Picture This: How Image Filters Affect Trust in Online News

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Abstract. Users of social media platforms face concerns about the accuracy and reliability of information shared on it. This includes images being shared online, which are often linked to news events. This study investigates what effects Instagram filters have on users' perceived trust of online news posts that include images. Trust ratings of four different articles across four image filter conditions were obtained in an online user study ($N = 204$). We also inquired on a user's general trust and familiarity with the news topic. Our analysis revealed that while Instagram filters overall did not affect perceived trust, specific visual attributes of the filters such as brightness and contrast affected trust levels. Additionally, individual differences in general trust and attitude towards a specific topic may influence the users' perception of trust.

Keywords: Online News · Social Media · Trust · Image Filters.

1 Introduction

Pew Research Journalism reported in 2022 that approximately 82% of U.S. adults "sometimes" or "often" find news through a digital device [12]. Similarly, in 2020, about 53% of U.S. adults reported that they get news from social media "sometimes" or "often". As such, major social media sites such as Facebook and YouTube becoming increasingly popular news sources. Facebook stands out as a common news source for U.S. adults, as 36% get their news regularly from the social media site, followed by YouTube with 23% [28].

Advancements in digital technology has made visual information prevalent. In particular, news media studies report that adding an image to a news article can increase the amount of time users spend on the article, as well as their engagement with the content [4]. At the same time, various visual content on social media has been edited, which might not be detected by all audiences [29].

As such, the growing availability of digital news platforms has sparked concerns about the reliability and accuracy of information shared online, particularly the formation of echo chambers and filter bubbles. Self-selection, reinforced by sophisticated search algorithms, exposes users to information that aligns with their prior beliefs [23]. Additionally, trust in news media has decreased gradually and fake news, or "entertainment TV shows that parody news, using satire to discuss public affairs", have become prevalent [11]. Flintham et al. [11] report that among a sample of young UK residents, around 1/3 experienced exposure to fake news they initially believed to be true. At the same time, fake news stories are 70 times more likely to be re-shared compared to true news stories [35]. Thus, social media platforms are key vectors of fake news [6, 1, **?**].

News consumption on social media platforms faces further limitations. Research also suggests that users find news less credible when they are exposed to it through social media platforms [17]. These findings support the notion that people generally have less trust in social media platforms such as Facebook [22].

To face the challenges accompanying the shift towards digital news delivery, there is a need to better understand the factors that contribute to trust in social media news platforms. This paper focuses on imagery presented in news stories on social media platforms, investigating the potential impact of filtered images presented with digital news articles on user behavior online, as well as exploring the role of the users' attitude on the topic of the news article. By examining the relationship between trust, visual information such as filters, and various news topics, we aim to give an insight into how news media can effectively communicate information, to establish, and uphold trust.

Furthermore, how polarized a certain news topic may further affect trust levels. News topics can be separated between soft news, i.e., entertainment and personal interest stories, and hard news, i.e., international affairs, politics, and economy [26]. Research by Fan et al. [10] has shown that users find hard news less credible when reported on social media compared to traditional news papers. In this study, we examine perceived trust across three primary hard news topics: Abortion, climate change, and gun control, while entertainment is classified as soft news. Combining our arguments, our study aims to address the following research questions:

- **RQ1**: To what extent does the use of Instagram filters in news content affect perceived trust in online social media?
- **RQ2**: Does an individual's general trust in media and attitude towards a specific news topic affect their perceived trust in that news post?
- **RQ3**: Is there a difference in the context of perceived trust across different topics, depending on whether they are generally perceived as polarized?

Main contributions. This study investigates and evaluates the potential impact of image manipulation on users' perceived trust in social media news. In particular, the contributions can be summarized as follows:

- Building on previous research on trust in news shared on social media [17, 16], this study explores how the use of Instagram filters may influence users'

perceived trust and the implications for social media platforms and news organizations.
- The study provides insights into the potential role of visual manipulation in shaping trust with a focus on key news topics such as climate change, abortion, gun control, and entertainment.
- This paper expands our understanding on how social media users assess the credibility of information in social media news posts.

