

Can Personality Type be Predicted by Social Media Network Structures?

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Abstract

Social media platforms have become an integral part of how we live our lives, in particular for those generations who have grown up in the digital world and use these platforms to connect and communicate with many different groups. Personality profiling now underpins many facets of our lives for example digital marketing campaigns target specific audience groups using information gleaned from how a person engages with social media (Seung, 2012). Specific personal information that could assist with precise targeting might be helpful to those who want to interact with people via digital media. Psychological Type suggests we are predisposed to certain behaviors and preferences (Jung, 1921). Traditional methods of assessing personality include observation or psychometric questionnaires. Both methods have their benefits and drawbacks but what are the alternatives? Can the digital world and in particular, social media platforms, provide an alternative method? If a person's digital personality footprint could be assessed by the way they engage in social media activity this information could be used to precisely target informative communications as well as product marketing campaigns (Maehle & Shneor, 2010).

This paper presents a summary of initial work undertaken to explore the nature of structural patterns represented by an individual's Psychological Type, as defined by their MBTI type and specific aspects of their social network data, as defined within the context of their Facebook connections and usage. Initial findings suggest that the virtual world is able to reflect personality differences that exist in the external world. Ongoing research is being undertaken to build on these initial findings.

INTRODUCTION

The world is shrinking. The concepts of Globalization and ‘Six Degrees of Separation’ mean that relationships between organizations and people are becoming more interconnected. It is now possible through the lens of social media to search for and connect to a person anywhere in the world without any prior physical or social contact. The current, popular social media platforms of Facebook, LinkedIn and Twitter encourage such networking. This means that people now develop relationships and connections with people for no reason, other than to widen their personal and business on-line contacts. Cyber-networking has replaced the need for face-to-face networking when searching for a job; when conducting research and appears to provide more efficient ways to engage in debates that extend existing knowledge and discourse.

Income generation from on-line advertising and sponsorship is now big business. In fact, digital marketing has become a discipline in its own right. Traditional marketing and advertising campaigns are now being substituted by social media campaigns to expand their reach towards targeted audiences (Seung, 2012). If marketers and those interested in disseminating information to specific groups of people could tap into reliable information about a person they could direct their campaigns more precisely (Maehle, Shneor; 2010). Currently marketers rely on information in the digital world that an individual makes known or is willing to reveal in the public domain, for example what products and services they use, like and share within and across their personal social media networks.

If organizations could know more about the personal characteristics of the people that they were aiming to target, the more focused their campaigns could be. However, such information is very personal to an individual and is unlikely to appear openly in the public domain. If information that characterizes personality could be translated into a format that appeared in a de-sensitized and anonymous configuration, it might prove advantageous to a range of end-users. The intention of this research is to find alternative ways of representing such personal information whilst maintaining confidentiality and integrity.

Understanding and Assessing Personality

There are different models that help to explain and understand the concept of personality. Two contrasting approaches are the trait and preference approach. The trait approach suggests that individuals possess characteristics which are inherent, immutable, ‘hard-wired’ and stable over time, whereas the preference approach suggests that people are predisposed to certain behaviors and characteristics that have been developed and are also consistent over time and usage. However, to some extent a person can modify their behavior, if motivated to do so, in certain situations and contexts. The Big Five Personality Model is based on the trait approach and is said to provide a framework of personality that subsumes all personality behaviors. Many

psychometric questionnaires used to assess personality are based on the Big Five Model. In addition, there are questionnaires that are based on the preference approach; the Myers Briggs Type Indicator (MBTI) developed by mother and daughter (Briggs Myers et al, 1998) is one such measure that is widely used in a variety of settings such as education, counseling, career development and conflict resolution. MBTI is based on the work of Carl Jung (1921) whose seminal work on Psychological Type has provided a legacy to researchers interested in expanding the body of knowledge on personality differences.

According to Jung, an individual's personality or Psychological Type is based upon the development and use of four mental functions, two of which relate to how we perceive information, sensing and intuition and two which relate to how we make decisions, thinking and feeling and our attitude to the outer world expressed through the preference of extroversion or introversion. Jung's conceptual model suggests a person's Psychological Type is predisposed to different behaviors and preferences according to the development of each mental function and attitude.

