

Interface Elements and Trust in Online Media: a Conjoint Analysis Approach

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Abstract. In the age of the Internet, where misinformation is spread with great ease, trustworthiness of news sources has become an important issue. The aim of this study is to assess how users perceive credibility of different online news interfaces by employing experimental methodology. An online experiment was conducted using the conjoint analysis approach. Participants were recruited to complete a series of surveys, which displayed different news interfaces, each with varying elements (e.g. menu type, presence of the author). Participants scored their perception of the credibility of each interface. Through conjoint analysis, the results were used to identify which element combinations have the strongest effects on credibility perception for different user groups. Findings from the logistic regression on the whole sample revealed that the presence of all elements is important, but has a detrimental impact on trust. Conversely, the k-means cluster analysis identified five distinct user segments based on demographic and conjoint data. Based on these clusters, the study offers recommendations for developing a trustworthy news interface. This study provides valuable insights into how users evaluate credibility of online news interfaces, and contribute to the development of strategies for improving trust in online news.

Keywords: Credibility · Online news · Social media · UX-analytics · Conjoint analysis.

1 Introduction

Modern communication is becoming more computer-mediated, with social media taking the lead in the dissemination of news content both true and fake. As Shu & Liu [28] point out, social media possesses good opportunities for dissemination of fake news and misleading information, as it is easily accessed, low cost, and provides opportunities for rapid information circulation.

Thus, the issue of trust in online information and the factors that can modulate trust is currently one of the most relevant in the study of computer-mediated communication. It is important to address here, that there are many ways to reach online news, and according to Bentley et. al, online news websites play a crucial role as an information channel, and users reach news not only in social media, but also in news sites [6]. Despite the preferred channel of news consumption, most consumers encounter news sites on a daily basis. In this context,

the interface of news sites plays an important role as an intermediary between a user and information, having an impact on perceived credibility. The purpose of this research is to understand the impact of different element combinations on credibility perception for different user groups. Various visual properties of websites have been widely studied and shown to be important predictors of user trust [24] [13], and specifically trust to news [29] [30] [36]. However, to the best of our knowledge, their joint effect on user trust has so far received little or no attention. This work contributes to covering this gap by carrying out a conjoint analysis of five visual features via an online survey experiment. In many ways, this is an exploratory study that relies on a conjoint analysis methodology that is new to this research field, yet has demonstrated high validity in other areas of research (e.g. [5] [11] [23]).

2 Theoretical Background

2.1 Credibility and Trust

Trust is “a psychological state comprising the intention to accept vulnerabilities based upon positive expectations of the intentions or behavior of another” [25]. In the context of measuring trust, it is important to understand that trust since long has been studied in sociology, psychology, economics and marketing, and conceptualized in a number of ways – as a rational choice, in terms of emotional attachment (psychological approach), in terms of trust in institutions (institutional approach) or in terms of subject reflexivity [31]. Trust can be also considered in its impact on behavior when different interventions are spread through online media. A study by Pagliaro et. al shows that psychological differences like moral principles in terms of trust are significant predictors of individuals’ behavioral intentions in different countries [22]. Thus, trust can influence behavior. At the same time, trust itself is influenced by various factors. Among such factors, the web interface (e.g., the interface of a news site) in which the news is presented is also presented.

2.2 Surface Elements of the Interface

In the context of this work, trust is an important feature in human-computer interaction, as users receive information shaped into interfaces, and interface design, in its turn, can influence content perception [37]. In a study by Simko et. al, for example, participants browsed through artificial Facebook feeds and determined the truthfulness of stories. Stimuli consisted of four groups: true-alarmist, true-denier, fake-alarmist, and fake-denier. As a result, fake articles caused more report calls, and unsuccessful participants (those who failed to detect fake news) relied more on information given in the feed as opposed to actual full article [29]. Thus, research on how interface design may impact trust into content is important and can bring new highlights in user experience shaping practices. Previous research has identified several groups of factors that can affect user’s

level of trust in online information sources: message or content elements, social and reputational elements, user-based elements, and surface elements. The latter are represented by graphical user interface elements which may be grouped into three main categories: (a) aesthetics, including colors and fonts, (b) usability, including navigation and device adaptability, and (c) website structure, including structural characteristics, presence of advertisements and other interface elements. The last group is of high interest in this article, as proper arrangement and organization of structural elements within an interface greatly impact the user's perception of trust and reliability in the system [36]. However, the effect of the structural features on trust to news content specifically was mostly studied in terms of the content provided in these boxes [19] [8] [35], while this study focuses on the presence of these elements as such. A detailed table with all surface elements found to have an impact on online trust are presented in Appendix 1.

