An Investigation About Influence of Personality Traits on Mobile Application Choosing- Using Behaviour

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Abstract

Personality can be referred as the mindset on which a person acts or motivates on. In this paper a research question vis-a-vis personality traits effects on individual mobile application adoption process is dealt with. It is formed as "Do personality traits have an influence on the ways people choose and use an app?" Moreover, there is data specifically on Big-Five Personality traits of individuals, app genres they download, and their purposes/ considerations when downloading an app. The data is from a 2014 research can be found on Harvard Dataverse by the name Worldwide Mobile App User Behavior Dataset(Lim, 2014). The data is first descriptively investigated to get an insight about the demographics of participants and personality trait means of the whole group. Furthermore, by referring to literature and giving an argument about each; prior to investigation 1 main null hypothesis:"there is an influence of personality traits on app adoption process" and 15 sub-hypotheses are formed, accompanied by an alternate hypothesis and null hypotheses consecutively. Sub-hypotheses are categorized by 5 personality traits, 3 for each. After a Levene's Test, means of personality traits are compared for groups formed by the dichotomous responses in data. An Independent t- Test was used to compare the means; resulting with almost all sub-hypotheses being accepted. Thus, the null hypothesis is also accepted and it is concluded that personality traits have an influence on app adoption process.

Keywords: app adoption; mobile apps; personality traits; five-factor model; decision making

Introduction

Technological advancements form the basis of modern civilized world and are implemented to daily life in forms of various portable devices such as laptops and mobile phones. Especially mobile phones; Lepp, Barkley and Karpinski (2014) also pointed out that they are almost always on-hand and allow users to connect with an array of services and networks at almost any time and any place. Thus, in some sense these devices can be considered as limbs due to their usefulness and irreplaceable functions in constraints of 21^{st} century. Functionality of mobile phones are linked to the number of applications that are present in the phone; the apps can be perceived as compact tools which owners use to cope with situations. They are either built-in (pre-downloaded and listed in factory settings) or downloadable from the correspondent digital distribution platform of the device. In some sense, every mobile phone can be personalized according to its owners preferences. Every individual has their unique needs and preferences. In order to fulfill these needs individuals, need to take some actions hence make decisions. In a 2016 study, significant relationships among personality traits and decision- making styles are found (Narooi & Karazee, 2016). Logically this result also suggests a correlation between the applications used by the individual and his/ her personality traits; since, apps are also referred as tools used in decision making. There are numerous apps that are available in platforms, they vary in genre, age limit, purpose *et cetera...* due to the enormous number of different needs people have. For instance, some can download an app in productivity genre to organize and time themselves, whereas some can download apps in gaming genre to kill time. These differences in app preferences can be investigated in terms of individuals personality traits hence give insights about each user group's approach to apps.

Furthermore, previous findings also point that personality has an impact on individuals internet usage adoption (Landers & Lounsbury, 2006), Facebook/ Foursquare (social media applications) usage adoption (Chorley, Whitaker, & Allen, 2015) and likewise. Broad user demographics and occurrence of different user types in platforms are two major reasons making this study particularly intriguing. The results of this study are expected to reveal a review of the processes undergone by people with different personalities when adopting an app. This information can aid *e.g.* application developers as to understand markets consumer segments and create new apps according to the needs of users, emphasizing a user-centric approach. For, users needs promote their motivations while choosing an app.

The paper will have the following order; first, personality traits will be discussed in the light of Five Factor model(Costa & R. Mccrea, 1992) and arguments about its relation with application adoption will be given. Secondly a research methodology will be given with appropriate hypotheses which will be advanced by descriptive analysis of the data and correspondent distribution plots in results section. Later on, the hypotheses will be answered by a statistical test applicable to the data and the answer will be further evaluated in discussion section. The last section, improvements, will be about the validity of results and possible improvements that can be undertaken to expand the research.

