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Trusting Social Media News: Role of Social Influence and Emotions Using EEG as a Brain Imaging Tool

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Abstract. Social Networking Sites have been all-pervasive in our lives. With a staggering 296 billion social media users in India itself, social networking sites have a considerable impact in shaping the views and opinions of people. These platforms provide people to not only lend voices to the cause they care for but also enable them to remain regularly updated with the latest news stories related to the cause. However, how social media affect a user's perception of a particular news feed item lacks clarity. In this paper, we analyze the trustworthiness of the widely circulated news feed items. Specifically, we examine the role of social influence and emotions in deciding social media users' trustworthiness of feed items by conducting EEG experiments. By demonstrating how the perceived trustworthiness of social media feed items is affected by our neurobiology, our study has significant implications for both information systems research and management. The study also has implications for policymakers and society.

Keywords: Social Media, EEG, NeuroIS, Trust, Influence.

1 Introduction

Humans are social beings. They seek relationships with others, usually forming social networks based on friendships on common professional or personal interests or some other interdependencies (Wasserman, & Faust, 1994). What is different now is that these social networks have increasingly become computer-mediated. With the increasing prevalence of social networking sites (SNSs) like Twitter, Whatsapp, Facebook, Linkedin, etc., people are connecting over these SNSs more than ever before. These SNSs have become a popular source for sharing information, exchanging ideas about various topics, political canvassing, and dissemination of new information (Haythornethwaite, 2005). The omnipresence of SNSs has increased its utility and appeal among the masses, with millions of users using it as a source of news (Holton, & Lewis, 2011). Previous researches indicate that SNSs allow the rapid proliferation of news through individual sharing of stories (Diakopoulos, & Naaman, 2011). Thus, every individual can become a potential news source, raising concerns about the authenticity of the information shared and the spread of fake news feed items.

Recent researches suggest that people these days are mainly relying on social media sites for getting news, with SNS platforms like Facebook, WhatsApp, and Twitter

slowly replacing the print media for the same (India Digital News Report, 2018). In SNSs like Twitter, Facebook, and Linkedin, users are exposed to a wide array of articles in their news feed, which are an amalgam of posts from family, friends and influencers, sponsored articles, and articles from sources that the users subscribe to (Moravac, Minas, & Dennis, 2019). Also, social media is emerging as a non-conventional source of providing information, where users do not consciously pick the source of all the news feed items. Instead, selective information (with little to no transparency) gets disseminated to users through proprietary algorithms. The news feed items and can be intentionally or unintentionally true or false, with some of them overtly created to influence netizens (Shane, 2017).

In an era where information, facts, and news are so widely prevalent and comes at a zero marginal cost, it becomes vital to understand how the varied exposure of information influences the judgments, opinions, and perceptions of the social media users. It is in this perspective that we seek to understand how users in social networking sites get influenced in trusting information, facts, and news shared in their SNS feed. What emotions do they carry towards certain news feed items? These research questions will provide us a way forward in preventing the infodemic where information can be used as a potential weapon to polarise the views and opinions of the masses.

We aim to carry out our research in the context of the user's cognitive response towards the news feed items on Twitter. Given the fact that Social Networking Sites offer a reflection of user's sentiments and perspectives, it underlies the basic behavioral traits that go behind the information that users of social networking sites choose to like, dislike, or share. Developing an understanding of what factors induce trustworthiness or emotional response towards a content will enable a better understanding of how misinformation in social media can be eliminated and information that triggers a positive change can be promulgated. We chose Twitter for this research study because of its popularity and its distinctive features. Twitter being a microblogging site, the content generated is bite-sized and requires less attention span, as a result of which the user consumes more content in a relatively short period. Additionally, the retweet, hashtag, and trending features available on twitter, provide a holistic view about group behavior of users and the impact a certain content has on developing the mindset of users.

