Perception of Bias: The Impact of User Characteristics, Website Design and Technical Features

Brendan Spillane
ADAPT Centre, Trinity College
Dublin, Ireland
brendan.spillane@adaptcentre.ie

Séamus Lawless
ADAPT Centre, Trinity College
Dublin, Ireland
seamus.lawless@adaptcentre.ie

Vincent Wade
ADAPT Centre, Trinity College
Dublin, Ireland
vincent.wade@adaptcentre.ie

ABSTRACT

Bias, whether real or perceived by the user, is inherent in news media. In this paper, we demonstrate that user characteristics, the design and common technical features of news websites impact users' perception of bias. A complex bias evaluation process was conducted using crowdsourced participants on webpages from nine popular news websites. Each webpage was subject to one of eight distortions which removed individual features of the design. Along with the control, a 9x9 experiment was conducted with participants asked to rate their perception of positive or negative bias in the design of the webpages. This tested the impact that removing each feature had on the user's perception of bias. Significant differences were found between how participants rated some distorted webpages and their respective controls. The category of news website was also found to influence the perception of bias. Furthermore, certain groups of users were found to have a predilection for rating certain categories of websites as more or less biased and were influenced by particular features of the design.

CCS CONCEPTS

• **Human-centered computing** → **User studies**; • **Information systems** → *Personalization*;

KEYWORDS

Bias; Adaptive Interfaces; News Website Design.

1 INTRODUCTION

Bias is a constant factor in the news production, dissemination and consumption cycle. Production biases, whether journalistic, editorial or publication, include: presentation; source; partisan; selection; agenda setting; framing; commercial; and bad news bias. All of these production biases have been widely covered in journalism

literature [2, 3, 8, 15]. The physical manifestations of such biases include, but are not limited to: headlines; article slant; word choice; selective quoting and editing; imagery; and even the use of names and personal titles. Dissemination bias in traditional news mediums includes: the level of coverage, attention, time, or repetition; and the prominence of an article or news report. It can manifest in the framing, layout/design, depth of coverage, tone and the level of respect given to sensitive subjects. Consumption or cognitive biases have also all received significant treatment within cognitive psychology literature [7]. These biases include: confirmation; salience; selective perception; stereotyping; choice support; blind spot; bandwagon; narrative; and agenda setting biases.

Currently there is a lacuna within the body of knowledge as to whether bias might be present, and if it is, its effect, within the presentation of news during dissemination, on what is increasingly becoming the most popular news medium, the Internet [27]. This research has begun to address this deficiency by highlighting how individual user characteristics, individual technical features of websites and the overall design of news websites impact upon the perception of bias among different groups of users. The research presented in this paper focuses specifically on bias relating to the dissemination of news online. It does not investigate linguistic bias in the text such as those identified by Recasens et al. including epistemological bias, through the use of factive verbs or entailments, or linguistic framing bias, such as subjective intensifiers or one sided terms [34].Other bias in the content or in the receiver, is out of scope for this research.

Bias in the dissemination of news on television and radio is mainly found in the duration of a segment, how often it is repeated in the news cycle and its order in news bulletins and current affairs programs [6]. In newspapers and news magazines the length of an article, its prominence and placement all contribute to the perception of one or more forms of bias. In newspapers and magazines, page layout, graphics, and the grouping of articles to create a spread can also affect attitudes in the reader [3]. However, there is little or no research on whether or not bias is present in the presentation of news online, how it is being introduced and the effect it has on different user groups.

News websites are increasingly adapting to the user [39]. Thus the experience of each user is increasingly tailored. In comparison, the articles, broadcasts and nightly news shows of traditional news sources are mass broadcasts to the collective. They are definitive items attributable to an author, editor, publication and point in time. Production and dissemination of serious news content in reputable organisations follows a standard procedure. Ethics, gatekeeping and privacy are considered at each step. Newspapers, news bulletins, and current affairs shows are constructed. Attention is given

to layout, order and balance. Journalists, news broadcasters and editors from reputable organisations claim a responsibility to the reader, a code of ethics they adhere to, industry and statuary organisations that may fine or sanction them and ultimately are subject to challenge in courts of law. Undoubtedly, even with all of these checks and balances, biased news has and continues to be produced and published. But the fact remains that each news article, story or broadcast is a definitive artefact, attributable and retrievable.