However, as far as we know from the literature review, the impact of interface elements is usually evaluated separately, while its impact on the user is usually cumulative. According to Schenkamn, and Jönsson [27], users form their first impressions of web sites based on the overall visual appearance, rather than on a particular element. That said, interfaces should be studied as a whole product. This study focuses on the presence of interface elements as such and their combination. Thus, the first research question is:

RQ1: Is there a combination of interface elements in an online news interface which will make users trust the respective news item more?

2.3 User-based Characteristics

User-based characteristics may play a significant role in online media trust formation. For example, according to [2], gender, age, and experience with internet usage have a significant impact on trust in online information. This study suggests that women exhibit higher trust and hold a more favorable view of online services than men; older users have higher levels of trust in e-government compared to younger individuals; and finally, a greater level of internet experience has a positive impact on users' trust. However, it is also important to know whether there are some user groups who have different preferences in the organization of a news interface. The second research question is stated as follows:

RQ2: Whether the combination of identified interface elements affecting trust will be the same for the Russian sample or different for different sample groups of people?

2.4 Interface Complexity and trust

Although the joint influence of different interface elements has not been studied previously, the effect of interface complexity characteristic on user trust has been slightly investigated. Research on interface elements organization implies different levels of stimuli complexity. According to Chassy [9], high levels of perceived complexity resulted in low aesthetic ratings of university webpages,

but fixation count correlated negatively with complexity and positively with aesthetics. That is, the more “difficult” interface is, the less appealing it is for users. Based on this idea, one can suppose that a low aesthetics site can cause rejection by users and receive less credibility ratings. However, according to Berlyne theory [7], there is an “optimal” level of complexity which results in the highest levels of aesthetics, reminding a U-curve relationship between these concepts.

In the context of the current study, stimuli materials were different not only in terms of which elements were present, but also in terms of the number of elements present. Taking this into account, the variable “complexity” was calculated for each profile; complexity was formulated as the number of present elements. Thus, in our study we also test whether this hypothesis is confirmed under the conditions of the chosen methodology for perceived trust:

H1: There will be a parabolic relationship between interface complexity and interface trust. The average levels of interface complexity will be characterized by the highest level of interface credibility compared to the extreme ones.

2.5 Conjoint Analysis

The choice of conjoint methodology (conjoint = consider jointly) lies in the possibilities of this approach: instead of asking respondents to evaluate different elements of the interface separately, they will evaluate a whole product. Choice-based conjoint methodology aims to explore the preferences and interactions of different attributes and their levels by presenting respondents with a choice of different alternatives. Respondents need to choose a variant among sets of 2-3 alternatives with different combinations of attributes and levels. Although conjoint analysis has been mostly used in marketing [26] [33], it is also increasingly being used for academic purposes, including testing website feature effects on trust in news [14]. Unlike most other methods testing the independent contribution of each predictor, it allows finding the most trustful combination of features and does so experimentally.

3 Method

To test our hypotheses and research questions, we conducted a large online experiment using a conjoint analysis methodology.

3.1 Pilot Study

To understand whether there are preferred platforms of online media consumption, as well as to understand the most popular online news topics, a pretest was conducted before the main experiment. An online survey with 24 questions designed to explore online news consumption experiences was collected with 153 HSE SPb students (mean age = 23.6, 26% male). As a result, Telegram was

mentioned as the main platform of online news consumption (55% of the sample use it), followed by VK (29.4%). Although participants mentioned mobile versions of the platforms, the majority (62%) stated that they transition from mobile version to web version to verify information always or very often. The most interesting topics of online news were politics, society, health, and economics. Thus, the results of the pilot study allowed us to choose exactly the web interface as the stimulus material for the main experiment. As for the theme, health was chosen as the most neutral one.

