Devices of Mass Distraction: Can They be Kept at Bay by Going Grey?

An Investigation into Greyscale as an Effective Strategy in Reducing Phone Use

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Figure 1. Colour vs Greyscale Screens

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Declaration Statement:

I hereby declare that this Thesis is entirely my own work, and has not been previously submitted to this or any third level institution.

Signature of Candidate: Date: 29-04-19

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Abstract

Due to the rise of problematic phone use, this study aimed to investigate whether greyscale is effective in reducing phone engagement. It employed a repeated measures between groups experimental design, with engagement on phone as dependent variable, measured through Screen Time, and independent variables screencolour (colour or greyscale) and self-reported problematic phone use scores (MPPUS-10). Two questionnaires were administered to 58 iPhone participants (41 female, 17 male), divided into the control or experimental group. A significant decrease was found for phone engagement, between the control and experimental group, although not significantly within social networking. This indicated that whilst greyscale was effective in reducing overall phone engagement, more research is needed to investigate the feasibility and underlying motivations.

Keywords: *problematic phone use, greyscale, screen time, social networking, gaming, MPPUS*

Devices of Mass Distraction: An Investigation into Greyscale as an Effective Strategy in Reducing Phone Use

The past decade has witnessed a digital transformation, with an exponential increase in global internet and smartphone use. Currently, over 4 billion people, 53% of the world's population, can be classified as smartphone users (McDonald, 2018). Smartphones have become deeply rooted in the routines and habits of people's lives (Shrestha, 2018). A myriad of previously offline actions such as listening to music, navigating around cities or booking holidays have now transitioned into online applications such as Spotify, Google Maps and Airbnb. In fact, the average smartphone user has between 60 - 90 apps on their phone and uses about 9 different apps a day (Perez, 2018). With so many functions integrated into one portable device, it is no surprise that people are dedicating an increasing amount of their time to their phones.

A survey of British participants found that users spend on average 3.3 hours a day, amounting to one full day a week, engaged with their smartphones (Ofcom, 2018). Other findings suggest an even higher average, with one in four user spending over seven hours a day engaged with their device (Lu, 2017). The extended hours of smartphone engagement were especially prevalent among young adults (Shambare, Rugimbana & Zhowa, 2012). An Irish study found that smartphones users check their phones on average 57 times a day, which comes down to about once every 18 minutes of a waking day (Pope, 2017). This is a sharp contrast to the findings a decade ago in 2008, where adults spent on average 18 minutes a day on their phones (Caulfield, 2015).

This heightened increase in phone engagement has prompted reports of problematic phone use. A Swiss study found that 30% of the participants perceived themselves as being addicted to their smartphone (Billieux, Van der Linden & Rochat 2008), while a study of US college students found 60% considered themselves addicted to their phone (McAllister, 2011). Ding, Xu, Chen and Xu (2016), found that social and communication apps, such as Facebook and Instagram were rated the most addictive categories by participants. Alarming reports of this nature seem to be increasing, indicating a global issue regarding problematic phone use behaviour.

Literature Review

Problematic Phone Use

There are many different and intermittently used terminologies to be found in the media and literature that describe the current smartphone usage issue, from 'problematic phone use', to 'smartphone dependency', to 'excessive/abusive phone use' and even 'smartphone addiction'. Although the term 'smartphone addiction' is used frequently, there is currently some debate among researchers given that the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (American Psychiatric Association, 2013) does not include any disorders specifically related to problematic technology use. It does however include the first behavioural addiction of gambling, which shares striking similarities with problematic phone use, involving craving, loss of control, withdrawal and negative life consequences (Billieux, Maurage, Lopez-Fernandez, Kuss, & Griffiths, 2015). Therefore, this paper will use the term problematic phone use, defined as the inability to regulate usage, resulting in experienced negative social, behavioural and affective consequences.

There is live further discussion concerning the methodology used to measure this construct. Different scales have been developed such as the Problematic Mobile Phone Use Questionnaire (Billieux, Van der Linden & Rochat, 2008), Problematic Use of Mobile Phones (Merlo, Stone, & Bibbey, 2013), and Cellular Phone Dependence Questionnaire (Toda, Monden, Kubo & Morimoto, 2006). This can cause both a wide range of measurements and results, and considerable discrepancies within them. The most widely adopted scale is the 27 item Mobile Phone Problem Use Scale (MPPUS), developed by Bianchi and Phillips in 2005, credited with high internal consistency and validity (Lopez-Fernandez, Honrubia-Serrano, Freixa-Blanxart & Gibson, 2014). A reduced version, MPPUS-10 was created by Foerster, Roser, Schoeni & Röösli (2015), to decrease non response, which will be used in this paper. The MPPUS-10 has no clear threshold differentiating between problematic and non-problematic phone use, but is rather viewed as a continuum with higher scores indicating higher problematic phone use behaviour. Roser, Schoeni, Foerster & Röösli (2016) found an average score of 30 for MPPUS-10 amongst Swiss adolescents.

According to Billieux (2012), in order to measure problematic phone use holistically, three aspects need to be taken into account: firstly, the user's profile of use which consists of the type of applications being used; secondly, the actual level of daily use which includes the amount of time spent engaged with the device; and lastly the self-reported degree of problematic use through the MPPUS.

Underlying Theories and Constructs

Research on problematic phone use has linked the phenomenon to a number of negative outcomes including sleep disturbance (Lemola et al., 2015), increased depression (Primack et al., 2009), loneliness (Kim, LaRose, & Peng, 2009) obesity (Adams, 2006), loss of attention span (Hooton, 2015), decline in empathy (Turkle, 2016), reduced academic performances (Hawi and Samaha, 2016) and lower levels of subjective well-being (Lepp, Barkley & Karpinski, 2014). The mere presence of a smartphone, even when switched off, can damage cognitive capacity (Ward, Duke, Gneezy & Bos, 2017). With such detrimental consequences of problematic phone use, gaining a better understanding of the underlying features that cause users to struggle with controlling their screen time is paramount.

One of the most powerful elements embedded in many apps are intermittent reinforcements. Each time a person grabs for their phone, they may or may not have a new email/like/message etc. According to Skinner's (1963) operant conditioning, this unpredictability increases feelings of addiction, whereby intermittent reinforcements release a larger amount of dopamine in the brain than if it was consistently given. This has elicited comparisons to be made between slot machines and smartphones, whereby the refresh button is the trigger, giving the users an illusion of control (Harris, n.d.). Other controversial features that promote increased engagement, are continuous scrolling and autoplay. According to Self-regulation Theory (Bandura, 1991), the omission of a stopping cue can cause ones self-control or willpower to become depleted. Furthermore, on a lot of popular social networking sites, there is a form of feedback, through likes, comments, followers, views etc. In line with Social Comparison theory (Festinger, 1954), this feedback-seeking behaviour is motivated by the need to improve one's self-esteem. Additionally, smartphones stimulate different senses through

distinctive tones, vibrations and colours. People unconsciously and often instantaneously grab for their phones when they experience negative feelings such as boredom, loneliness, frustration or indecisiveness, in order to quell the painful sensation (Eyal, 2014). The more frequently this connection is made, the more difficult the habit becomes to break.

In other words, phones and the apps on them have been intentionally built to take advantage of psychological vulnerabilities, attract the user's attention, and keep them hooked. Since smartphones represent a gateway to meeting psychological needs, users are often in a state of constant alert.

Initiatives to Reduce Phone Use

These troubling findings on problematic phone use have caused an outcry from sections of the public, demanding change and regulations. Unlike other addictive like behaviour, total abstinence from smartphones is no longer a feasible option for most people, since phones have become such an integral part of their lives (Shrestha, 2018). This has resulted in a number of alternative solutions being proposed to help users control these devices of mass distraction.

Phone companies such as Apple have recently started taking more drastic steps in developing tools in their iPhone's to support users in managing their screen time and increasing their usage awareness (Appel, 2018). The new Apple iOS update (12) introduced a feature called Screen Time, which allows users to easily track how often they pick up their phone and view the amount of time they spend on each app or category (social networking, gaming, fitness etc.). Users can schedule "downtime" to only access certain apps and can set time limits that will prompt them to stop using an app after a certain amount of time. This detailed overview will be used in this study as it provides the most comprehensive and in depth insights into users phone use. Additionally, a number of applications have been specifically developed to aid users in their controlled phone usage, such as Offtime (2014), Moment (2014), and Breakfree (2014). Each app aims to increase transparency of time spent online, and limit the use of certain distracting apps. According to Billieux et al (2015), increasing users awareness of phone usage, helps towards reducing the overall time spent on their

phones.

Furthermore, in response to public demand, large entertainment and social networking applications such as Facebook, Instagram and Netflix are attempting to implement strategies to improve users' well-being. Instagram introduced a feature that alerts a users when they are "all caught up" to reintroduce a stopping cue and to combat continuous scrolling. Facebook CEO, Mark Zuckerberg (2018), has also committed to decreasing isolated feed scrolling, since it is shown to be harmful to people's health. Instead, Zuckerberg wants to focus on private chatting with friends and back-and-forth discussion of content which was found to boost positive sentiments (Verduyn et al., 2015).

However, it is debatable whether the social networking companies are motivated enough to decrease the time wasted online. Skepticism is warranted since their business models are predominantly based on fighting for the user's attention (Harris, n.d.). Therefore, it is important that users themselves take their own measures. Former Google ethicist and founder of the movement "time well spent", Tristan Harris (n.d.), advocates realigning technology with humanity's best interests. Harris suggests that users "downgrade" their phone by the following strategies (1) turn off non-human notifications, (2) restrict the home screen to everyday tools and (3) switch the phone to greyscale.

Colour & Greyscale

Tristan's third strategy - using greyscale to decrease phone use - is a relatively unknown feature within smartphones' accessibility settings. It removes colour from the user's screen, effectively allowing them to view their phone in black and white (Appendix A). Users who have switched their phone to greyscale, often report that their phones have become a lot more boring, and less distracting (Stderr, 2018).

