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Smartphone Addiction: Its Relationships to Personality Traits and Types of Smartphone Use

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Abstract

Studies found that smartphone addiction is relevant to the personality of smartphone users, especially the extroverts and introverts. However, the findings of the associations between extroverts/introverts and smartphone addiction are not consistent, and it is suggested that the inconsistency results can be relevant to the types of smartphone use. Accordingly, this study adopts the use and gratification theory as a framework to examine the relationships among extroverts/introverts, smartphone addiction, and the types of smartphone use, and the mediating effect of the types of smartphone use in the relationships between extroverts/introverts and smartphone addiction. Three hundred eighteen undergraduates were recruited to fill in a questionnaire using the purposive sampling method. Results show that both introverts and extroverts are associated with smartphone addiction. However, introverts are more likely to use smartphones for process usage but extroverts for social usage. In addition, process usage but not social usage is positively associated with smartphone addiction. Moreover, only process usage is the statistical mediator for the effects of introverts on smartphone addiction. The findings indicate that intervention programs can be developed to provide more alternative activities to reduce the dependence on smartphones among introverts to gratify their process needs.

Introduction

Due to the advancement of information technology, a smartphone's functions have extended to serve multiple purposes, including entertainment, information upgrade, immediate communication, social relationship, and self-education (Osman et al., 2012). Therefore, it is not surprising to find that more people are dependent on their smartphones without the realization of being addicted to it (Subramani Parasuraman et al., 2017). Smartphone addiction is defined as the action of continuously using a smartphone without the ability to control the usage despite knowing its harmful effects (Cha & Seo, 2018). According to Lin et al. (2014), smartphone addiction is a type of technological addiction that is non-chimerical and involves human-machine interaction. Smartphone addiction is similar to internet addiction in that it has similar aspects and is conceptualized as a multi-dimensional construct (Kwon et al., 2013; Y.-H. Lin et al., 2014). Panova and Carbonell (2018) suggested to include two dimensions for the definition of addiction: The negative consequences, and the psychological and physical dependence.

The signs of smartphone addiction include anxiousness when the smartphone is not around and the behaviors of continuous checking for communication updates, and various harmful effects have been reported, including those relevant to mental health, behavioral problems (De-Sola Gutiérrez et al., 2016), physical health (S.-E. Kim et al., 2015), social relationships (Shahrestanaki et al., 2020) and academic performance (Khan et al., 2019).

Studies have shown that the decision to use or avoid using smartphones is linked to individuals' psychological characteristics (Y. Kim et al., 2015), including the introvert and extrovert personality traits. A person who has the extraversion trait is defined as sociable, impulsive, jocular, lively, quick-witted, and optimistic. In contrast, a person who has the introversion trait is characterized as less talkative, passive, unsociable, careful, reserved, thoughtfully pessimistic, sober, in control of oneself, and a peace-lover (Feist & Feist, 2012).

Both the introvert and extrovert personality traits open the risk to smartphone addiction. Individuals who identify themselves as introverted or shy would use information and communication technology to build their social life, meet their social needs, and promote natural tendencies without face-to-face interactions (Cohn, 2016). Therefore, introverts are more vulnerable to developing smartphone addiction as they depend on smartphones to lessen their social anxiety (Enez Darcin et al., 2016). On the other hand, since extroverts are more sociable and were more likely to treat smartphones as convenient and effective communication devices, they are also more likely addicted to using their smartphones (T. T. Lin et al., 2015).

However, not all studies support the positive relationships between extroverts and introverts with smartphone addiction. Horwood and Anglim (2018) recruited 393 Australian undergraduates for a survey, and their findings did not find significant relationships between extroversion and smartphone addiction. Pearson and Hussain (2016) also recruited 256 British undergraduates and Internet users for an online survey, and their findings also did not reveal significant relationships between extroversion and smartphone addiction. It is discussed that the non-significant relationship can be because extroverts may develop other behaviors to fulfill their social needs, thus making them less likely to engage in excessive use of social media (Horwood & Anglim, 2018). Also, Roberts et al. (2015) recruited 346 US college students to participate in a survey, and they found a significant negative instead of a positive relationship between introversion and smartphone addiction. They explained that this negative relationship might be caused by the sense of being connected to introverts who are shy or bashful to using smartphones for socializing.

A possible explanation for the inconsistent results between extroverts and introverts with smartphone addiction is the types of smartphone use (Hussain et al., 2017; Pearson & Hussain, 2016). There are two types of smartphone use, which are social usage and process usage. Social usage is the engagement of smartphone users in social activities, including social networking, messaging, handling phone calls, and maintaining relationships. In contrast, process usage is smartphone users' engagement in searching and reading news, entertainment, relaxation, and other non-social activities (Elhai et al., 2017).