Analysis of Concepts

Five- Factor Model

Personality, in English language, is defined as the type of person you are, shown by the way you behave, feel, and think; and as implicated by the meaning it has a direct effect on individuals expression of self and interaction with the

world. Thus, many experimental tools were designed by social scientists, in some sense, to measure psychometrics. A comment on the topic would be ”the predictability of actions is what typifies personality because it gives the observer an insight about the nature of behaviour individual will perform in certain conditions”, as to do that prediction, quantifiable scales were required. Throughout the years various questionnaire and surveys were constructed, mostly being introspective tests. Fraley(2005) also quoted, quantitative methods such as factor analysis, also, played an important role in facilitating the discovery of the fundamental dimensions of personality, highlighting the impact of quantifiable research methods. By assessing people, these experiments produced personality trait inventories as well. There are different personality trait tests currently on use, one of them is called the Big-Five Inventory(Costa & R. Mccrea, 1992) and its based on 2 postulates of Lexical Hypothesis; which posit the existence of common language descriptors and that more socially important person descriptors show greater density in the lexicon(Wood, 2015). Therefore, The Big-Five Structure or Five-Factor Model has a linguistic basis rather than a neuropsychological one. It uses reductionist logic and classifies personality traits on 5 bipolar items(R. Goldberg, 1991). 5 items are listed as openness to experience, conscientiousness, extraversion, agreeableness and neuroticism. One can also see the reductionist logic involved e.g. by extending extraversion to such related qualities like gregariousness, assertiveness, excitement seeking, warmth, activity, and positive emotions(Matthews, Deary, & Whiteman, 2008). 5 personality dimensions are, in more detail, given as;

Openness to experience is the measure of an individuals intellectual curiosity, aesthetic sensitivity and imagination, consequently it is also referred as intellect. Highly open people have joy thinking, appreciate art and are more creative. They are also noted to be more risk takers in seek for euphoric experiences and related with drug taking. The opposite of this perception is having a narrow and closed approach towards life.(Soto, 2018) They lack to depict personal preference and often act pragmatic and data-driven in extend to being dogmatic.(Wikipedia contributors, 2019)

Conscientiousness represents ones organization and productivity skills in addition to responsibility level. Conscientious people are efficient, more structured and usually follow an order to achieve a goal.(Soto, 2018) They also act dutifully and are perceived to be stubborn and focused.(Wikipedia contributors, 2019) Low conscientious is related with spontaneity and lack of reliability.

Extraversion stands for the individual differences people have in social activities and social engagements. People with high extraversion are tending to be more talkative, more comfortable in social environments and can express emotions like enthusiasm. Whereas less extraverted people are emotionally reserved and usually self-absorbed.(Soto, 2018)

Agreeableness diverge in terms of peoples acceptance of others and their compassion. Meaning agreeable people are more likely to care and empathize others. Disagreeable individuals tend to have less regard for others and social norms of politeness.(Soto, 2018)

Neuroticism captures differences in the frequency and intensity of negative emotions. Also defined by Friedman and Schustak (2016) as tendency to be prone to psychological stress Main difference between poles of neuroticism is the degree of emotional stability. Highly neurotic people are more likely to experience mood swings and anxiety.

All of these personality traits combined form the Five-Factor Model. According to the statements about five traits each, responder gives a numeric value according to his/ her likeliness to the statement. The scales and number of statements used in the questionnaires may vary.

From another perspective, it can be seen that personality traits are a result of stable individual differences in people’s motivational reactions to circumscribed classes of environment stimuli.(Bayram & Aydemir, 2017) Then, the Five-Factor Model can also be seen as a taxonomical system summarizing most human personality differences in five dimensions. It is also a hierarchical system as each dimension covers such related traits and can be extended in their selves to cover each other too.

In Relation to Decision Making and App Adoption

Decision making is the process underlying an individuals path from a certain situation to the next one. In the end of this process one end of the path is taken and it might or might not give rise to an action; which, in both, ways are an action. This phenomenon can be portrayed as a system with input, output and processor mechanism in the middle. Processor mechanism is also related with the approach of the individual to the issue promoting the decision-making process in the first place, and there are different types of approaches called decision making styles. Examples of decision-making styles are rational, intuitive, dependent, avoidant and spontaneous decision making.