In comparison, the experience of news consumers online is much less definitive. Certainly, many online news resources, typically those that are the online presence of existing traditional outlets, follow rigorous news production procedures. However with the increasing use of adaptive interfaces in news websites, personalised to the user through a multitude of user models and social profiles, each consumer is increasingly having a tailored or even unique experience [22, 40]. The interface, layout, type and frequency of advertisements are all examples of the features of a website's design that are being adapted to the user. Article content, once a static column of text in print and early news websites, has become the latest feature to be personalised to the user. Content suggestions are now standard additions to a news website article, many of which now adapt to individual users [5, 28]. News websites now suggest articles based on previous interests, what your friends have read or what is trending in social media. Each of these features contributes to both the physical and psychological framing of an article, which in turn could be influencing how the reader perceives it. These adaptive features also now mean that the experience of each reader is increasingly tailored or even unique.

As traditional news dissemination methods continue to lose ground to online news, research is required to ascertain if features of a news website's design, either wittingly or unwittingly, could be affecting the perceived level of bias. News producers and consumers should also be made aware that increasingly adaptive interfaces might be unintentionally impacting on perceived bias, a key human factor during the consumption of news online. In a large study with 2,684 participants, Fogg et al. found that 11.6% of participants cited bias as a particular concern when evaluating the credibility of information online and this rose to 30.2% when evaluating news online [12]. This raises the question, can this powerful human factor be harnessed during the news dissemination process to adapt news websites interface to decrease perceived bias and thus increase perceived credibility among different users or groups of users? To this end, research is required to study the impact of user characteristics, design and technical features on perceived bias.

2 RELATED WORK

The identification and analysis of bias in news is a longstanding research area that has evolved from its original focus on bias in television reporting [18] and news anchor bias, to a more broad-based examination of the different media formats, including journalistic bias, editorial bias and even the use of photographs in newspapers [3]. In recent years, bias research has begun to focus on identifying and or mitigating content bias online. Presentation bias, which has been looked at in traditional media and online search, has yet to be investigated in the presentation of news online [2].

Currently there is a paucity of empirical research to identify bias in the dissemination of online news. One notable contribution to the field is the efforts of Park et al. who developed frameworks for the mitigation of bias in online news content [30] and for the computational analysis of news articles and user comments to facilitate it [31]. Although this research focuses on text, Park et al. maintain that further research should be undertaken into the detection of other types of bias.

A closely related and intertwined domain that has faced the same challenge is that of credibility. Bias is one of the most common measures of Credibility. Recently research has been undertaken on the influence of websites, their features and design, as channels of dissemination. Sundar's MAIN model, one of several credibility judgement and assessment frameworks, maintains that differing technologies behind websites bring their own affordances and cues which determine how a message is displayed and therefore the judgement it receives [38]. Research by Flanagin and Metzger demonstrated that a websites attributes were primarily responsible for credibility assessment [11]. More recently, Lowry et al. found that there was a relationship between logos and credibility [24]. Robins and Holmes have also demonstrated the link between higher levels of aesthetic treatment and positive perceptions of credibility in websites displaying the same content [35].

3 MOTIVATION

Bias is a constant concern of the news producer and consumer. If the consumer believes that information has been misrepresented, hidden or omitted, intentionally or otherwise, their appetite for, and belief in the news they consume is reduced [4]. As online news consumption continues to grow, study is required to determine if news websites design and technical features affect the perceived level of bias among different user groups, and if so, what is the comparable level of effect on them. Understanding which features of a website's design, through their inclusion, omission or distortion, increase or decrease the perceived level of bias among different groups, has thus far not been considered within the journalistic or wider information science domains, this is the focus of this research. The motivation is firstly to inform news consumers, producers and researchers, that just as in print news media, bias may be wittingly, or unwittingly, introduced into the medium of dissemination. Secondly to ascertain if a users perception of bias, and by extension their perception of credibility (of which bias is a component), can be modeled for adaption purposes.

