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CONFIRMATION BIAS, ANALYTICAL THINKING, AND EMOTIONAL INTENSITY IN EVALUATING NEWS HEADLINES ONLINE

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ABSTRACT

This study examines the role of prior beliefs, analytic thinking, and emotional intensity of content in believing that information is truthful or not. Participants (*N* = 169 Facebook users) were presented with a series of news headlines previously categorised into three specific subgroups – for or against vaccination, true or false, and high or low in emotional intensity. Each participant first answered questions about their attitude and behaviour towards vaccination against COVID-19 based on the theory of planned behaviour (TPB) and filled out a cognitive reflection test (CRT), a measure of analytic thinking, followed by an evaluation of each headline on whether it is truthful or not. The results showed strong evidence of overall confirmation bias in the group that supports vaccination; however, when considering whether the headline is real or false, the most significant differences between the groups were found in the case of trust in fake headlines against vaccination – those against vaccination to a larger extend believed in false headlines confirming their prior beliefs. In contrast, such differences between the groups in case of false headlines supporting vaccination were weak. Further analysis showed that analytic thinking described by the CRT score had a weak yet statistically significant tendency to promote one's ability to distinguish real from false information. The intensity of headlines had the most significant differences when evaluating real news headlines supporting vaccination with low emotional intensity and false news headlines against vaccination with low emotional intensity. Overall, these findings provide additional insight into the complex nature of information evaluation online and the critical role of one's prior beliefs and emotional components of the content.

Keywords: *analytic thinking, confirmation bias, emotional intensity, misinformation, disinformation*

Introduction

Social networks and online media have become one of the primary global sources of information. They contain daily information, opinions and other information often found and perceived by individuals. Available information could provide an objective point of view – it is possible to

gain broad and comprehensive information in just a few seconds. However, there is often questionable information: stories and opinions of individual experiences unintentionally misleading (misinformation) or even blatantly false information, such as conspiracy theories, pseudo-scientific statements, content created for phishing user data, and knowingly misleading news (disinformation). Understanding how individuals perceive, react, and involve themselves in information flow, is crucial to understanding the underpinning factors involved in this process: biases, emotions, and individual thinking styles one uses when perceiving information online.

Analytic thinking

When it comes to confronting natural tendencies in how individuals perceive information, media literacy and critical thinking are the solutions that come to mind to many. However, it also has its ups and downs. Critical thinking provides individuals with the skills needed to critically evaluate available information, for example, by seeking evidence to support someone's claims and assessing the reliability of the reasoning. In the studies on media literacy, critical thinking is an essential skill for identifying false messages (Machete & Turpin, 2020). Critical thinking covers a broad spectrum of skills that includes verbal judgment skills, argument analysis, hypothesis testing, and the ability to embrace uncertainty, decision-making, and problem-solving. Many studies on the perception of false messages stress that examining and judging information (critical thinking) is vital for identifying false messages. In other words, it is crucial to think deliberately rather than intuitively. In one of the studies (Pennycook & Rand, 2019), researchers, using the cognitive reflection test as an indicator of analytical thinking that is deliberative and would suggest usage of some critical thinking skills, conclude that high cognitive reflection indicators correlate negatively with the perceived accuracy of false messages and correlate positively with the ability to distinguish false messages from trustworthy ones.

In another study (Bago, Rand & Pennycook, 2020), the authors stress that the results point to the fact that fast and intuitive information processing contributes to belief in false content. The "success" of inaccurate content on social media may be related to the tendency of users to scroll through the news stream quickly without going into details about the information. Although the results of these studies are contrary to the approach of confirmation bias, it is essential to distinguish between the fact that, in this case, the authors only look at the ability of respondents to distinguish factually accurate information from false and might indicate the specific nature of superficial processing of information in the context of news content, not user-created content. Even though someone analyses the content

in detail and varies with the source of information, people's initial opinion might play a more critical role and, therefore – essential activation of critical thinking.