There are studies suggesting a relation between people’s decision-making styles and personality traits. Hough and Ogilvie (2005) studied the connection between personality types based on MyersBriggs Type Indicators with rational and intuitive decision making styles. Likewise, Riaz and Batool (2012) investigated personality traits and decision-making styles for university students; and found personality types contributed 15.4 percent to 28.1 percent variance in decision-making styles.(Bayram & Aydemir, 2017) Narooi and Karazee (2016) extended the study to personality traits, decision-making styles, and attitude to life for university students; including one more variable. For personality traits, they used the Five-Factor approach and

conclude that they found significant relationships between personality traits and decision-making styles. Another example would be a study conducted in Italy, (Di Fabio & Palazzeschi, 2015) they investigated career decision-making difficulties and the Big Five personality factors among participants from three educational settings. As Five- Factor Model is based on linguistics, an Italian lexicon-based questionnaire is used. Di Fabio et al.(2015) noted that the personality factors of Extroversion and Neuroticism consistently explained a significantly larger percentage of variance in participants developmental career indecision levels in all three samples than did educational setting or age. // Earlier, a system with input, output and processor mechanism has been mentioned as an analogy to decision making process. In most of the times that processor mechanism is also depicted as a black box due to the abstractness of the information processing done there. Based on the literature review provided, an answer for what is behind that processor mechanism, will be the bias or effect of the personality traits. Meaning personality traits might manipulate the way people perceive things and in result of that; give an output, which is the made decision for that occasion/ perception. After a decision has been made a path is selected implying elimination of other paths. Selection is a very routine and daily process for humans. It is executed every moment and one particular example for selection in daily life is mobile application selection. It is said that the number of mobile phone users in the world is expected to pass the 5 billion mark by 2019 and smartphone users to reach 2.9 billion by 2020. (*Number of smartphone users worldwide 2014-2020*, n.d.) On the other hand annual numbers of apps downloaded is also expected to exceed 248 billion mark by 2022. (*Annual number of global mobile app downloads 2017-2022*, n.d.) Nowadays a multitude of mobile applications have become everyday tools in the life of people who want to be connected 24/7 (Roma & Ragaglia, 2016) and the question here is, what drives people to select and use specific applications they do? In the light of researches done in the field of decision making, an investigation will be explained regarding personality traits of people and the mobile application they use.

Research Methodology

Description

It is said that five factors can be seen as five dimensions summarizing most human personality differences. By this extend it is also expected that human personality differences called traits, will classify certain people with certain traits under the same roof and form groups. If there is a connection between personality traits and mobile application selection; then it is assumed that user group of a specific app will consist mostly from individuals having the same trait and from the same trait group. So, in most of the times there will be a dominant trait driving people to use an app. As every assumption, this assumption also offers a framework to evaluate itself. This will be done by comparing an app user group's particular personality trait to the same of a non-user group.

Hypotheses Development

In this study, several hypotheses will be tested. The main hypotheses that will be tested is the correlation between participants personality traits (based on Five- Factor model) and their mobile app adoption process. Adoption process can be elaborated as participants timeline in approach to an app. It starts with the purpose for downloading an app, then there is a finding strategy involved and finally the things people consider to choose an app. Another important thing contributing to this process is the genre of app since it is the main subject of the process. The null hypothesis, H_0, regarding the issue is "there is an influence of personality traits on app adoption process" and the alternate hypothesis H_A: "there isn't an influence of personality traits on app adoption process". The main hypotheses will be tested by the accompanying sub-hypotheses.