Whilst the trait and preference approach differ conceptually, a research study by McCrae and Costa (1989) shows a relationship between the Big Five Factor model and the MBTI scales. The study showed that the four MBTI scales measure aspects of four of the five major dimensions of normal personality and that the five-factor model provides an alternative basis for interpreting MBTI findings within a broader, more commonly shared conceptual framework.

The descriptions of the MBTI scales given below are taken from the Introduction to Type handbook (Briggs Myers, 1998). Interpretation of the Big Five personality traits and correlations to MBTI preferences are shown below:

Table 1. Correlations between Big Five personality traits and MBTI preferences

Big Five Trait	MBTI Dimension	MBTI scales
Openness to Experience (Positive correlation to Intuition)	Preferred way of taking in information	Sensing: Take information in that is real and tangible using the five senses. Trusts experience. Intuition: Take information in by seeing the big picture. Trusts inspiration.
Agreeableness (Positive correlation to Feeling)	Preferred way of making decisions	Thinking: Look for logical consequences in a situation. Feeling: Look to create harmony in a situation
Extroversion (Inverse correlation to Introversion)	Preferred focus of attention / energy	Extroversion: focus on the outer world. Introversion: focus on the inner world.
Conscientiousness (Inverse correlation to Perceiving)	Preferred way of dealing with the external world	Judging: Methodical and ordered approach to life. Perceiving: Spontaneity and casual approach to life.

The trait neuroticism which is referred to as emotional instability is not correlated with any of the MBTI scales.

Whichever approach to personality is considered, the notion of assessing, discussing and identifying aspects of an individual's personality, with or without their consent, in the public domain could be considered to be intrusive and unethical. If it were possible, therefore, to find an alternative way of assessing personality in a less intrusive way, it could open up an array of applications in many aspects of life.

Personality is typically assessed by observation or completion of psychometric questionnaires. Both these methods could potentially cause the person being observed or tested to consciously or unconsciously alter their behavior to suit a given purpose or desired outcome. However, when a person is engaging in normal social media interactions, it is unlikely that they are consciously trying to alter their personality and so their social media interaction patterns may provide a reflection of their true self. However, research indicates that for some people they use the virtual world of on-line interaction as a way of hiding their true self (Amichai-Hamburger, Wainapel & Fox; 2002).

Technology and Personality

With the current technological revolution of social media and its pervasiveness into daily life, an interesting question that is raised is whether social media could provide a reflection of personality between that which exists in the real world with that which exists in the virtual world. Could social media activity output provide an alternative way to assess personality? A groundbreaking research study into such a question has been conducted by a collaboration between Cambridge University and Microsoft Research (Bachrach, Graepel, Kohli, Kosinski & Stillwell; 2012). This team conducted a study that examined personality and patterns of Facebook usage. Their findings have been significant in relation to assessing personality and correlations of social network use. Their results show that there are significant relationships between each of the Big Five personality traits and usage of Facebook features. Their methodology was based on frequency measures, for example, how many friends does a person have in their network; how many times has a person been tagged in photos; how many status updates has a person made and other similar measures? The study's findings show a prediction of personality traits given a user's Facebook profile and usage. These findings are summarized below:

Table 2. Prediction accuracy on personality traits and Facebook usage

Prediction Accuracy	Big Five Factor	MBTI Scale	Correlation
Best	Extroversion	Introversion	Inverse relationship
Best	Neuroticism	NA	NA
Middle	Openness	Intuition	Positive relationship
Middle	Conscientiousness	Perceiving	Inverse relationship
Lowest	Agreeableness	Feeling	Positive relationship

RESEARCH QUESTION

According to Jung (1921) Introverts are private and contained individuals, whereas extroverts are social and expressive. Introverts like to focus on depth whereas extroverts tend to focus on breadth. In the actual world, extroverts and introverts behave in different ways. We wondered how these behavioral differences would be manifested in the digital world and what would these differences look like structurally? According to Bachrach et al, extroverts can be identified from their Facebook social media activity. Our area of interest focuses on what the network structure for an extrovert and conversely an introvert would look like? Using network theory and analysis, we speculate what the type of connections within and between introverts' and extroverts' network groups would look like structurally. More specifically we wondered whether a person's personality footprint is the same in the actual world as it is in the digital world; and how those differences might be

represented? Could these digital structural patterns provide an alternative way of identifying different personality types?