Critical thinking (assuming that its use and meaning are perfectly understood and not selective) could significantly help an individual perceive and evaluate information when assessing the information superficially and when going into details, regardless of the original individual's perspective or opinion. Machete and Turpin (Machete & Turpin, 2020), in their review of the role of critical thinking in disinformation recognition, highlight the general inability of people to identify disinformation. Media literacy and critical thinking are essential skills to prevent exposure to misleading online information; however, it is not enough with the willingness to think critically – one needs to utilize the skills in reality. Machete and Turpin also stress that, given the limited number of studies on critical thinking in identifying false messages, it is crucial to continue research to clarify the role of critical thinking and training in the perception of mundane information. Therefore, the first (H1) prediction is as follows: people scoring higher in analytical thinking will evaluate truthfulness of news headlines significantly more accurately.

Confirmation bias

Confirmation bias is one of the weak spots in the perception of information. Confirmation bias is an individual's natural tendency to seek, interpret, prefer, and remember information consistent with the original view, attitude, or hypothesis (Hastie, 2014). Confirmation bias encourages individuals to choose the information consistent with their existing opinion. It can quickly address individuals through ideas that are acceptable and effortlessly perceived (Ciampaglia & Menczer, 2018) by using it in dishonest and misleading ways. They can include ideological extremism, threaten public safety and lead to conflicts, although such development would be impossible without the influence of malicious actors.

In 1969, Miller mentioned that we desperately need tools to prevent conflicts and make them not become a source of public confrontation from which finding a sensible exit is impossible. This notion has gained significance in recent years, as individuals live in an "information bubble" that they like and, sometimes, do not understand why they tend to defend their positions so fiercely. It is partly the responsibility of the media, social networks, and other sources, which, under the pretext of the interests of consumers, offer the individuals (users) precisely the information they have shown interest about in the past. It often can help users not to become lost in the vast realms of information. However, there are cases where such information can be misused, and studies on the possibility of fighting

extreme confirmation bias should be among the most critical priorities of psychology (Lilienfeld, Ammirati & Landfield, 2009).

The prevention of disinformation is closely linked to confirmation bias studies since the most significant risk is further strengthening individuals' initial views, one-sided, and sometimes false information. Although there are many strategies to overcome confirmation bias, their effectiveness is often minimal. For example, Lewandowski looks at the withdrawal of information, alerts before the perception of information, and availability of alternative information (Lewandowsky et al., 2012). Other authors consider disconfirming recommendations as a solution and constructs of a trust/distrust mindset (Schul, Mayo & Burnstein, 2004; Schwind et al., 2012); however, they all fail to address the underlying mechanisms of perception, thinking styles, emotions, and situational factors.

In summary, confirmation bias encourages individuals to choose and interpret the information consistent with their existing opinion, which would constitute the interpretation of information consistent with prior attitudes as truthful versus information that postulates opposing views. Therefore, our second prediction is (H2): headlines will be rated as significantly more truthful if the information is congruent with one's prior beliefs.

Emotional intensity

Another bias closely related to promoted and unconscious engagement in misinformation flow is negativity bias – the fact that something positive will usually have less of an effect on an individual's behavior and perception than something equally emotional but negative (Baumeister, Bratslavsky, Finkenauer & Vohs, 2001). The latest research suggests that negativity is strongly related to extremity and attitude polarisation in the political domain (Buder, Rabl, Feiks, Badermann & Zurstiege, 2021). Overall, adverse reactions, emotions and negative stereotypes are quicker to develop and more resilient to disconfirming than positive ones, and barely any exceptions suggesting superior strength of good can be discovered. These findings imply that negative is more potent than positive, which is also true in the perception of online content.

Martel, Pennycook & Rand have noted that disinformation authors tend to use very emotional content that is processed quickly and superficially and can cause additional difficulty distinguishing it from the truth (Martel, Pennycook & Rand, 2020). Moreover, negative emotions, such as anger, fear and disgust, can foster rapid yet superficial engagement. The authors stress that relying on emotion increases confidence in disinformation to an extent where higher reported emotionality was positively associated with disinformation belief and higher cognitive reflection scores. These results

point to the role of emotional information and its perception in susceptibility to misinformation. Karina Val-Jorgensen notes that even professional and successful journalists, despite their commitment to objectivity, use emotional content to create their own stories (Wahl-Jorgensen, 2013). Therefore, subjective feelings appear to be an essential factor in the perception of information.

