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The Effects of Personality Traits on Rumors

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Abstract. The spread of rumors has often been linked to major social and political impacts with consequences that oftentimes may prove to be severe. While there are multiple factors that could make a rumor more believable, this paper focuses on investigating the effects of personality traits on believing or disbelieving rumors. Participants were given a survey which included rumors relating to a single topic, COVID-19, to avoid topic-bias. Participants were also given a personality test which assessed the participants' traits based on the Big 5 Model and categorized them as high or low. The effect of valence (pleasure) and arousal (excitement) on believing or disbelieving rumors was also explored, along with how this effect differs from one trait to another. The results showed that people with high agreeableness tend to believe rumors more than people with low agreeableness and that there was a correlation between valence and believing rumors for people with high neuroticism and people with low agreeableness. No correlation was found between arousal and believing rumors for any of the personality traits.

Keywords: Rumors · Big 5 · Personality Traits · Character Computing · Self-Assessment Manikin · COVID-19

1 Introduction

A rumor is defined as a statement that is an unproven narration or explanation of an event that concerns the public [3], which means that it is not verified as either true or false. Despite this, rumors have been proven to have a rather significant effect on people as well as enough power to influence them and their actions just as much as true and verified information can [1]. Inspiring feelings of hope, fear and hate, rumors can also weaken people's trust in their governments, shape public opinion, as well as cause political tensions [2]. Consequently, it is evident that rumors play a very important role in people's lives and that is why social psychologists and other scientists are motivated to to understand what rumors are, how they spread, who believes them, how they can be identified and what their effects are.

Most studies [3,4,5,6] are concerned with two aspects when studying rumors; rumor detection and rumor analysis. Rumor analysis is studied in multiple fields, including economics, psychology and social science, where rumors are classified based on different criteria, characteristics and dimensions. The criteria are: how

rumors differ, where they originate, what topics they address, the emotions they invoke, how they spread and how users interact with them [3]. Other classifications consider whether the rumor is deemed newsworthy or not. Rumors are classified as newsworthy if they concern the public and are of interest to social media users, whereas non-newsworthy rumors only concern a small community or group of people and are more personal [4]. Rumors are also classified based on the emotions they evoke, varying from positive to negative and the need to take action [4]. The emotions evoked are evaluated based on 3 dimensions that measure human reactions to different stimuli: valence (pleasure), arousal (excitement) and dominance (sense of control) [28].

Since the majority of the studies focused on the different facets of the rumor itself, this study was carried out in an attempt to examine a factor not often focused on: the personality traits of people who accept or reject rumors. This is Phase II of a previously conducted study which analyzed the effect of buzz users on rumors' lifetime [7] and generated author profiles on Arabic-speaking social media users in Egypt. The study found that buzz users were capable of sparking a rumor as well as significantly affect its lifetime due to their believable and trustful features, leading more people to believe them.

Identifying personality traits can help predict behavioral patterns a person tends to display [13], since personality captures a person's stable individual characteristics, and this allows us to understand which types of people would be more likely to accept or reject rumors. This can be done using trait models, which can represent an individual's personality in terms of numerical values. One of these trait models is the five-factor model of personality (FFM). Often referred to as the "Big- Five", FFM is currently the "dominant paradigm in personality research, and one of the most influential models in all of psychology" [14] and consists of five traits: extraversion, agreeableness, conscientiousness, neuroticism and openness.

Ergo, the aim of this study is to examine three major problem statements:

- Do personality traits have an effect on believing rumors in general?
- Does valence have an effect on believing rumors for each personality trait?
- Does arousal have an effect on believing rumors for each personality trait?

In order to understand the effects of personality traits, valence and arousal on believing rumors, this study explored and evaluated personality traits of several participants, as well as the emotions evoked by the participants upon reading a set of rumors.

The entire study is documented in this paper and the remaining sections of this paper are organized as Related Work, Implementation and Methods, Results and Analysis, Discussion and Conclusion.

2 Related Work

2.1 Believing a Rumor

While examining the factors that lead people to believe and spread rumors, researchers have looked into the characteristics and contents of a rumor and

have found that the length, sentiment and presence of pictures in a rumor affect people's intention to believe and spread the rumor [5]. One study by Schwarz et al [6] found that the metacognitive experience of people - which is how easy it is to recall and understand new information based on how it is presented - leads them to believe or disbelieve a rumor; meaning that when statements are made easier to read by writing them in color, people will be more likely to accept these statements as true. Another study [5] found that people tend to support a rumor that is spread on Twitter before it has even been verified rather than deny it.