Our thinking and speculation about these factors led the research team to propose and test the following hypotheses.

Hypotheses

1. *Extroverts will have more connections within their social media network than introverts.*
2. *The density of an extrovert's network will be more intense than that of an introvert's*

Our study intends to build on the work of Bachrach et al but with two specific differences.

The first difference is that this current study will examine the structure of an individual's social media network in order to identify specific network patterns that might be associated with different personality preferences.

The second difference is that the researchers have chosen to use the MBTI (Myers-Briggs Type Indicator) instrument as the tool for identifying the specific personality preferences. This is because existing MBTI data is available for the targeted sample population and it might allow for a greater differentiation in personality in that the combination of preferences result in 16 different Types. It is not the authors' intention to argue for or against the applicability of the instrument, as evidence and studies exist to support its strength. The body of literature on the validity and reliability of the MBTI contains many studies that have been carried out using the MBTI to predict or determine success in specific settings such as educative courses (Bispong, Patron; 2008) or as a way of helping to identify specific competencies for particular jobs, such as R & D Managers (Dreyfus, 2007).

The focus of this research project will examine the best prediction findings from the Bachrach et al's study and therefore concentrate on the MBTI Introversion / Extroversion scale. The research proposition of this study is predicated on the Cambridge Team's findings that an extroverted type's personality can be predicted from their social media usage. This current study is looking to establish what specific structural patterns exist within an extroverted type's social media network and by definition for an introverted type too.

METHODOLOGY

This study takes a quantitative approach to data gathering and data analysis. We asked for volunteers from the current cohort of MBA students who are studying at the Asian Institute of Management to participate in this study as they had already undertaken the MBTI and would, therefore, know their MBTI Type. We used the

participants' MBTI data as well as data that were extracted from their personal Facebook social media networks. Mathematica 9 software was used to analyze the Facebook data files.

Sample Population

Our sample population was drawn from the current MBA student community within our teaching institution (AIM) for the following reasons. First, on entry to the MBA program each student completes the MBTI for learning and development purposes and so an MBTI database already exists. Second, with average age of 26, the age range of these MBA students suggests that they are more likely to be social media savvy and to have a developed and active Facebook account.

The total number of students who participated was 49. As we were only interested in the Introversion / Extroversion scales, we show below the division in numbers between these two scales:

Table 3. Sample Data

Sample Size	Introverts Total number	Extroverts Total number
Total n = 49		
Sample n = 44	23	21

The reason for the discrepancy between the total number of participants and actual sample size used in the study was due to a few participants that were undecided about their best fit type in respect of the extroversion / introversion scales or that their network data were incomplete so we therefore had to eliminate them from the study.

Ethical Considerations

The researchers were sensitive to the issues of confidentiality and anonymity. They approached the task of gathering data from the students' Facebook accounts in a way that would minimize concerns about how these personal datasets would be used and help to avoid situations where students felt they were not in control of producing and sending the requested data to the researchers. This was accomplished by setting aside some time at the start of one of the students' classes and walking them through the process step-by-step so that they could sign up to participate and produce the required data all at the same time. This meant that all questions, concerns and issues could be dealt with at a single point in time and everyone would receive the same instructions thus avoiding misinterpretation and misunderstandings.

The researchers assured the participants of confidentiality and that their data would be only used for research purposes. If participants wanted to maintain complete anonymity they were advised to set up and use an anonymous email account to send the dataset which would mean that there would be no traceable connection between a

particular dataset and an individual. Participants were assured that participation or non-participation in this project would in no way affect any of their grades or student assessments. Participation in the study was purely voluntary. The researchers also sought participants' permission to gain access to their MBTI data and only to use it in the context of the study. Participants were advised that they would be sent a copy of the journal article resulting from the study if they were interested in the final results.

DATA ANALYSIS

Each of the 49 AIM MBA students who volunteered to participate in the research was asked to follow a procedure so that their Facebook friends network could be extracted using an app called Netvizz (Reider, 2010). They then sent the output file containing their network to the research team for processing along with their MBTI personality type indicator. However, only 44 were selected as their MBTI type was either indeterminate or their network data were incomplete.