3.2 Participants

Participants were native Russian speakers ($N = 1236$, Mean age = 39.4 ($SD = 10.8$)) recruited via *Toloka.com*, a Russian replica of Amazon Mechanical Turk, so as to represent the age and gender composition of the Russian population. Compared to the latter, the sample is expected to be a little more educated and a little lower-income, but otherwise fairly well representative of the Russian population. The average age equals 39.4 years, with the minimum equal to 18, and maximum equal to 77. There are 52% of female respondents in the sample. As for the education level, nearly half of the sample had completed a bachelor's degree (48.9%). Specialized education followed as the second most common level of education (28.8%), while unfinished education accounted for 10.8% of the sample. Finally, respondents indicated their frequency of online news consumption, with the majority (69.1%) reporting that they consume online news every day or almost every day. A smaller proportion reported consuming online news less frequently, and a few respondents declared that they never read or watched online news (1.5%). Despite this, it was determined that these respondents still provided valuable information for the construction of the news interface and were retained in the sample.

Minimal sample size, as calculated based on [21] power analysis methodology, equals 1143 which led us to aim at 1200 valid participants. All answers were anonymized before analysis, as respondents received unique codes. Given the specific motivation of crowdsourcing workers, the experiment employs a number of quality control techniques, such as exclusion of excessively fast participants, participants giving the same responses to all items and failing to answer control questions correctly.

3.3 Stimuli

As the existing literature does not provide consistent results on the structural features most important for trust production, especially in cross-cultural perspective, their choice was made based on the analysis of typical web structure among the most popular news agencies in Russia as the country of this study. After identifying 9 most visited agencies according to similarweb.com (see list in Appendix 2), a traffic rank analytical company, the author developed a list of five most frequent, yet testable structural elements which are presented in Table 1. The stimulus material for the conjoint study was created to imitate the

style of short news articles. It contains information on a neutral topic related to health - the impact of chocolate consumption on the cardiovascular system. Important to note that the text has questionable information and, as far as it is known from the literature, there is no scientific consensus on this topic. The stimuli text contains some links and third-party references. Overall, the news interface mimics a typical news interface with common structural elements such as news agency logo, search option, login button, date of publication, text and a photo. These common elements do not vary among the whole experiment.

Table 1. Interface elements and their levels of presentation.

Elements	Presentation Levels
Information box (weather, currency rate)	Present or absent
Live stream	Present or absent
Menu	Extended or hidden
Author of the post	Present or absent
Recommended news	Present or absent

3.4 Procedure

The online experiment was conducted using the *conjointly.com* platform - a tool designed specifically to conduct such experiments, which provides the needed possibilities to create a survey, to collect the data, and receive primary analytics. Participants were presented with 14 pairs of news web interfaces each containing the same news item and a different combination of the five listed above features (see Figure 1). The main question of the conjoint phase sounded like follows: “Which of the following interfaces do you trust more?”. To answer this question, the respondent needed to choose one of two interfaces, or choose the “I trust them equally” option. Each element was represented with two conditions: present or absent, with the same content when present. Each feature combination was randomly selected among 32 possible combinations ($2^5 = 32$). The experiment was limited to 14 tasks per participant to achieve statistical power.

Additionally, participants were asked to respond to a number of demographic questions before the experiment (including age, gender, education level, and frequency of online news consumption) and to explicitly rate the importance of the five structural features after it. To prevent participants from speeding up their completion of the survey and getting unreliable data, special control questions were added after the conjoint phase.

4 Analysis and Result

4.1 Ranking Test

The *conjointly.com* platform on which the experiment was implemented offers a ranking of interfaces based on participants’ responses. This is a list of the most

