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Risk factors in susceptibility to misinformation

Abstract

The spread of misinformation on prominent societal topics has seen an increase in recent years. As a result, research into factors that explain why people believe false information has become more relevant. What are the factors that drive people to readily adopt false information, and are people who believe false information on one topic more likely to believe on another? This paper reports research investigating four possible mechanisms; online literacy, analytical thinking skill, trust in science and medicine and risk perception to find out to which degree they influenced belief in misinformation. Among other findings, the research found that online literacy had an effect on belief in all topics of misinformation that were investigated. Trust in science and medicine was particularly relevant with regards to the acceptance of misinformation on Covid-19 and climate change. On the other hand, risk perception and analytical thinking skills seemed to play a larger role in people's belief in misinformation on the US elections of 2020. This paper will introduce the underlying factors and discuss the findings as well as their theoretical and practical significance.

Introduction

It has been argued that we currently live in a post-truth era of information (Rochlin, 2017). When looking at the big societal issues being discussed today, from climate change to the coronavirus pandemic and political issues such as the 2020 US elections or the Brexit referendum, it becomes apparent that a sizable number of people support and propagate views that range from counterfactual to downright absurd and dangerous. One much publicized example of the effect that this phenomenon can have is the January 6th, 2021, storming of the United States Capitol by thousands of protesters who were fed demonstrably false information that the election had been stolen and that their votes were being ignored. The Capitol, a symbol of democracy in the United States, was ransacked, causing millions in damages and five deaths while millions of people from all over the world watched on their TV screens (Levenson, 2021). While the existence and spread of misinformation is not new, it is now more easily accessible and spreads on an unprecedented scale due to online media (Zucker, 2020). This sharp increase in the availability and adoption of fake news has resulted in major political institutions conducting investigations into the origins of and reasons for the rapid spread of misinformation and conspiracy theories as well as publishing manners of how to identify and resist them (PBS NewsHour, 2020; EU Commission, 2021).

Among the issues addressed were the question of what underlying factors make people more susceptible to conspiracy theories and fake news, a number of which were chosen for the purpose of this research according to their prominence and relevance. These factors include online literacy, analytical thinking capacity, risk perception and trust in institutions. This paper will take a closer look at the aforementioned factors, starting with a definition of the concept of misinformation, followed by an explanation of the selected risk factors and a short outline of the three topics of misinformation chosen for their societal prominence, media coverage and amount of research that disproves the conspiracy theories related to them. These are the coronavirus pandemic, climate change and the 2020 US election.

Misinformation
It is important to distinguish between misinformation and the widely used term fake news, or disinformation. Misinformation has been defined by Thorson (2016) as information that is inaccurate but not necessarily intentionally misleading and not supported by empirical evidence or expert knowledge

(Nyhan & Reifler, 2010). Disinformation, or fake news, on the other hand are characterized by an intentional effort to spread information that is false or inaccurate in order to accomplish a goal (Wardle, 2017). For the purpose of this research paper, we will refer to misinformation, as it also encompasses disinformation.

Psychological mechanisms
What drives the widespread adoption of misinformation? Among the myriad of factors that contribute to an individual's susceptibility to misinformation, this paper will focus on a few select concepts, namely online literacy, analytical thinking skills, trust in medicine and scientists and risk perception.

Online literacy
An important determinant of the rate at which people accept misinformation is the ability of individuals to navigate the information environment, particularly on more recent and evolving topics such as climate change and Covid-19 which are often available online. A lack of online-, or digital media literacy manifests itself in people's inability to discern high- and low-quality online sources of information from each other. Especially older adults have been shown to lack online literacy and are therefore more susceptible to misinformation online. This has been linked to an unfamiliarity with social media, which can result in difficulty detecting sponsored content or manipulated images. Furthermore, old age has been linked to "social changes, including general trust, difficulty detecting lies, and less emphasis on accuracy when communicating" (Brashier & Schacter, 2020). Regardless of age, the fragmented and complex nature of the online information ecosystem means that most individuals have difficulty in determining what information is reliable (Eshet, 2004). The lack of regulation and editorial controls online allows misinformation to spread efficiently and without checks via algorithmic news feeds, according to Guess, Lerner and Lyons, (2020). Subsequent studies by those same researchers have concluded that interventions targeting the media literacy of individuals caused a decrease in the perceived accuracy of false news articles. Interestingly the effectiveness of the treatment decayed over time, but approximately half of its effect still remained after two weeks (Guess, Lerner & Lyons, 2020). With regards to different topics of misinformation, online literacy is likely to have an effect on all three topics discussed in this paper: misinformation on climate change, the US elections of 2020 and Covid-19.