People also tend to believe rumors based on the trustability of the person who tweeted the rumor, where trust in Twitter's retweet network includes two factors: trustworthiness and trustingness. Trustworthiness is when user A finds user B trustworthy and chooses to trust user B and believe and retweet a rumor that user B has shared. Trustingness is when user A trusts the rest of the people in the network which leads user A to believe the rumors that people share easily. People with high trustworthiness tend to be more careful with what they share and their reputation, leading them to be less likely to spread and believe unverified or false information compared to people with low trustworthiness. The trustworthiness of a user can be measured using several factors including the number of retweets of a user's tweet; the higher the number of retweets, the more trustworthy the user is [8].

To further understand people's inclination to believe rumors, researchers started looking into people's characteristics such as demographics, cognition, and behaviors and how they contribute to them believing rumors [9]. Chua and Banerjee [10] showed that people's personal involvement with the content of the rumor would make them more likely to believe it. Psychological factors such as uncertainty, belief, lack of control, and anxiety, were also proven to have an effect on the tendency to believe rumors. Grinberg et al [11] found that more conservative and older people are more likely to believe and spread rumors. Young users are more immune to misinformation and the stress caused by rumors since they spend more time on social media, while older users are more prone to the anxiety caused by rumors, which makes them more likely to believe and share rumors [9]. Therefore, after surveying 171 university students on 16 motivations regarding believing and spreading rumors, Chen and Sin [12] found the top motivations to spread rumors were to acquire other people's' opinions on the information being spread, to convey their own opinion on the information, and to interact with other people. They also found that while gender showed no significant effect in the spread of rumors, personality did, consequently they found that extroverts shared more rumors in order to socialize more. Accordingly, studying the personalities of people who spread rumors is of high importance to understand their characteristics of people and how they affect the belief of rumors.

2.2 Social Media, Misinformation and Personality

Due to the flexibility and incredible ease of sharing up-to-date news on social media, as well as it being highly unregulated, it is incredibly easy for rumors to spread amongst social media users [16] and multiple studies [17,18,19,20,21,22]

have shown that Facebook, YouTube and Twitter all play major roles in the spread and circulation of rumors and misinformation on multiple topics including medical ones.

According to Heinstrom [23], out of the five personality traits, extraversion and neuroticism personalities are more associated with online activities, where social media users with high extraversion or high neuroticism are more engaged with online activities. In a study by Amnieh and Kaedi [24], it was found that those with high extraversion eagerly await new messages and are more likely to forward them on Twitter, which leads us to expect those with high extraversion to be more likely to believe and spread rumors. Conscientious people were found to be more likely to use social media for academic or work purposes, and hence, when gathering information, they tend to make more effort in verifying facts and searching for resources [23]. As a result, it is expected that conscientious people be less inclined to believe rumors without further investigating them.

Neurotic people tend to spend more time online, but usually do not use information- related features [25], and due to their fear of producing a negative outcome when communicating, they avoid exchanging a lot of information on social media and are less likely to share rumors [26], but that does not necessarily mean that neurotic people are less likely to believe rumors.

Open people were found to be more likely to use news and information features as well as personal information features on Facebook [27]. They are also more open to new and unexpected ideas and are more likely to question authority; therefore, we expect open people to believe rumors for their "unconventional ideas" [23].

Moreover, Hamburger and Ben- Artzi [25] suggest that gender may change the effect of personality on social media usage. For example, women's internet use of social services was negatively related to extraversion and positively related to neuroticism, while for men, it is positively related to both.

3 Implementation and Methods

3.1 Collecting Rumors

Being one of the most sought after and controversial topics for the past 2 years, COVID-19 has had - and continues to have - a profound effect on people's lives. Thus, people follow it closely on the news outlets and on social media platforms, eagerly waiting for any and all updates, some of which may simply be rumors. Accordingly, five rumors related to COVID-19 - shown in Table 1 - that were already circulating on the internet were collected from four different websites; *nashra.com*, *arabic.cnn.com*, *snopes.com*, and *britannica.com*.