Studies using eye-tracking equipment have shown that eyes particularly gravitate to bright red, and are naturally more attracted to warm colours (Lee, Tang & Tsai, 2005), while being less stimulated by tones of grey. This phenomenon may originally have had an environmental and ecological purpose whereby humans who were better at recognizing bright, "good looking" fruits, were more likely to reproduce than their

partners who had difficulty distinguishing them from the “bad looking” fruits that may had gone off (Palmer & Schloss, 2010). Furthermore, the colour red has historically been an important attention-grabbing colour, as it is the colour of blood and fire. More recently, this importance has been symbolized and reinforced by red traffic lights and stop signs. It is therefore no surprise that notification bubbles on phones are almost always red in order to signal importance.

However, this was not always the case. In fact, Facebook’s notification icon was originally blue, to fit in with their overall colour scheme (Lewis, 2017). Designers soon realised that users were barely clicking the notifications, but then witnessed a drastic increase once they made them red. This has now been adopted by almost all other apps. What people might not realise is the amount of money and impact behind small changes in colour. For instance, Google once ran an A/B experiment, whereby they tested 41 shades of blue in the ad links on gmail to investigate which had the highest click through rate. When they subsequently applied this particular shade to all users, they recorded an increase of $200m a year in ad revenue, thanks to the nature and scale of their company (Hern, 2014). Over the years, many companies have redesigned their logos to be brighter and bolder. One example is Instagram (2017), which used to have a brown/beige icon but changed it to vibrant pink and orange, thereby attracting users attention as soon as they opened their phones. Research generally suggests that color leads consumers to judge ad content as more attractive, interesting, and powerful (Bohle & Garcia 1986; Click & Stempel 1976; Schindler 1986),

It has been argued that designers are exploiting and encouraging subconscious decisions by manipulating colours. Bevil Conway specializes in colour and emotion and is worried that the current colour palettes on phone screens are taking a cognitive toll on users’ attention, by keeping them in a constant state of high alert (Bowles, 2018). The significance of colour has become less about identifying objects, and more about identifying what is important. Conway therefore suggests that phones and apps should be redesigned, with less high contrast colours (Conway, 2018, cited in Bowles, 2018).

Switching to greyscale could help nullify attempts at manipulation by large technology companies, and put the users back in control of their own attention. However, despite the available research on colour and attention, the researcher is

unaware of any scientific study that has directly tested Harris's strategy that greyscale reduces phone use.

Aims, Research Question and Hypotheses

This study aimed to fill the gap in the existing literature and provide an innovative framework, by measuring participant's self-reported problematic phone use through the 10-MPPUS and comparing their screen time data in colour to their screen time data when a week in greyscale. This should help answer the main research question:

Is switching phone screens to greyscale an effective strategy to reduce phone usage?

Hypotheses:

H1: Phone engagement will decrease in greyscale

H2: Screen time will especially decrease for social networking and games

H3: Higher MPPUS scores indicate more difficulty in greyscale

Method

Design

The study employed an experimental design based on repeated measures between groups combined with a series of quantitative measures. The independent variable was the colour of the participants screen, with regular colour for the control group and the intervention of greyscale for the experimental group. The self-reported measures of problematic phone use (10-MPPUS) constituted an independent covariate. The dependent variable was phone engagement measured through screen time, including total number of hours spent on phone, hours per category and the total number of pickups.

Participants

The researcher recruited participants through convenience sampling, via online platforms and by word of mouth. The requirements for participating were that the subject was at least 18 years of age and used an iPhone which had Screen Time enabled for the past 7 days. The researcher chose to only include iPhone users, since other operating systems measured screen time slightly differently, potentially making comparisons less precise.

A total of 77 participants completed the first survey, of which 40 were randomly allocated to the experimental group, and 37 randomly assigned to the control group. From this sample, 58 participants completed the second survey (25 control group, 33 experimental group). Of these participants, 17 were male (29%) and 41 female (71%), with ages ranging from 18 to 68 (M = 29.41, SD = 9.40).

Materials

The materials used in the study consisted of 4 surveys (2 pre-test, 2 post-test) which were created and completed via Google forms and the participant's iPhone with the Screen Time function.

The first surveys included an information sheet (Appendix B), consent form (Appendix C), eligibility and demographic questions (Appendix D), Foerster et al (2015) 10-item MPPUS (Appendix E), weekly screen time report (Appendix F) and first debrief

(Appendix G). The experimental survey additionally included instructions to change screen to greyscale (Appendix H).

The second surveys, both included a short information sheet (Appendix I), weekly screen time report (Appendix E) and debriefing form (Appendix J). The experimental version, further included questions about the experience of greyscale (Appendix K) and instructions to change the screen back to colour (Appendix L).

The original Bianchi and Phillips's (2005) Mobile Phone Problematic Use Scale (MPPUS), consisted of 27 items. However to reduce completion time and maintain participant completion rates, the researcher chose to use the reduced 10-item scale, which has been found to highly reflect the original MPPUS-27 (Kendalls' Tau: 0.80 with 90% concordant pairs). Furthermore, the widely used MPPUS-10 has good internal consistency with Cronbach's alpha of 0.85 (Foerster, Roser, Schoeni & Röösli, 2015). The 10-items were measured along a Likert scale ranging from (1) not true at all, to (10) extremely true, and included questions such as *I find it difficult to switch off my mobile phone*.

Procedure

Participants were randomly assigned to the experimental or control group and were sent a link to join the study. After reading the information sheet and agreeing to the consent form, participants were directed through the first survey which took approximately 5 - 7 minutes. After completion, the researcher emailed the second survey 7 days later to each participant, which took approximately 3 - 5 minutes to complete. At the end, all participants were debriefed on the study and were given the opportunity to contact the researcher for further questions.

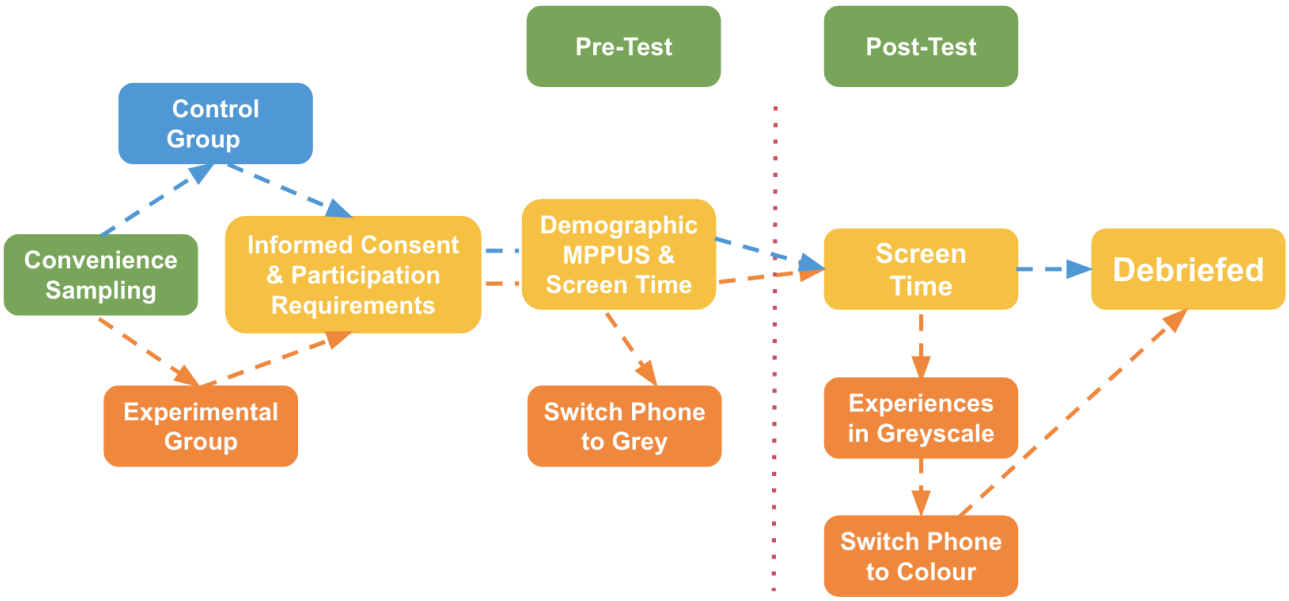


Figure 2.

Flow Chart of Procedure

Ethical Considerations

Prior to conducting the research, the study was submitted for ethical screening by the Department of Technology and Psychology's Ethics Committee (DTPEC), and approved for Ethics A (Appendix M). There was no element of deception involved, nor did the research target a vulnerable population or include compensation for taking part. All participants were at least 18 years of age, and participation was entirely voluntary. Consent was obtained at the start of the study where participants were informed about the purpose of the study, the requirements, expectations and duration, and were given the opportunity to agree to the terms. Participants were further assured that their data would be handled and stored confidentially and securely. At the end of each survey, participants were fully debriefed, thanked for their participation and given the opportunity to contact the researcher with any questions or concerns.

Results

Descriptive Results

The sample sizes, minimums, maximums and means of age, MPPUS scores, and pre- and post-intervention weekly phone hours and pickups, were calculated for each of the variables, and split by group type. The results are presented in Table 1, and the distribution of gender in Figures 3 & 4.