Cognitive ability, analytical reasoning and numeracy (analytical thinking skills)
The ability to discern correct from false information is also related to differences in cognitive ability and analytical reasoning. For instance, research conducted by Greene and Murphy (2020) found that individuals with higher analytical reasoning skills and cognitive ability tend to report less false memories when presented with a selection of true and false information about the coronavirus pandemic. An increased ability to retain factually correct information helps guard against false beliefs. Humans have a tendency to avoid resource intensive cognitive processing, and instead, follow their intuition and first inclinations. Individuals with a lower tendency to avoid this resource intensive cognitive processing have been shown to perform better overall better on cognitive reflection and rational thinking tests (Pennycook & Rand, 2019), such as the CRT test by Frederick (2005), which measures out of the box, analytical thinking ability and intuitiveness. Lower cognitive ability and analytical reasoning skills have thus been linked with a higher inclination to accept information more readily as factual without proper evaluation. In the CRT test, it was found that particularly fast response times were more likely to lead to a poor performance, something which Baron et al. (2015) blames on "reflexive impulsivity". Both the

unwillingness to invest the required time to think analytically, and a lack of ability to do so may therefore be a predictor of one's susceptibility to misinformation. The more complex the misinformation topic, the more important cognitive ability and analytical reasoning should be in warding off misinformation. Both are important factors in helping individuals understand and critically reflect on complex topics and discern misinformation from facts.

Another useful construct in measuring someone's susceptibility to misinformation, which is also related to cognitive ability and analytical reasoning is numeracy. Numeracy includes a person's ability to solve mathematical problems and a tendency to approach quantitative information in a reflective and systematic manner and use it to support valid inferences (Peters, Västfjäll, Slovic, Mertz, Maocco & Dickert 2006; Liberali et al. Pardo, 2011). High numeracy has been connected to a greater ability to conduct reflective and analytical thinking and has been consistently linked with a lower susceptibility to misinformation (Roozenbeek, Schneider, Dryhurst, Kerr, Freeman, Recchia, van der Bles & van der Linden, 2020). High numeracy alone does not guard against misinformation however. Research conducted by Dawson, Kahan, Peters and Slovic (2017) for example concluded that high numeracy is likely to reinforce preexisting false beliefs and tendencies in issues characterized by high levels of political partisanship in opinions. Individually with high levels of numeracy who already hold strong politically charged opinions on subjects are therefore more likely to believe them even more.

Trust in government, scientists and medical professionals
The level of trust in scientists, government and government-related institutions has also been shown to affect the degree to which misinformation is readily adopted by individuals. With regards to the coronavirus pandemic, high trust in scientists was shown to be positively correlated with a reduced susceptibility to misinformation (Roozenbeek et al. 2020). Research on diseases such as Ebola corroborates this. Research by Vinck, Pham, Bindu, Bedford & Nilles (2019) found that respondents in the DR Congo were more likely to undertake individual preventive behavior against Ebola as instructed by authorities, if their trust in these institutions was high. Trust in politicians and government is quite complex however, due to wide ranging differences in the tendency of governments and politicians to propagate or fall victim to misinformation themselves. For instance, Rozenbeek et al. (2020) shows a higher level of susceptibility to Covid-19 related misinformation in the United States for those with higher trust in politicians and government, which could be related to the tendency of the administration at the time to itself be a source of misinformation during the pandemic (BBC, 2020). Therefore, while trust in scientists remains a good indicator of resistance to misinformation of all kinds, trust in government is not quite as straightforward, and will be omitted from the research.

Risk perception
Lastly, individual risk perception and anxiety about the topic of misinformation has also been shown to have an effect on the susceptibility to misinformation. This was especially evident when people were confronted with public health issues such as Covid-19 or Ebola. Research by Betsch, Renkewitz, Betsch and Ulshöfer (2010) found a positive correlation between risk perception and preventive health behavior. Furthermore, emotions of dread, threat or fear were likely to increase risk perception, which in turn increased the susceptibility to misinformation (Kim & Kim, 2020; Betch et al. 2010). This suggests that individuals who feel at risk are more likely to believe false information, and that dread and fear increase the frequency and volume of rumors. Therefore, the more fear and dread is present within a population

towards a specific topic, the more false information becomes available, making it more difficult to distinguish between facts and fables (Kim & Kim, 2020).