3.1 Bias

Any definition of bias is context sensitive. Gaddy and Tanjong offer one of the most succinct definitions of news bias as "selective inaccuracy in news coverage" [14]. A general definition of bias in media from McQuail is"a consistent tendency to depart from the straight path of objective truth by deviating either to left or right" [26]. There are as many definitions of bias as there are forms. In Lowry's analysis of the problem of defining and measuring bias he points out that bias may only be measured when two conditions are met: "The first condition is that one must be willing to accept a relative definition of bias and must recognize that it is impossible to measure bias in human communication in any 'absolute' sense.

Therefore, bias in news reports and any other kind of human communication must always be subjectively defined. However, once it is so defined, it may be objectively measured within the context of the definition" [23].

As per Lowry, it is necessary to put forward a relative definition of bias so that it may be measured within this context. Therefore, within the scope of this research, bias is defined as: "The degree to which an online news resource attempts to intentionally, or otherwise unintentionally, influence or prejudice a user's opinion through its features, presentation or design". The detection and or measurement of news bias, whether of any of the aforementioned production, dissemination or consumption varieties, require a definition and a measurement scale anchored by one or more measurement terms. Whether it is network or media bias, journalistic, editorial, news anchor, or bias relating to a specific issue such as agenda setting in economic news, or elections, the overarching concept being measured is whether or not the subject or topic is being portrayed in a positive or negative light. Researchers have reported on this in domains ranging from health care, to attitudes towards immigrants in political campaigns. Consequently, positive and negative are used to anchor the measurement scale, as they formulate the overarching concept being measured in the majority of bias related research.

4 METHODOLOGY

The experiment required participants to rate their perception of positive or negative bias in the design of nine news webpages. Each webpage was subject to one of eight distortions which removed individual features of the design. Along with the control, a 9x9 experiment thus tested the impact that removing each feature had on the user's perception of bias. 135 experiment submissions were evaluated ensuring that each webpage/distortion variant was rated by 15 participants.

4.1 Content

In total nine webpages were used in the study, three each from traditional print newspapers, news magazines and international news agencies. Each website has been selected based upon popularity, professionalism, the range of testable features in their design and their level of adaption to their users. To begin with, four un-emotive and non contentious articles relating to weather were selected from each website. The four articles from each site were subject to a pre-test with 12 participants using a two round binary selection process to identify the least biased articles from each website which were then included in the final experiment.

4.2 Distortions

To ascertain which technical features of a website may affect the perception of bias among different user groups, each webpage had eight distortions applied. Each distortion, D0 - D8, involved the removal of the feature listed, below.

- D0 - No distortion, the control.
- D1 - Branded or explicit advertising, e.g. banner ads.
- D2 - Reputation lending advertising, e.g. Guardian Dating
- D3 - Self-promotional subscription services, e.g. subscription advertisements

- D4 - Promoted external content and services, e.g. external clickbait articles
- D5 - Promoted internal content and services
- D6 - Comment facilities.
- D7 - Article interaction buttons, share, send, vote
- D8 - Article embellishments, e.g. author profile info etc.

When a feature was removed from the design the elements below it were moved up, as if the feature was removed from the underlying code. Figure 1 shows the removal of explicit advertising. The features were chosen based on three main factors. Firstly, a simultaneous design review of all nine webpages was undertaken to identify common features. Feature categorisation was achieved by applying a common transparent colour overlay to the most obvious common features such as explicit advertising. These included banner ads, search, login, contact facilities, footers etc. Using an iterative process this colour coding was successful in categorising most of the individual elements on each page. Secondly their size and prominence was considered, thus advertising features heavily in the list. Thirdly, existing aligned research in the domain which has looked at elements such as the effects of advertising and top level domains on website credibility [41].