Their friends' network data were processed using Mathematica 9 (Wolfram, 2013) software. A visualization of a Facebook friends network is shown in Figure 2.

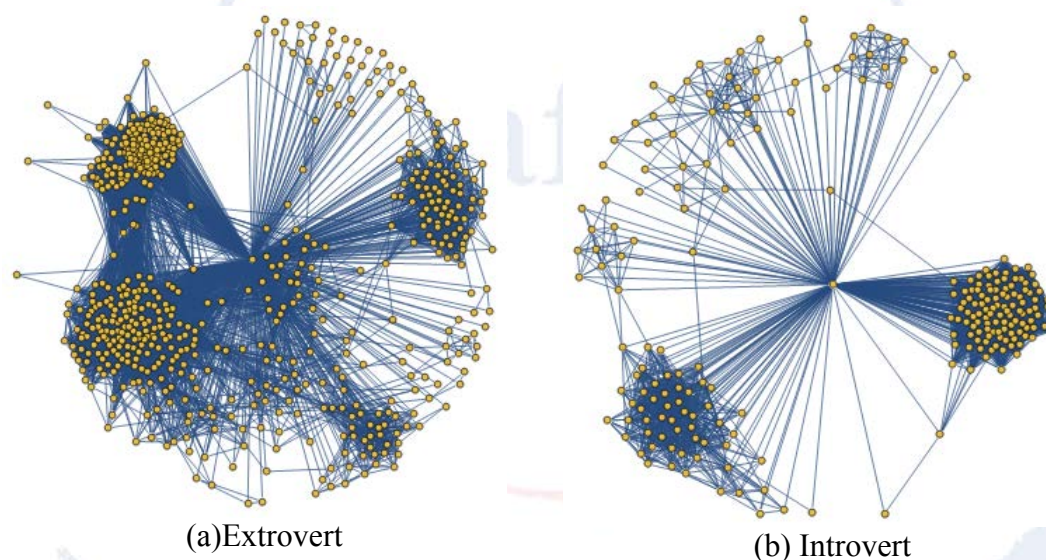


Figure 1. Sample friends network of an extrovert and introvert

The dots shown in the figure are the nodes of the network. The lines connecting the nodes are the edges. The node at the center is the person whose personality type we want to infer given the network structure.

Metrics to describe the structure of their network were computed. These metrics included number of friends (nodes) one is connected to and the number of connections the friends would have to each other (edges). We also measured the average degree (Jackson, 2008) which is the ratio between the total number of connections (edges) compared to the total number of friends (nodes).

We also computed the graph density (Jackson, 2008) to describe how the structure departs from a complete graph. A complete graph has a graph density of 1 which means all the nodes are connected to all the other nodes as depicted in Figure 3:

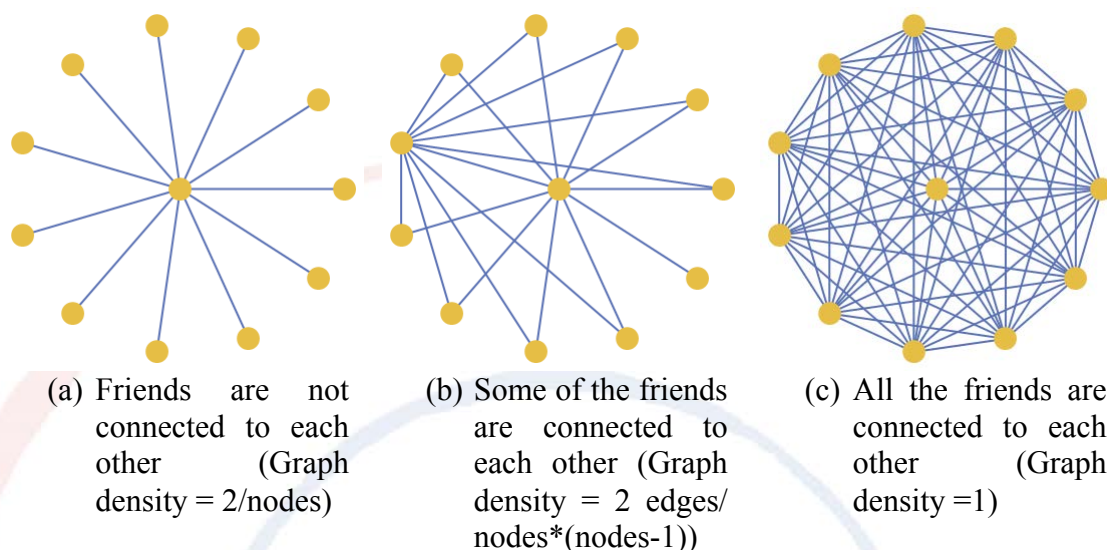


Figure 2. Graph density of the friends network

After looking at the individual connections, we considered how the nodes in the network are grouped. Instead of relying on Facebook's Groups (Facebook Groups, 2013) facility which depends on formal membership even though they are already connected, we look only at how dense the connections are among the nodes. We then use modularity (Newman, 2006) to algorithmically identify the communities formed by the nodes. By communities we mean grouping of nodes where the connections are more dense internally but sparser between nodes from a different community. For instance those, belonging to the same community would have high modularity and less if from different communities. Lastly, we also count the number of connected components to check the largest network a node is connected to (Freeman, 2004).

FINDINGS

First, we acknowledge that the sample population is small and not representative of the general population but we wanted to run the project as a pilot study and a precursor to a follow-up study. Since beginning this project, we have been given access to the data that the Cambridge study has generated and thanks to their generosity we now have additional data resources to hand. We acknowledge that our findings are neither representative nor statistically significant, but the findings alert us to potential points of interest for our follow-up study. We, therefore, present our findings for discussion purposes.

We first considered the Extroverted and Introverted groups. From the different analyses mentioned above, we focused on 3 measures for these groups.

1. The number of nodes for extroverts is slightly bigger compared to introverts. The extroverts in our sample have on average 660 friends while the introverts have 585 friends. Superimposed on the graph is the standard error to give us an idea of the precision of the data.

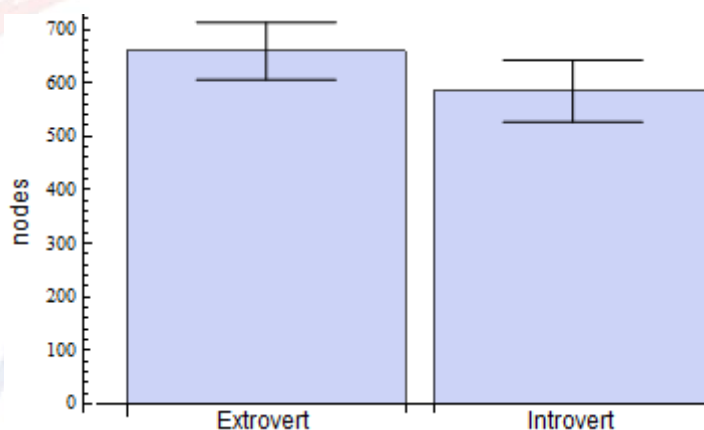


Figure 3. Number of Nodes for extroverted and introverted types

2. The number of edges for extroverts is slightly bigger compared to introverts. The personal network of an extrovert has about a thousand more connections than an introvert (17457 vs. 16680).