2 Theoretical Background and Hypotheses Development

2.1 Social Media and Trust

Trust plays a very pivotal role in social interactions. A high level of trust helps in facilitating democratic and efficient institutions, socio-economic developments, and reduced violence. In this backdrop, social networking sites have proved to be an effective mechanism in nurturing social connections, even though the contribution of social media in fostering trust formation remains indefinite (Hakansson, & Witmer, 2015). According to Robert Putnam, trust gets created due to reciprocity, which gets developed during coordination with others. Putnam is doubtful about the positive

relationship between trustworthiness and digitalized social media. He reasoned that user interactions over social media, unlike live face to face interactions, are time-consuming and limit the interactions to people one already knows (Putnam, 2000). In support of this view is the fact that some individuals exist in the online domain using false identities to persuade unsuspecting and unguarded individuals into relationships that can have dangerous consequences (Rheingold, 1993). In counterargument of this, it can be stated that social media has a positive impact on the user's trustworthiness. Social media enables faster dissemination of information as compared to information sharing in a live interaction. Also, information proliferates at a relatively lower cost through social media. Since information sharing becomes an essential part of the trust-building mechanism, faster information transmission through social media has a positive impact on the user's trust formation (Hakansson, & Witmer, 2015). Uslaner, on the other hand, attributes trust as a moral issue, which gets entrenched by family relationships in the formative years of life and thus supports the fact that social media has no impact on trust creation (Uslaner, 2002).

Social Networking Sites have a marked influence on strengthening social connections and augmenting existing social networks (Ellison, Steinfield, & Lampe, 2007). A considerable amount of content generated by social networking sites gets consumed and shared daily by a large chunk of the audience, who rely upon it and occasionally acts upon it. Assimilating such information can sometimes pose a high degree of risk and uncertainty for the users, particularly when they choose to act upon the information obtained. This information needs a certain degree of verification, which can help in risk evaluation, before the users place their trust in it and act upon it (Moturu & Liu, 2011). An objective assessment of risk factors is needed, which can be obtained by backing up the information with knowledge of real facts. It becomes a time consuming and cumbersome process.

Individuals use social media for hedonic purposes (Chauhan & Pillai, 2013) rather than for gaining utility (Johnson, & Kaye, 2013). This difference in the user's mindset alters the way they perceive information, making the user's consumption of news in social media different from his consumption of news from elsewhere on the internet. The hedonic mindset makes users in social media avoid activities involving arduous thought processes but choose articles and information, which makes them feel good and confirms their existing beliefs. Additionally, the source of the news feed items appearing in the social networking sites is not entirely decided by the users. These news feed items are an intermixture of articles: either chosen by social media algorithms, or feeds subscribed by users, or sponsored advertisements, or the news shared by family and friends, or other items with the unclear source (Moravec et al.,2019). Given the enormous volume of content exchanged in social media platforms daily, the task of separating truth from fiction becomes highly challenging and effortful, making the users in the hedonic mindset not feel motivated enough to invest time and energy to find and understand the source (Kim,& Dennis, 2019). Thus the users are more likely to trust facts that align with their opinions, whereas information that challenges their views and beliefs receives little cognitive attention (Moravec et al.,2019).

In the current scenario, fake news and posts have become widely prevalent in social networking sites. Common users, as well as many of the prominent news media hous-

es, famous personalities, and social media influencers (individuals having a high number of follower base on SNS), get affected by it. This scenario makes fake posts and news appear more authentic, making unsuspecting people easily fall for it and reshare it without fact-checking or verifying the authenticity of the information collected over the SNS. The escalation of misinformation in SNS gives a subtle indication that people are gullible to the information that appears on social networking sites. A news feed content can be considered trustworthy by people if it gathers a more number of likes, dislikes, retweets, and shares. These parameters make the visibility of the post more prominent among the masses. Thus based on the theoretical literature of trust and the present trend that the users of social media exhibit, we hypothesize that:

H1: SNS news feed item having a high number of likes, shares, and retweets has a positive effect on trustworthiness toward the social media feed item.

H2: SNS news feed item shared by a social media influencer has a positive effect on trustworthiness toward the social media feed item.

2.2 Social Media and Emotions

Emotions are pervasive. They can either induce positive feelings (a pleased or relaxed state) or negative (a nervous, annoyed, or sad state) feelings in a person (Lee, Back, & Kim, 2009). Emotions have a significant impact on human behavior with their effects, at times overshadowing the rationality of humans (Hudson, Roth, Madden, & Hudson). Often, human actions are guided by feelings from the heart or a hunch, which is independent of conscious control, indicating high emotional and intuitive behavioral traits of individuals. Shedding some light on how emotions are processed, Damasio theorized that activities involving emotions and feelings (which forms in 'proto -self') precede the activities involving thought process (which forms in 'core consciousness'). Therefore, the creation of emotions and feelings happens pre-cognitively and pre-attentively. However, the potency of a non consciously processed emotional content gets weakened when it is processed consciously (Bornstein, 1989). This suggests that less aware social media users project greater emotional vulnerability to the content that gets circulated on social networking sites.