4.3 The Experiment

There were three main stages to the experiment, setup, profile building, and bias rating. Participants were directed to the setup stage from Prolific Academic. Upon agreeing to terms and conditions and viewing instructions, they were provided with the aforementioned definition of Bias. They were also provided with two clearly labeled instruction tasks to ensure they understood how the experiment interface worked. Each instruction task had a popup message directing the participants to use the scale beneath each website design to rate the amount of positive or negative bias they perceived in each design. The second stage focused on profile building with questions on physical, political, socioeconomic and news access habits. The third stage, bias rating, required users to rate the positive or negative bias in nine webpage/distortion combinations.

The experiment stage was set up as a 9x9 within subject incomplete counterbalanced measures design. The incomplete counterbalance was achieved by arranging the webpages and distortions, D0 - D8, in a reduced form Latin square. Distortion 0, or D0 is the control, an original version of each webpage with no distortion applied. Participants were randomly assigned to one of 9 diagonal paths through the Latin square that intersected with nine webpage/distortion combinations, thus ensuring that each participant experienced each webpage and each distortion once. To avoid carryover effects or the encroaching effects of task fatigue, once assigned to a path the webpage/distortion combinations the participant would encounter were displayed in random order. Attention questions, to determine continued diligence to the task were also added to each participant's path. Consequently, when investigating the effects of each distortion on each webpage the data can be analyzed as a series of single variant A/B tests where A is D0 and B is D1 - D8.
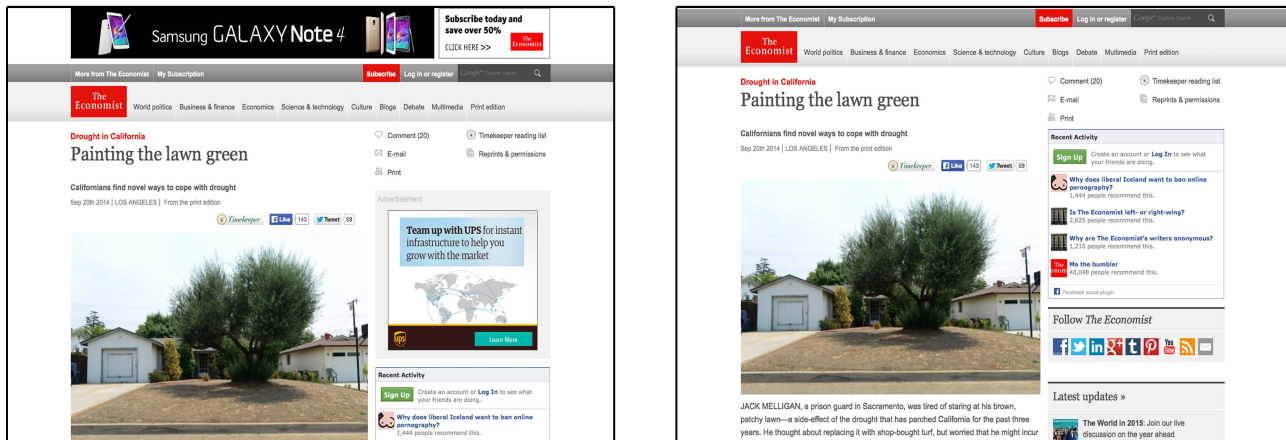
Figure 1: Partial screen captures showing a webpage from the Economist website. The left is the control, the right is D1