By help of previous studies and projection of 2 taxonomical systems, sub-hypotheses will be formed regarding app adoption. One taxonomical study to be used is Norman's 75 Categories(Norman, 1963). Norman had investigated 2,800 trait terms selected from unabridged English dictionaries, by using some research methods he later classified the remaining 1,431 terms into 75 categories.(R. Goldberg, 1991) Goldberg then studied the relation of these 75 categories to the Big- Five model. Second study used is Revised NEO Peronality Inventory (NEO PI-R) by Costa and Mccrae. It is a more elaborate model of their previous taxonomy, Big- Five model, including subcategories for all five factors called facets.(1992). Selected Norman and NEO PI-R classifications of Big- Five model is given below.

Extraversion:Talkative, sociable, outgoing, active, adventurous, energetic, impulsive (Norman, 1963); warmth, positive emotions, excitement seeking(Costa & R. Mccrea, 1992)

Agreeableness:Trustful, friendly, cooperative, polite, honest, patient(Norman, 1963); trust, modesty, altruism, compliance(Costa & R. Mccrea, 1992)

Conscientiousness:Organized, orderly, aimful, serious, formal, mature, cultured (Norman, 1963); order, dutifulness, self-discipline, competence(Costa & R. Mccrea, 1992)

Neuroticism:Timid, unventurous, dependent, immature, fearful(Norman, 1963); depression, impulsive, vulnerable(Costa & R. Mccrea, 1992)

Opennes to Experience (Intellect):Intelligent, complex, curious, studious, logical, artistic, musical(Norman, 1963); aesthetics, actions, ideas, values(Costa & R. Mccrea, 1992))

List of Hypotheses

$H_{E.1}$: More extraverted people are more likely to use an app with the purpose of interacting with other people.

$H_{E.2}$: More extraverted people are more likely to download an app due to impulsive buying behaviour.

$H_{E.3}$: More extraverted people are more likely to use an app

in the genre of travel.
$H_{A.1}$: More agreeable people are more likely to use apps that are recommended by their friends.
$H_{A.2}$: More agreeable people are more likely to download an app that they see in a media channel.
$H_{A.3}$: More agreeable people are more likely to download an app in the genre of social media.
$H_{C.1}$: More conscientious people are more likely to use an app with the purpose of performing a task.
$H_{C.2}$: More conscientious people are more likely to do research when finding an app.
$H_{C.3}$: More conscientious people are more likely to download an app in the genre of news.
$H_{N.1}$ Neurotic people are more likely to not use an app with the purpose of interacting with other people.
$H_{N.2}$: Neurotic people are more likely to not download an app for entertainment purposes.
$H_{N.3}$: Neurotic people are more likely to not download an app in the genre of social media.
$H_{I.1}$ More open people are more likely to use an app with the purpose of performing a task.
$H_{I.2}$ More open people are more likely to consider artistic aspects of an app when choosing.
$H_{I.3}$ More open people are more likely to download an app in the genre of music.

Data Analysis

Dataset

The dataset used for this study is titled Worldwide Mobile App User Behavior Dataset (Lim, 2014) and it can be found in its entirety on Harvard Dataverse; https://doi.org/10.7910/DVN/27459. It is compiled by Soo Ling Lim, a postdoctoral researcher from University College London back then, in 2014. It consists of mobile app user behavior, demographics, and Big-Five personality traits of 10,208 people worldwide. More than 15 countries were involved, the countries are from 5 continents. USA, China, Germany, Brazil, Italy, Russia and Australia can be given to name a few.
The results of the questionnaire produced the data as follows;

- Demographics of participants including gender, age, nationality, education level and income
- Purposes for downloading an app,
- Times people look for an app,
- Strategies participants use to find an app,
- Things participants consider when downloading an app,
- The reasons participants stop using an app,
- The type/ genre of apps participants download,
- Personality traits of participants gathered by using an 8-likert scale, 10 element big-five personality traits test.

More detailed version of each question with the dichotomous choices can be seen in the appendices section.