Table 1. Participant Pre & Post Descriptive Statistics

	Descriptive Statistics				
Group	Variable	N	Min	Max	Mean
Control	Age	25	18	66	28.44
	MPPUS	25	14	72	48.92
	Pre Weekly Hours	25	11.0	40.5	24.58
	Pre Weekly Pickups	25	117	1138	660.56
	Post Weekly Hours	25	9.5	40	23.82
	Post Weekly Pickups	25	116	1101	655.28
Experimental	Age	33	22	68	30.15
	MPPUS	33	17	90	47.82
	Pre Weekly Hours	33	7.0	50.5	22.26
	Pre Weekly Pickups	33	90	1221	545.97
	Post Weekly Hours	33	6.5	43	19.89
	Post Weekly Pickups	33	70	1190	494.55
Pre Total	Age	58	18	68	29.41
	MPPUS	58	14	90	48.29
	Pre Weekly Hours	58	7.0	50.5	23.26
	Pre Weekly Pickups	58	90	1221	595.36

Figure 3. Gender Control Group

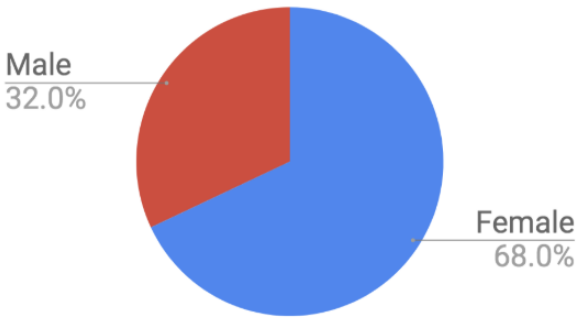
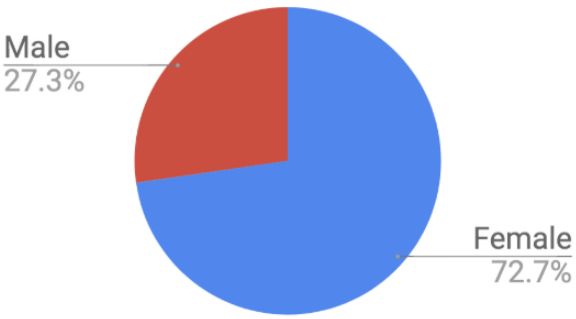


Figure 4. Gender Experimental Group



Inferential Results

To answer the primary research question and test the supporting hypotheses, a number of statistical tests were conducted in order to analyse the data using Statistics Package for the Social Sciences (SPSS) Version 25 (2017). The SPSS output can be found in Appendix M.

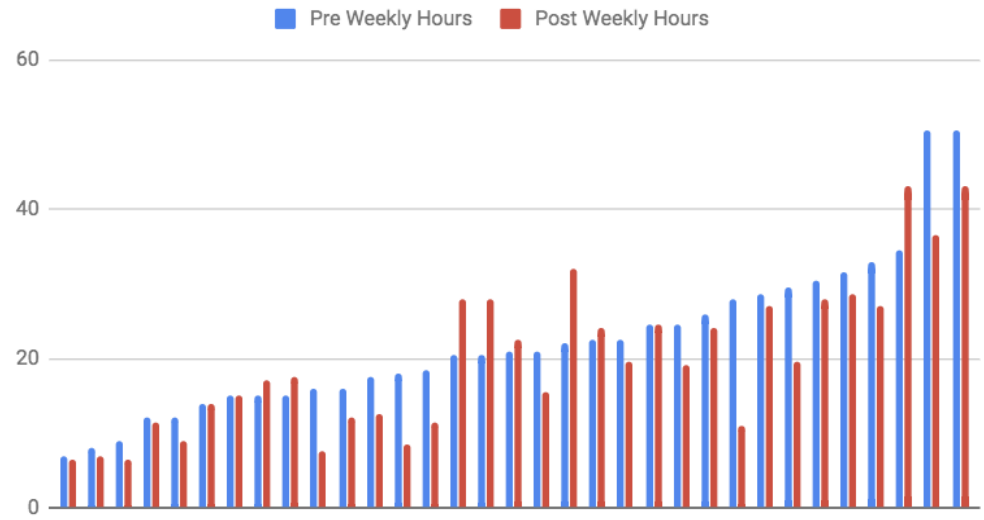
H1 - Phone engagement will decrease in greyscale

A paired sample t-test was conducted to evaluate the impact of greyscale interface on participants screen time. There was a statistically significant decrease in the experimental group's screen time from time 1 (M = 22.26, SD = 10.24) to time 2 (M = 19.89, SD = 10.13), t (33) = 2.26, p <.03. The mean decrease in screen time was 2.36 with a 95% confidence interval ranging from .24 to 4.49. The Eta squared statistic (.14) indicated a large effect size. Figure 5 below sets out the data.

A paired sample t-test was also conducted for the control group. There was no statistically significant decrease in screen time from time 1 (M = 24.58, SD = 8.51) to time 2 (M = 23.82, SD = 7.58), t (25) = 1.08, p = .29. The mean decrease in screen time was 0.76 with a 95% interval ranging from -.70 to 2.22. The Eta squared statistic (.05) indicated a medium effect size.

Furthermore, an independent-samples t-test was conducted to compare the post intervention number of pickups for the control and experimental groups. There was a significant difference in scores for the experimental group (M = 494.55, SD = 260.22) and the control group (M = 655.28, SD = 277.22); t (58) = 2.26, p < .03, two-tailed). The magnitude of the differences in the means (mean difference = 160.74, 95% CI: 18.58 to 302.89) was moderate (eta squared = .08).

Figure 5. Pre Weekly Hours vs Post Weekly Hours

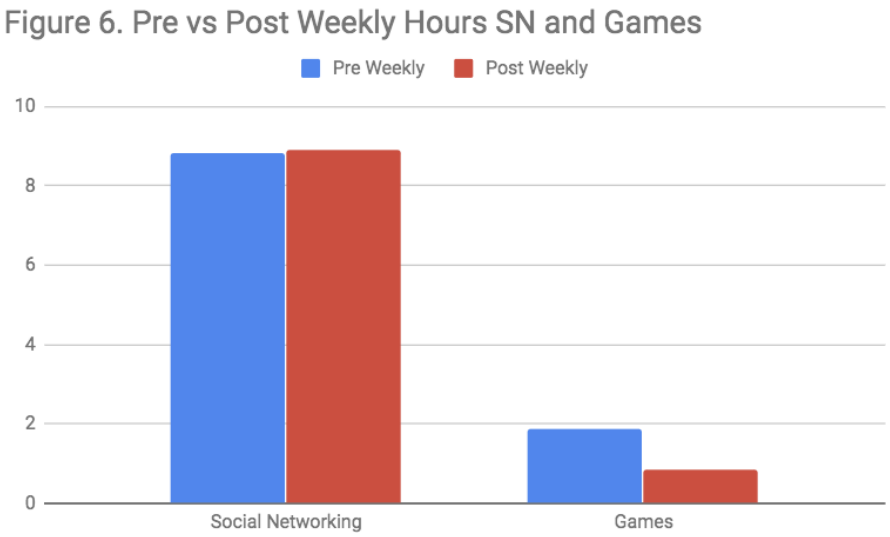


These findings support the first hypothesis that participants both spent less overall time on their phones, and picked up their phones less frequently when in greyscale.

H2 - Screen time will especially decrease for social networking and games.

A further paired sample t-test was conducted to evaluate the impact of greyscale on participants screen time for the category Social Networking. There was no statistically significant decrease for the category from time 1 (M = 8.83, SD = 4.97) to time 2 (M = 8.91, SD = 6.19), t (33) = -.12, p > .90. The mean increase in Social Networking screen time was .08 with a 95% confidence interval ranging from 3.56 to .62. Eta squared statistic (> .01) indicated no effect size.

A paired sample t-test was also conducted to evaluate the impact of greyscale on participants screen time for the category Games. For this category, there was a statistically significant decrease in screen time from time 1 (M = 1.86, SD = 5.25) to time 2 (M = 0.83, SD = 3.09), t (33) = 2.31, p < .03. The mean decrease in screen time was 1.03 with a 95% interval ranging from .13 to 2.00. The Eta squared statistic (.14) indicated a large effect size. These findings are represented in Figure 6 below.



These findings partially support the second hypothesis, suggesting that while switching to greyscale does not significantly reduce screen time on Social Networking applications, it might be effective in reducing screen time for Gaming applications.

H3 - Higher MPPUS scores indicate more difficulty in greyscale.

The relationship between problematic phone use (as measured by the MPPUS) and users' difficulty in remaining in greyscale, (as measured by the 7 point likert item), was investigated using the Pearson product-moment correlation coefficient. Preliminary analyses were performed to ensure that there was no violation of the assumptions of normality, linearity and homoscedasticity. There was a very small, positive correlation between the two variables, $r = .09$, $n = 33$, $p = .62$, with higher levels of problematic phone use associated with higher levels of perceived difficulty.

Further analysis comparing the difficulty of remaining in greyscale, (as measured by the 7 point likert item), with the frequency of switching, (as measured by the 3 point likert item), was investigated using the Pearson product-moment correlation coefficient. Preliminary analyses were again performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was a medium, positive correlation between the two variables, $r = .42$, $n = 33$, $p < .02$, with higher reported levels of difficulty associated with higher frequency of switching back to colour.

Furthermore, the data from the experience in grey scale (Appendix K) was analysed to determine the overall difficulty of the intervention. The majority of participants (60.6%) reported having difficulty remaining in greyscale (*M* = 4.03, *SD* = 1.96) (Figure 7), with 54.5% managing to remain in black and white for the full length of the week (Figure 8). Furthermore, 81.8% reported being more aware of their phone use during the intervention (Figure 9). However, with regards to potentially extending the period in greyscale, the majority (51.5%) would not consider switching to greyscale more frequently, and 93.9% of the participants would not consider greyscale permanently (Figure 10).