2 Background

2.1 Visual Information and Manipulation

News consumers tend to engage with news content through visual information. Such visual information, including pictures or graphics, tend to result in a quicker cognitive processing [13]. According to Messaris [20], the symbolic nature of visual elements allow for a more immediate comprehension, thereby making them more persuasive. Research by Starke et al. [30] in the food domain found that manipulation of visual information can significantly influence user behavior and decision-making. Furthermore, the intentional use of manipulated photos is common. Journalists, for example, often use unfavorable camera angles, images, and visual cues when reporting on political scandals [18].

Von Sikorski et al. [34] studied how visual background cues affect the evaluation of a political candidate, as well as the role of an individual's trust in media in shaping this effect. Their studies revealed that visual background cues can polarize the evaluation of political candidates, with distrustful individuals offering more positive assessments, while trustful individuals tended toward more negative evaluations. Similarly, De Smaele et al. [7] conducted an extensive qualitative study on visual gatekeeping processes, revealing that the newsroom culture and the pace of the newspaper exert a greater influence on visual selection than the personal preferences of photo editors.

2.2 Instagram Filters

Among major social media platforms, Instagram is the fourth most-used social media platform worldwide [31]. Previous studies on Instagram have established that one of the key reasons contributing to its popularity, particularly among younger users, is the availability of filters [14, 5]. Filters enable users to modify and enhance their through stylization and saturation adjustments. According to research by Pettersson [24] 18% of all photos on the platform are edited using filters. Among these, the Juno filter was identified as the most flattering filter on the platform, while Hefe was regarded as the least flattering. Studies from Borges et al. [2] examined news images posted on Instagram, revealing that photojournalists utilize aesthetic conventions and performative discourses reflective of their roles either amateurs or professionals, however both groups attempt to emulate the conventions and discourses of the other. Despite these observations, Instagram has not publicly disclosed the technical specifications of its filters, making it challenging to determine the specific manipulations applied.

2.3 Trust in News Media

Trust in news, or news credibility, is often discussed alongside related concepts such as media credibility or media trustworthiness [8]. The interdisciplinary nature of trust research, spanning fields such as philosophy, economics, and sociology, has made it challenging to establish a universal and precise definition of trust [15]. In the relevant literature, news trust is conceptualized as a relationship between the trustor, the party placing trust, and the trustee, the party being trusted [25]. Lucassen et al. [19] introduced an integrated layer model of news trust, proposing that trust arises from a general disposition and is structured into three distinct layers, trust in the information, trust in the source, and trust in the medium used to disseminate the message. These layers influence one another dynamically. where trust in the information depends on the level of trust in both the source and the medium of delivery.

In the social media context, news consumption via social media platforms differs significantly from carefully edited and curated context of the traditional news media [11]. The presence of social media intermediaries such as Facebook and Instagram adds a layer of complexity to the issue of news trust and credibility, with research by Karlsen and Aalberg [17] indicating that these platforms can influence perceptions of media credibility. Higher levels of news trust correlate with more effective media in informing citizens, while lower trust may reduce the media's impact on its audience with studies indicating that people's overall trust in news media is declining [21]. Heuer and Breiter [16] argue that the risks of trusting online news range from minor, like wasting time on fake news, to severe, such as being misinformed.

Trust is crucial on social media, where users rely on information to guide decisions and form opinions. However, misinformation, biased reporting, and fake news, particularly manipulated images, can distort these processes and weaken users' trust in social media platforms. To address this challenge, Shen et al. [29] conducted a large-scale online experiment to explore how individuals evaluate the credibility of images across various online platforms. Their study showed that participants' internet competence, image editing experience, and social media usage were significant predictors of how they evaluated image credibility, while most social and heuristic cues of online credibility had no notable impact. Other research suggests colors, distinctly green and blue, can influence trust in the context of brands, logos, and web pages [3].

3 Methods

We addressed our research questions by setting up an online experiment. Participants would be presented screenshots of news posts on different topics shared on social media platform Facebook. These posts would contain either a normal image or one on which an Instagram filter was applied.

3.1 Dataset and Materials

The dataset used for this study consisted of four news articles, which were collected by browsing various news websites. The article selection was based on source credibility, topic, and relevance. News headlines were selected, along with the published images and lead (first 30-50 words). This is described in Table 1. The photos depicted persons, namely UN chief António Gueterres, Hungarian prime minister Viktor Orbán, former President of the USA Donald Trump, and actress Jennifer Aniston.