Data Cleaning

In the framework of the hypotheses, some variables are excluded from data. The variables concerning the hypotheses are; purpose for downloading an app, strategies for finding an app, things considered when downloading an app, the genre of the apps downloaded, and 10 variables associated with positive and negative attitudes of five traits. In addition, demographics (gender, age) is also stored in the remaining data for descriptive purposes. A meta variable is used to filter out responses that contain faulty or incomplete data, resulting with 4824 valid responses to investigate.
10 variables are related with personality traits, each ranging from 1 to 7 in a likert scale. By using appropriate double combinations, 10 variables are reduced to 5 variables according to the Five-Factor model. To do this, negatively associated elements are subtracted from the positively associated variables. Only exception is neuroticism, which is a fundamentally negative attitude. Thus, positive element is subtracted from the negative element in that case. The derived variables ranged between -6 and 6, with 6 being the highest likeliness.

Hypotheses Testing

In this section, mentioned sub-hypotheses will be tested. In order to perform hypotheses tests a measure for assessment is needed, which will be the means of the groups in this case. The mean of a specific personality trait will be compared. Grouping is done by answers given to selected dichotomous questions for each variable. All sub-hypotheses will be converted as in the examples.
$H_{E.1}$: More extraverted people are more likely to use an app with the purpose of interacting with other people.
$H_{E.1}$is redefined as;
$H_{E.1}$: User group who use an app with the purpose of interacting with other people have higher extraversion mean than that of people who dont use an app with that purpose.
$H_{E.2}$: More extraverted people are more likely to download an app due to impulsive buying behaviour.
$H_{E.2}$ is redefined as;
$H_{E.2}$: User group who download an app with impulsive buying behaviour have higher extraversion mean than that of people who dont download an app with that reason.
$H_{E.3}$ $H_{A.1}$, $H_{A.2}$, $H_{A.3}$, $H_{C.1}$, $H_{C.2}$, $H_{C.3}$, $H_{N.1}$, $H_{N.2}$, $H_{N.3}$, $H_{I.1}$, $H_{I.2}$ and $H_{I.3}$ are redefined likewise with the general redefinition pattern "User group who ... an app with ... have higher mean than that of people who dont ... an app with that ... .". All redefined sub-hypotheses also have a linked null sub-hypothesis claiming that means for two groups are equal. The redefined version of all hypotheses can be found in the appendices section.
The hypotheses test to be used is Independent Samples t-Test. It has some data requirements, which also overlap with the reasons why this test is chosen. In this case, a dependent

interval-wise continuous variable, personality trait index, is being grouped by the dichotomous categorical responses of participants to questions. Samples used are independent meaning there is no influence of a group over another one. Final requirement is the homogeneity of the samples, it assumes that samples have equal variances. This is not the case in subject group of each hypothesis; thus Levene's Test is performed beforehand checking the variances. If the Levene's Test scores lower than the significance level ($p = 0.05$), then t- Test is performed without assuming homogeneity of variances. IBM SPSS software is used to carry out the tests.

Results

Demographics and Group Descriptives

Group consists of 4824 people, the distribution of the age grouped by gender is given by a pyramid histogram.

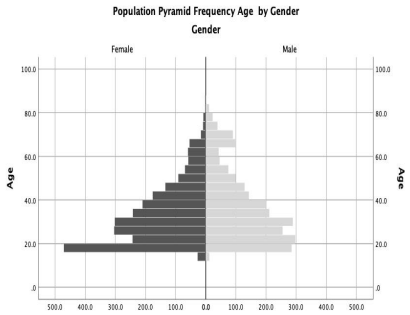

Figure 1: Pyramid Histogram of Age by Gender

The demographic distribution of participants indicates an equally balanced number between males and females, with 51.4 percent of participants being female. The mean age of the group is 35 and the standard deviation is 15. The youngest participant is 11 years old and 76 years younger than the oldest participant, 87.