Figure 7. Difficulty of Remaining on Greyscale

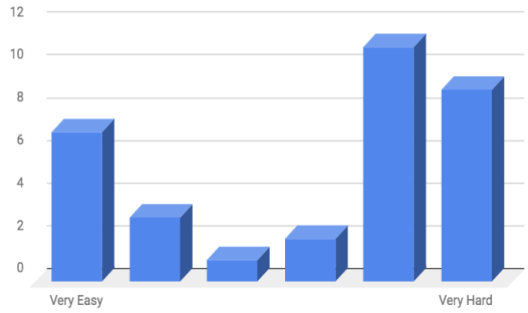


Figure 8. Frequency of Switching Back to Colour

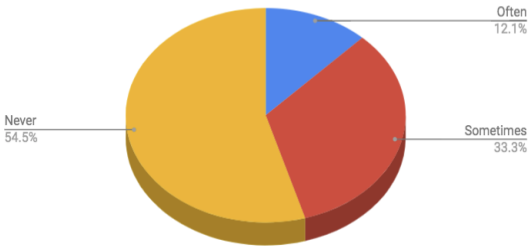


Figure 9. Increased Awareness of Phone Use

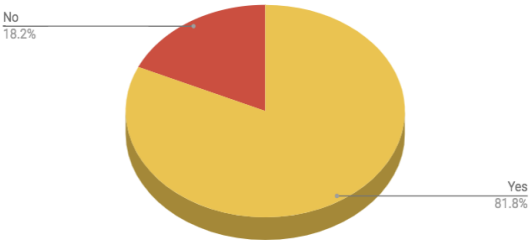
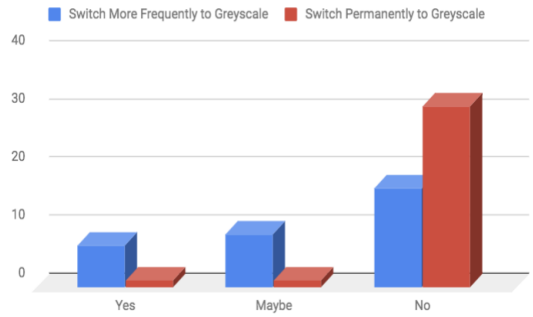


Figure 10. Extending Greyscale



The findings therefore do not support the third hypothesis that participants with higher levels of MPPUS scores have more difficulty remaining in greyscale. It does however suggest that there is a significant correlation between reported difficulty of greyscale and frequency of switching back to colour. It further highlights the overall perceived difficulty of the intervention greyscale.

Discussion

The aim of the study was to investigate whether greyscale was an effective strategy in reducing mobile phone use. It also took a deeper look into the categories Social Networking and Games, as they rely most on colour stimulation. In addition, problematic phone use levels, measured through MPPUS-10 were investigated to identify if they were related to the difficulty rating of the intervention greyscale. The following section discusses the key findings and their place within the existing literature. The limitations and strengths were then critically evaluated, concluding with the implications and suggested future research.

Key Findings

H1: Participants will use their phones less when they are on greyscale.

The first hypothesis focused on overall phone engagement, measured by total weekly hours on the phone and the number of weekly pickups. The average pre-intervention weekly hours were similar for the control and experimental groups, and equated to one full day per week (23 hours) or 3.34 hours per day on average. This is the same usage uncovered by Ofcom (2018) amongst British participants, but lower than the findings by Lu (2017). The overall average in pre-intervention number of pickups for the total sample group was 595, which equates to 85 times a day. Assuming people sleep 7 hours a night, this implies that smartphone users check their phones on average every 12 minutes. This is in notable contrast to the findings of Pope (2017), who measured that smartphone users picked up their phones on average 57 times a day. This may indicate that phone engagement has increased over the two years since Pope's research in 2017.

Further investigation tested whether the measurements of the experimental group would decrease due to the intervention of greyscale. For both groups, the total hours of phone use, and the total number of pickups declined over the course of the week. This might be due to the Hawthorne effect (Mayo, 1949), whereby the participants in the control group were more aware of being observed, and which may

consciously or unconsciously have influenced their behaviour. Alternatively, it could be caused by the participant's providing their screen time data at the start of the experiment, thereby becoming more aware of their actual phone use. This is in accordance to findings by Billieux et al (2015). However, despite the activity of both groups declining, the decrease in weekly hours was only significant for participants in the experimental condition. There was also a significant difference between the post-intervention weekly pickups between groups, suggesting that this was due to the intervention itself. This could be explained by the research of Lee, Tang & Tsai (2005), which found that grey is an understimulating colour, and does not attract the attention of users as much as warm bright colours such as red. It furthermore lends support to Harris (n.d.) and his claim that greyscale is an effective strategy in decreasing phone engagement. This confirmed the first hypothesis that participants indeed used their phones less when they were on greyscale.

H2 - Screen time will especially decrease for social networking and games.

It was expected that the categories social networking and games would show significant decreases in usage hours for participants in the experimental groups. This was due to these apps relying most on techniques to keep users hooked (Eyal, 2014), in particular, the sensory input of bright colours, guiding the users attention. The analysis found a significant decrease in hours spent gaming, indicating that greyscale was effective in reducing time spent on games via smartphones. However, surprisingly, the same was not found for the category social networking.

This could be explained by the strong dependence of users on social media, as highlighted by the findings of Ding, Xu, Chen and Xu (2016). It could also indicate that these apps rely heavily on other powerful elements, such as intermittent reinforcements and feedback loops, suggesting that just omitting the visual element is not enough to break the habit. Another possible explanation is that only half of the participants managed to stay on greyscale for the full one week duration. This may have reduced the effects found in social media, therefore, future research should delve deeper into participants who have committed to greyscale full time, together with the specific apps used for social networking.

H3 - Higher MPPUS scores indicate more difficulty in greyscale.

The third hypothesis concerned the MPPUS scores and the perceived difficulty of working in greyscale. Although there is no clear cut-off point as to whether a participant flags as exhibiting problematic phone use behaviour or not, the average score from this study (48) is strikingly higher than the average MPPUS score (30) measured by Roser, Schoeni, Foerster & Röösli (2016). This implies that there may have been an increase in awareness of phone use amongst smartphone users, over the past few years. It might also indicate cultural or demographic differences, since the study by Roser, Schoeni, Foerster & Röösli (2016) involved Swiss adolescents.

Furthermore, in terms of 'difficulty', analysis revealed that the majority of participants struggled with remaining in greyscale, which significantly correlated with those switching back to a coloured screen in the course of the week. This ties in with the findings of Eyal (2014) that people rely heavily on their smartphones and find it difficult to break those habits. Although the participants were more aware of their phone use, the majority would not consider switching to greyscale more frequently, and almost none of the participants would consider greyscale permanently. This chimes with Foerster's work (2015) on behavioural addictions, i.e. that problematic phone use is characterized by maintaining the short highs despite users awareness of its harmful consequences. This means that, although it reduced overall phone engagement, most participants did not find greyscale a feasible permanent solution. This should be further investigated as part of future research, incorporating qualitative questions or additional measures for motivation or reducing phone use.

Unexpectedly, no significant correlation was found between MPPUS-10 scores and reported levels of difficulty in using greyscale, thereby failing to support the third hypothesis. Future research is necessary to explore whether this finding is replicated with a larger sample size. Additionally, it would be interesting to administer the MPPUS-10 post- intervention to determine whether it has decreased.

Limitations of the Present Study

The present study has a number of limitations that must be considered. Firstly, it was limited in terms of its small sample size, gathered through convenience sampling. Although initially the first survey was completed by 77 participants, the final sample size declined to 58 participants, due to incomplete data and non-responses for the repeated measure. This therefore increased the likelihood of a Type II error, which may have had the effect of skewing the results and decreasing the power of the findings. Possible outliers could also have had significant impact on the overall results. Similarly, the sampling method posed problems in terms of external validity, as it was not representative of the true population.

Regarding the methodology, the study relied on a number of self-reported measures, including the participants MPPUS-10 score and their weekly hours of screen time. This method is susceptible to different biases such as social desirability, whereby the participant might alter their answers to be viewed more positively, or to act in a way that they think the researcher wants them to. However, the results did show that pre and post-intervention scores in screen time were significantly correlated suggesting they are reasonably valid. Furthermore, a control group was added to control for the Hawthorne effect (Mayo, 1949), whereby participants might unconsciously alter their behaviour due to the awareness of being observed.

It is noteworthy that there could also have been confounding variables at play that decreased the internal validity of the study. For instance, only participant's phone screen time was measured, while screen time on other electronic devices which were not accounted for, such as iPads and laptops, might have consequently increased. Finally, there were certain imprecisions in the measures, whereby not all experimental participants managed to keep their phones on greyscale continuously for 7 days. Overall, these limitations must affect one's confidence of the results.

Strengths and Research Implications

Despite its limitations, this study filled a recognised gap in the literature regarding the scientific testing of greyscale as an effective tool in reducing phone engagement. Since the screen time setting on phones has only been available for a few months, this

study qualifies as a pioneer by incorporating accurate and insightful data on participant's phone use. It's combining of MPPUS-10 scale with screen time data and greyscale intervention also constitutes an innovation. Given the general public's increased awareness of the issue, the study's theoretical theoretical framework and empirical results are considered an important contribution to our existing knowledge of problematic phone use. And in particular, it has expanded the body of research into the relative effectiveness of greyscale use as a possible solution.

Furthermore, the findings' suggestion that changing screen settings can reduce screen time could have clinical implications for patients/clients struggling with problematic phone use. The effect of colour and other phone settings needs to be understood by professionals, in order to provide support to clients struggling to control their phone use. It may also further prompt governments and/or educational institutions to put policies in place to protect the public from the effects of problematic phone use.

The study highlights a global issue and its results allow for the evaluation of one simple and affordable solution. The practical implications of this research should include heightened awareness among app and phone developers as to the effect of their designs, as well as the need to provide alternative colour options to help users control their screen time. Users themselves also need to become more aware of the tools available, together with the impact of their settings, in reducing their phone use.

Conclusions and Future Research

In summary, this study has highlighted the importance of ongoing research into the field of problematic phone use and the tools currently available to reduce screen time. The self-reported MPPUS-10 scores and the weekly screen time data emphasize the amount of time people spend engaging with their phone, and their difficulty in efficiently controlling it.