We presented the news articles in the context of social media platform Facebook. Figma[3] was used to design the interface, to resemble the look and feel of Facebook. Figure 1 demonstrates how the social media news post was put together after adding all the data from the web scraping.

Table 1: The title, first paragraph, and date of publication of the articles used in the study.

Topic	Title	First paragraph	Date of publication
Climate change	"Climate change: IPCC report is 'code red for humanity'"	"Human activity is changing the climate in unprecedented and sometimes irreversible ways, a major UN scientific report has said. The report 'is a code red for humanity', says the UN chief."	9. August 2021
Abortion	"Women must listen to embryo's heartbeat before abortion under new Hungarian law"	"Hungarian women seeking an abortion will be obliged to 'listen to the fetal heartbeat' before they can access the procedure, according to a new decree issued by the government of the far-right prime minister, Viktor Orbán."	14. September 2022
Gun control	"What happened to Trump's promises on gun control reform?"	"US President Donald Trump said after recent mass shootings that he wanted the country to have stricter gun laws. 'We don't want people who are mentally ill, people who are sick - we don't want them having guns', said President Trump in August."	11. November 2019
Entertaintment	"Jennifer Aniston says she's skipping the Emmys because of Covid-19"	"The actress has been vocal about her coronavirus safety concerns since the start of the pandemic. Speaking on Jimmy Kimmel Live! this week, Aniston said: 'I will not be going. It is still a big step for me just to be here. It is just baby steps.' "	14. September 2021

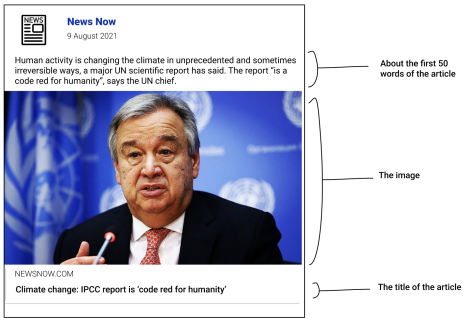

Fig. 1: An example of how our study presented a news article in the context of social media platform Facebook.

[3] https://www.figma.com/

Instagram filters. Images were manipulated using a set of three Instagram filters. The chosen filters were Nashville, Willow, and Lo-Fi; see Figure 2. The image features associated with each filtered image were extracted using Java code [27], using the freely available OpenIMAJ Java Framework [4] in version 1.3.10. This included the following low-level features: brightness, sharpness, contrast, colorfulness and Shannon entropy. Mathematical details can be found in Trattner et al. [32] and Pedro and Siersdofer [27]:

- **Brightness.** This feature measures the light emitted or reflected by the image pixels [27]. Brightness was extracted using the AvgBrightness[5] class, which applies the default NTSC weighting and a standard luminance algorithm to compute the average brightness without using a mask.
- **Contrast**. This feature measures the variance between the lightest and the darkest areas of the image. In our study, contrast of an image, or the relative difference in luminance, is computed using the intensity of each pixel with the root-mean-square contrast (RMS contrast) method [32].
- **Sharpness.** This feature measures the image's level level of detail and clarity. Sharpness is computed by using the Laplacian of an image, normalized by the local average luminance around each each pixel [27].
- **Colorfulness.** This feature describes how chromatic a perceived color appears to be, calculated from the color distance of an image's pixels [27]. The image was first converted to the sRGB color space.
- **Entropy.** This feature of an image refers to the amount of information it contains. Shannon entropy was used to compare two greyscale images by counting the occurrence of each distinct intensity value [32].

(a) 'Nashville' filter (b) 'Willow' filter (c) 'Lo-Fi' filter

Fig. 2: The chosen Instagram filters for the study shown on the image of Jennifer Aniston with the topic entertainment.

The results from the feature extraction code are depicted in Table 2 which summarizes the mean of each feature for each filter. All features had values between 0 and 1, except Entropy, which ranged from 6.91 to 7.65 ($M = 7.35$, $SD = 0.20$). As seen in Table 2 and Figure 2, the Nashville filter increases brightness and colorfulness, while decreasing sharpness and entropy. The Willow filter, a black-and-white filter, scores lowest on colorfulness ($M = 0.022$). It increases

[4] http://www.openimaj.org
[5] http://openimaj.org/apidocs/org/openimaj/image/feature/global/AvgBrightness.html

Table 2: The mean of the low-level features extracted for each feature for each filter.