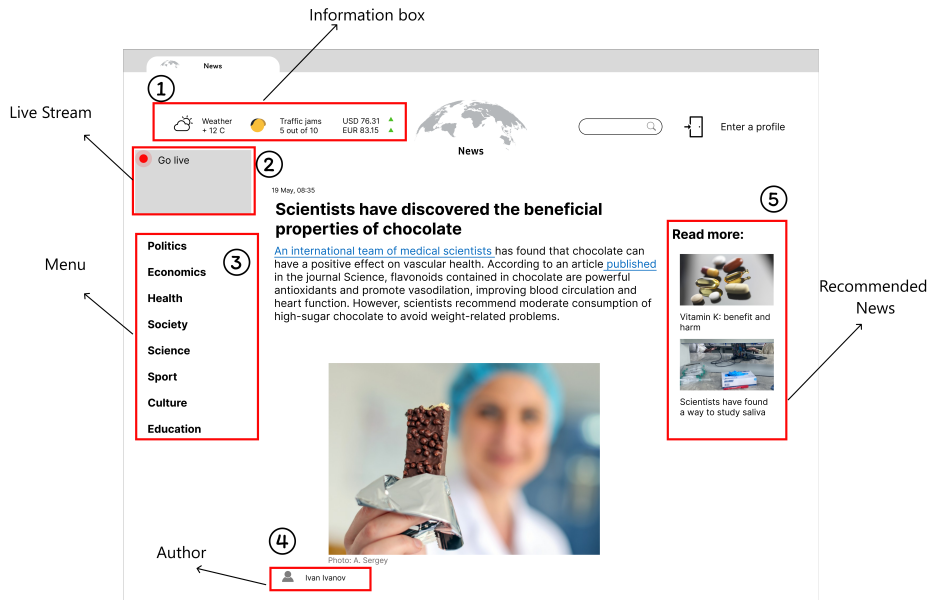


Fig. 1. Example of a stimulus material (translated from Russian). This is an example of experiment stimuli. In this profile all elements are present. Other variations include different combinations of presence or absence of the elements. 1 - Information box; 2 - Live stream; 3 - Menu; 4 - Author; 5 - Recommended news.

preferred interfaces and the least preferred ones. This number is calculated as the average partworths across individual respondent’s total partworth utility scores for the combination. Table 3 shows the best and the worst interfaces according to the partworth ranking. However, conjoint experiments are traditionally analyzed with the use of logistic regression, and the results are described according to regression analysis [11], which will be described in the next section.

4.2 Logistic Regression

As it was already mentioned, traditionally, the results of conjoint experiments are analyzed using logistic regression [4]. Thus, the logistic regression was built based on the *sm.logit.logit* function from the Statsmodels package in Python. Overall, 34552 observations were obtained (1236 respondents, 14 questions with 2 variants each). In addition to building a logistic regression model, we also created a graph of the odds ratios to visualize the relationship between the independent variables and the dependent variable. The results of a logistic regression analysis can be seen in Table 3 & Fig. 2.

The results of a logistic regression on elements preference on the whole sample yielded no statistical influence of interface elements on trust. Thus, RQ1 may not be answered on the whole sample.

Table 2. The best and the worst interfaces according to conjointly.com ranking test.

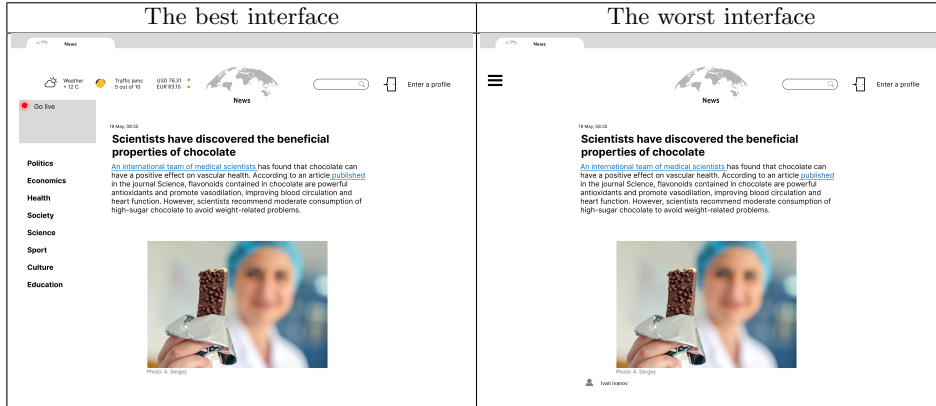


Table 3. Logistic regression results.

	coef	std err	z	$P > z $	[0.025	0.975]
Intercept	0.5893	0.027	21.526	0.000	0.536	0.643
Recommended	-0.0351	0.022	-1.572	0.116	-0.079	0.009
Author	-0.0253	0.022	-1.132	0.258	-0.069	0.018
Infobox	-0.0245	0.022	-1.100	0.271	-0.068	0.019
Live	-0.0185	0.022	-0.831	0.406	-0.062	0.025
Menu	0.0146	0.022	0.655	0.513	-0.029	0.058