The second survey found that there is a high consistency of phone use over time, and that switching to greyscale statistically decreases overall screen time and number of pickups. However, these results are caveated by the finding that there was no significant decrease for the category social networking, which is hypothesised to be due to the high dependency and addictive tendencies for these apps.

In conclusion, the study has identified a paradox concerning the role of greyscaling as a solution to the problem of excessive phone use. The findings confirm that while using greyscale has a significant impact on reducing phone use, users remain highly reluctant to deploy it as a mechanism for managing their phone time. This suggests that future research may need to focus as much on the motivational, as on the technical, aspects of the problem. Beyond that, future studies should also determine whether the findings are replicable, and look to improve validity by gaining larger and more varied samples with regards to gender, age and nationality. Furthermore, the scope could be usefully broadened to see whether the same findings are found for non iPhone users and other types of device. Finally, the efficacy of greyscaling as an answer to excessive phone use needs to be compared to alternative solutions. When it comes to devices of mass distraction, going grey may not be the only way of keeping them at bay.

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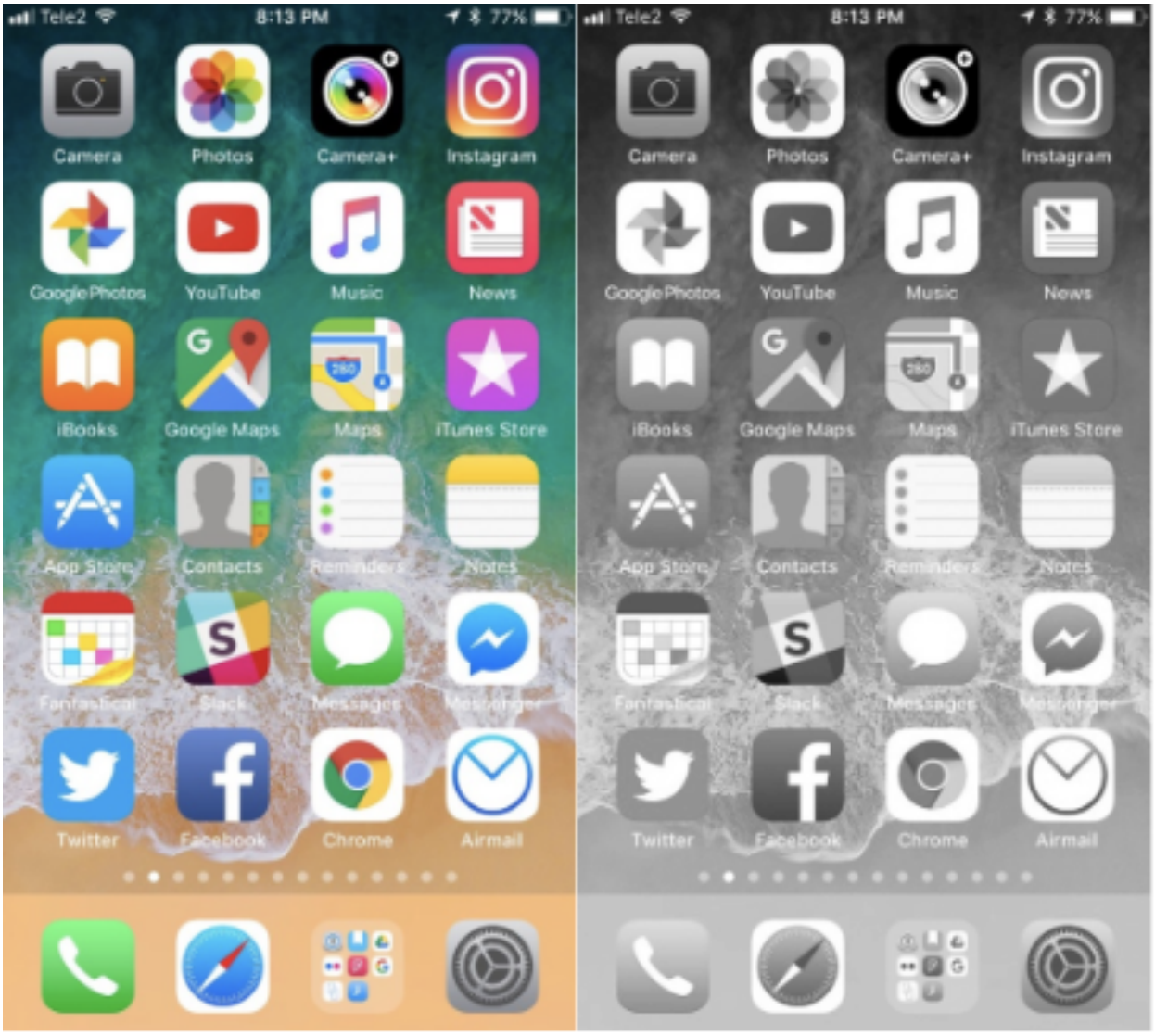
Appendices

Appendix A: Colour vs Greyscale Screen



Appendix B: Information Sheet

Thank you for your interest in taking part in this research project for the MSc Cyberpsychology at IADT. The research aims to investigate the effects of greyscale on screen time.

The requirements for taking part in this study are:
- you are an iPhone user
- you have screen time enabled in your settings

If you choose to take part in this two-part study, you will first be asked to answer a number of survey questions and provide data on current screen time. Some participants will then be requested to change their phone settings to greyscale for a week. All participants will receive the second part of the survey 7 days after completion of the first survey. Each survey should take approximately 5 minutes to complete.

Your responses will be collected and treated with full confidentially, and if published will not be identifiable. The data will be stored on a password protected computer only accessible by the researchers, and any hard copies will be safeguarded in a locked cabinet.

There are no risks associated with partaking in this study, however you are under no obligation to take part and can withdraw at any moment. This study has been approved by the Department of Technology and Psychology Ethics Committee (DTPEC). If you have a concern about any aspect of this study, please feel free to reach out to one of the researchers:
- Ingrid Elliott: N00172923@student.iadt.ie
- Liam Challenor: liam.challenor@dcu.ie

Appendix C: Consent Form

Please enter your email address below if you wish to take part in this study:
Email address:

If you are happy to proceed, please confirm by ticking the following boxes:

- ❑ I confirm that I have read and understand the information above
- ❑ I understand that my participation is voluntary and that I am free to withdraw at any time
- ❑ I understand that data collected about me will be treated with full confidentiality
- ❑ I agree to allow the data collected to be used for future research projects
- ❑ I confirm that I am 18+

Appendix D: Eligibility and Demographic Questions

Do you have an iPhone?

- ❑ Yes
- ❑ No

Is Screen Time currently collecting data on your daily phone use?

- ❑ Yes
- ❑ No

Are you colourblind?

- ❑ Yes
- ❑ No

Age:

Gender:

- ❑ Female
- ❑ Male
- ❑ Transgender
- ❑ Prefer not to say

Appendix E: 10 - Item Mobile Phone Problematic Use Scale

1. I have used my mobile phone to make myself feel better when I was feeling down.

	1	2	3	4	5	6	7	8	9	10	
Not true at all	○	○	○	○	○	○	○	○	○	○	Extremely true

2. When out of range for some time, I become preoccupied with the thought of missing a call.

	1	2	3	4	5	6	7	8	9	10	
Not true at all	○	○	○	○	○	○	○	○	○	○	Extremely true

3. If I don't have a mobile phone, my friends would find it hard to get in touch with me.

	1	2	3	4	5	6	7	8	9	10	
Not true at all	○	○	○	○	○	○	○	○	○	○	Extremely true

4. I feel anxious if I have not checked for messages or switched on my mobile phone for some time.

	1	2	3	4	5	6	7	8	9	10	
Not true at all	○	○	○	○	○	○	○	○	○	○	Extremely true

5. My friends and family complain about my use of the mobile phone.

	1	2	3	4	5	6	7	8	9	10	
Not true at all	○	○	○	○	○	○	○	○	○	○	Extremely true

6. I find myself engaged on the mobile phone for longer periods of time than intended.

	1	2	3	4	5	6	7	8	9	10	
Not true at all	○	○	○	○	○	○	○	○	○	○	Extremely true

7. I am often late for appointments because I'm engaged on the mobile phone when I shouldn't be.

	1	2	3	4	5	6	7	8	9	10	
Not true at all	○	○	○	○	○	○	○	○	○	○	Extremely true

8. I find it difficult to switch off my mobile phone.

	1	2	3	4	5	6	7	8	9	10	
Not true at all	○	○	○	○	○	○	○	○	○	○	Extremely true

9. I have been told that I spend too much time on my mobile phone.

	1	2	3	4	5	6	7	8	9	10	
Not true at all	○	○	○	○	○	○	○	○	○	○	Extremely true

10. I have received mobile phone bills I could not afford to pay.

	1	2	3	4	5	6	7	8	9	10	
Not true at all	○	○	○	○	○	○	○	○	○	○	Extremely true

Appendix F: Screen Time Past Week

This next section requires you to provide some data concerning your WEEKLY phone use.