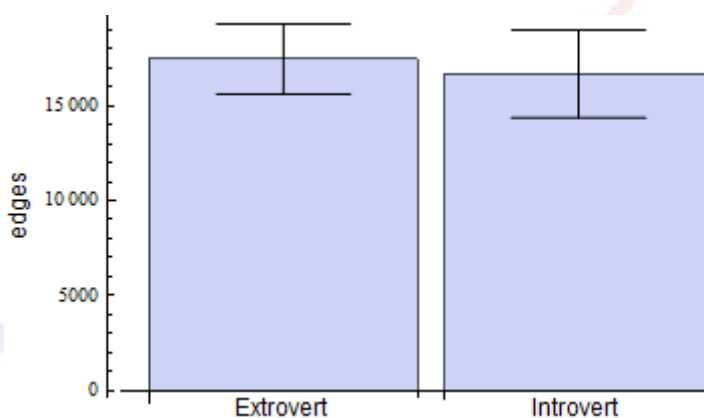


Figure 4. Number of edges for extroverted and introverted types

3. The value of the graph density for the extroverted group is slightly lower than the introverted group.

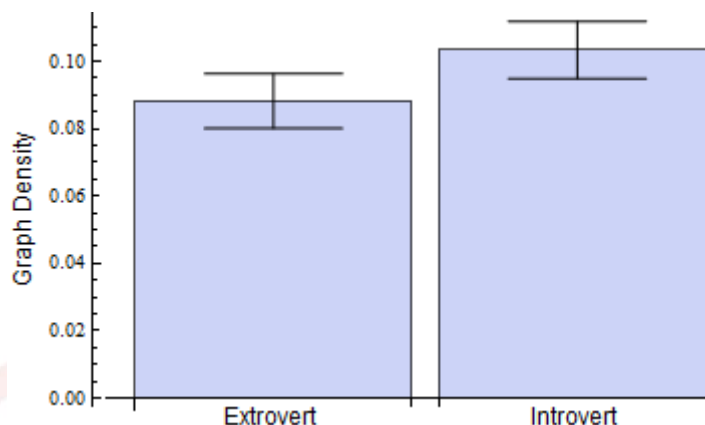


Figure 5. Graph density of extroverted and introverted types

DISCUSSION

We first look at the comparisons between the introverts and extroverts groupings.

1. The comparison of nodes which represents the number of friends a person has, in our study, suggests that extroverts have more friends than introverts or put another way, introverts have less friends than extroverts. The explanation for this could be as extroverts need to have social interaction with people and events in the external world they may find it easier to connect to people on Facebook than introverts. They may be replacing the external world with the cyberworld and may be substituting cyber connections for real connections. This finding is in line with that of the Cambridge study (Bachrach, et al; 2012) that found people who have a high degree of extroversion had more friends than those who had a lower degree of extroversion.
2. When comparing the number of edges, which represents the number of connections between friends, for the extroverts groups to the introverts group, the number was slightly bigger for extroverts. This could be explained by the fact that extroverts have more friends to begin with.
3. But even though extroverts have more friends to begin with, when comparing the graph density, introverts have more concentrated connections between friends than extroverts suggesting a tighter-knit grouping of people. A speculative explanation for this might be that extroverts might act like 'Social Butterflies', they are happy to have 'open-ended' connections and lots of them whereas introverts are selective about their connections and will only let people into their network after careful consideration and selection. Following the notion that extroverts go for breadth and introverts like depth, it could be that each group applies this concept to their virtual relationships as well.

After further analyses, we noticed something interesting, although the numbers are very small, we felt it was worth highlighting and adding into the discussion. We added the additional scale of Perceiving to the Extrovert and Introvert groups and

produced two new groups; Extroverted Perceiving types, EPs and Introverted Perceiving types, IPs. The comparison of nodes and edges between EPs and IPs produced the same trend as the pure extrovert and introvert groups but these differences were magnified. In addition, we found something interesting when analyzing the number of communities and connected components.

When we looked at the number of communities for the Extroverts and Introverts we expected the trend of Extroverts having more than Introverts to continue and it did, even though the difference was small. Similarly, we saw the same trend for extroverts to have more than introverts when we compared the number of connected components, (Figure 7, below)

However, when comparing the number of communities and the number of connected components for EPs and IPs (See Figure 7, below) we found this trend was reversed in that IPs had a bigger number of communities than EPs and IPs had a bigger number of connected components than EPs. It seems that this ‘introverted’ group (IP) is exhibiting more extroverted type behavior. The limited sample size and high standard deviation among IPs show a higher standard error.

