared to mean SPAI scores from all participants at the start of the study (95). See supplementary materials for mean differences between participants who completed or discontinued based on Session 1 scores (Table S1).

Materials

We used a number of paper-based measures to assess anxiety (Marteau & Bekker, 1992), mood (Mayer & Gaschke, 1988), craving for smartphones (modified desire for drinking questionnaire: Love et al., 1998), and smartphone addiction (Lin et al., 2014). The STAI-6 (State-trait Anxiety Inventory) is a 6-item measure where participants can respond to each statement using a 4-point Likert scale e.g. "I feel calm". Responses can range from "not at all" to "very much". The Brief Mood Introspection Scale (BMIS) consists of two parts, [1] a 16-item questionnaire (e.g. happy, lively, sad) with a 4-point Likert response scale ranging from "definitely do not feel" to "definitely feel" and [2] an 'overall mood' question where participants indicate their current mood on a 21-point scale ranging from "very unpleasant" to "very pleasant". To assess craving, we used a modified version of the Love et al (1998) Desire for Alcohol Questionnaire with smartphone terminology replacing alcohol terminology. This is a 37-item questionnaire (e.g. "I could easily limit how much I use my phone") with a 7-point Likert response scale ranging from "strongly agree" to "strongly disagree". Finally, the Smartphone Addiction Inventory (SPAI) is a 26-item questionnaire (e.g. "I feel restless and irritable when my smartphone is unavailable") with 4 responses ranging from "disagree" to "agree". Cronbach alpha's were > .75 for all measures.

Procedure

In the first lab session, participants completed all questionnaires. They then returned to the lab one week later and had their phone placed in an evidence bag, which they were requested to not open/use. Selected questionnaires were also administered: mood, craving, anxiety. 24 hours after the abstinence task began, participants returned to the lab and completed the selected questionnaires again (session 3). After the abstinence task was completed the participants were asked to return to the lab a fourth and final to complete the selected questionnaires.

During the abstinence period, participants were instructed to place their smartphone in a secure evidence bag. In the case of an emergency or if they wished to withdraw from the study, it was possible to quickly tear the bag open and use their phone at any time. Note that no participants returned to the lab with opened or tampered evidence bags.

Results

A number of measures were taken at different time periods. Therefore, for each measure, we initially calculated a repeated-measures ANOVA with 4 levels (session: 1, 2, 3, 4). If appropriate, comparisons were then conducted between different sessions. Additionally, a Bayes factor with default prior scales is computed for each analysis (Love et al., 2015; Morey, et al., 2015; Rouder, et al., 2012). Computing a Bayes factor provides us with the ability to interpret p-values > .05. As we are speculating whether differences exist between different sessions, for us to be able to meaningfully interpret a null p-value, it is important to use Bayes factors. Therefore, if a $BF_{10} < .33$, then we can interpret that result indicates some

evidence for the null hypothesis and BF_{10} >3 as strong evidence for the alternate hypothesis (e.g. Rouder, et al., 2012).

Mood and Anxiety

Overall, Figure 2 suggests that mood was lower immediately before the abstinence task, but gradually increased toward the end of the study. A small reduction in anxiety is also apparent during the final session. However, ANOVAs did not reveal a significant main effect of session on mood [F(3,105)=1.79;p=.153; BF_{10}=.29] or anxiety [F(3,105)=1.08;p =.36; BF_{10}=.13].