Emotional intensity is also an essential component for cognitive dissonance to arise. In the selective-exposure paradigm (Mills, 1999), it is noted that people will attend more to information that underpins their pre-existing beliefs, and they will try to avoid conflicting information to prevent potential negative outcomes or, in other words, – cognitive dissonance. People might use different strategies to escape the cognitive dissonance in a selective exposure situation with low versus high-intensity stimuli. For instance, in case if information comes in low intensity, people might rather reappraise than distract themselves from it (Sheppes, 2014). However, in the case of high intensity, the opposite pattern could emerge. Within this study, participants will be exposed to both congruent and discongurant information; we expect to see a pattern, where when high intensity discongurant information is presented, one will commit more to salvage one's prior beliefs by discounting it as false. Hence our final prediction is: (H3) Discongurent headlines high in emotional intensity will be rated as less truthful than those low in emotional intensity and vice versa for congruent headlines – headlines high in emotional intensity will be rated as more truthful than those low in emotional intensity.

Summary and study overview

In summary, the amount of information online is growing daily, and almost everyone must face varying quality content daily. When an individual perceives this content, he can be influenced by various factors: biases, initial attitudes, and emotions at the individual level, and content-specific factors such as source and emotional saturation. In superficial processing, studies so far can provide evidence that more careful, critical thinking rather than rapid and intuitive information processing can help identify misleading content and reduce individuals' engagement in its spread. On the other hand, in perception and interpretation, initial opinion and motivated reasoning may impact incongruous denial of views opposing their strengthened attitudes and the justification of consistent opinions. Media literacy and critical thinking can help individuals make judgments by utilising critical thinking; however, the full use of these skills, the quality of training, and the individual's ability to transfer them to real-life play an important role.

We conducted an online quasi-experiment to understand how confirmation bias, analytical thinking, and emotional intensity of content influence

the evaluation of the truthfulness of news headlines online. According to the literature review, three predictions were proposed. Firstly, headlines will be rated as truthful significantly more if the information is congruent with one's prior beliefs. Secondly, discongurent headlines high in emotional intensity will be rated as less truthful than those low in emotional intensity and vice versa for congruent headlines – headlines high in emotional intensity will be rated as more truthful than those low in emotional intensity. Lastly, people scoring higher in analytical thinking will evaluate truthfulness of news headlines significantly more accurately.

Methodology

Sample

169 respondents (76.90% females, mean age = 38.11, *SD* = 10.03) participated in the survey. We used the QuestionPro platform to collect data in an online survey mode and distributed the survey on the social network "Facebook" to multiple public groups in March of 2021. Participation in this study was voluntary, anonymous and without any remuneration.

Materials and Procedure

First, participants were presented with an informed consent form to ensure participants had an understanding of this survey's main objective, ethical standpoints and anonymity of participation in the survey. After acknowledging informed consent, participants were asked basic demographic questions regarding their age, gender and education level.

Secondly, participants answered several questions about their attitude towards COVID-19 vaccination created according to Theory of Planned Behaviour (Ajzen, 1991) and raw scores where indexed as per authors suggestions. The questions covered attitude, subjective norm, and perceived behavioural control for the COVID-19 vaccination: "I believe that vaccination is an appropriate way to stop a COVID 19 pandemic", "I am familiar with information about COVID19 and the vaccination process", "My friends support vaccination against COVID19", "My family members support COVID19 vaccination" and "If in the next two days I would be offered to receive COVID19 at a convenient place and time, I would do so".

Next, a short version of the cognitive reflection test followed (Frederick, 2005). The test had three open-ended questions: "A bat and a ball cost EUR1.10 in total. The bat costs EUR1.00 more than the ball. How much does the ball cost?", "If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?" and "In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If

it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?".

Finally, participants were asked to assess 24 news headlines whether they were "True" or "False". The stimuli for this part were created according to Penycock et A Practical Guide to Doing Behavioral Research on Fake News and Misinformation (Pennycook et al., 2021). As per suggestions from the mentioned article, the news headlines were presented as Facebook posts and pre-tested for emotional intensity and whether they were pro vs against vaccination. As per pre-test values, twelve of the headlines were real and 12 fake (as per fact-checking sources). Please see pictures 1 and 2 to illustrate pro vs against vaccination headlines.