Present study

In order to find common factors that facilitate the susceptibility to misinformation, this study will seek to answer *whether the factors analytical thinking, trust in institutions, risk perception and online literacy increase an individual's susceptibility to misinformation, and whether being susceptible to one topic of misinformation also makes people susceptible to another topic of misinformation*. To answer this question, we proposed that the constructs discussed above; online literacy, analytical reasoning, trust in institutions and risk perception, all have an effect on whether someone is susceptible to misinformation. The following hypotheses were put forward:

H1: Lower levels of online literacy, analytic reasoning, numeracy, trust in institutions and risk perception increase the likelihood of believing in all the topics of misinformation.

Exploratory: Believing in one topic of misinformation increases the likelihood of believing in another topic of misinformation.

Method

Design

To test the relationship between the constructs and the degree to which people believed in topics of misinformation, a survey design was employed. The dependent variables, the degree to which a subject believes in three topics of misinformation, namely misinformation on climate change, the US elections of 2020 and Covid-19, were hypothesized to be influenced by four constructs: analytical thinking, trust in institutions, risk perception and online literacy. The survey was ethically approved by the ethical committee of Behavioral, Management and Social Sciences at the University of Twente.

Participants

A total of 66 participants between the ages of 20 and 84 ($M = 39.46$, $SD = 18.56$) took part in the survey. Due to incomplete responses, 12 participants were removed from the data set, with 54 remaining. Of those 54, 30 participants were male, 23 female, while one chose not to specify. 26 participants filled the survey out in German, 20 in English and eight in Dutch. All 26 participants who filled out the survey were German nationals, and all Dutch respondents were of Dutch nationality. The English language respondents were a mix of Dutch and Germans, with at least three US citizens and one French citizen having filled out the survey. Participants were recruited by distributing the online questionnaire via social media of the researcher and by contacting acquaintances. Participation was voluntary.

Measures

Independent variables

Analytical thinking
The participants' level of analytical thinking was measured using the CRT test by Frederick (2005). Respondents were required to answer three mathematical questions. The first was a multiple-choice question requiring participants to identify the greater infection risk between 1 of 12 and 1 of 37. The other two were questions requiring calculations and out of the box thinking. This measure had a Cronbach's alpha of .73 (see Table 1). Respondents were given a point for each of the three mathematical questions they had answered correctly, resulting in an aggregate analytical thinking score between 0 (low analytical reasoning skills) and 3 (high analytical reasoning skills).

- Which of the following numbers represents the biggest risk of getting a disease? (A: 1 in 12 B: 1 in 37 (correct answer))
- A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost? (The correct answer was 5 cents, no multiple choice)
- If it takes 5 machines 5 minutes to make 5 widgets, how many minutes would it take 100 machines to make 100 widgets? (The correct answer was 5 minutes, no multiple choice)

Trust in institutions
Questions designed to measure the participants' trust in institutions were based on previous research conducted by Rozenbeek et. al (2020). Two questions were asked, one asking participants to indicate their level of trust in scientists, and another about trust in medical doctors and nurses. Both questions measured trust on a 1 (not at all) to 5 (a great deal) scale. This combined trust measure had a Cronbach's alpha of .71 (see table 1). Trust score was given according to the mean of the two questions respondents had to answer and resulted in an aggregate trust score between 1 (low trust in scientists and medical professionals), and 5 (high trust in scientists and medical professionals). As previously mentioned, trust in government was omitted from the research due to large differences between political leanings and health and science policies even amongst western countries.

- How much do you trust the following?
  - Scientists (1 = not at all, 5 = a great deal)
  - Medical doctors and nurses (1 = not at all, 5 = a great deal)

Risk perception
Risk perception was measured using three items from research conducted by Roozenbeek, et al. (2020). respondents were asked to rate the degree to which they felt threatened and likely to be personally affected in the future by climate change and the coronavirus pandemic on a scale, ranging from 1 (not at all) to 5 (a great deal). The combined risk perception measure had a Cronbach's alpha of .53. Since there were three questions on risk perception with regards to Covid-19 and only one each on climate change and fake news, the three Covid-19 questions were combined into one mean score, which were then combined with the two other questions to calculate a total risk perception score, ranging from 1 (low risk perception) to 5 (high risk perception).