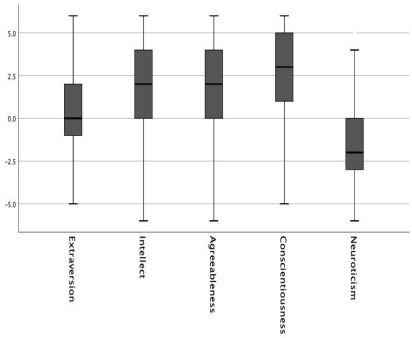

Figure 2: A Boxplot Visualization of Personality Trait

It can be seen that extraversion trait shows slightly normal distribution while other traits are distant from that. These plots give a general view of participant groups five factor model summary. The participants' two significant figure rounded mean for extraversion is 0.22, agreeableness is 2.0, conscientiousness is 2.7, neuroticism is -1.5 and intellect (openness to new experience) is 2.2. Except from extraversion, all other traits seem to show a skewed behaviour to the positively associated part of the scale. Which may also be a result of a phenomenon called illusory superiority. Meaning, participants might be in a mental condition where they overestimate their qualities and abilities. (Hoorens, 1993) In particular, one study also found illusory superiority in relationship happiness(Buunk, 2001), which provides a logical explanation for these distribution plots; as personality traits are subsequently related with one-on-one relationships.

Hypotheses Results

Used IBM SPSS software produced the following table for each hypothesis.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					
								95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Extraversion	Equal variances assumed	6.646	.010	-6.319	4822	.000	-.507957	.0803817	-.665542	-.350373
	Equal variances not assumed			-6.252	2595.217	.000	-.507957	.0812528	-.667284	-.348631

Figure 3: Test Table for $H_{E.1}$

This table shows the results of test for $H_{E.1}$. Levene's Test records a significance 0.010 therefore rejects the null hypothesis of homogeneity. So, second row is used for t-Test significance which is 0.000 meaning extraversion mean of the group using apps with the purpose of socialization has significantly higher mean than people without that purpose. The mean difference is recorded as 0.51, in magnitude. The same procedure is carried out for all sub-hypotheses and results formed the table at the end of this section.
It is also observed that Levene's Test scored less than the significance level in 7 out of 15 observations. This means nearly half of the group differ by its deviation/ spread. On the other hand, most t- Tests scored less than the significance level implicating differences in means of groups. Only in 2 tests, for $H_{A.2}$ and $H_{N.2}$, the null hypothesis isn't rejected.

Table 1: Levene's Test and t- Test Results

Hypotheses	Levene s Test	Mean Difference	t- Test
$H_{E.1}$	0.010	0.510	0.000
$H_{E.2}$	0.266	0.330	0.015
$H_{E.3}$	0.031	0.690	0.000
$H_{A.1}$	0.630	0.230	0.010
$H_{A.2}$	0.281	0.086	0.278
$H_{A.3}$	0.865	0.310	0.000
$H_{C.1}$	0.008	0.500	0.000
$H_{C.2}$	0.012	0.260	0.000
$H_{C.3}$	0.000	0.520	0.000
$H_{N.1}$	0.764	-0.300	0.000
$H_{N.2}$	0.014	0.070	0.334
$H_{N.3}$	0.010	-0.190	0.008
$H_{I.1}$	0.622	0.590	0.000
$H_{I.2}$	0.294	0.400	0.000
$H_{I.3}$	0.202	0.530	0.000