Filters	Brightness	Sharpness	Colorfulness	Contrast	Entropy
Original image	0.398	0.107	0.225	0.188	7.392
Nashville	0.449	0.089	0.306	0.205	7.313
Willow	0.459	0.054	0.022	0.159	7.272
Lo-Fi	0.372	0.148	0.304	0.297	7.418

brightness, but decreases sharpness, colorfulness, contrast, and entropy. The Lo-Fi filter, increases sharpness, colorfulness, contrast, and entropy, but decreases the brightness.

The differences may explain why some filters are more trustworthy or popular than others. Studies [27] show that images with higher brightness, colorfulness, sharpness, and naturalness are more appealing and engaging. Therefore, filters that enhance these features may increase user engagement, while filters that reduce these features may decrease the attractiveness of the images.

3.2 Research Design

To examine the effects on users' perceived trust, news articles in the online study were subject to a 4x4 within-subject design. The study examined the effects of 4 levels for image filters (Original, Nashville, Willow, Lo-Fi) and 4 levels for different news article topics (Abortion, Climate change, Gun control, Entertainment), all predicting perceived trust as the dependent variable.

The order in which each participant saw the different filters was determined using a Latin square design. Participants were randomly assigned to one of four Latin square sequences and presented the articles in the same order, but the order in which they saw the different filters varied. Refer to Figure 3 for more details.

3.3 Procedure

We developed an online, self-developed questionnaire that was hosted on Qualtrics[6]. The questionnaire included a consent form, demographic questions, and trust-related items from Social Trust Scale (STS) [9], and the pages displaying the stimuli. Before starting, participants received introductory information and a consent form. Participants were asked to provide demographic details and complete a brief trust questionnaire from STS, followed by simulated social media news posts and statements to respond to.

Upon starting the survey, participants were randomly assigned to one of the four Latin squares conditions. Once assigned, the study followed five steps: instructions, demographic questions, followed by the STS questionnaire. Participants were asked to rank statements from four articles in succession. Upon

[6] https://www.qualtrics.com/uk/

completion, participants were given a debrief explaining the purpose of the study and its aim. The full procedure is outlined in Figure 3.

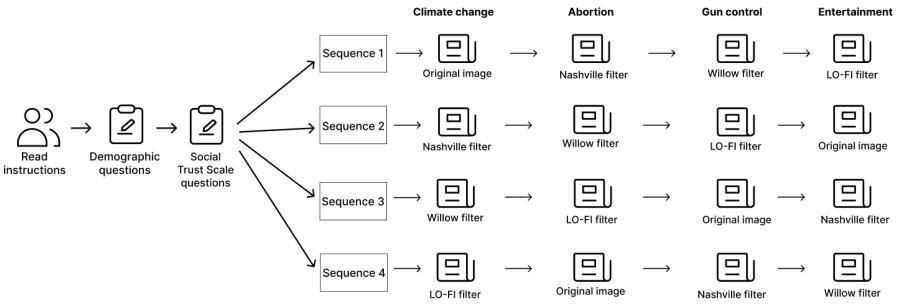

Fig. 3: An overview of the full procedure for the study, including the within-subject research design. Each participant was assigned one of four Latin square conditions after the demographics questions. Then, participants each completed a sequence of four tasks and 6 questions before completion.

First, participants were asked to answer three questions about their general level of trust. Details of the Social Trust Scale follow in Section 3.5. Thereafter, participants were presented four news articles posted from social media and given the following instructions: "In the next subsection you will be presented with a news post, a news article published on the social media platform Facebook. Please read the post carefully and answer the questions about it to the best of your ability". Under each post, participants responded to six statements, three trust-related statements and three attitude/preferences-related statements, using a 5-point Likert scale from 1 (Strongly disagree) to 5 (Strongly agree).