Some studies have supported this view. Lane and Manner (2011) conducted an online survey by recruiting 448 US participants aged above 18. They found that extroverts greatly valued the texting function on smartphones due to their strong desire for communication and no relationship between extroversion and smartphone use for

gaming or music functions. Kim et al. (2015) use secondary data from a Korean household survey that includes 9482 household members aged ten or above. They found that the types of smartphone use were correlated differently among personality types, and extroversion was positively correlated with relational application use but not with entertainment, information, and literacy application uses.

Besides the relationships between extraverts/introverts with the types of smartphone use that have been revealed, some studies also found the relationships between types of smartphone use and smartphone addiction. Elhai et al. (2017) conducted a web survey by recruiting 322 US participants whose ages averaged 33.15 years. They found that process usage is more relevant to problematic smartphone use behaviors than social usage. Besides, they found that process usage mediated the relationship between anxiety and smartphone addiction, and they explained that individuals with greater anxiety might use process usage as a mechanism for social avoidance and thus leading to smartphone addiction.

A similar finding was reported by Bae (2017). Using the secondary data from a survey data collected by the National Information Society Agency, data collected from 24386 persons aged 3 to 70 years were analyzed. The findings found that the use of smartphones for information seeking (news, product or service information, and traffic or location information), entertainment seeking (movies, television channels, videos, music, books, webtoon, and novels online) and gaming purposes are positively associated with smartphone addiction. In contrast, mobile social network services and mobile instant messenger did not significantly correlate with smartphone addiction. In other words, process usage but not social usage was associated with smartphone addiction.

Based on the literature mentioned above, it seems that extroversion, types of smartphone use, and smartphone addiction are interrelated. The Uses and Gratifications Theory was used as a framework to examine further their relationships and the mechanism that exists in these variables. The Uses and Gratifications Theory suggests that technology users are not passive users; instead, they actively explore media experiences to meet specific needs (Ruggiero, 2000). In other words, users would actively choose certain media to satisfy their individual needs and to fit their characteristics. Since certain users cannot control their behaviors and highly dependent on the use of certain media to gratify their needs, the constant repetition behavior eventually leads to addiction (Chen et al., 2017).

Research Purpose

Based on the uses and gratification theory that users would use certain types of media to gratify their needs, and the repeated uses of the media would cause the addiction, this study expected that participants high in introversion or extroversion scores would be high in smartphone addiction score, as they would use smartphones to gratify their needs. However, introverts are more likely to use smartphones for process usage, but extroverts are more likely to use smartphones for social usage. Since introverts depend on process usage to gratify their needs, the process usage would associate with their smartphone addiction. Since extroverts have more alternative ways to gratify their needs, the social usage would not associate with their smartphone addiction.

The hypotheses and conceptual framework (see Figure 1) are as follows:

- H1: Extroversion and Introversion personality are significant predictors of smartphone addiction.
- H1a: introversion is positively associated with smartphone addiction.
- H1b: extroversion is positively associated with smartphone addiction.
- H2: Extroversion and Introversion personality are significant predictors of the types of smartphone use.
- H2a: Introversion is positively associated with process usage.
- H2b: Introversion is not associated with social usage
- H2c: Extraversion is not associated with process usage.
- H2d: Extraversion is positively associated with social usage.
- H3: Types of smartphone use are significant predictors of smartphone addiction
- H3a: process usage is positively associated with smartphone addiction.
- H3b: social usage is not associated with smartphone addiction
- H4: types of smartphone use mediate the effects of extroverts/introverts on smartphone addiction
- H4a: Process usage is a statistical mediator for the effects of introversion on smartphone addiction.
- H4b: Social usage is not a statistical mediator the effects of introversion on smartphone addiction
- H4c: Process usage is not a statistical mediator the effects of extroversion on smartphone addiction.
- H4d: Social usage is not a statistical mediator the effects of extroversion on smartphone addiction