Pāvests aicina vakcinēties un paziņo, kad pats saņems poti pret Covid-19

Picture 1. Pro-vaccination Headline example

Brīdina cilvēkus ar nopietnām alerģijām nevakcinēties ar "Pfizer" un "BioNTech" Covid-19 vakcīnu

Picture 2. Against-vaccination Headline example

Results

Firstly, to test our prediction regarding the influence of analytical thinking of respondents on the ability to identify truthful articles from false correctly, we split respondents by their score in CRT into two groups consisting of 78 individuals scoring 0–1 points in the test (low scoring individuals) and 91 individuals scoring 2 or 3 points (high scoring individuals), respectively. A further analysis of variance revealed significant differences between these groups, $F(1, 167) = 11.64$, $p = .001$. Individuals in the high scoring group were able to a larger extent ($M = 16.81$; $SD = 2.49$) than those in the lower scoring group ($M = 15.58$; $SD = 2.17$) to correctly identify truthful headlines from false. Though the difference between the groups is relatively small, it supports our first prediction that the analytical thinking style helps evaluate news headlines.

Secondly, we predicted that when considering prior attitude towards vaccination, individuals will rate significantly more articles as truthful if they confirm their prior attitude, therefore indicating confirmation bias. We first calculated the average score on the TBP scale, buy creating index of the 5 questions about participants attitudes, social norms and behavioural control. Next, we created two clusters consisting of individuals pro-vaccination and against it to test this hypothesis. The cluster analysis showed a good fit of 2 clusters consisting of 109 (64.5%) individuals in the pro-vaccination group and 60 (35.5%) individuals in against vaccination group, with an average silhouette score of 0.8.

To test if confirmation bias influences the rating of articles as true, we calculated if individuals in the pro-vaccination group rated pro-vaccination headlines as more truthful than vice versa. The results showed that there were significant differences between the groups in the evaluation of both pro-vaccination headlines $F(1, 167) = 26.91$, $p = .001$ and even more significant in case of headlines against vaccination $F(1, 167) = 30.26$, $p = .001$. Paired sample t-test showed significant differences between believing that pro-vaccination headlines are true ($M = 7.08$; $SD = 1.50$) and headlines against vaccinations are false ($M = 3.79$; $SD = 1.61$) for participants in the pro-vaccination group; $t(108) = 15.21$, $p = 0.000$. However, in the case of the against-vaccination group, the differences between the mean scores of pro-vaccination headlines ($M = 5.60$; $SD = 2.04$) and against-vaccination headlines ($M = 5.50$; $SD = 2.43$) rated as true were not significantly different; $t(59) = .242$, $p = 0.810$. These results partially support our prediction that the prior attitude influences the evaluation of news headlines in attitude endorsing way. However, further analysis shows that this prediction is supported only in the case of pro-vaccination participants, jet not in those against vaccination. Please see Table 1 for illustration.

Table 1. Means, Standard Deviations, and Analyses of Variance of Stimuli Pro or Against Vaccination Rated as True

Stimuli type	Pro-vaccination cluster		Against vaccination cluster		*F* (1, 167)
	M	***SD***	***M***	***SD***	
Pro vaccination headlines	7.08	1.50	5.60	2.04	26.91***
Against vaccination headlines	3.79	1.61	5.50	2.43	30.26***

*$p < .05$. ***$p < .001$.

We conducted additional analyses to examine further the influence of headlines' emotional intensity on its evaluation. Articles were grouped by their value of truthful vs false, pro vs against vaccination and highly emotionally intense vs low on emotional intensity – three articles in each subgroup. The results show statistically significant differences in the case of truthful headlines in both pro-vaccination headline groups with high emotional intensity $F(1, 167) = 11.85$, $p = .001$. and with low emotional intensity $F(1, 167) = 21.26$, $p = .001$. Individuals supporting vaccination to a larger extent than those against rated truthful headlines as being truthful than individuals in against-vaccination group. An opposite pattern also emerged when asked about truthful headlines with high emotional intensity and against vaccination $F(1, 167) = 15.25$, $p = .001$; however, there were no differences between the groups when truthful articles against vaccination were low in emotional intensity $F(1, 167) = 1.12$, $p = .291$.