- How worried are you personally about the following issues at present?
  - Coronavirus/Covid-19 (1 = not at all, 5 = a great deal)
  - Climate change (1 = not at all, 5 = a great deal)
  - The risk posed to elections by fake news (1 = not at all, 5 = a great deal)
- How likely do you think it is that you will be directly and personally affected by the following in the next 6 months?
  - Coronavirus/Covid-19 (1 = extremely unlikely, 5 = extremely likely)
  - I am more vulnerable to Covid-19 compared to others. (1 = not at all, 5 = a great deal)

Online literacy

Online literacy was measured by asking respondents to rate the following on a 1 (totally disagree) to 5 (totally agree) scale: whether they verified the sources of articles they came across online, whether they verified the sources of articles shared with them via social media and their tendency to believe information shared with them online via friends or family without questioning it. Each respondent was given an online literacy score from 1 (lowest) to 5 (highest), calculated from their responses on the three questions. This measure had a Cronbach's alpha of .67 (see table 1). The score for this measure was calculated by giving respondents a score between 1 (low online literacy) and 5 (high online literacy), calculated by using the mean of the three questions measuring online literacy.

- When friends or family send me news articles on Facebook or other social media, I tend to believe the information without questioning it. (1 = strongly disagree, 5 = strongly agree)
- When friends or family send me news articles on Facebook or other social media, it is important to me what the source of the article is. (1 = strongly disagree, 5 = strongly agree)
- When reading news articles online, I make sure that the source is trustworthy. (1 = strongly disagree, 5 = strongly agree)

Dependent variables; topics of misinformation

Three scores each were awarded for belief in misinformation as participants had been presented with three false statements on each of the three topics of misinformation (climate change, US elections and Covid-19), ranging from 1 (totally disagree) to 5 (totally agree). These scores were calculated from the mean result of the three questions about the topic. For example, participants were asked to rate three false statements on climate change. The final score for the participants' belief in false information on climate change was the mean score of all three questions. The higher the score, the stronger the belief in false information on the topic.

Covid-19 pandemic

Participants' belief in misinformation regarding the covid-19 pandemic was assessed in four questions, where they were asked to indicate the degree to which they agreed with the following false statements about the coronavirus on a 1 (totally agree) to 5 (totally disagree) scale. This measure had a Cronbach's alpha of .81 (see table 1).

- To what extent do you agree/disagree with the following statements?
  - The effect of the corona virus has been exaggerated by the government and the media. (1 = strongly disagree, 5 = strongly agree)
  - The coronavirus vaccines are ineffective and dangerous. (1 = strongly disagree, 5 = strongly agree)

- Face masks are not effective in blocking the transmission of the virus. (1 = strongly disagree, 5 = strongly agree)

US elections of 2020

Participants were presented with four false statements about the US elections of 2020 and asked to indicate their level of agreement with those statements on a scale from 1 (totally agree) to 5 (totally disagree). This measure had a Cronbach's alpha of .67 (see table 1).

- To what extent do you agree/disagree with the following statements?
  - The 2020 elections in the United States were conducted in an unfair and dubious manner. (1 = strongly disagree, 5 = strongly agree)
  - Donald Trump is the legitimate winner of the 2020 elections in the United States. (1 = strongly disagree, 5 = strongly agree)
  - Millions of votes for Donald Trump were illegally destroyed or deleted. (1 = strongly disagree, 5 = strongly agree)

Climate change

On climate change, participants were presented with three false statements on climate change and asked to indicate their level of agreement with those statements on a scale from 1 (totally agree) to 5 (totally disagree). This measure had a Cronbach's alpha of .67 (see table 1).

- To what extent do you agree/disagree with the following statements on climate change?
  - The global rise in temperature in unrelated to human activities (1 = strongly disagree, 5 = strongly agree)
  - The science behind climate change is unreliable (1 = strongly disagree, 5 = strongly agree)
  - Reducing our carbon footprint will have no effect on the climate. (1 = strongly disagree, 5 = strongly agree)

Procedure

The research was conducted in the form of a questionnaire administered via an online link, accessible through smartphones, tablets and PC. The survey was created using Qualtrics. The questionnaire was administered in English, Dutch and German. First, respondents were asked to agree to the ethical consent form. After indicating their age and gender, participants were presented with questions designed to measure their level of online literacy, analytical thinking, trust in institutions and risk perception, in that order. Then, they were presented with four false statements each on the covid-19 pandemic, 2020 US elections and climate change.