$p < 0.05$ for both tests

Conclusion

Discussion

The aim of this study was to show the influence of personality traits on people's app choosing and using behaviour. This is done by comparing personality trait means of groups by independent t- Test. The groups are formed by participants answer to purpose, strategy and preferred app genre. For each question in each variable, two groups are formed. One for the ones who answered yes and one for no. Most of results for these groups showed consistent scores complementing the aim of the study.
Hypotheses concerning extraversion trait were related with their social interactions, impulsivity and adventurous nature. Extraversion trait has a wider spread and almost normal distribution compared to other traits suggesting it to give more definitive results. As expected all three hypotheses are accepted. For purpose, their dominant trait of interaction and impulsive behaviour are shown to drive them. Also, people preferring apps in travel genre are more extraverted then people who dont. So, extraversion trait explained some differences in app adoption.
The hypotheses used for agreeableness trait were rather implicit. The characteristics and facets of this trait makes it difficult to relate with app adoption due to limited data present. For instance, trustworthiness is not something completely necessary in app selection process. As, agreeableness is a more socially accepted trait, its social attributes were used for. Its concluded that more agreeable people use apps recommended by their friends than that of less agreeable people and they use social media apps more often. However, $H_{A.2}$ is rejected meaning agreeableness is not related with app selection by media influence.
All related hypotheses about conscientiousness trait are accepted as well. The emphasis was on its neatness and order aspects. As predicted conscient people preferred to use news apps and it is shown that they choose apps with the purpose of carrying out a task. In addition, their rational thinking is projected in app finding strategy as they did researches prior to choosing an app. When looked overall, conscientiousness displayed significant influence to an individuals app adoption process.
Neuroticism is how timid, and depression inclined an individual is. Neurotic people were expected to be not motivated by social interaction and entertainment purposes when choosing an app. Expectations match with the results of social interaction purposes and less neurotic people are shown to use social media apps more than neurotic people. It is also found that neuroticism is not related with choosing an app for entertainment purposes, consequently $H_{N.2}$ is rejected. Yet, the general mean for neuroticism is -1.5; showing a highly skewed distribution and negative mean. The data involves minimally neurotic sample, and less neurotic an individual is less influence neuroticism will have on his/ her behaviour. So, comparing two slightly neurotic groups will weaken the power of statistical tests done for $H_{N.1}$, $H_{N.2}$ and $H_{N.3}$.
Finally, intellectual people are described to be more artistic and more considerate about aesthetics. This behaviour is also exhibited in app adoption. They are shown to prefer music apps more than less intellectual people and interestingly, seem to care more about icons and other artistic features of apps. As a result, all hypotheses, $H_{I.1}$, $H_{I.2}$ and $H_{I.3}$ are accepted. Deducing an influence of intellect over app adoption.
So, by 13 out 15 sub-hypotheses being accepted it is safe to say that personality traits have an influence on app adoption process and null hypothesis, H_0, is accepted.

Possible Improvements

Some data regarding the questions about apps were not relevant for this study as they are dependent on other factors. Considering the price when choosing an app, for example, is not a good variable to assess effect of personality traits on app adoption as not everyone has the same wealth. Social science studies depend on reliable data; one way data, for this research, can be improved is gathering it from more personality- centric apps. Apps that are designed for people with specific personality traits can be used to gather more reliable data. More personal mobile phones get more distinctive data about personality traits can be collected. This can be done by the cumulative data of similar researches in this field to give developers an idea about each personality traits motivation regarding apps. More reliable data can construct better prediction models both for researchers and developers, feeding each other in a cycle.
In addition, apps- personality trait interaction can be viewed as multi-way channel, affecting each other. A longitudinal study can be conducted to observe apps influence on personality during an interval.

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Appendix

Dichotomous Choice Questions Used

How do you find apps? (please select all that apply)

I compare several apps in order to choose the best ones. (1)
I download the first app that I see on the list of apps presented to me. (2)
I look for apps that are featured on the front page of the app store. (3)
I look at the top downloads chart. (4)
I browse randomly for apps that might interest me. (5)
I search the app store using keywords. (7) (keyword/name)
I visit websites that review apps. (8)
I use search engines (e.g., Google). (9)

Q9 What do you consider when choosing apps to download? (please select all that apply)

Reviews by other users (1)
Name of app (e.g., catchy name) (2)
Number of users who have downloaded the app (3)
Icon (e.g., if the icon is attractive) (4)
Description of the app (5)
Features (6)

Number of users who have rated the app (7)
Price (8)
Star rating (9)
Size of app (10)
Screen shots (e.g., to see how the app looks like when running) (11)
Who developed the app (12)

Q10 Why do you download an app? (please select all that apply)