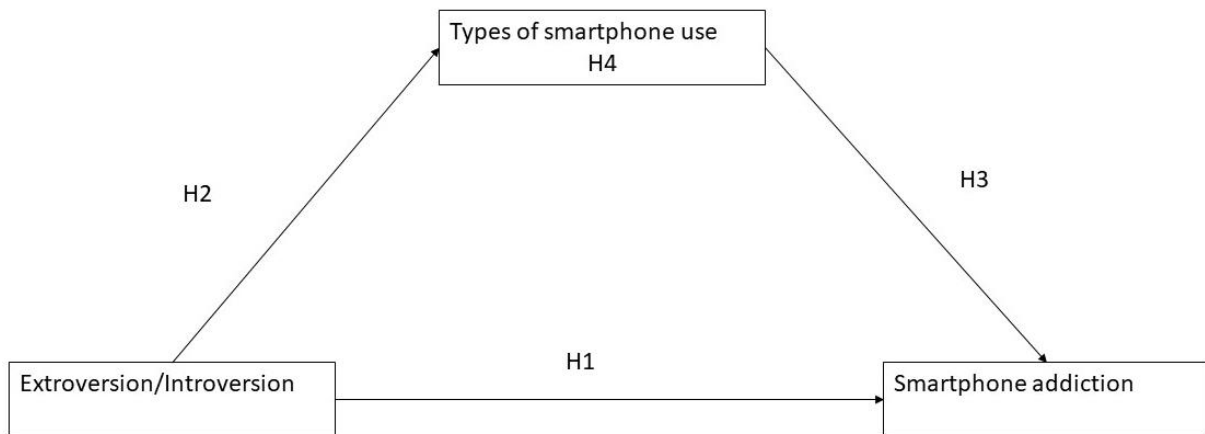


Figure 1. Conceptual Framework Model

Method

Participants

Three hundred eighteen undergraduates were recruited as participants for this study. The total valid sample was 308 due to missing data. About half of them are males (49.4%) and females (50.6%). The sample size is larger than the total sample size calculated by G*power version 3, in which 85 samples would be sufficient when there are four predictors, with a power of .8, an alpha of .05, and a medium effect size. The age range is between 18 years old and 26 years old. All participants reported that they own a smartphone.

Instruments

Participants were asked to fill in a questionnaire that contains four measurements, which are demographic information, scales to measure their levels of introversion and extroversion, a scale to measure their process and social usage, and their smartphone addiction.

Demographic Information

In this part, participants need to fill in their ages and gender, and their possession of smartphone(s).

International Personality Item Pool-Five Factor Model-50 (IPIP-5-50)

This scale was developed by Goldberg (1992). There are five subscales, which are openness, conscientiousness, extroversion, agreeableness, and neuroticism. Each of the subscales contains ten items and is measured using a 5-point Likert scale (1=very inaccurate; 2=moderately inaccurate; 3=neither accurate nor inaccurate; 4=moderately accurate; and 5=very accurate). However, only ten items from the extroversion subscale were chosen to be used in this study. The Cronbach's Alpha coefficient was reported as .87 for the extroversion subscale. In this subscale, five items were used to measure extroversion, and another five items were used to measure introversion. The higher the mean score, the higher the individuals' extroversion or introversion. A sample item is "I don't talk a lot" for introversion and "I am the life of the party" for extroversion.

Process and Social Usage Scale

This scale was developed by Van Deursen and Helsper (2015). It consists of 12 items in which seven measure the process usage while five measure social usage. The items are assessed using a 5-point Likert scale (ranging from "1=strongly disagree" to "5=strongly agree"). A higher mean score indicates more process or social usage. The Cronbach's Alpha coefficient of process usage was reported as .89, and social usage was .73. A sample item for process usage is "I use my smartphone in order to escape from real life", and a sample item for social usage is "I use my smartphone to maintain relationships".

Smartphone Addiction Inventory (SPAI) scale

This scale is developed by Lin et al. (2014), and it consists of 26 items. The items are measured using a 4-point Likert scale (ranging from "1=strongly disagree" to "4=strongly agree"). The higher the mean score, the higher the individuals' level of smartphone addiction. The Cronbach's Alpha coefficient was reported as .94. A sample item is "I was told more than once that I spent too much time on smartphone".

Research Procedure

After getting approval from the Scientific and Ethical Committee of the university to conduct the study, the

purposive sampling method was used to recruit participants. Only undergraduates who owned a smartphone were invited to complete the paper-and-pencil questionnaire. Data were collected from different locations at the campus, such as the library and cafeterias. After explaining the aims of the study, undergraduates who agreed to answer the questionnaire were asked to fill in the consent form that includes the study's objectives, their right to withdrawal from the study without any consequences, and the information regarding confidentiality. The questionnaire would take about 15 to 20 minutes to complete. Throughout the process, participants could raise inquiries regarding this study, and the researchers would then answer their questions to clarify any doubts. Questionnaires were collected from the participants after they had finished answering, and a token of appreciation (a pack of snacks) was given to appreciate their help. All collected data were then keyed into Microsoft Excel for analysis using SmartPLS program version 3. Partial least square structural equation modeling was used to analyze the data (Willaby et al., 2015).