3.4 Participants

Participants were recruited via Prolific, limited to U.S. residents due to the relevance of the article topics and declining trust in U.S. news media [1]. To ensure quality, only participants with a 99% approval rate and fluency in English were eligible. In total, 204 participants completed the surveys, and were compensated 0.85£ per hour. 119 participants were male, 83 were female, and 2 identified as other, with the majority having a bachelor's degree. The mean age of the participants was 38.5 years. About half of the participants read news either "Every day of the week" or "Multiple times a day". Social media was the most popular news source, followed by newspapers and online news media.

3.5 Measures

- *Social Trust Scale (STS):* The STS included three items to assess the degree to which individuals can expect fairness and trust from other individuals. The STS is used frequently in various European countries, using the same three items [9], measuring social trust on 10-point scales. All items were retained.
- *Perceived Trust:* Perceived trust was measured through two items: (1) 'I trust the information presented in this news post', (2) 'I trust the person in the image'. A Principal Component Analysis (PCA) was performed, revealing that both items could be combined into a single perceived trust factor.
- *Attitudes towards news topics:* To measure attitude and preferences, participants responded to three statements evaluating their agreement with the post, the topic's importance, the strength of their feelings, and their familiarity with the topic. To this end, we performed another PCA on all three items. Due to a slightly lower loading for the item on familiarity, we formed an news topic attitude construct using the items on topic importance and strength of feelings.

3.6 Statistical Analysis

We conducted statistical analyses to identify significant differences between the conditions. A one-way ANOVA examined how image filters affected perceived trust, while linear regression models assessed the impact of filter features. Multiple Linear regression analyzed the influence of general trust and topic attitudes on perceived trust. Furthermore, a one-way ANOVA compared the effect of news topic posts on perceived trust, and a two-way ANOVA examined whether the filter had a significant effect. For significant ANOVA results ($p < 0.05$), Tukey's HSD test was used to test differences between groups.

4 Results

4.1 Effects of Image Filters on Perceived Trust (RQ1)

We first examined to what extent different filters affected a user's perceived trust. Table 3 shows that the one-way ANOVA did not reveal a statistically significant difference in perceived trust between the filters. Only a small, non-significant difference between the perceived trust of the original image and the manipulated images was observed ($F(3, 812) = 2.051$, $p = 0.105$). Levene's test confirmed homogeneity of variances, ($p > 0.05$), and although the Shapiro-Wilk ($W = 0.98, p < 0.001$) indicated a violation of normality, ANOVA is generally robust to this, particularly with a small sample. This suggested that Instagram filters had minimal impact on users' perceived trust, while users seemed to most prefer news posts that contained the original image. Other aspects of news posts, such as the written content or the individual depicted in the image, may have a more significant role in shaping users' perceived trust.

Linear regressions, shown in Table 4, were performed to examine the effects of different image attribute features on perceived trust. Brightness ($\beta = -0.945$) and contrast ($\beta = -1.993$) had small, but significant negative effects on perceived trust. This was consistent with Von Sikorski's findings [34], whereas no significant effects were observed for the other image attributes.

Table 3: The results for the one-way ANOVA.

	Sum sq.	df	Mean sq.	F value	p
Filter	5.587	3.0	1.862	2.051	0.105
Residual	737.322	812.0	0.908		

Table 4: Linear Regression Analyses of Low-Level Features Predicting Perceived Trust.

	Intercept	Coef.	St. Error	t-value	95% CI
Brightness	3.291	-0.945	0.397	-2.381*	[-1.723, -0.166]
Sharpness	2.936	-0.375	0.659	-0.569	[-1.668, 0.919]
Colorfulness	2.936	-0.174	0.264	-0.657	[-0.693, 0.345]
Contrast	3.318	-1.993	0.439	-4.453***	[-2.854, -1.132]
Entropy	4.382	-0.202	0.168	-1.203	[-0.532, 0.128]

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

4.2 The Role of Media Trust and News Topic Attitudes (RQ2)

We further examined whether general levels of media trust and attitudes towards specific news topic affected perceived trust levels. Our regression analysis, shown in Table 5, revealed that both general trust and news topic attitudes had a statistically significant effect on perceived trust ($F(2, 813) = 24.94$, $p < 0.05$, $R^2 = 0.058$), with the model explaining 5.8% of the variance. The 95% confidence intervals were [0.033, 0.098] for general trust and [0.111, 0.236] for attitude. General trust ($\beta = 0.065$, $p < 0.001$) and attitude ($\beta = 0.173$, $p < 0.001$) emerged as significant predictors, though the model explains only a small portion of the variance. This is in line with prior work [34], as our analysis found that participants with lower levels of general trust reported lower perceived trust ratings, while those with higher social trust provided higher ratings. Additionally, as suggested by Heuer [16], topic familiarity did positively influence perceived trust.