4.4 Crowdsourcing

Participants for this research were crowdsourced using the Prolific Academic[1] marketplace and paid a fee of GBP£1.25 to partake in the experiment. The experiment was run over two days in late November 2015. Contribution was limited to the U.S to build a more homogenous profile for data analysis. To increase the validity of the results two attention questions, in the form of two news articles contained in webpages, thus designed to look like the bias rating task, were added at the start and middle of each participants path. The article for the first attention question detailed the fears of a small community due to toxic bacteria in stagnant flood water full of raw sewage. The article for the second attention question related to sunny weather for the upcoming weekend. Both articles, contained in their webpages, were taken from websites not included in the experiment. The interface for both tasks, including the bias rating scale, was exactly the same as that used in experiment. However the instruction above each task required the participants to rate whether each article was a positive or a negative news story. Participants were expected to answer 'negative' and 'positive' respectively. Contributions from participants who failed one or more of these questions were not assessed.

In total 171 completed submissions were recorded. 9 were rejected due to failing one or both attention questions. To undertake a group comparison via a two-way repeated measures ANOVA, it is necessary to have balanced data. Therefore, the first 15 submissions to each of the 9 paths (15 is the total number of submissions in the path with the fewest submissions), were included. Thus 27 were not included in the statistical analysis. Consequently 135 submissions were included in the final dataset. G*power was used to determine that this results in a > 95% statistical power of detecting an effect size of 0.42 with an error probability of 0.05% [9, 10].

4.5 Measuring Perceived Bias

Bias is a multi-faceted construct, the definition of which changes depending on which facet is being addressed and its context. As such it is notoriously problematic to define and subsequently to

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measure. Park et al. states "it is intrinsically difficult to objectively define what bias is and so is to measure or correct it." [29]. Even when a definition is put forward there is no standard method of measurement. Previous attempts to measure perceived bias as one metric of credibility, have used four, five, seven and ten point Likert scales, [11, 13, 19, 20, 37]. Semantic differential scales and bipolar adjective rating scales have also been used. In some instances the scales are mono directional anchored with derivatives of the absence of bias to extremely biased, while in others they are bi-directional anchored with terms such as 'strongly disagree' or 'describes very poorly' to 'strongly agree' or 'describes very well' [38].

As a result of this lack of cohesion and noting the limitations of Likert scales, such as the lack of suitable and commonly understood terms and the requirement to use non-parametric statistical methods on the resulting ordinal type data or converting it so that it approaches an interval type scale, it was decided to adopt a new approach, Visual Analogue Scales (VAS). Originally described by Hayes and Patterson, they were popularized by Aitken as a new technique for measuring pain and as a communication aid between the patient and the clinician to address concerns about accurately communicating a subjective personal experience such as pain [1, 17]. The recording of a subjective construct such as bias is analogous to the recording of a subjective personal feeling such as pain between patient and clinician. The benefits include, a more powerful form of interval data, increased accuracy for small nuances, wider range of scores and less confusion with language or terminology. The resulting data is continuous interval type data, a form of parametric data where the variance between the homogeneity of each of the tested designs is considered the same. To improve validity and reliability, no metering, ticks or decorations were applied to the scales [25]. A bi-directional VAS ranging from -100 to +100, positioned under each webpage/distortion, was used as the measurement instrument. The scale was anchored with "Positive Bias" and "Negative Bias" and large plus and minus symbols. Above each VAS was the instruction "Please rate from -100 to +100 the amount and direction of Bias you perceive in this Design". See Fig 2.

Positive and negative bias in a website's design is the perception by the consumer that a news story or topic is being portrayed in a
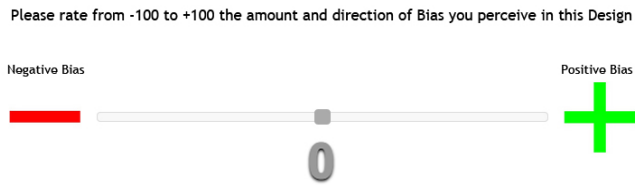
Figure 2: Visual Analogue Scale used in the experiment

more positive or negative light than it warrants by the news agency and or it's website. Compared to traditional print media, news websites provide unbounded opportunities to present or physically frame a news article with additional interactive features which can be personalised to the consumer. These often contain further information or links to other articles on the same topic that are capable of influencing a consumers opinion.