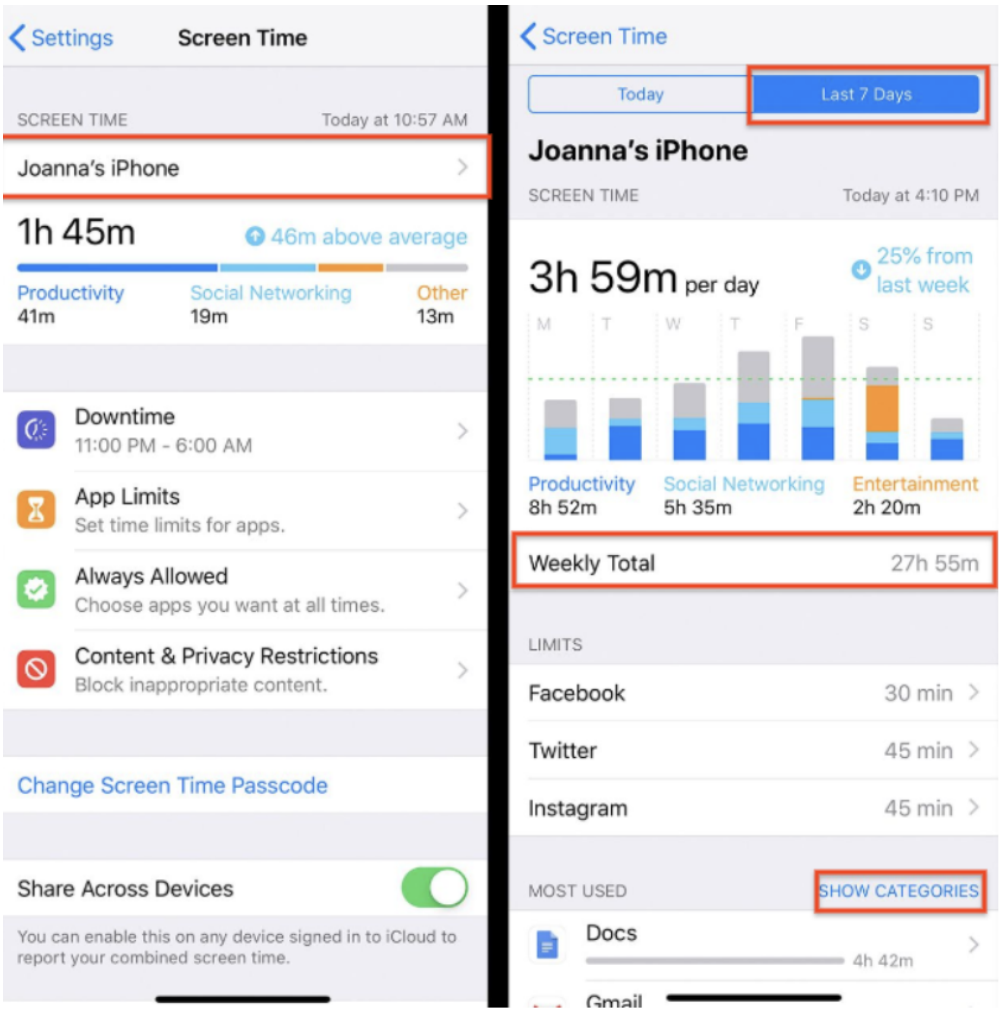
> Click on the SETTINGS app on your phone

> Navigate to SCREEN TIME

> Click in the top on IPHONE

> Then on the right on LAST 7 DAYS

> Under most used, click on SHOW CATEGORIES



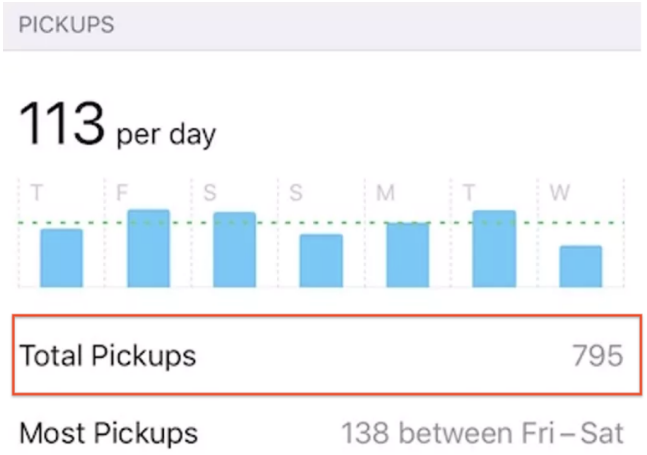
From the last 7 days, what is your weekly total of hours (h) and minutes (m) spent on your phone?

…….

In the section "SHOW CATEGORIES" note down the number of hours (h) and minutes (m) spent per category:

- Social Networking:
- Reading & Reference:
- Productivity:
- Entertainment:
- Creativity:
- Education:
- Health & fitness:
- Games:
- Other:

Scroll down to find the number of PICKUPS.



For the past 7 days, what is your TOTAL number of pickups?

……...

Appendix G: Debriefing 1

Fantastic, you have now completed the first part of this study! (Don't forget to SUBMIT your response below)

You are requested to try and keep your phone on grey as much as possible. However, in case you do want/need to change back to colour, please keep track of how often and for how long you switched.

Once again, thank you for your participation so far! You will receive an email in 7 days with the final section of the study.

If you have any concerns or questions in the meantime, feel free to contact one of the researchers and they will get back to you or fill in the field below:
- Ingrid Elliott: N00172923@student.iadt.ie
- Liam Challenor: liam.challenor@dcu.ie

Do you currently have any questions?
……..

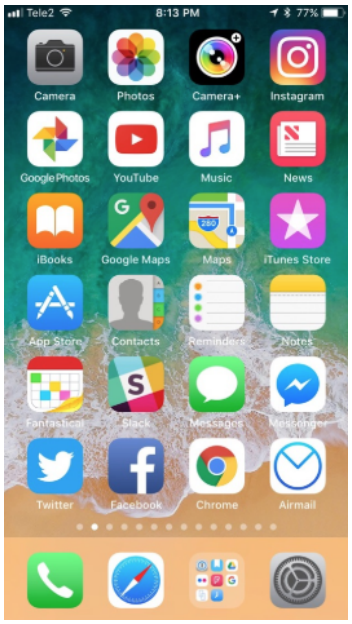
Appendix H: Switching to Greyscale

Setting your phone to greyscale:

1. Go to SETTINGS on your phone
2. Click on GENERAL
3. Click on ACCESSIBILITY
4. Click on DISPLAY ACCOMMODATIONS
5. Click on COLOUR FILTERS
6. Slide the colour filters on and select GREYSCALE

If needed, you can find a video with these steps (start at 0:48) here: https://www.youtube.com/watch?v=JNuziJOl61o

Your screen should look like this:



>

If you are having any difficulty setting your phone to grey, please contact N00172923@student.iadt.ie

Appendix I: Part 2 Information Sheet

Thank you for coming back to the second (and last) part of this study! You will be requested to answer a number of questions about your phone use this past week and your experience of greyscale. It shouldn't take more than 5 minutes to complete. You will be debriefed about the study at the end of the survey.

Email address:

……..

Appendix J: Final Debriefing

Thank you so much for your participation in this study! Don't forget to submit your response below.

You were part of the control/experimental group and your app usage will be compared with participants in the other group.

If you would like to receive a copy of the study per email once completed, please tick the box below. This will be stored anonymously from your results.

For any further questions you can contact the researchers via
> Ingrid Elliott: N00172923@student.iadt.ie
> Liam Challenor: liam.challenor@iadt.ie

Tick this box if you would like to receive a copy of the research.

- ❏ I would like to receive a copy of the results per email

Appendix K: Experience in Greyscale

1. How often did you switch back to colour?
   - ❑ Never
   - ❑ Sometimes (1 - 3 times per week)
   - ❑ Often (daily)

2. Did you have difficulty keeping your phone on grey?

	1	2	3	4	5	6	7	
It was super easy	○	○	○	○	○	○	○	It was very difficult

3. Were you more aware of your phone use this week?
   - ❑ Yes
   - ❑ No

4. Would you consider switching your phone to greyscale more frequently?
   - ❑ Yes
   - ❑ No
   - ❑ Maybe

5. Would you consider switching your phone to greyscale permanently?
   - ❑ Yes
   - ❑ No
   - ❑ Maybe

Appendix L: Switch Back to Colour

Setting your phone back to colour

1. Go to SETTINGS on your phone
2. Click on GENERAL
3. Click on ACCESSIBILITY
4. Click on DISPLAY ACCOMMODATIONS
5. Click on COLOUR FILTERS
6. Slide the colour filters off

Is your phone back in colour again?

- ❑ Yes
- ❑ No

If you have difficulty switching back to colour please send an email to N00172923@student.iadt.ie

Appendix M: Ethics Form A

DEPARTMENT OF TECHNOLOGY AND PSYCHOLOGY
ETHICAL APPROVAL FORM A

Title of project: Devices of Mass Distraction: a Black & White Issue (or grey area)
Name of researcher: Ingrid Elliott
Email contact: N00172329@student.iadt.ie
Name of supervisor: Liam P. Challenor

			Yes	No	N/A
1	Will you describe the main research procedures to participants in advance, so that they are informed about what to expect?		X		
2	Will you tell participants that their participation is voluntary?		X		
3	Will you obtain written consent for participation (through a signed or 'ticked' consent form)?		X		
4	If the research is observational, will you ask participants for their consent to being observed?				X
5	Will you tell participants that they may withdraw from the research at any time and for any reason?		X		
6	With questionnaires, will you give participants the option of omitting questions they do not want to answer?		X		
7	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?		X		
8	Will you debrief participants at the end of their participation (i.e., give them a brief explanation of the study)?		X		
9	If your study involves people between 16 and 18 years, will you ensure that passive consent is obtained from parents/guardians, with active consent obtained from both the child and their school/organisation?				X
10	If your study involves people under 16 years, will you ensure that active consent is obtained from parents/guardians and that a parent/guardian or their nominee (such as a teacher) will be present throughout the data collection period?				X
11*	Does your study involve an external agency (e.g. for recruitment)?			X	
12	Is there any realistic risk of any participants experiencing either physical or psychological distress or discomfort?			X	
13	Does your project involve work with animals?			X	
14	Do you plan to give individual feedback to participants regarding their scores on any task or scale?			X	
15	Does your study examine any sensitive topics (such as, but not limited to, religion, sexuality, alcohol, crime, drugs, mental health, physical health)			X	
16	Is your study designed to change the mental state of participants in any negative way (such as inducing aggression, frustration, etc.)			X	
17	Will your project involve deliberately misleading participants in any way?			X	
18	Do participants fall into any of the following special groups?	People with learning or communication difficulties		X	
		Patients (either inpatient or outpatient)		X	
		People in custody		X	

If you have ticked **No** to any of questions 1 to 11, or **Yes** to any of questions 12 to 18 you should refer to the PSI Code of Professional Ethics and BPS Guidelines and consult with your supervisor without delay. You will need to fill in Ethical Approval Form B and submit it to the Department of Technology and Psychology Ethics Committee (DTPEC) in place of this form.