The general topic of the rumors collected was kept constant to avoid having the topic become a factor in determining whether people will believe the rumor or not, and the rumors were collected based on specific criteria that could trigger some personality traits, thus possibly causing people exhibiting these traits to believe the rumor more. The criteria were:

- How much detail was given in the rumor presented, meaning how specific was the rumor.
- The emotions evoked on the person after reading the rumor.
- If the person found the rumor positive or negative.
- Whether or not the rumor would have been more believable if more details were added.
- Whether the rumor was in Arabic or English. Arabic was included since the study was conducted in Egypt, where Arabic is the main language used.

Table 1. Rumors Collected

Rumor number	Rumor	Language	Details Provided	Emotion Evoked
R1	The UK Medicines and Healthcare Products Regulatory Agency (MHRA) will use artificial intelligence to monitor the safety of COVID-19 vaccines because the agency knows that vaccines are extremely dangerous.	English	Yes	Positive
R2	Chinese doctors confirmed that African people are "genetically resistant" to new coronavirus.	English	No	Positive
R3	COVID tests and PCRs contain the carcinogenic chemical compound Ethylene Oxide and the packaging belonging to the tests provided by the UK Medicines and Healthcare Products Regulatory Agency (MHRA) are marked as using Ethylene Oxide.	Arabic	Yes	Negative
R4	The COVID-19 vaccines will cause "pathogenic priming" or "disease enhancement", meaning that vaccinated individuals will be more likely to develop severe cases of COVID-19 if they are infected with the COVID-19 virus.	English	Yes	Negative
R5	A person who has already previously caught COVID-19 does not need to be vaccinated against it	Arabic	No	Positive

3.2 Study Survey

The survey was filled by participants residing in Egypt, who speak both English and Arabic, and as shown in the sample screenshots in Figures 1 and 2, it consisted of demographic questions on the age, gender, and education level of

the participants, the Big Five Inventory BFI-10 personality test [15] to assess the personality traits of the participants, and four questions on each of the five the rumors collected. The survey also included using the Self-Assessment Manikin (SAM) [28] in order to evaluate the emotional response and reaction of a person after a certain stimulus [29]. A summary of the questions asked on each rumor is shown in Table 2, along with the measurement or scale used.

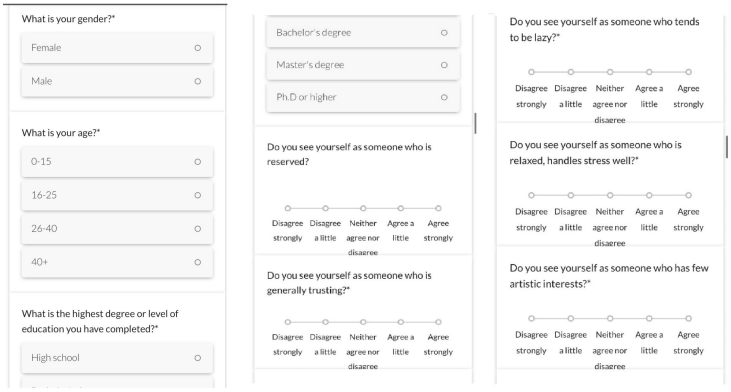

Fig. 1. Survey Screenshots I

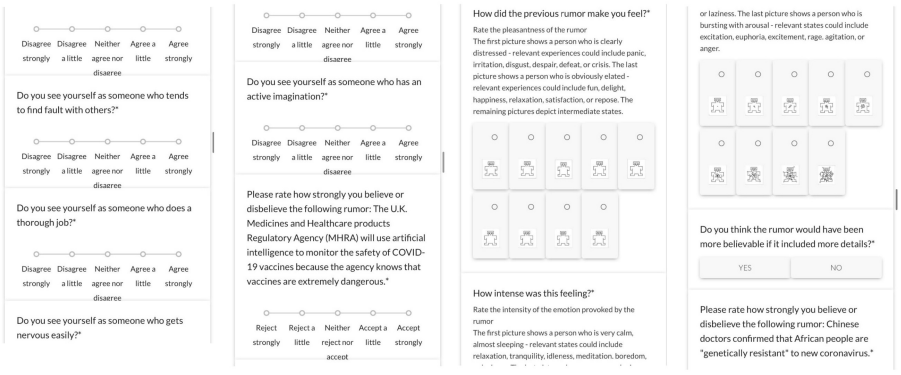

Fig. 2. Survey Screenshots II

The null hypotheses of the experiment are:

1. Personality traits do not have an effect on believing rumors in general.

2. Valence does not have an effect on believing rumors for each personality trait.
3. Arousal does not have an effect on believing rumors for each personality trait.