Emotions are contagious (Fowler,& Christakis, 2008) and play a vital role in the way people interact with each other online. It gets reflected in the form of excitement before an event (Wakefield & Wakefield, 2016), a retweeting decision (Gruzd, 2013), or discerned utility of an online review (Salehan & Kim, 2016). Emotions in the social media environment also result in rumor-mongering behavior (Agarwal & Rao, 2013). Emotions influence what we see, what we hear, what we learn, and how we behave, making it a useful tool to trigger user response through general sentimentalism. Previous research suggests that, when it comes to written communication, the emotional composition of messages, and emotional sentence framing, kindles cogni-

tive responses, and accentuates user attention. In the context of information sharing, higher cognitive response, and increased attention span, increase the probability of generating behavioral responses to the emotional stimuli.

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The communication over the computer has a considerable influence on the receiver's processing and interpretation of the message (Riordan,& Kreuz, 2010). The receivers of the message can identify with the sender's emotions through the verbal and non-verbal cues used in framing the messages. The verbal cues in messages are the emotional words or linguistic markers used in its composition, while the non-verbal cues are in the form of paralinguistic cues or emoticons. The use of emoticons in the messages attract more feedbacks than those which do not use emoticons (Harris,& Paradice,2007). A previous study found that the positive effect of messages augmented community sense and increase in user engagement, whereas the negative effect of messages attracted belligerent and offensive user responses (Joyce, & Kraut, 2006).
Emotions have a huge potential to generate public interest for a topic that may or may not be relevant in terms of the impact it has on individual lives. Time and again, we find instances where social media has been used as a weapon to generate sympathy, acknowledgment, praise, and, to polarize views and thought process, to garner public support. The positive and negative feedback received in the comments, the number of likes and dislikes, and the emoticons used to show the feelings towards the content posted in the SNS, indicate the user's sentiments towards a post. Sometimes individuals develop their emotions towards a certain content posted online by taking cues from others' reactions to the post. If this is true, then SNS can be used as a medium to

promote social campaigns, which can significantly improve people's participation in facilitating positive social changes and eliminate societal prejudices and biases. Thus on the basis of this, we hypothesize that:

H3: SNS news feed item having information about the number of likes, retweets, and comments generate a high emotional response in social media users.

H4: SNS news feed item shared by a social media influencer generates a high emotional response in social media users.

2.3 EEG for measuring Trustworthiness and Emotions

The concept of NeuroIS is a new and emerging field in the Information Systems (IS) research domain. NeuroIS research will prove to be path-breaking in the evolution of new theories backed by a high degree of accuracy in measuring the behavioral interaction of users in a computer-mediated environment. In the field of NeuroIS research, the earliest research involved in exploring research questions based on trust in the online environment using functional magnetic resonance imaging (fMRI) came in the year 2010 (Dimoka 2010; Reild, Hubert,& Kenning, 2010). Prior research in this field indicates that EEG is a dominant neuroscience research tool due to its relative benefits in researching as compared to other neuroscience tools. EEG, as a neuroscience research tool, offers many benefits. Not only it has an exceptional temporal resolution, but also it is relatively cheaper and less intrusive (Muller-Putz, Reild, & Wriessenegger, 2015).

EEG, as a neuroscience tool, has been used in the study of the human neural response of trust and emotions in varied situations before. In one such behavioral experiment conducted on social media users to understand their truth judgments of articles circulated in social networking sites, it was found that confirmation bias is prevalent among users. While the fake news flag generated increased cognitive activity and an increased attention span, the flag did not alter the user's beliefs about the information's veracity. The users are more likely to consider news information and facts which support their opinion than the one which challenges it (Moravec et al., 2019). In another experiment carried out by Dong to assess the trustworthiness of humans on the machine, it was found that humanlike cues are vital in generating trust in the partner's technical capability during the theory of mind game (Dong, Kim, Lee, & Lee, 2015).