There is an obligation on the researcher to bring to the attention of the DTPEC any issues with ethical implications not clearly covered by the above checklist.

I consider that this project has **no** significant ethical implications to be brought before the DTPEC. I have read and understood the specific guidelines for completion of Ethics Application Forms. I am familiar with the PSI Code of Professional Ethics and BPS Guidelines (and have discussed them with my supervisor).

Signed _____ Print Name _____ Date _____

Ingrid Elliott 05.04.2018

Appendix M: SPPS Output

Descriptive Statistics					
Group		N	Minimum	Maximum	Mean
Control Group	Age	25	18	66	28.44
	Gender	25	1	2	1.32
	MPPUS	25	14	72	48.92
	Pre_Weekly_Hours	25	11.0	40.5	24.580
	Pre_Pickups	25	177	1138	660.56
	Valid N (listwise)	25			
Experimental Group	Age	33	22	68	30.15
	Gender	33	1	2	1.27
	MPPUS	33	17	90	47.82
	Pre_Weekly_Hours	33	7.0	50.5	22.258
	Pre_Pickups	33	90	1221	545.97
	Valid N (listwise)	33			

Descriptive Statistics		
Group		Std. Deviation
Control Group	Age	8.747
	Gender	.476
	MPPUS	13.048
	Pre_Weekly_Hours	8.5131
	Pre_Pickups	247.893
	Valid N (listwise)	
Experimental Group	Age	10.069
	Gender	.452
	MPPUS	14.233
	Pre_Weekly_Hours	10.2371
	Pre_Pickups	240.920
	Valid N (listwise)	

Paired Samples Statistics					
Group			Mean	N	Std. Deviation
Control Group	Pair 1	Pre_Weekly_Hours	24.580	25	8.5131
		Post_Weekly_Hours	23.820	25	7.5841
Experimental Group	Pair 1	Pre_Weekly_Hours	22.258	33	10.2371
		Post_Weekly_Hours	19.894	33	10.1264

Paired Samples Statistics			
Group			Std. Error Mean
Control Group	Pair 1	Pre_Weekly_Hours	1.7026
		Post_Weekly_Hours	1.5168
Experimental Group	Pair 1	Pre_Weekly_Hours	1.7821
		Post_Weekly_Hours	1.7628

Paired Samples Correlations					
Group			N	Correlation	Sig.
Control Group	Pair 1	Pre_Weekly_Hours & Post_Weekly_Hours	25	.910	.000
Experimental Group	Pair 1	Pre_Weekly_Hours & Post_Weekly_Hours	33	.826	.000

Paired Samples Test					
Group			Paired Differences		
			Mean	Std. Deviation	Std. Error Mean
Control Group	Pair 1	Pre_Weekly_Hours - Post_Weekly_Hours	.7600	3.5270	.7054
Experimental Group	Pair 1	Pre_Weekly_Hours - Post_Weekly_Hours	2.3636	6.0017	1.0448

Paired Samples Test				
Group			Paired Differences	
			95% Confidence Interval of the Difference	
			Lower	Upper
Control Group	Pair 1	Pre_Weekly_Hours - Post_Weekly_Hours	-.6959	2.2159
Experimental Group	Pair 1	Pre_Weekly_Hours - Post_Weekly_Hours	.2355	4.4917

Paired Samples Test					
Group			t	df	Sig. (2-tailed)
Control Group	Pair 1	Pre_Weekly_Hours - Post_Weekly_Hours	1.077	24	.292
Experimental Group	Pair 1	Pre_Weekly_Hours - Post_Weekly_Hours	2.262	32	.031

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Post_Pickups	Control Group	25	655.28	277.216	55.443
	Experimental Group	33	494.55	260.216	45.298

Independent Samples Test					
		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
Post_Pickups	Equal variances assumed	.114	.737	2.265	56
	Equal variances not assumed			2.245	50.019

Independent Samples Test				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
Post_Pickups	Equal variances assumed	.027	160.735	70.962
	Equal variances not assumed	.029	160.735	71.595

Independent Samples Test			
		t-test for Equality of Means	
		95% Confidence Interval of the Difference	
		Lower	Upper
Post_Pickups	Equal variances assumed	18.580	302.889
	Equal variances not assumed	16.933	304.536

Paired Samples Statistics					
Group			Mean	N	Std. Deviation
Control Group	Pair 1	Pre_Social_Networking	12.320	25	6.5302
		Post_Social_Networking	11.520	25	6.3713
	Pair 2	Pre_Health	.420	25	1.4119
		Post_Health	.360	25	1.1594
	Pair 3	Pre_Games	.740	25	2.0316
		Post_Games	.700	25	1.7678
	Pair 4	Pre_Pickups	660.56	25	247.893
		Post_Pickups	655.28	25	277.216
Experimental Group	Pair 1	Pre_Social_Networking	8.833	33	4.9666
		Post_Social_Networking	8.909	33	6.1915
	Pair 2	Pre_Health	.091	33	.3635
		Post_Health	.136	33	.3806

	Pair 3	Pre_Games	1.864	33	5.2504
		Post_Games	.803	33	3.0846
	Pair 4	Pre_Pickups	545.97	33	240.920
		Post_Pickups	494.55	33	260.216

Paired Samples Statistics			
Group			Std. Error Mean
Control Group	Pair 1	Pre_Social_Networking	1.3060
		Post_Social_Networking	1.2743
	Pair 2	Pre_Health	.2824
		Post_Health	.2319
	Pair 3	Pre_Games	.4063
		Post_Games	.3536
	Pair 4	Pre_Pickups	49.579
		Post_Pickups	55.443
Experimental Group	Pair 1	Pre_Social_Networking	.8646
		Post_Social_Networking	1.0778
	Pair 2	Pre_Health	.0633
		Post_Health	.0663
	Pair 3	Pre_Games	.9140
		Post_Games	.5370
	Pair 4	Pre_Pickups	41.939
		Post_Pickups	45.298

Paired Samples Correlations					
Group			N	Correlation	Sig.
Control Group	Pair 1	Pre_Social_Networking & Post_Social_Networking	25	.945	.000
	Pair 2	Pre_Health & Post_Health	25	.470	.018
	Pair 3	Pre_Games & Post_Games	25	.929	.000
	Pair 4	Pre_Pickups & Post_Pickups	25	.806	.000
Experimental Group	Pair 1	Pre_Social_Networking & Post_Social_Networking	33	.818	.000
	Pair 2	Pre_Health & Post_Health	33	.642	.000
	Pair 3	Pre_Games & Post_Games	33	.930	.000
	Pair 4	Pre_Pickups & Post_Pickups	33	.596	.000

Paired Samples Test					
Group			Paired Differences		
			Mean	Std. Deviation	Std. Error Mean
Control Group	Pair 1	Pre_Social_Networking - Post_Social_Networking	.8000	2.1457	.4291
	Pair 2	Pre_Health - Post_Health	.0600	1.3410	.2682
	Pair 3	Pre_Games - Post_Games	.0400	.7627	.1525
	Pair 4	Pre_Pickups - Post_Pickups	5.280	165.832	33.166
Experimental Group	Pair 1	Pre_Social_Networking - Post_Social_Networking	-.0758	3.5644	.6205
	Pair 2	Pre_Health - Post_Health	-.0455	.3153	.0549
	Pair 3	Pre_Games - Post_Games	1.0606	2.6362	.4589
	Pair 4	Pre_Pickups - Post_Pickups	51.424	225.974	39.337

Paired Samples Test				
Group			Paired Differences	
			95% Confidence Interval of the Difference	
			Lower	Upper
Control Group	Pair 1	Pre_Social_Networking - Post_Social_Networking	-.0857	1.6857
	Pair 2	Pre_Health - Post_Health	-.4935	.6135
	Pair 3	Pre_Games - Post_Games	-.2748	.3548
	Pair 4	Pre_Pickups - Post_Pickups	-63.172	73.732

Experimental Group	Pair 1	Pre_Social_Networking - Post_Social_Networking	-1.3396	1.1881
	Pair 2	Pre_Health - Post_Health	-.1573	.0664
	Pair 3	Pre_Games - Post_Games	.1259	1.9953
	Pair 4	Pre_Pickups - Post_Pickups	-28.703	131.551

Paired Samples Test

Group			t	df	Sig. (2-tailed)
Control Group	Pair 1	Pre_Social_Networking - Post_Social_Networking	1.864	24	.075
	Pair 2	Pre_Health - Post_Health	.224	24	.825
	Pair 3	Pre_Games - Post_Games	.262	24	.795
	Pair 4	Pre_Pickups - Post_Pickups	.159	24	.875
Experimental Group	Pair 1	Pre_Social_Networking - Post_Social_Networking	-.122	32	.904
	Pair 2	Pre_Health - Post_Health	-.828	32	.414
	Pair 3	Pre_Games - Post_Games	2.311	32	.027
	Pair 4	Pre_Pickups - Post_Pickups	1.307	32	.200