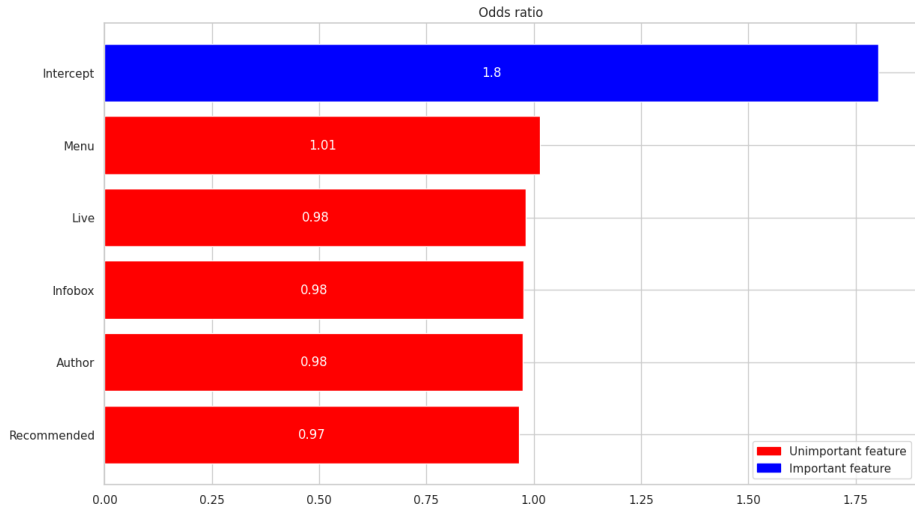


Fig. 2. Logistic regression results visualization.

As for the interface complexity, the variable “complexity” was calculated for each profile; complexity was formulated simply as the number of present elements. Based on this variable, a new regression model was built. However, as it can be observed on Table 4 & Fig. 3, regression models again yielded no significant results according to complexity.

Table 4. Logistic regression results.

	coef	std err	z	$P > z $	[0.025	0.975]
Intercept	0.5893	0.027	21.526	0.000	0.536	0.643
Recommended	-0.0202	1.58e+05	-1.28e-07	1.000	-3.09e+05	-3.09e+05
Author	-0.0104	1.58e+05	-6.6e-08	1.000	-3.09e+05	-3.09e+05
Infobox	-0.0097	1.58e+05	-6.15e-08	1.000	-3.09e+05	-3.09e+05
Live	-0.0037	1.58e+05	-2.34e-08	1.000	-3.09e+05	-3.09e+05
Menu	0.0295	1.58e+05	1.87e-08	1.000	-3.09e+05	-3.09e+05
Complexity	-0.0149	1.58e+05	-9.43e-08	1.000	-3.09e+05	-3.09e+05

4.3 Cluster Analysis

On this stage, results were analyzed with the use of clusterization methods to understand the distribution of respondents and their preferences more thoroughly. K-means clusterization method was used for this purpose. This clustering method is advantageous due to its scalability, simplicity, flexibility in specifying the number of clusters, speed in convergence, linear complexity with respect to

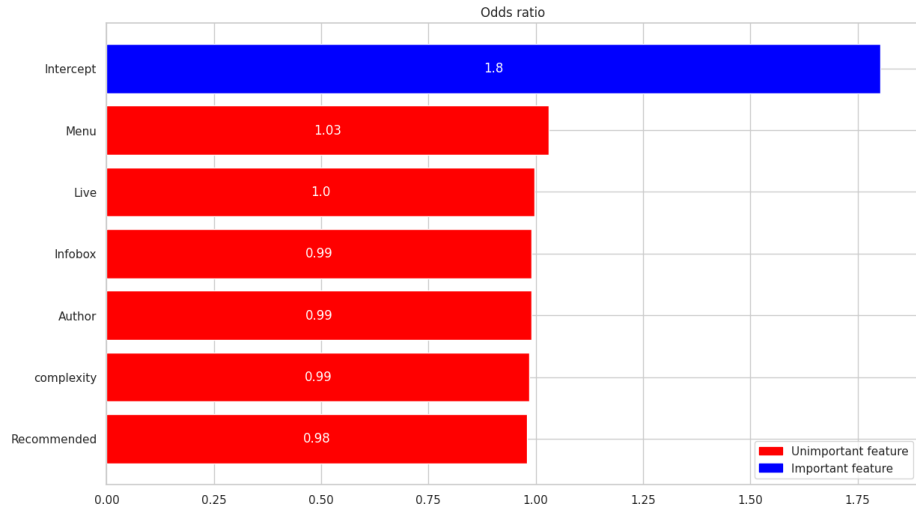


Fig. 3. Logistic regression results visualization.

data points, and effectiveness for datasets with spherical clusters. While other methods like DBSCAN and hierarchical clustering have their strengths, k-means is a popular choice for its efficiency and ease of implementation. Database for clusterization included following data: age of the respondent, gender, education level, self-reported frequency of reading / watching news, and 5 columns indicating percentages of choices without specific elements (N of choices without element / N of all interfaces seen). The optimal amount of clusters was determined with the use of silhouette metric. Based on this method, there are 5 clusters in the final sample. Table 5 describes the clusters that were obtained during this stage of the analysis with the maximum number of iterations for a single run equal to 1000.