Results

Measurement Model

Construct Reliability and Validity

The composite reliability of all parenting measurements exceeded the recommended value of .7 for the composite reliability (Hair Jr et al., 2016), in which the composite reliabilities of the scales are: .82 for introversion is .82, .84 for extroversion, .79 for process usage .79, .87 for social usage, and .93 for smartphone addiction. Correspondingly, the findings suggest that latent constructs of all measurements are acceptable.

Discriminant Validity

The results of the analyses were shown in Table 2. No collinearity issue was found as the variance inflation factor of all scales were also below 5 (Hadi et al., 2016). All predictors explained 24% of smartphone addiction's total variance, which is medium effect size.

Table 1. Discriminate Validity of All Measurements

	1	2	3	4	5
1. Extroverts	.71				
2. Introverts	-.48	.70			
3. Process usage	-.10	.21	.62		
4. Social usage	.14	-.03	.35	.75	
5. Smartphone addiction	.18	.15	.38	.05	.58

Coefficient of Determination, Effect Size and Collinearity Statistics of Measurements

The results of the analyses were shown in Table 2. No collinearity issue was found as the variance inflation factor of all scales were also below 5 (Hadi et al., 2016). All predictors explained 24% of smartphone addiction's total variance, which is medium effect size.

Table 2. Coefficient of Determination (R^2), Effect Size (F^2) and Collinearity Statistics (VIF)

Dependent Variable	Predictors	R^2	f^2	VIF
Process usage		.05		
	Introversion		.04	1.29
	Extroversion		.001	1.29
Social usage		.002		
	Introversion		.002	1.29
	Extroversion		.02	1.29
Smartphone addiction		.24		
	Introversion		.05	1.35
	Extroversion		.12	1.33
	Process usage		.19	1.21
	Social usage		.02	1.18

Structural Model

As shown in Table 3, after controlling gender and ages, both introversion and extroversion are positively associated with smartphone addiction, $ps < .001$. Besides, introversion is positively associated with process usage, $p = .005$, whereas extroversion is positively associated with social usage, $p = .039$. Moreover, only process usage but not social usage is associated with smartphone addiction, $p < .001$.

Table 3. Path Coefficients of Measurements

	Hypothesis	Beta	SE	T values	P Values
<u>Direct effects</u>					
Introversion -> Smartphone Addiction	H1a	.24	.07	3.37	.001
Extroversion -> Smartphone Addiction	H1b	.34	.06	5.37	<.001
Introversion -> Process usage	H2a	.22	.08	2.85	.004
Introversion -> Social usage	H2b	.05	.11	.48	.635
Extroversion -> Process usage	H2c	.01	.09	.07	.945
Extroversion -> Social usage	H2d	.17	.08	2.11	.035
Process usage -> Smartphone Addiction	H3a	.40	.06	7.29	<.001
Social usage -> Smartphone Addiction	H3b	-.12	.07	1.63	.104
<u>Control variables</u>					
Gender		.05	.05	.86	.389
Age		-.20	.05	3.98	<.001

Mediating Effect

As shown in Table 4, the specific indirect effect results indicated that process usage is a statistical mediator for the effect of introversion on smartphone addiction, $p = .006$. Following the decision tree from Zhao (2010), since the direct effect of introversion on smartphone addiction is significant, $p = .001$, this indicated a complimentary mediation. No other significant indirect effect emerged.

Table 4. Indirect Effects of Smartphone Usage

	Hypothesis	Beta	SE	T values	P Values
<u>Indirect effects</u>					
Introversion -> Process usage -> Smartphone Addiction	H4a	.09	.03	2.81	.005
Introversion -> Social usage -> Smartphone Addiction	H4b	-.01	.02	.38	.706
Extroversion -> Process usage -> Smartphone Addiction	H4c	.01	.04	.07	.946
Extroversion -> Social usage -> Smartphone Addiction	H4d	-.02	.02	1.13	.259

Discussion

Inconsistent results were reported on the relationships between introverts/extroverts and smartphone addiction, and the inconsistent results might be relevant to the types of smartphone use. The uses and gratification theory was used as a framework to examine the relationships among introverts/extroverts, smartphone addiction, and types of smartphone use, and whether types of smartphone use is a statistical mediator on the effects of introvert/extrovert personality traits on smartphone addiction. It is expected that introverts are more likely to use smartphones for process usage to gratify their needs and thus increases their addiction to smartphones. Extroverts are more likely to use smartphones for social usage. However, since extroverts have more alternative ways to gratify their social needs than heavily dependent on the smartphone, they are less likely to become addicted to smartphones through the social process.