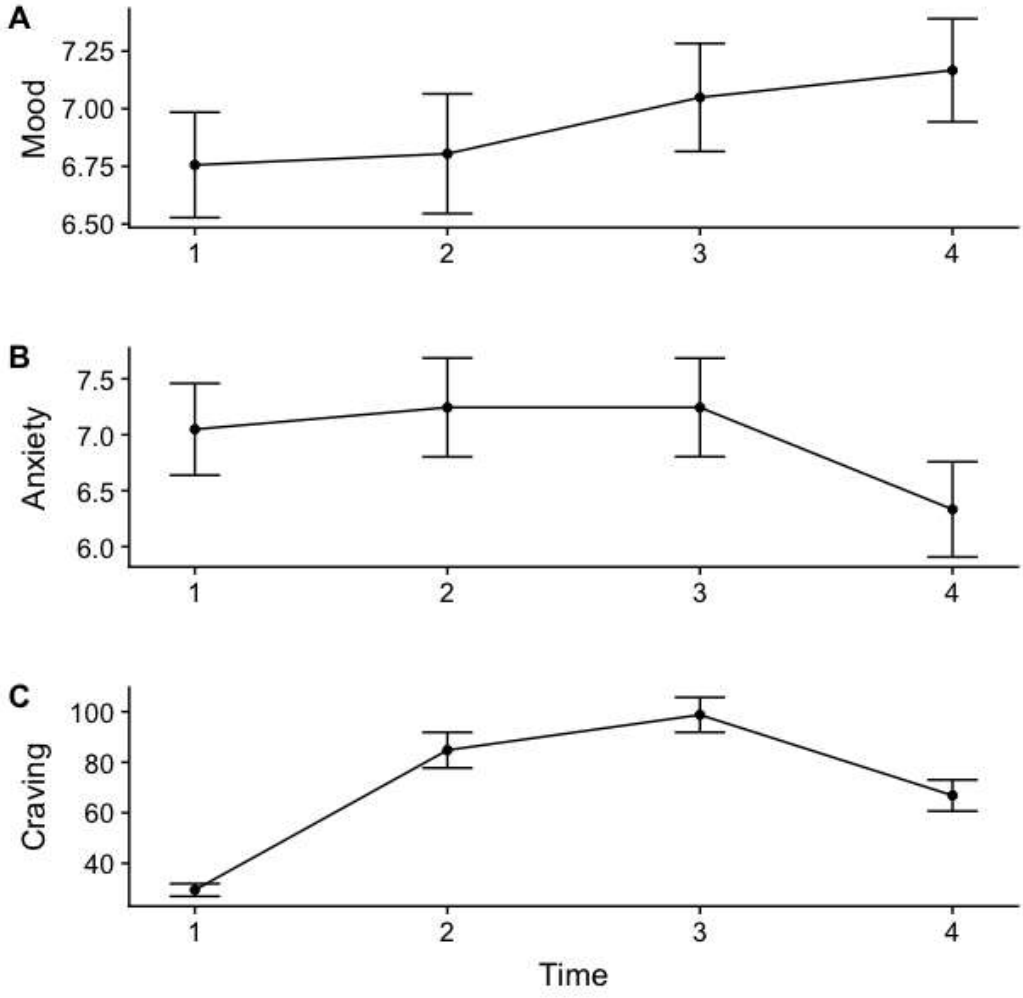

Figure 2. Average scores across sessions for [A] mood, [B] anxiety, and [C] craving. Note that a 24-hour period of smartphone abstinence occurred between sessions 2 and 3. Error bars represent standard error of the mean.

Craving

A significant main effect of session was observed [$F(3,105)=73.69$; $p<.0005$; $BF_{10}>100$]. Uncorrected comparisons revealed that all sessions differed significantly: session 1 [$M = 29.46$; $SD = 16.02$] and session 2 [$M = 84.80$; $SD = 45.22$; $t(40)= 9.64$; $p<.0005$; $BF_{10}>100$]; session 1 and session 3 [$M = 98.78$; $SD = 44.21$; $t(40)=12.162$; $p<.0005$; $BF_{10}>100$]; session 1 and session 4 [$M = 66.86$; $SD = 37.06$; $t(35)=8.07$; $p<.0005$; $BF_{10}>100$]; session 2 and session 3 [$t40)= 3.089$; $p=.004$; $BF_{10}=9.68$]; session 2 and session 4 [$t(35)= 3.93$; $p<.0005$; $BF_{10}=74.19$]; session 3 and session 4 [$t(35)= 8.16$; $p<.0005$; $BF_{10}>100$].

Problematic smartphone usage

During the first session, participants completed the problematic phone usage questionnaire (SPAI). We observed that this measure positively correlated with craving measures taken during session 1 [$r(45)= .69$; $p <.0005$; $BF_{10}>100$], session 2 [$r(41)= .79$; $p <.0005$; $BF_{10}>100$], session 3 [$r(41)= .72$; $p = .001$; $BF_{10}>100$], and session 4 [$r(36)= .76$; $p <.0005$; $BF_{10}>100$]. Therefore, while levels of craving varied between each session, it would appear that participants who believed they used their smartphone more consistently reported higher levels of craving. Mood and anxiety scores were not associated with the SPAI at any time point [all p's>.05].

Discussion

Whether or not behavioural addictions are akin to substance addictions remains a matter of considerable debate (Kardefelt-Winther et al, 2017). However, our results suggest that while smartphone abstinence can lead to craving, mood and anxiety remain unaffected. The craving results may indicate that smartphone users like to use their smartphones and crave them when they are unavailable, but the lack of evidence for mood modification and increased anxiety suggests a key distinction between technology-related behaviours and substance abusers. Substance abusers during abstinence would demonstrate mood modification and increased anxiety. Therefore, this distinction suggests that behavioural addictions (e.g. technology usage) are unlikely to inhabit the same underlying processes as substance-related addictions (e.g. alcohol usage). This distinction is important from an addictions perspective as substance abusers continue to take substances in the absence of liking (see Robinson & Berridge, 1993). While liking is not necessarily the strongest motivator in substance abuse addiction, it may be the strongest driver in any technology-related behavioural addiction.

Although there was no significant effect of abstinence on mood, we note that some improvement in mood does occur between sessions 2 and 4. This suggests that once participants were reunited with their phone following abstinence, they reported improved mood compared to immediately before the abstinence period (session 2). While being reunited with their phone may have made people feel happier, this difference may also be the result of poorer mood when pre-empting abstinence. These factors combined could also magnify this effect. However, while this may provide some evidence to support mood modification, our Bayes result suggests that more evidence is required to support any effect of mood before or after any period of smartphone abstinence.

This study involved restricting the use of smartphones, but not all technology (e.g., laptops) completely. Our findings are therefore limited by the possibility that participants may have been using other digital devices. This may explain why anxiety and mood were not affected, but changes in craving scores contradict this interpretation somewhat. It would have also been ethically difficult to restrict all technology use completely. Further, our sample may not harbour problematic smartphone usage and have therefore not responded accordingly. However, as problematic usage scores increased, so too did craving. Problematic smartphone users in the current study may have simply discontinued (see Figure 1). It is striking that drop-outs had higher SPAI scores on average. This may indicate that smartphone 'addicts' were unable to fully participate in the study and so discontinued, thus affecting our findings and interpretation. However, we would caution this interpretation somewhat as these scales do not align favourably with objective behaviour (Ellis, 2019). Future research may benefit by carefully selecting only very heavy users, based on objective behaviour, who may be more likely to demonstrate expected patterns of withdrawal.

In summary, our data suggest that normal emotional functioning is not impaired by smartphone abstinence, which is outlined as a key symptom of any addiction (see Kardefelt-Winther et al, 2017; Robinson & Berridge, 1993). Therefore, heavy smartphone usage may not meet the criteria for a behavioural-type addiction. It does appear that smartphones develop an intense liking, and craving-type feelings are common, but this alone does not necessarily reflect any form of addiction.

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