To measure the quality of the clusterization, Adjusted Rand Index (ARI) metric was used. Using ARI after K-Means clustering with different random states can show which of the obtained results is the most accurate and optimal. If the ARI value is high (close to 1), it indicates that the clustering was successful and all objects were correctly classified. If the ARI value is low (close to 0), it may indicate that the clustering results were not accurate enough and further optimization or change of algorithm parameters is required. The ARI metric was counted on 100 runs of k-means clustering, and the average number of this measure was 0.81. This result indicates the consistency and robustness of the clustering to changes in initial conditions such as random state. Overall, this value is high enough to state that the clusterization was successful and consistent.

Table 5. Cluster description.

Cluster	Description
Cluster 1	<ul style="list-style-type: none"> - Women only; - Read online news every day or almost every day; - Only the menu element is not significant, i.e. the presence of the extended or hidden menu does not affect the decision to trust the interface; - Other elements influence the decision to trust at statistical significance of 0.05; - The most influential element is the presence of live streaming - the chances that the interface is trusted increase 1.16 times with the presence of the live streaming element; - N = 340.
Cluster 2	<ul style="list-style-type: none"> - All elements are significant and positively influence the decision to trust the interface at a statistical significance of 0.05; - The most influential element is the presence of an extended menu - the chances that the interface is trusted increase 2.19 times with the presence of this element; - On average, respondents in this cluster have the highest scores for all elements in the self-reported evaluation of elements; - N = 238.
Cluster 3	<ul style="list-style-type: none"> - Smallest average age; - Only the menu and the extra information are significant factors, i.e. the presence of these elements increases the chances of trusting the interface by 1.21 and 1.16, respectively; - The presence of other elements, i.e. recommended news, author and live streaming are not significant features at a statistical significance of 0.05, but also positively influence the decision to trust the interface; - N = 158.
Cluster 4	<ul style="list-style-type: none"> - College or incomplete higher education; - Important elements affecting trust in the news interface are the presence of recommended news, a menu, and an author; - N = 136, the smallest cluster.
Cluster 5	<ul style="list-style-type: none"> - Men only; - Read online news every day or almost every day; - Important attributes positively influencing trust in the interface are the extended menu and the presence of live streaming; - N = 362, the largest cluster.

5 Conclusion

The findings of this article point to the importance of the interface in building trust in news sources. Answering the research questions stated in the beginning, the clear answer on what features of news website layout make users trust the respective news item more could not be provided on a general sample. This research has shown that there is no one-solution-fits-all decision, and different user groups should be taken into account. Thus, clusterization analysis has provided several user groups for which different interface organizations are preferable. Among those groups, it is important to mention that almost every cluster preferred an extended menu, except the first cluster, where menu was an insignificant element. Further, presence of the author in the news interface was significant for 3 out of 5 groups, however in some clusters it highly increased trust. The same situation happened with the live translation element in the news interface - it was a significant factor influencing trust in only 3 out of 5 clusters. Interestingly, recommended news also increased trust for some clusters. And finally, the information box was significant for 3 out of 5 groups, however it does not drastically increase trust. An interesting conclusion to point is the inconsistency of self-reported data (Likert scale answers) and behavioral data (conjoint choices). When users were directly asked about their preferences regarding the presence of several interface elements and their influence on trust, users chose presence of author, extended menu and live translation to be elements with the highest rate; whereas recommended news was the lowest element by this scale. If we look at the conjoint block data, it can be clearly seen that only for some groups of users recommended news is not preferable, when other groups perceive it as an important factor in building trust. Recommendations for improving the interface of news websites can help increase user trust and improve the quality of the information provided. However, these recommendations should consider the target audience and make decisions based on their preferences.