Furthermore, when analysing false headlines rated as true, in the case of pro-vaccination headlines, there were significant differences in case of emotionally intense stimuli $F(1, 167) = 7.84$, $p = .05$, yet not significant in case of stimuli with low emotional intensity $F(1, 167) = 1.45$, $p = .231$. Similarly to truthful headlines, the opposite pattern emerges in the case of false headlines against vaccination. There were significant differences in high emotional intensity stimuli rated as true $F(1, 167) = 9.09$, $p = .05$. However, the most significant differences for false news headlines were in the case of low emotional intensity stimuli against vaccination rated as true $F(1, 167) = 39.09$, $p = .001$. All together these results add evidence to our second hypothesis, and we can see that confirmation bias is strong in case of emotionally intense stimuli in all subgroups, however by far the largest difference between the groups is visible in case of false stimuli with low emotional intensity and against vaccination. Please see Table 2 for detailed results and mean scores.

Table 2. Means, Standard Deviations, and Analyses of Variance of Stimuli per Group Rated as True

Stimuli pretested value	Pro-vaccination cluster		Against vaccination cluster		*F* (1, 167)
	M	***SD***	***M***	***SD***	
Truthful headlines					
Pro, Emot. int. high	2.71	0.52	2.33	0.90	11.85***
Against, Emot. int. high	0.72	0.83	1.30	1.09	15.25***
Pro, Emot. int. low	2.50	0.69	1.92	0.93	21.26***
Against, Emot. int. low	1.75	0.68	1.86	0.65	1.12
False headlines					
Pro, Emot. int. high	0.77	0.72	0.47	0.60	7.84*
Against, Emot. int. high	1.16	0.70	1.53	0.91	9.09*
Pro, Emot. int. low	1.06	0.89	0.88	0.89	1.45
Against, Emot. int. low	0.17	0.42	0.80	0.90	39.09***

$^{*}p < .05$. $^{***}p < .001$

Lastly, to understand how emotional intensity influences headline truthfulness evaluation, we conducted paired- samples t-tests for both pro-vaccination and against-vaccination individual subgroups separately. We predicted that discongruent headlines high in emotional intensity would be rated as less truthful than those low in emotional intensity and vice versa for congruent headlines. Results, however, did not support this hypothesis when testing differences between high versus low-intensity stimuli rated as true – in both congruent and discongurent cases differences between scores were not statistically significant. To understand these findings in more detail, we also conducted paired sample t-tests for each subgroup considering not only the intensity and congruity of headlines, but also whether they are truthful or false. These results showed that there are statistically significant differences in all content specific subgroup ratings. The pattern remained the same for both pro-vaccine individuals and against-vaccine individuals. Truthful pro-vaccination headlines high in emotional intensity were rated as more true by individuals from both pro-vaccination, $t\,(108) = 2.95$, $p = 0.004$, and against-vaccination, $t\,(59) = 3.08$, $p = 0.003$, group. Truthful against-vaccination headlines high in emotional intensity were rated as less true both by individuals form the pro-vaccination, $t\,(108) = –12.59$, $p = 0.000$, and against-vaccination, $t\,(59) = –4.19$, $p = 0.000$, group. False pro-vaccination headlines high in emotional intensity were rated as true less both from individuals pro-vaccination $t\,(108) = –2.73$, $p = 0.007$ as well as against $t\,(59) = –3.41$, $p = 0.001$. And false against-vaccination

headlines high in emotional intensity were rated as true more both from individuals pro-vaccination $t\,(108) = 12.94$, $p = 0.000$ as well as against $t\,(59) = 5.01$, $p = 0.000$. These results still did not support our hypothesis about differences in perception of stimuli based on the contents' congruity with one's opinion. However, they provide an exciting facet for further research, and support the basic notion – that the emotional intensity of the content proves influential in evaluating its truthfulness.