Since highly conscientious people pay more attention to detail than lowly conscientious people, it is expected that highly conscientious people will believe rumors more if the rumors include more detail; however people with low conscientiousness will not be affected by the extra detail.

It is also expected that positive rumor - or a rumor that evokes positive emotions - may lead people who are high in neuroticism to believe the rumor more, while people who are low in neuroticism are not affected by the positive or negative emotions evoked by the rumor. The reasoning behind this is that those who are high in neuroticism may experience a lot of stress, feel anxious and get upset really quickly, while those low in neuroticism are more emotionally stable and can deal well with stress.

Furthermore, because people high in agreeableness have more empathy for others, it is expected that this may lead them to refuse to accept negative rumors - or rumors evoking negative emotions - more than those low in agreeableness.

Table 2. Questions on Rumors

Question	Measurement
Please rate how strongly you believe or disbelieve the rumor.	Likert scale
How did the rumor make you feel?	SAM
How intense was this feeling?	SAM
Do you believe the rumor would have been more believable if it had more details?	Yes/ No

4 Results and Analysis

There were 69 participants in the study, more of which were female (n=36, 52.1%) than male (n=33,47.8%), all aged 16 and above. The largest age group was 16-24 (n=53,76.8%), the second age group was 25-40 (n=13, 18.8%), and the last age group was 40 and above (n=3, 4,3%).

As shown in Table 3, the most prevalent personality trait among all the participants was low agreeableness (n= 41, 59.4%) and the least prevalent was high agreeableness (n=28, 40.5%).

4.1 Personality Trait vs. Believing Rumors

As the data sample collected was categorical, non-linear and small in size, Chi-square analysis was used. As shown in Table 4, only two traits showed a re-

Table 3. Personality Traits Percentages

Personality Trait	n value	Percentage
High openness	39	56.5%
Low openness	30	43.4%
High conscientiousness	39	56.5%
Low conscientiousness	30	43.4%
High extraversion	34	49.2%
Low extraversion	35	50.7%
High agreeableness	28	40.5%
Low agreeableness	41	59.4%
High neuroticism	34	49.2%
Low neuroticism	35	50.7%

lationship with believing some of the rumors: openness showed a correlation with believing R3 (P=.009), while agreeableness showed a correlation with R2 (P=.019) and R3 (P=.016).

Table 4. Personality Traits versus Rumors

Personality Trait	R1 p-value	R2 p-value	R3 p-value	R4 p-value	R5 p-value
Openness	0.52935	0.54617	0.00887	0.229857	0.67395
Conscientiousness	0.91047	0.89950	0.49952686	0.3252282	0.252512453
Extraversion	0.4017834	0.5486375	0.7657644	0.42952997	0.8556222
Agreeableness	0.1191626	0.018854	0.01565293	0.1324283	0.4810904
Neuroticism	0.759667	0.1476201	0.55592045	0.7217332	0.8271240

4.2 Valence per Trait versus Accepting/ Rejecting Rumors

As shown in Table 5, all personality traits, except for low openness and high conscientiousness, were affected by valence when choosing to accept or reject at least one of the given rumors.

However, there were traits that showed a higher contribution to the influence of valence on accepting or rejecting rumors and the two traits that showed the most contribution were low agreeableness and high neuroticism.

4.3 Arousal per Trait versus Accepting/ Rejecting Rumors

The results in Table 6 showed that arousal in general did not affect the participants' decision in rejecting or accepting the rumors. The traits that showed some relation between arousal and accepting and rejecting just one of the rumors were low openness, high extraversion, low extraversion, high agreeableness, low

Table 5. Personality Traits with Valence versus Rumors

Personality Trait	R1 p-value	R2 p-value	R3 p-value	R4 p-value	R5 p-value
High Openness Valence	0.1331651	0.000017037	0.171593	0.0962218	0.001121672
Low Openness Valence	0.0517629824	0.307635	0.5944507	0.35916584	0.413165513
High Conscientiousness Valence	0.52155245	0.119177652	0.117761106	0.62624263	0.272043603
Low Conscientiousness Valence	0.230635052	0.01206255894	0.547834171	0.284658810	0.0231353339
High Extraversion Valence	0.07132987	0.0003366619	0.67799819376	0.45599853002	0.18153383001
Low Extraversion Valence	0.14962214	0.091825102	0.330169598	0.024595058	0.00744932
High Agreeableness Valence	0.038449660	0.00207923231	0.1606250326	0.50888909258	0.6651729006
Low Agreeableness Valence	0.4911898	0.0556049563	0.000735770977	0.00028821553	0.0001292718
High Neuroticism Valence	0.0512704	0.006350	0.002894440	0.00000283652	0.06529042
Low Neuroticism Valence	0.12100129	0.000774485	0.16212025	0.57744021	0.0939897

agreeableness, and low neuroticism. Low extraverted people were more affected by arousal than high extraverted people and lowly agreeable people are also more affected by arousal than highly agreeable people.