6 Discussion

Current research was planned with the assumption that interface construction has an important role in building trust of users. However, there are other factors which should be taken into account when researching user trust. As it was outlined in a study by [29], in most of the cases strength of trust reflects the level of users' interest. Also, different heuristics are often applied in deciding whether to trust the interface [20]. Important to mention different levels of skepticism of users, which may lead to different initial levels of their trust. For gullible users who tend to trust news more, different interface variations might not lead to drastic changes in the trust level. On the other hand, there are users who question every information piece they receive, thus even a credible interface might not be enough for them to make conclusions. This assumption should be addressed in the future studies. Also, it is important to mention that stimuli material only differentiated in the combination of elements which were included.

Although users were instructed to only evaluate visual characteristics, for some users it might be important to understand the content of the news item. All stimuli material was similar in the context of text and picture, and this absence of the topic diversity has either advantages or disadvantages. Among advantages, it brings similar results for all participants throughout the whole survey process; as for the disadvantages, users could get bored and provide thoughtless answers. This is a difficult question, because just increasing the topic diversity to two different topics, it will double the stimuli material amount. This question should be also addressed in the further studies. Finally, only five interface elements were analyzed in the research. Although this is a common limitation of the conjoint-type research, that might lead to some problems regarding representation of real online news interfaces. In the future studies, it makes sense to increase the number of elements for the analysis and shorten the number of final profiles by excluding similar interfaces or obvious ones. Moreover, other sources for analyzing the relevance of different interface elements in online news should be studied, as this study only implemented nine Russian most popular sources, according to the traffic rank website.

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Appendix 1

Table 6. Surface elements influencing trust on the Internet.

Group	Element	Influence on trust / effect	Reference
Attractiveness	Aesthetics	In a study by Robins and Holmes, “higher aesthetic treatment” led to higher perceived credibility ratings, given the same content; a linear connection between aesthetics and credibility. In a study by Asluadi, aesthetics was operationalized as a combination of contrast, dominance, balance, and harmony. Contrast, dominance by contrast and dominance by size were 100% conclusively appreciated for all the evaluated objects/ attributes.	[24] [1]
	Color	A study by Hawlitschek provides inconclusive results on how color (red or blue) impacts trust, however, participants in the red color condition perceived the experimental interface as warmer than subjects in the blue color condition.	[16]
	Professionalism	According to Chaiken, an impressive presentation, perceived expertise in the content, affiliation with a respected institution, desirable features and functions, and engaging interactive elements all significantly influenced the level of trust. Professional appearance of the website was one of important conditions for perceiving the site as credible in one of the heuristics suggested by Metzger and Flanagin.	[8] [20]
Usability	Type of the interface	The conversational interface proved to be notably more successful in fostering user trust and contentment in the decision-making tool compared to the graphical user interface. This held true regardless of the housing recommendation system’s accuracy levels in different scenarios.	[13]
	UX	Ease of use, navigation, interactivity are proven to increase user satisfaction, intention to use, and most importantly trust in the interface.	[8] [10] [12] [15] [3] [30]
Structural elements	Structure of the site	According to Tseng, the amount of text is positively correlated with trust (more text - more trust), while the amount of images suggest the opposite relationship. Findings from Wobbrock study suggest that credibility is affected by article length, image count and density, and font face and size. And the “most credible” article with 2000 total words, 15/36 px (17/41 pt) body/title serif font, one video, and four images. Hong found that only message features influence credibility perceptions (in comparison to content features).	[32] [34] [36] [17]
	Advertisements	According to Hong, the presence of advertisements does not statistically influence trust in the interface. In a study by Kakol, however, the presence of advertisements was negatively associated with trust.	[17] [18]

Appendix 2

Table 7. News sites that were used to design the stimulus material in terms of interface elements.

News source	URL
Lenta.ru	https://lenta.ru/ (date of retrieval: 06.06.2023)
RIA News	https://ria.ru/ (date of retrieval: 06.06.2023)
Dzen News	https://dzen.ru/ (date of retrieval: 06.06.2023)
RBK News	https://www.rbc.ru/ (date of retrieval: 06.06.2023)
KP.ru	https://www.spb.kp.ru/ (date of retrieval: 06.06.2023)
Fontanka	https://www.fontanka.ru/ (date of retrieval: 06.06.2023)
TASS	https://tass.ru/ (date of retrieval: 06.06.2023)
Vesti.ru	https://www.vesti.ru/news (date of retrieval: 06.06.2023)
Gazeta.ru	https://www.gazeta.ru/ (date of retrieval: 06.06.2023)