Results

Descriptive statistics

The means and standard deviations are displayed in Table 1. To test the first hypothesis that there is a significant effect of the constructs online literacy, analytical thinking skills, trust in scientists and doctors/nurses and risk perception on the topics of misinformation climate change, US elections 2020 and Covid-19, a linear regression analysis was performed in SPSS.

Belief in misinformation on **climate change** was found to have a highly significant correlation with trust in scientists, doctors and nurses ($r = -.42$, $p < .01$). Overall, respondents did not show high levels of trust in science and doctors, with a value of 3.39 on a scale between 1 (lowest) and 5 (highest). Participants who showed high levels of trust were therefore significantly more likely to not believe misinformation about climate change.

For belief in misinformation on the **US elections of 2020**, a significant positive correlation was found with online literacy ($r = .34$, $p < .05$). Higher online literacy scores meant in this case that an individual was more likely to believe in misinformation about the elections. Furthermore, a significant, negative correlation ($r = -.315$, $p < .05$) was found with regards to analytical thinking skills, suggesting a lower likelihood of believing in misinformation on the election with higher analytical thinking skills.

As for **Covid-19**, a significant positive correlation ($r = -.34$, $p < .05$) indicates that people with high risk perception are less likely to believe misinformation about the coronavirus pandemic.

For the third, explorative hypothesis, that respondents with a strong belief in one topic of misinformation were more likely to believe strongly in other topics of misinformation, a correlational analysis was performed (see Table 1 for the correlations). Highly significant correlations were found between belief in misinformation on climate change and covid-19 (.46) and covid-19 and the US elections (.38).

<u>Linear regressions</u>
Linear regression analyses were performed with respectively belief in misinformation on climate change, US elections and Covid-19 as dependent variables, and the four constructs of online literacy, analytical thinking skills, trust and risk perception as independent variables.

The linear regression used to predict the effect of the constructs on **climate change** (see Table 2) yielded significant results with regards to the construct of trust. The amount of trust was found to explain the amount of variance in belief in misinformation on climate change to a significant degree, ($b = -.68$, $t(54) = -3.16$, $p < .01$). Lower values for trust in scientists and doctors/nurses therefore reduced the belief in misinformation on climate change. Marginally significant results were also obtained for online literacy, ($b = .07$, $t(54) = 1.91$, $p = .06$). Higher levels of online literacy therefore also reduced the belief in misinformation on climate change.

The regression model for belief in misinformation on the **US elections** (see Table 2) yielded significant results for relations with two of the constructs. The effect of online literacy on belief in misinformation on the US elections was significant: ($b = .07$, $t(54) = 2.32$, $p = .02$). Similarly, the effect of analytical thinking skills on the same topic was also significant: ($b = .36$, $t(54) = 3.29$, $p < .01$).

Two of the constructs also had a significant effect on misinformation related to **Covid-19** (see Table 2), with online literacy having a significant effect on the model: ($b = .83$, $t(54) = 2.06$, $p = .04$), trust: ($b = -.56$, $t(54) = -2.33$, $p = .04$). Higher levels of online literacy and trust therefore reduced belief in misinformation on Covid-19.

To recap, high online literacy reduced belief in misinformation for all three topics: climate change, US elections and Covid-19. Analytical thinking was found to reduce belief in misinformation on US elections, while trust reduced belief in misinformation for climate change and Covid-19. Risk perception was not found to have influenced belief in misinformation to any significant level.

<u>Comparison of topics</u>
A within subjects ANOVA was conducted to compare the differences in mean values of susceptibility to topics of misinformation. Marginally significant differences were found in the means of the three different topics of misinformation. Mauchly's test indicated that the assumption of sphericity was not violated ($\chi2(2) = .83$, p = .66). The scores of the belief in the three topics of misinformation was not rated equally at the 90% significance level $F(2,54) = 2.52$, p = 0.09.