To interact with friends and/or family. (1)
To interact with people I don't know. (2)
To help me carry out a task. (3)
It is featured in the app store. (4)
It is on the top downloads chart. (5)
It is advertised in the apps that I am using. (6)
For entertainment. (7)
Out of curiosity. (8)
An impulsive purchase. (9)
It features brands or celebrities that I like (e.g., Coca-Cola, Michael Jackson). (10)
It was mentioned in the media (e.g., TV, newspaper, radio, blogs). (11)
It is an extension of the website that I use (e.g., Facebook app). (12)
It is recommended by friends and/or family. (13)
For someone else (e.g., children, partner). (14)

Q15 Which type of apps do you download? (please select all that apply)

Navigation (e.g., GPS Navigation, Gyro Compass) (1)
Business (e.g., PrintCentral, Quickoffice) (2)
Catalogues (e.g., 1001 Home Interior Catalog, Art) (3)
Travel (e.g., TripAdvisor, Lonely Planet Traveller) (4)
Books (e.g., Kindle, Audiobook Podcast Player) (5)
Photo video (e.g., Adobe, iMovie) (6)
Lifestyle (e.g., eBay, Gumtree) (7)
Entertainment (e.g., X Factor, Toca Hair Salon) (8)
Finance (e.g., Debt Manager, Account Tracker) (9)
News (e.g., Sunday Times, Bloomberg Businessweek) (10)
Health fitness (e.g., Calorie Counter, Simply Yoga) (11)
Games (e.g., Angry Birds, Flight Control) (12)
Food drink (e.g., Dominos Pizza, Good Food Magazine) (13)
Education (e.g., MathStudio, TED) (14)
Medical (e.g., iStethoscope, Vision Test) (15)
Social networking (e.g., Skype, Facebook) (16)
Reference (e.g., Birds of Brazil, Worlds Longest Rivers) (17)
Sports (e.g., NFL Game Pass, LiveScore) (18)
Utilities (e.g., Calculator, Alarm Clock) (19)
Weather (e.g., Weather+, Weather Live) (20)
Productivity (e.g., Dropbox, Pages) (21)
Music (e.g., djay, Piano*) (22)

Redefined Hypotheses

$H_{E.1}$: User group who use an app with the purpose of interacting with other people have higher extraversion mean than that of people who dont use an app with that purpose.

$H_{E.2}$: User group who download an app with impulsive buying behaviour have higher extraversion mean than that of people who dont download an app with that reason. $H_{E.3}$: User group who download an app in the travel genre have higher extraversion mean than that of people who dont download an app in that genre.

$H_{A.1}$: User group who download apps recommended by their friend have higher agreeableness mean than that of people who dont download an app with that reason.

$H_{A.2}$: user group who download an app that they see in a media channel have higher agreeableness mean than that of people who dont download an app with that reason.

$H_{A.3}$: User group who donwload an app in the genre of social media have higher agreeableness mean than that of people who dont download an app in that genre.

$H_{C.1}$: User group who download an app with the purpose of carrying out a task have higher conscientiousness mean than that of people who dont download an app with that purpose.

$H_{C.2}$: User group who do research prior to downloading an app have higher conscientiousness mean than that of people who dont download an app with that strategy.

$H_{C.3}$: User group who download an app in the genre of news have higher conscientiousness mean than that of people who dont download an app in that genre.// $H_{N.1}$: User group who don't use an app with the purpose of social interaction have higher neuroticism mean people than that of people who use an app with that purpose.

$H_{N.2}$: User group who don't download an app in search of entertainment have higher neuroticism mean than that of people who download an app in the that search.

$H_{N.3}$: User group who don't download an app in the genre of social media have higher neuroticism mean than that of people who download an app in that genre.

$H_{I.1}$: User group who use an app with the purpose of of performing a task have higher intellect mean than that of people who dont use an app with that purpose.

$H_{I.2}$: User group who consider artistic aspects of app when downloading have higher intellect mean than that of people who dont consider that aspects of an app when downloading.

$H_{I.3}$: User group who download an app in the genre of music have higher intellect mean than that of people who dont download an app in that genre.