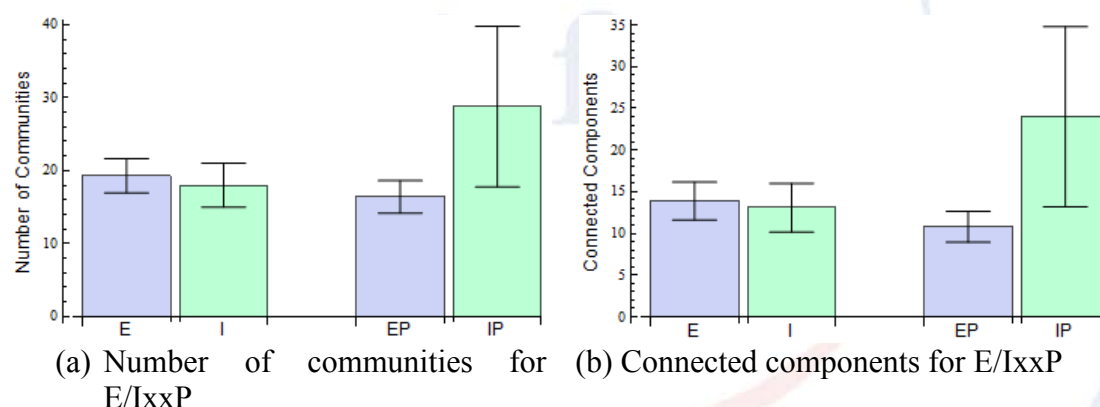


Figure 6. Comparison for E/I and E/IxxP

In MBTI terms, EPs are known as ‘Adaptable Extroverts’ and IPs are known as ‘Adaptable Introverts’. A possible explanation for this unusual anomaly might be that by adding the additional dimension of Perceiving to both extroversion and introversion adds the characteristics of spontaneity; flexibility and open-endedness. To some extent, these characteristics are already present in an extrovert and so could be either cancelled or leveled-out in the EP group, therefore, having no additional effect; whereas for introverts these characteristics are absorbed and treated as an additional component of their type. This combination of introversion and perceiving may cause introverted types to express more extroverted behavior. It is as though the IP group is emulating the extroverted ‘Social Butterfly’ effect.

Hypotheses

At the start, the project set out to test two hypotheses:

1. *Extroverts will have more connections within their social media network than introverts.*
2. *The density of an extrovert's network will be more intense than that of an introvert's*

Our initial findings suggest that the first hypothesis is supported although we cannot claim any statistical significance due to the small sample size. Our data tentatively shows that the second hypothesis is in fact reversed; the density of an introvert's network seems to be more intense than that of an extrovert's. It is our intention to follow up and further examine these tentative findings by increasing our existing sample population so that all MBTI types are represented. We will also consider how the Cambridge Team's database could provide an additional resource that may help to further investigate these initial findings.

CONCLUSIONS

This pilot study has helped to set the direction for further research. It appears that extroverts are more likely to engage differently than introverts with social media platforms, such as Facebook and therefore, each group appears to produce a different network structure. What has also been interesting and is worthy of further investigation is that when adding another dimension to the extrovert / introvert dimension, a different network structure is produced yet again. This adds credibility to the idea that it could be possible that each of the 16 MBTI types could produce different and possibly discrete network structures. So instead of treating personality groups as single entities, such as, extroverts or introverts, the MBTI already allows the categorization of personality into 16 different types. As we have seen by adding in another dimension to a single entity, a richer picture of a network structure is produced, as demonstrated by the additional Perceiving dimension to extroverts and introverts. If each of the MBTI personality types can be found to have typical, individualized network structures, it would suggest that each MBTI type could be identified through their own typical network structure. These datasets could offer an alternative way of assessing personality in line with the digital age in which we live. In addition, this information would allow further segmentation of groupings by personality type and could open up a range of applications that would enable each type to be specifically targeted for marketing and communication purposes.

LIMITATIONS

We acknowledge the limited sample size used in this study. This was in part due to the voluntary nature and response rate of participation. Whilst the researchers used an efficient way to gather the data, the drawback was that once participants left the classroom environment it proved difficult for the researchers to maintain the levels of

enthusiasm and motivation to participate that was initially evident. We also accept that the sample population was drawn from our institution's student community which is not representative of the general population. It would be our intention when conducting further research to expand the size and diversity of the sample population.

Another limitation to the study is the MBTI questionnaire itself and the opportunity to find participants who have both completed the questionnaire and have an active Facebook account. There are also resource limitations for completing the MBTI, both in terms of cost and time.

FURTHER RESEARCH

At the start of this project, it was intended to run this project as a pilot study to see whether our methodology was able to replicate some of the results of the Cambridge Team's study but using the MBTI framework instead of the five-factor model and particularly to examine what differences might exist between extroverts and introverts in terms of their network structures. Whilst our tentative findings do show that differences in network structures exist for these one-dimensional groupings, our findings and thinking have been further stimulated by the idea that adding in additional dimensions to personality, which the MBTI allows, more marked differences might be found. This line of investigation will be the subject of a follow-up study.

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