Furtherance in neuroscience allows us to leverage the opportunity of delving deeper into the emotional aspects of consumer and user sentiment in the social media environment. EEG gives an insight into this with much relative ease and offers a high degree of accuracy (Takahashi, 2004). An experiment carried out for understanding the subjective experience of social media users in both PC and mobile settings indicated increased physiological arousal, valence, apprehension during Facebook navigation, with the effects in mobile being far more prominent than in the PC setting (Cipresso, Serino, Gaggioli, Albani, Mauro,& Riva, 2015). Kuan, in another controlled

experiment, measured the effects of group buying information on the opinions and emotions of users of social networking sites. He found that positive and negative buy information had a disproportionate impact on the user's attitude and intention (Kuan, Zhong, & Chau, 2014).

EEG gauges cognitive activities using brain waves as sound waves, measured in hertz. It makes use of electrodes, which act as sensors and are placed across the scalp covering different regions of the brain. These sensors catch the electrical signals from the brain and region of cognitive activity. These brain waves fall into five categories based on the frequency band, which are as follows:

- Delta: 1 – 4 Hz
- Theta: 4 – 8 Hz
- Alpha: 8 – 12 Hz
- Beta: 12 – 30 Hz
- Gamma: 30 – 100 Hz

The above categories have different mental states associated with them. The delta represents deep sleep or coma, and theta represents drowsiness or meditative state. The alpha represents readiness or relaxed state, and beta represents active concentration or focussed attention. The gamma represents arousal or peak performance state. Thus alpha and beta hold relevance in decision making and is a useful measure to evaluate user trustworthiness and emotions in response to the visual stimuli (Kuan et al., 2014; Muller - Putz, 2015). Alpha bands are of two types: low alpha band (8-10Hz) and high alpha band (10-12Hz). The high alpha band represents emotional processing, whereas the low alpha band represents awareness and attention. In addition to this, positive emotions and negative emotions get reflected in different regions of the brain. Positive emotions trigger the left frontal hemisphere, whereas negative emotions trigger the right frontal hemisphere (Kuan et al., 2014). On the other hand, previous researches suggest that some parts of the medial frontal cortex (MFC) are pivotal in tracking neural responses for trust measurement. Hence, our focus of attention will be alpha and beta activity in the medial frontal cortex region and the brain's right and left hemispheres.

3 EXPERIMENT

We plan to examine the influence of Social Media newsfeed items on the trust and emotions of the subjects using a controlled experiment. The experiment will consist of two sessions per subject and will take an average of 40 minutes per session. In these two sessions, the mental response of the subjects will be captured for neural correlates of two variables, trust, and emotion, using separate stimuli for each variable. The change in trust and emotions due to social influence on the subjects will be measured using EEG. Newsfeed items from a popular social networking site Twitter, will be used as stimuli for the experiment.

3.1 Procedure

Each variable will be measured using 30 stimuli grouped into two sets with 15 stimuli in each set. It will comprise tweets from social media influencers (individuals having a large number of followers on twitter who are well-known public personalities in the country). The first set of stimuli will contain tweets in baseline format (described in the succeeding section) containing information only about the number of likes, re-tweets, and comments in the tweet. The second set will have an enhanced format with added information about the number of likes on the tweet by other social media influencers.

In the first session, the subjects will be shown 30 stimuli randomly taken from each set. The stimuli in the first session will be manipulated to trigger trust inducing mental responses in the subjects. The second session will be undertaken half an hour after the first session. In this session, the subjects will be shown 30 stimuli randomly chosen from either of the two sets, inducing emotional responses from the subjects.