Table 1. Means, standard deviations and intercorrelations among the variables

Variables	M	SD	1 OL	2 AL	3 TR	4 RP	5 CC	6 US	7 CV	8 Ag
1. Online literacy[1]	9.11	4.07								
2. Analytical thinking[2]	1.87	.87	.09							
3. Trust	3.39	.77	.63*	.09						
4. Risk perception	3.55	.79	.08	-.16	.20					
5. Climate change	1.88	.92	-.75	-.04	-.42*	-.19				
6. US elections	1.77	.78	.34*	-.32*	.20	-.18	.15			
7. Covid-19	2.08	1.01	.07	-.10	-.22	-.34*	.46*	.38*		
8. Age	39.46	18.56	-.26	-.13	-.33*	.46*	.09	-.34*	-.19	
9. Gender[3]	1.46	.54	-.06	.05	.01	.09	.07	.01	.01	-.15

* p < .05

Table 2. Linear regressions topics of misinformation vs psychological mechanisms

	Effect	Estimate	SE	t	95% CI LB	UB
Climate change	Intercept	-.82	.83	-.10	-2.50	.84
	Online literacy*	.07	.04	1.91	-.00	.14
	Analytical thinking	-.03	.13	-.20	-.03	.24
	Trust*	-.68	.22	-3.16	-1.11	-.25
	Risk perception	-.17	.19	-.88	-.55	.21
US elections	Intercept	1.31	.67	1.96	-.03	2.65
	Online literacy*	.07	.03	2.32	.01	.13
	Analytical thinking*	-.36	.11	-3.29	-.57	-.14
	Trust	-.03	.17	-.19	-.38	.31
	Risk perception	-.15	.15	-1.01	-.46	.15
Covid-19	Intercept	-.59	.92	-.64	-2.44	1.26
	Online literacy*	.08	.04	2.06	.00	.16
	Analytical thinking	-.17	.15	-1.11	-.47	.13
	Trust*	-.56	.24	-2.33	-1.03	-0.8
	Risk perception	-.31	.21	-1.47	-.73	.11

*p < .05

Discussion

This study sought to establish a relationship between commonly cited causes of people's belief in misinformation. It also sought to explore whether people who believe in one topic of misinformation are more likely to believe in another. Of the three topics of misinformation, misinformation on Covid-19 was

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[1] between 1 (lowest) and 15 (highest)

[2] between 0 (lowest) and 3 (highest)

[3] Male = 1, female = 2, other = 3

the most likely to be accepted. In general however, people's acceptance of misinformation was rather low, with mean values hovering between 1.77 and 2.08 out of a possible 5. This could be explained by the sample population, of which a majority was highly educated, shown for example by the consistently high scores on analytical thinking.

Interestingly, the different topics of misinformation were explained by a different combination of constructs. Of those, only online literacy explained susceptibility to misinformation on all topics. A possible explanation can be found in research conducted by Guess, Lerner and Lyons, (2020), which suggests that since respondents were asked to indicate their own perceived levels of online literacy, the items on online literacy may have acted as primers that instilled an attitude which was more likely to reject false information. In other words, participants may have answered in line with what they felt was socially desirable. While this may not have applied to all respondents, it may have impacted the scores. Furthermore, targeted messaging to undermine the scientific consensus on climate change has been found to be very effective (van der Linden, S., Leiserowitz, A., Rosenthal, S., & Maibach, E.; 2017). Due to the large quantity of information found online that seeks to do exactly this, high online literacy may prove vital in guarding against misinformation online, independent of the topic of misinformation.

Inevitably the question poses itself why the other constructs only explain belief in misinformation on specific topics. Analytical thinking explained only misinformation belief in the US election. Ability to interpret statistics and numeric data was a key metric being measured by the CRT test which the items of this research were based on, and the sheer volume of statistical data which accompanied the election coverage was likely much more easily interpreted by respondents with high analytical thinking skills. There is also a possibility that individuals with higher levels of analytical thinking followed the election coverage more closely and were made more aware of misinformation. A majority of respondents were not American and therefore less interested and also less exposed to more politically biased reporting. This could introduce information search as a mediating variable since some news channels were more likely to point out and dissect misinformation while others did not. The more different news sources an individual was exposed to, the higher the likelihood of at least being made aware of potential misinformation. Either way, the link between analytical thinking skills and perhaps an increased ability to navigate the quagmire of political controversy obscuring the results of the elections is worth further investigation. In contrast to these findings, the numeracy-based research by Kahan, Dawson, Peters and Slovic (2013) suggests that high numeracy should be linked to all topics of information, not just the US elections, as they are all related to science education and critical reasoning skills. Possible links between numeracy and the ability to reflect on one's own political orientation is also worth exploring in relation to this topic.