Firstly, the results failed to reject the hypothesis that participants with higher introversion and extroversion scores are more likely to be addicted to their smartphones. These findings are similar to other studies (Biglu & Ghavami, 2016; Hong et al., 2012; Panda & Jain, 2018). Due to the multi-functions provided by a smartphone, it is not surprising to find that both introverts and extroverts are attracted by certain applications and may use the applications frequently to meet their personal needs and thus use their smartphone frequently.

Secondly, the results showed that introverts are more likely to use smartphones for process usage and extroverts for social usage. These results are also consistent with a study (Lane & Manner, 2011). Also, they meet the expectation of the uses and gratification theory that different technology users use technology in different ways

to gratify their personal needs.

Thirdly, the results showed that it is process usage, but not social usage, that is positively associated with smartphone addiction. This result is also consistent with other studies (Bae, 2017; Elhai et al., 2017). It could be due to the reason that process usage may provide some functions that increase the dependence on smartphones, such as positive reinforcement (Van Deursen & Helsper, 2015), negative reinforcement (J. Roberts et al., 2014), and mood regulation (Panova & Lleras, 2016). Therefore, smartphone users would repeat smartphones' process usage to get reinforcement (Van Deursen & Helsper, 2015). In contrast, as there are more other alternatives to meet the social needs, the social process may also be used when such alternatives are unavailable, and thus social usage did not directly affect smartphone addiction (Whalen, 2015).

Lastly, the results showed that only process usage is a statistical mediator for the effects of introverts on smartphone addiction. As Elhai et al. (2017) suggested, individuals with a higher level of anxiety, such as introverts who have social anxiety, were more inclined to non-social smartphone usage due to social avoidance. In other words, it is the process usages provided by the smartphone that introverts can gratify their needs without actual face to face contact, increasing the smartphone addiction among introverts.

In contrast, even though the results showed extroverts are more likely to use smartphones for social usage and are also more likely to be addicted to it, the social usage is not a statistical mediator for the relationships between extroverts and smartphone addiction. One possible reason is that extroverts prefer to communicate using face-to-face interaction for better expressions of themselves, and thus they require less mediated social interactions through smartphones due to their outgoing and sociable nature (Whalen, 2015). Another possible explanation for the insignificant results could be due to the current categorization of smartphone usage into the process and social usages. As smartphones evolve with the advancement of technology, different types of smartphone use may also emerge. These new types of usage that might lead to smartphone addiction have yet to be measured among extroverts (Elhai et al., 2017). Further studies may be required to find out factors that lead to extroverts to smartphone addiction.

Conclusion and Implications

In conclusion, this study's findings support the predictions that the inconsistent results that were reported on the relationships between introverts/extroverts and smartphone addiction applications can be relevant to the types of smartphone usage. Besides showing that the levels of introversion and extroversion may affect the types of smartphones use and the addiction in smartphone; the results also reveal that the introverts are more likely to use the smartphone for process usage and thus are more likely to addict in a smartphone, whereas the extroverts are more likely to use the smartphone for social usage and are more likely to addict in a smartphone. Nonetheless, extroverts are less likely to become addicted to smartphones through social usage, as there are more alternative ways to gratify their social needs. Future study may need to examine further other types of smartphone usage that lead to smartphone addiction among extroverts, as the current two types of smartphone usage may not be able to measure the type of usage that cause smartphone addiction among extroverts.

In theoretical application, this study's findings suggest that use and gratification can be a useful framework to understand and predict smartphone addiction among different individuals. In practical application, the results show the importance of considering smartphone users' personality traits in designing prevention programs for smartphone addiction. Educators may consider providing more alternative strategies to gratify introverts' needs to reduce their dependence on process usage in smartphones.

Limitations of Study

Findings from this study need to be interpreted with caution due to certain limitations faced. Since purposive sampling was used to recruit the participants, and the location was only in one institution of higher learning, the findings cannot be generalized to all graduates. It is recommended that future studies repeat the study by recruiting participants from different populations to examine the robustness of the results. The other challenge is the fast evolution of technology in smartphones; the types of smartphone usage may need to update frequently to meet the trend of smartphone use among undergraduates. As such, the current findings may remain valid for a certain period and only towards undergraduates. Lastly, since a cross-sectional study design is used in this study, the cause-effect explanation that based on the statistical model may need to further examine (Shaughnessy et al., 2015).

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