Correlations

Group			MPPUS	Post_Social_Networking
Control Group	MPPUS	Pearson Correlation	1	.542**
		Sig. (2-tailed)		.005
		N	25	25
	Post_Social_Networking	Pearson Correlation	.542**	1
		Sig. (2-tailed)	.005	
		N	25	25
	Post_Pickups	Pearson Correlation	.597**	.549**
		Sig. (2-tailed)	.002	.005
		N	25	25
	Pre_Pickups	Pearson Correlation	.527**	.439*
		Sig. (2-tailed)	.007	.028
		N	25	25
	Pre_Social_Networking	Pearson Correlation	.537**	.945**
		Sig. (2-tailed)	.006	.000
		N	25	25
Experimental Group	MPPUS	Pearson Correlation	1	.146
		Sig. (2-tailed)		.417
		N	33	33
	Post_Social_Networking	Pearson Correlation	.146	1
		Sig. (2-tailed)	.417	
		N	33	33
	Post_Pickups	Pearson Correlation	-.066	.271
		Sig. (2-tailed)	.714	.127
		N	33	33
	Pre_Pickups	Pearson Correlation	.063	.181
		Sig. (2-tailed)	.726	.312
		N	33	33
	Pre_Social_Networking	Pearson Correlation	.278	.818**
		Sig. (2-tailed)	.118	.000
		N	33	33

Correlations

Group			Post_Pickups	Pre_Pickups
Control Group	MPPUS	Pearson Correlation	.597**	.527**
		Sig. (2-tailed)	.002	.007
		N	25	25
	Post_Social_Networking	Pearson Correlation	.549**	.439*
		Sig. (2-tailed)	.005	.028

		N	25	25
	Post_Pickups	Pearson Correlation	1	.806**
		Sig. (2-tailed)		.000
		N	25	25
	Pre_Pickups	Pearson Correlation	.806**	1
		Sig. (2-tailed)	.000	
		N	25	25
	Pre_Social_Networking	Pearson Correlation	.616**	.483*
		Sig. (2-tailed)	.001	.014
		N	25	25
Experimental Group	MPPUS	Pearson Correlation	-.066	.063
		Sig. (2-tailed)	.714	.726
		N	33	33
	Post_Social_Networking	Pearson Correlation	.271	.181
		Sig. (2-tailed)	.127	.312
		N	33	33
	Post_Pickups	Pearson Correlation	1	.596**
		Sig. (2-tailed)		.000
		N	33	33
	Pre_Pickups	Pearson Correlation	.596**	1
		Sig. (2-tailed)	.000	
		N	33	33
	Pre_Social_Networking	Pearson Correlation	.252	.242
		Sig. (2-tailed)	.157	.175
		N	33	33

Correlations			
Group			Pre_Social_Networking
Control Group	MPPUS	Pearson Correlation	.537**
		Sig. (2-tailed)	.006
		N	25
	Post_Social_Networking	Pearson Correlation	.945**
		Sig. (2-tailed)	.000
		N	25
	Post_Pickups	Pearson Correlation	.616**
		Sig. (2-tailed)	.001
		N	25
	Pre_Pickups	Pearson Correlation	.483*
		Sig. (2-tailed)	.014
		N	25
	Pre_Social_Networking	Pearson Correlation	1
		Sig. (2-tailed)	
		N	25
Experimental Group	MPPUS	Pearson Correlation	.278
		Sig. (2-tailed)	.118
		N	33
	Post_Social_Networking	Pearson Correlation	.818**
		Sig. (2-tailed)	.000
		N	33
	Post_Pickups	Pearson Correlation	.252
		Sig. (2-tailed)	.157
		N	33
	Pre_Pickups	Pearson Correlation	.242
		Sig. (2-tailed)	.175
		N	33
	Pre_Social_Networking	Pearson Correlation	1
		Sig. (2-tailed)	
		N	33

Correlations					
Group	MPPUS	Post_Social_Networ	Post_Pickups	Pre_Pickups	Pre_Social_Networki

					king			ng
Control Group	Kendall's tau_b	MPPUS	Correlation Coefficient	1.000	.460**	.364*	.343*	.401**
			Sig. (2-tailed)	.	.002	.012	.017	.006
			N	25	25	25	25	25
		Post_Social_Networking	Correlation Coefficient	.460**	1.000	.388**	.368*	.787**
			Sig. (2-tailed)	.002	.	.007	.011	.000
			N	25	25	25	25	25
		Post_Pickups	Correlation Coefficient	.364*	.388**	1.000	.580**	.478**
			Sig. (2-tailed)	.012	.007	.	.000	.001
			N	25	25	25	25	25
		Pre_Pickups	Correlation Coefficient	.343*	.368*	.580**	1.000	.411**
			Sig. (2-tailed)	.017	.011	.000	.	.004
			N	25	25	25	25	25
		Pre_Social_Networking	Correlation Coefficient	.401**	.787**	.478**	.411**	1.000
			Sig. (2-tailed)	.006	.000	.001	.004	.
			N	25	25	25	25	25
	Spearman's rho	MPPUS	Correlation Coefficient	1.000	.599**	.511**	.473*	.564**
			Sig. (2-tailed)	.	.002	.009	.017	.003
			N	25	25	25	25	25
		Post_Social_Networking	Correlation Coefficient	.599**	1.000	.534**	.473*	.911**
			Sig. (2-tailed)	.002	.	.006	.017	.000
			N	25	25	25	25	25
		Post_Pickups	Correlation Coefficient	.511**	.534**	1.000	.764**	.645**
			Sig. (2-tailed)	.009	.006	.	.000	.000
			N	25	25	25	25	25
		Pre_Pickups	Correlation Coefficient	.473*	.473*	.764**	1.000	.528**
			Sig. (2-tailed)	.017	.017	.000	.	.007
			N	25	25	25	25	25
		Pre_Social_Networking	Correlation Coefficient	.564**	.911**	.645**	.528**	1.000
			Sig. (2-tailed)	.003	.000	.000	.007	.
			N	25	25	25	25	25
Experimental Group	Kendall's tau_b	MPPUS	Correlation Coefficient	1.000	.094	.013	.105	.206
			Sig. (2-tailed)	.	.455	.914	.393	.099
			N	33	33	33	33	33
		Post_Social_Networking	Correlation Coefficient	.094	1.000	.276*	.207	.708**
			Sig. (2-tailed)	.455	.	.026	.096	.000
			N	33	33	33	33	33
		Post_Pickups	Correlation Coefficient	.013	.276*	1.000	.444**	.225
			Sig. (2-tailed)	.914	.026	.	.000	.069
			N	33	33	33	33	33
		Pre_Pickups	Correlation Coefficient	.105	.207	.444**	1.000	.241
			Sig. (2-tailed)	.393	.096	.000	.	.052
			N	33	33	33	33	33
		Pre_Social_Networking	Correlation Coefficient	.206	.708**	.225	.241	1.000
			Sig. (2-tailed)	.099	.000	.069	.052	.
			N	33	33	33	33	33
	Spearman's rho	MPPUS	Correlation Coefficient	1.000	.102	.020	.132	.268
			Sig. (2-tailed)	.	.570	.911	.464	.131

			N	33	33	33	33	33
		Post_Social_Networking	Correlation Coefficient	.102	1.000	.423*	.291	.863**
			Sig. (2-tailed)	.570	.	.014	.101	.000
			N	33	33	33	33	33
		Post_Pickups	Correlation Coefficient	.020	.423*	1.000	.577**	.340
			Sig. (2-tailed)	.911	.014	.	.000	.053
			N	33	33	33	33	33
		Pre_Pickups	Correlation Coefficient	.132	.291	.577**	1.000	.332
			Sig. (2-tailed)	.464	.101	.000	.	.059
			N	33	33	33	33	33
		Pre_Social_Networking	Correlation Coefficient	.268	.863**	.340	.332	1.000
			Sig. (2-tailed)	.131	.000	.053	.059	.
			N	33	33	33	33	33

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

Group			MPPUS	Pre_Weekly_Hours
Control Group	MPPUS	Pearson Correlation	1	.428*
		Sig. (2-tailed)		.033
		N	25	25
	Pre_Weekly_Hours	Pearson Correlation	.428*	1
		Sig. (2-tailed)	.033	
		N	25	25
	Post_Weekly_Hours	Pearson Correlation	.432*	.910**
		Sig. (2-tailed)	.031	.000
		N	25	25
Experimental Group	MPPUS	Pearson Correlation	1	.321
		Sig. (2-tailed)		.069
		N	33	33
	Pre_Weekly_Hours	Pearson Correlation	.321	1
		Sig. (2-tailed)	.069	
		N	33	33
	Post_Weekly_Hours	Pearson Correlation	.122	.826**
		Sig. (2-tailed)	.500	.000
		N	33	33

Correlations

Group			Post_Weekly_Hours
Control Group	MPPUS	Pearson Correlation	.432*
		Sig. (2-tailed)	.031
		N	25
	Pre_Weekly_Hours	Pearson Correlation	.910**
		Sig. (2-tailed)	.000
		N	25
	Post_Weekly_Hours	Pearson Correlation	1
		Sig. (2-tailed)	
		N	25
Experimental Group	MPPUS	Pearson Correlation	.122
		Sig. (2-tailed)	.500
		N	33
	Pre_Weekly_Hours	Pearson Correlation	.826**
		Sig. (2-tailed)	.000
		N	33
	Post_Weekly_Hours	Pearson Correlation	1
		Sig. (2-tailed)	

		N	33

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Correlations				
Group			MPPUS	Difficulty
Experimental Group	MPPUS	Pearson Correlation	1	.091
		Sig. (2-tailed)		.615
		N	33	33
	Difficulty	Pearson Correlation	.091	1
		Sig. (2-tailed)	.615	
		N	33	33
	Frequency_Switch	Pearson Correlation	.169	.415*
		Sig. (2-tailed)	.348	.016
		N	33	33

Correlations			
Group			Frequency_Switch
Experimental Group	MPPUS	Pearson Correlation	.169
		Sig. (2-tailed)	.348
		N	33
	Difficulty	Pearson Correlation	.415*
		Sig. (2-tailed)	.016
		N	33
	Frequency_Switch	Pearson Correlation	1
		Sig. (2-tailed)	
		N	33

*. Correlation is significant at the 0.05 level (2-tailed).
a. Cannot be computed because at least one of the variables is constant.