Trust in scientists and medical professionals predicted belief in misinformation on climate change and Covid-19, but not on the US elections. As trust in government institutions was omitted from the research, the lack of a significant relationship between trust in science and medicine and US election beliefs makes sense. The findings suggest that the science-based topic of climate change and the more medicine-based topic of Covid-19 is explained in the model by trust. This can partially be explained by the fact that data on Covid-19 and climate change, lay persons do not only depend on professionals for the gathering of the data but also its interpretation. Especially the link between trust and acceptance of misinformation on diseases is supported by related research on other diseases such as Ebola. In their research, found that respondents in the DR Congo were more likely to undertake individual preventive behavior against Ebola as instructed by authorities, if their trust in these institutions was high (Vinck et al., 2019).

Risk perception played a role in explaining belief in misinformation in both the US elections and

Covid-19, but not climate change. This could be because Covid-19 and the US elections presented more tangible and immediate threats to people than climate change. While the long-term risks of climate change are difficult to assess and quantify, the immediate threat of a coronavirus infection or a disputed US election are much easier for people to imagine. Research by Sjöberg (2000), identified risk sensitivity and specific fear as instrumental in explaining variance in risk perception models, including how imminent a threat was. Further research should be conducted to determine the differences in how underlying factors influence risk perception towards topics of misinformation.

The relationship between the misinformation topics themselves was the theme of the exploratory hypothesis, and significant correlations between belief in misinformation on almost all topics means that at least for the three topics chosen, there appears to be a strong link between belief in one misinformation topic and another. Specifically, as explored earlier, the relationship between opinions on the US elections and Covid-19, as well as climate change and Covid-19 were of note here. Links between political leaning of participants and their susceptibility to false information on the topics may be worth exploring, as research has shown that political attitudes can have an influence on people's attitudes towards these topics (Ziegler, 2017). The lack of data suggesting a link between opinions on climate change and the US elections is puzzling, as the relationship between the other topics of misinformation was evident.

Limitations
There were limitations to this study. First, the sample was largely drawn from a combination of university students and highly educated adults and was therefore not representative of the general population. This could also be seen with an above expected dedication to some of the questions, especially the analytical thinking questions. As most respondents had been personally contacted by the researcher, they may have felt a stronger need to get the math questions correct. Several respondents later told the researcher how long they had worked on the math question, where anonymous respondents may have skipped the question or gotten it wrong. Especially the highly educated sample size would impact results regardless of the topic of misinformation.

Furthermore, it must be taken into account that while the analytical thinking questions were designed to require out of the box thinking, they also exclusively measured mathematical ability. If analytical reasoning skills unrelated to mathematics had been measured, it is possible that the correlation between analytical thinking and belief on US elections could have been even stronger. This could also apply to the other topics of misinformation. One issue that must be addressed is the measurement of online literacy in this study. It is important to consider that participants were asked to indicate their own perceived level of online literacy. Just because someone says that they always verify whether the source of an information is credible does not mean that they actually do so. What online literacy may have actually been measuring is a conviction that one's sources of information are reliable and accurate. Follow-up research could therefore use a more scientifically valid method of determining someone's level of online literacy.

In general, to prevent participants from losing interest during a long questionnaire, the number of items per construct and belief was kept small, and often in an inconsistent manner. For example, trust was measured using only two items, while risk perception used five, three of which were Covid-19 related questions, which may have affected responses in the following misinformation on Covid-19 section. A larger number of items could serve to increase reliability.

Finally, while online literacy, analytical thinking and trust can be seen as the basic building blocks of susceptibility to misinformation, risk perception can be influenced by these three factors and is

therefore not an independent measure. Future research should take this into account by measuring risk perception independent of specific factors. While questions in this research asked specifically about risk perception with regards to Covid-19 for example, these questions could ask about risk perception with regards to health in general.

Conclusion

Overall, the study highlighted some of the links between people's attributes and their attitudes. The fact that some participants readily accepted statements that have often very publicly been proven false is noteworthy, and the findings support the view that most of the constructs play a role in reducing belief in misinformation. One way in which this could be accomplished is by educating people on how to better discern reputable news sources from those who are not and helping them to better navigate the online news environment. Increasing levels of online literacy is as relevant as ever due to the increasing availability of information, and misinformation, online. Furthermore, this research has highlighted the importance of trust in scientists and medical professionals in combatting the adoption of misinformation. Increasing trust in these institutions through better education and increased transparency could prove helpful. The widespread acceptance of misinformation is a very relevant issue which complicates a coordinated effort to tackle the big problems of our time and continuous research and concerted efforts are required to combat this phenomenon.