4.3 Effects of News Topic Attitude on Perceived Trust (RQ3)

We finally examined whether trust levels depended on the presented news topic. In particular, whether the topic was considered polarizing or not (e.g., abortion vs entertainment news). A one-way ANOVA showed a significant impact on

Table 5: Multiple Linear Regression Analysis of General Trust and Familiarity Predicting Perceived Trust.

	Coef.	St. error	t	95% - CI
Intercept	1.910	0.144	13.285***	[1.628; 2.192]
General trust	0.065	0.017	3.919***	[0.033; 0.098]
Attitude	0.173	0.032	5.452 ***	[0.111; 0.236]

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

news topic perceived trust, with post-hoc tests highlighting differences between various news topics. A two-way ANOVA confirmed significant main effects of both topic and filter, as well as an interaction affect suggesting that filters influenced perceived trust differently across topics. This finding can be interpreted in light of the polarizing impact of visual cues on users' evaluations of polarizing political figures, as suggested by von Sikorski (2022) [34]. This interaction effect is visualized Figure 4. Our findings, consistent with past research by Fan et al. [10], suggest that soft news, particularly Entertainment, is generally perceived as more trustworthy than hard news.

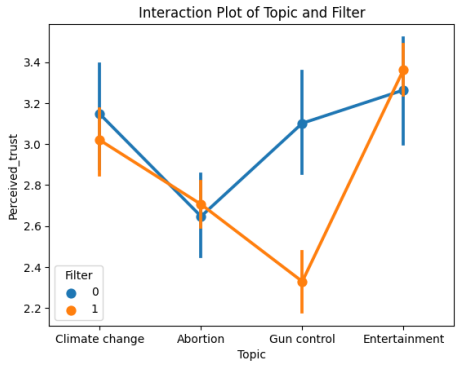

Fig. 4: Interaction plot for the interaction between the topics and filters which shows how perceived trust varies between filtered (1) and non-filtered (0) images across different news topics.

5 Discussion

This study examined the impact of Instagram filters on users' perceived trust in news and images on social media, as well as the roles of familiarity and attitude. Perceived trust and attitude were measured through pre-questionnaires and ranked statements during the survey. The findings suggest that Instagram

filters did not significantly affect users' trust in social media news, while the topic of the news had a notable influence on perceived trust.

The most notable finding is that brightness and contrast specifically affect perceived trust levels. It seems that these two low-level image attributes are an actual determinant of how an news image is perceived, indicating that possible manipulations could 'overdo' it. Higher levels of brightness and contrast are associated with lower levels of trust. This taps into previous research on how 'hyperreal' depictions of news events can affect how it is experienced [2]. Hence, a slight misrepresentation of reality by means of specific filter-based changes does not constitute a trustworthy news perception.

The study's methodology and sample representation present certain limitations. Firstly, the use of a questionnaire limits the depth of responses, as participants are confined to predefined questions and answer choices, which may not capture the full extent of their perspectives. Secondly, the sample, including users and items chosen, may affect the generalizability of the findings and potentially limit the validity of the conclusions drawn from this study. For one, the news context in which the experiment was set did not allow for many choices, nor did it reflect an actual Facebook feed. Moreover, the use of Instagram filters in news posts on Facebook is arguably not the most common practice. Nonetheless, the study still has sufficiently ecological validity to provide valuable insights into the role of filters in shaping trust in online news.

We recommend future research further investigate the impact of filters across various contexts and settings. While Instagram may not specifically be used often for news consumption, a study on that platform (or their affiliated platform 'Threads') may be an interesting follow-up case. In addition, other, non-traditional filters could be used, also from other social media platforms. Building upon this, news consumption is becoming more prevalent on video-based platforms such as TikTok [33]. While this may not apply to the mean age in our sample (people in their late thirties), manipulated or filtered video footage may play a large role in contemporary media consumption of current young adults.

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