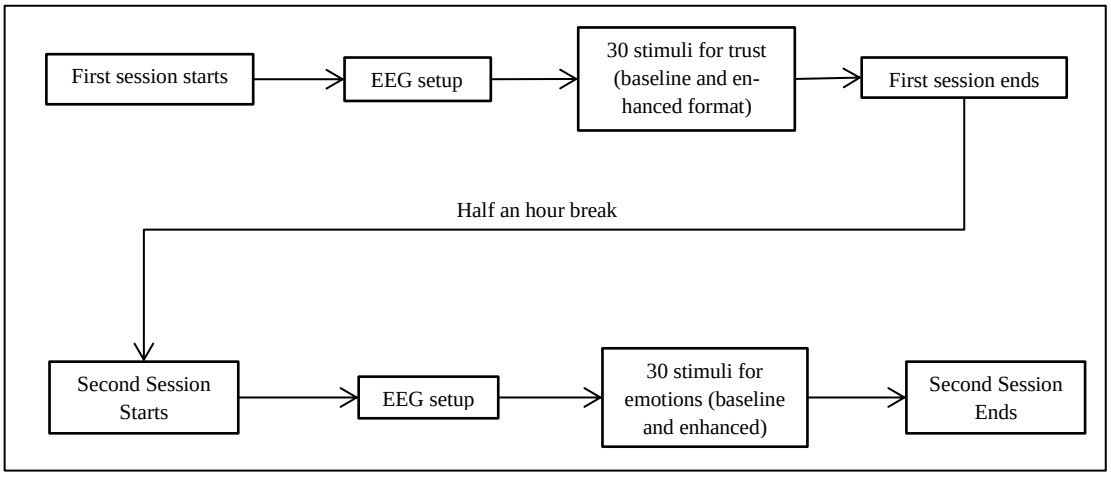


Fig. 1. Experiment Design

3.2 Stimulus Material

Stimulus material for this research will be identified from newsfeed items taken from Twitter. The decision to prefer Twitter over other SNS is that Twitter has a large user base attracting opinions and views of prominent people and well-known personalities across different domains. Opinions from such prominent people mold the thinking of their followers and people in general. The advantage of using tweets from Social Media influencers as a potential stimulus is that social influencers enjoy a huge follower base. Their tweets can thus have a direct impact on their follower's trustworthiness about the information being shared through their tweets. This information can have both positive and negative implications for society.

Each session will involve 30 chosen stimuli, which are likely to trigger changes in the level of trust and emotions about the information disseminated by the tweet. The stimuli will be grouped into two sets: Set A and Set B. The stimuli from set A will be manipulated to include tweets from Social media influencers, in baseline format. Figure 2 shows a sample stimulus in baseline format. In this format, we shall include details of the tweet along with information about the number of people who liked the tweet, number of views, and the number of retweets garnered by the tweet. Set B will include stimuli in an enhanced format. As shown in Figure 3, the enhanced format will include additional information about other social media influencers who like the tweet.

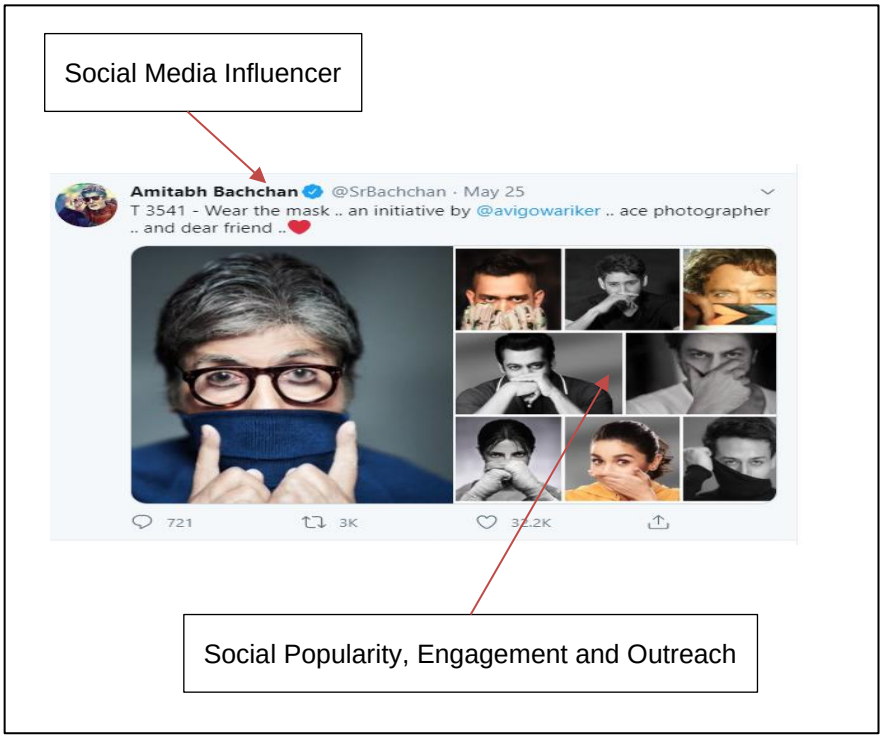


Figure 2. Sample Stimulus in Baseline Format

3.3 Measurements

We will capture EEG measures during the experiment. We may also add a pre or post-experiment questionnaire, which will provide us with additional information about the subjects. This can include information like the subjects' interests on social media, frequency of social media usage, and opinions regarding the stimuli shown. We will be using a 128 channel EEG machine, similar to a clinical-grade EEG. More

number of channels will allow us to capture a significant amount of neural responses, thus increasing the research validity. Measurement variables like trust and emotion are adapted based on previous research (Kuan et al., 2014; Riedl, Mohr, Kenning, Davis, & Heekeren, 2014).