References

BBC. (2020, April 24). Coronavirus: Outcry after Trump SUGGESTS INJECTING Disinfectant as treatment. *BBC*.
https://www.bbc.com/news/world-us-canada-52407177

Brashier NM, Schacter DL. Aging in an era of fake news. *Curr Dir Psychol Sci.* 2020;29(3):316–323. doi: 10.1177/0963721420915872.

Eshet, Y. (2004). Digital Literacy: A Conceptual Framework for Survival Skills in the Digital era. *Journal of Educational Multimedia and Hypermedia*, 13(1), 93-106.

EU Commission. (2021, March 09). Identifying conspiracy theories. https://ec.europa.eu/info/live-work-travel-eu/coronavirus-response/fighting-disinformation/identifying-conspiracy-theories_en

Frederick, S. (2005). Cognitive reflection and decision making. *Journal of Economic perspectives*, 19(4), 25-42.

Guess AM, Lerner M, Lyons B et al. A digital media literacy intervention increases discernment between mainstream and false news in the United States and India. *Proc Natl Acad Sci U S A*. 2020;117(27):15536–15545. doi: 10.1073/pnas.1920498117.

Kahan, D. M., Peters, E., Dawson, E. C., & Slovic, P. (2013). Motivated Numeracy and Enlightened Self-Government. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2319992

Kim, S., & Kim, S. (2020). The crisis of public health and Infodemic: Analyzing belief structure of fake news about Covid-19 pandemic. *Sustainability, 12*(23), 9904. doi:10.3390/su12239904

Levenson, M. (2021, February 06). Today's rampage at the Capitol, as it happened. *The New York Times*. https://www.nytimes.com/live/2021/01/06/us/washington-dc-protests

PBSNewsHour. (2020, October 15). *WATCH: House EXAMINES spread of online MISINFORMATION, conspiracy theories ahead of election* [Video file]. YouTube. https://www.youtube.com/watch?v=_5u2PkJYp4Q&ab_channel=PBSNewsHour

Pennycook, G., & Rand, D. G. (2019). Who falls for fake news? The roles of bullshit receptivity, overclaiming, familiarity, and analytic thinking. *Journal of Personality*. doi:10.1111/jopy.12476

Peters, E., Västfjäll, D., Slovic, P., Mert, C.K., Maocco, K. & Dickert, S. Numeracy and Decision Making. *Psychological Science, 17*, 407-413 (2006).

Rochlin, N. (2017). Fake news: belief in post-truth. *Library Hi Tech*, *35*(3), 386–392. https://doi.org/10.1108/lht-03-2017-0062

Sjöberg, L. (2000). Factors in Risk Perception. *Risk Analysis*, *20*(1), 1–12. https://doi.org/10.1111/0272-4332.00001

Thorson, E. (2016). Belief echoes: The persistent effects of corrected misinformation. *Political Communication*, 33, 460–480. https://doi.org/10.1080/10584609.2015.1102187

van der Linden, S., Leiserowitz, A., Rosenthal, S., & Maibach, E. (2017). Inoculating the Public against Misinformation about Climate Change. *Global Challenges*, *1*(2), 1600008. https://doi.org/10.1002/gch2.201600008

Vinck, P., Pham, P. N., Bindu, K. K., Bedford, J., & Nilles, E. J. (2019). Institutional trust and misinformation in the response to the 2018–19 Ebola outbreak in North Kivu, DR Congo: a population-based survey. *The Lancet Infectious Diseases*, *19*(5), 529–536. https://doi.org/10.1016/s1473-3099(19)30063-5

Wardle, C, (2017). Fake news. It's complicated. *First Draft*. https://medium.com/1st-draft/fake-news-its-complicated-d0f773766c79

Ziegler, A. (2017). Political orientation, environmental values, and climate change beliefs and attitudes: An empirical cross country analysis. *Energy Economics*, *63*, 144–153. https://doi.org/10.1016/j.eneco.2017.01.022

Zucker, H. A. (2020). Tackling Online Misinformation: A Critical Component of Effective Public Health Response in the 21st Century. *American Journal of Public Health*, *110*(S3). https://doi.org/10.2105/ajph.2020.305942