Table 6. Personality Traits with Arousal versus Rumors

Personality Trait	R1 p-value	R2 p-value	R3 p-value	R4 p-value	R5 p-value
High Openness Arousal	0.246276879	0.565881055	0.46933748	0.087082806	0.1431241204
Low Openness Arousal	0.127228911	0.24701788	0.01982169	0.123556055	0.487592128
High Conscientiousness Arousal	0.349923249	0.3499374	0.14761635	0.56912347	0.64115717
Low Conscientiousness Arousal	0.823926938	0.491547057	0.142330876	0.20571553	0.16639188
High Extraversion Arousal	0.78239310810	0.9304412413	0.5350930017	0.012362447	0.7718887
Low Extraversion Arousal	0.42865151	0.2246352385	0.09755469	0.002110787	0.22180383
High Agreeableness Arousal	0.828949169	0.52472195	0.19314369	0.0427318310	0.451340170
Low Agreeableness Arousal	0.481146830	0.35475609	0.01305601	0.06855075	0.31706365
High Neuroticism Arousal	0.3152544	0.44227017	0.32759874	0.15231373	0.055832
Low Neuroticism Arousal	0.529083	0.393220317	0.50007492	0.022406515	0.749199563

5 Discussion

We failed to reject the null hypothesis for any of the rumors for conscientiousness, extraversion, and neuroticism. For openness, the null hypothesis was only rejected for R3, consequently, we cannot reject it in general for all the other rumors and accept that openness has an effect on believing rumors.

For agreeableness, the null hypothesis was rejected for two rumors: R2 and R3; however, this was also not enough for the null hypothesis for agreeableness

to be rejected in general. Therefore, the results concluded that there is no great effect of personality traits on rumors and the null hypothesis was accepted.

As previously discussed, people with high extraversion were expected to believe rumors more since they spend more time on social media, are more exposed to rumors and tend to share rumors more; however, the results showed no correlation. This could be due to the increase of social media use during COVID-19 quarantine and as a result, introverted people may have been spending just as much time on social media as extroverted people did.

Highly conscientious people were expected to reject the rumors more since all the rumors had no citations and conscientious people tend to check the source and make sure the information is correct before accepting it. However, the results showed no correlation between conscientiousness and believing rumors.

It was also expected that highly agreeable people believe rumors more because they tend to be more trusting than lowly agreeable people. The results support this hypothesis; open people were expected to believe rumors that contained unconventional ideas. R3 may contain a different idea that is not often heard of, which may be the reason it showed a correlation between believing it and high agreeableness.

For valence, agreeableness and neuroticism showed the most correlation, hence the null hypothesis was rejected and the alternative hypothesis was accepted.

The results also showed that highly neurotic people tend to believe rumors more if they are negative, which was expected, since they have a tendency to be drawn to negative feelings, and this means they may rely on emotions more than lowly neurotic people.

Finally, since arousal showed a correlation for only some traits when believing at most 1 rumor, the null hypothesis was accepted for all of the personality traits.A summary of the results are shown in Table 7.

Table 7. Summary of Acceptance/ Rejection of Null Hypotheses

Personality Trait	Null Hypothesis 1	Null Hypothesis 2	Null Hypothesis 3
Agreeableness	Accepted	Rejected	Accepted
Openness	Accepted	Accepted	Accepted
Conscientiousness	Accepted	Accepted	Accepted
Extraversion	Accepted	Accepted	Accepted
Neuroticism	Accepted	Rejected	Accepted

6 Conclusion

The only trait that showed any significant effect on believing or disbelieving rumors was agreeableness, showing that highly agreeable people are more likely

to believe rumors than lowly agreeable people. The rest of the traits may have shown some relation to believing rumors; however, they were not significant enough to reject the null hypothesis all together. Valence has been found to affect accepting or rejecting rumors for highly neurotic and lowly agreeable people, whereas arousal does not show any significant correlation with accepting or rejecting rumors for any of the personality traits.

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