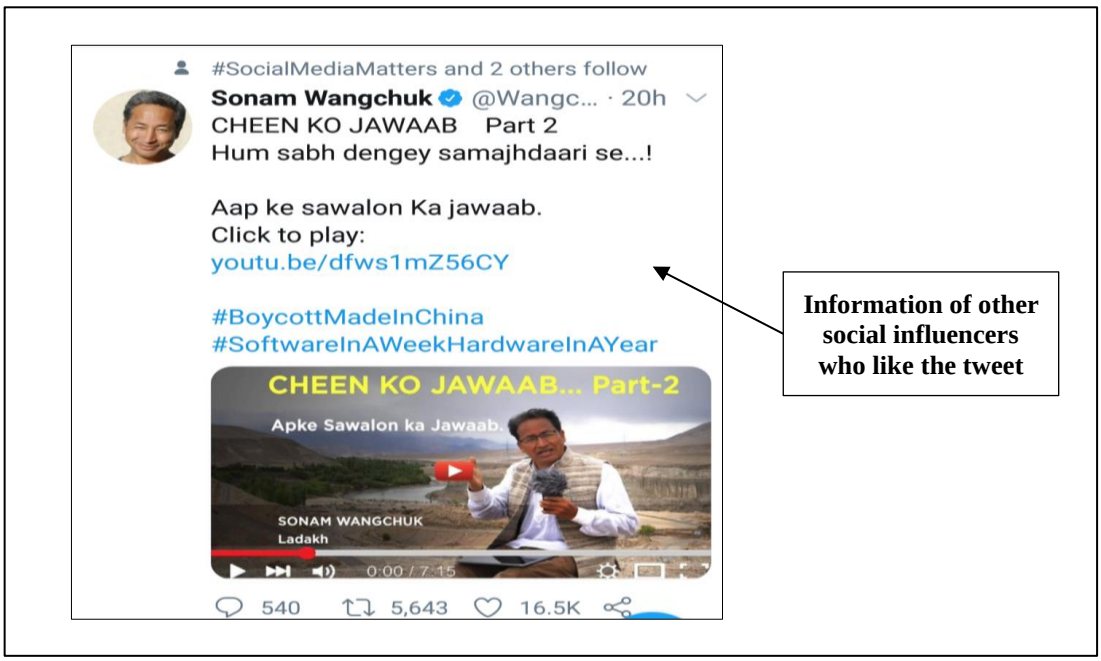


Figure 3. Sample Stimulus in the enhanced format

EEG is highly effective in picking up brain activities induced by a stimulus. It measures brain wave patterns in the form of sound waves measured in Hertz (Kevin K. Y. Kuan, Yingqin Zhong & Patrick Y. K. Chau, 2014). In line with the prior research in this area, our study will specifically focus on tracking brainwaves in the range of 8- 12Hz and 13- 25Hz. Brain waves in the range of 8-12 Hz are called alpha waves and are characterized by medium frequency activity. It indicates a state of relaxed wakefulness. Brain waves in the range of 13- 25Hz constitute beta waves and include high-frequency activities such as active concentration, task engagement, or attention (Müller-Putz, Gernot R.; Riedl et al., 2015).

3.4 Participants

The experiment will be undertaken with 50 undergraduate, postgraduate, or Ph.D. students from a major university in India. Subjects shall be asked to give details on their familiarity with social networking sites, particularly Twitter, and their social media experience in years. The data collection will be undertaken in the EEG lab of the university. All the subjects will be provided with refreshments and snacks during their participation. We shall obtain subjects' consent before allowing their participation. They will be provided with an adequate briefing about the whole process so that they feel relaxed during the entire process of experimentation. This is to keep our study data free from any biases or errors.

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