Discussion

In our theoretical framework, we set three distinct predictions about how respondents' prior attitudes, analytical thinking style, and emotional intensity of the evaluated news headlines would influence their rating of whether these articles were true. Firstly, we tested if individuals who scored higher in CRT, and were therefore relying more on analytical thinking than intuitive one, significantly better identified truthful headlines from false ones. Our results showed that there were significant differences in the final correctly identified headline score. This supported our first hypotheses and findings from previous studies on analytical thinking style (Pennycook & Rand, 2019). However, it is worth noting that the effect was relatively small and analytical thinking alone is not an overly significant predictor of one's ability to identify true headlines within this study's framework correctly. This might be because while individuals scored higher on CRT, it did not necessarily mean that they were think particularly more critically when evaluating the information presented to them, as they were not using these skills at that specific moment (Machete & Turpin, 2020). Overall, this supports the notion that analytical thinking alone is not a silver bullet for reducing the influence of falsehoods online.

Secondly, we looked for evidence of confirmation bias. Our analysis discovered that, indeed, prior beliefs were a strong predictor of whether one would consider information as truthful, but with a limitation – only in case the prior attitude was pro-vaccination. This finding is controversial to the public opinion, that those who support vaccination do not fall for false information, whereas those against vaccination are considered to fall more for disinformation and fake news, ultimately distrusting "facts and scientific proof". Though relatively unexpected for public, these findings illustrate exactly the expected results from theoretical and scientific standpoint. In contrast, these findings show that those who have decided to get vaccinated (or support it) are more prone to misclassifying true concerns and doubts about vaccinations as false. Though our second hypothesis is partially supported and is consistent with theoretical background (Hastie, 2014; Ciampaglia & Menczer, 2018; Lewandowsky et al., 2012), it is clear that

even those opposing vaccination can perceive information that promotes it as truthful. Hence analysis of content specific attributes sheds some light on these results: confirmation bias is strong in the case of emotionally intense stimuli if we consider whether stimuli are emotionally intense or not and whether headlines are true or false. The largest difference between the groups in our sample appeared when headlines with low emotional intensity against vaccination are evaluated. In conclusion, confirmation bias is influential when considering the truthfulness of the information. However, content-specific characteristics, e. g. emotional intensity, also play into such evaluation.

When we look at how high versus low-intensity stimuli are evaluated within the confirmation bias paradigm, it first seems that there are no differences between these content characteristics. However, an asymmetrical pattern emerges when additional characteristics are studied – whether false or true information are presented. Regardless of prior attitude towards vaccination, in the case of truthful content supporting vaccination, emotionally intense stimuli are evaluated as more truthful (vice versa for false content pro-vaccination). Moreover, as for content against vaccination, the opposite pattern is seen – in the case of truthful headlines, those low in emotional intensity are seen as more truthful, and in the case of falsehoods, headlines high in emotional intensity are seen as more truthful. While these findings are not in line with some results from previous research (Wahl-Jorgensen, 2013; Sheppes, 2014; Martel, Pennycook & Rand, 2020), it is clear that the emotional intensity is influential though the exact pattern is not yet clear. Within our sample, participants showed that emotional intensity has a connection with the article's content (pro-vaccination or against) and not with individuals' attitudes (pro-vaccination or against), which might explain why traditional media literacy methods are limited in their success in protecting individuals from misinformation online.

Conclusions

To recap and add some final thoughts, we have found evidence for confirmation bias on multiple levels, the positive effect of analytical thinking on accuracy judgment and the complex nature of emotions that impacts the evaluation of information online. We also noticed a relatively high ability to spot falsehoods by looking at headlines without any other cues. Meanwhile, there are also some limitations and thoughts for further research – first, just the ability to spot truth is not enough to stop falsehoods from spreading; therefore, improving one's analytical thinking can lack the necessary effectiveness. There is a need for further research on the emotional component in information consumption online – preferably

from the percipient's viewpoint. The questions set to be answered within this study are just growing in importance, therefore, further research is necessary, but it also seems to be vital to keep living in a time where unverified information is spreading like wildfire.

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