5 PARTICIPANT PROFILE

In total 135 submissions were evaluated, 56.3% of which were male, 43.7% female. The average age was 30.1, with 44.4% of respondents between 18 and 25. Participation was limited to the U.S. with 36 states represented.

Occupation results point towards a pattern of young students and early career professionals from upper middle class backgrounds. Only 9.7% of responders reported undertaking skilled, semi-skilled or unskilled manual labour roles. Professional, semi professional and skilled professional accounted for 54.1% of responders. A high rate, 19.3%, of unemployed individuals took part. Living arrangements also fit a student or young professional profile. 20.7% rent in multiple occupancy, 5.2% in a dormitory and 26.7% live with their family. 14.1% and 12.6% reported owning a home with and without mortgages respectively. Although the average user profile is young, it is representative of the core audience of many news website. This can be seen in the fact that 99.3% of participants reporting that they access news online, see section 5.4.

5.1 Education, Socioeconomic

Educational achievement among the participants was very high, with just 10.4% reporting having completed second level education alone. 83.7% have completed a minimum of a four-year college degree, in comparison to 34% for the wider population [41].

The income range reflects the age profile of the participants. 29.6% earn less than $10,000 and 43% earn less than $20,000. The average wage of the participants in the survey was $33,622.47. This is in comparison to an average wage in the U.S. in 2014 of $46,481 [36]. The low average wage is likely due to the high response rate from young participants, especially college age responders. This is also backed up by the reported high rate of participation in education.

5.2 Elections, Political Leaning and Ideological Viewpoints

Participants were also asked to indicate their political ideology and party affiliation during the initial survey stage of the experiment,

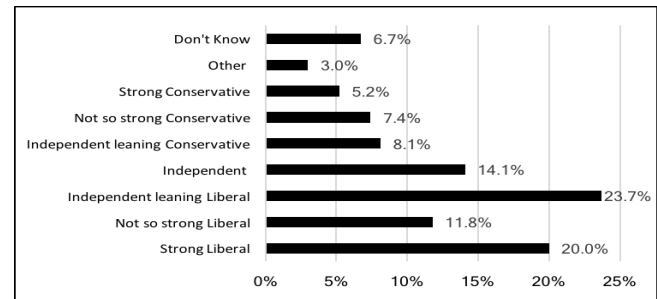Fig. 3 and Fig.4 show a clear liberal and independent trend among participants.

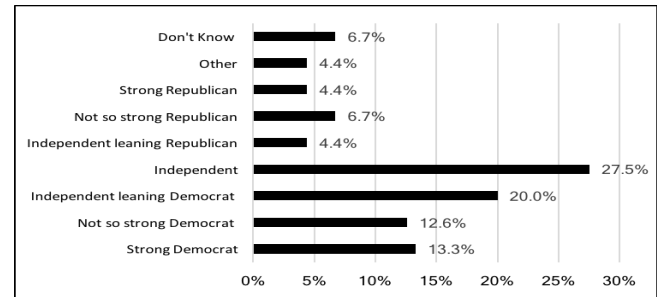Figure 3: Political ideology of participants

Figure 4: Party affinity of participants

76.3% of respondents believe that voting is important with 33.3% saying it is extremely important. Only 3.0% believe that voting is not important. When asked which elections they partake in, the results were: "Local" 43%, State e.g. "Governorship" 60.7%, "National e.g. Senate and or Congress" 67.4% and "Presidential" 86.7%. 10% of responders selected "None", while 4.4% and 0.7% selected "Other" and "Don't Know". Compared to actual rates of participation in US elections, the 2012 Presidential election participation rate was just 53.6% of the voting age population, the responders to this experiment claim a participation rate of 86.7%.

5.3 Internet Usage and News Access

Internet usage among the respondents was extremely high. 97.8% report browsing the Internet for a minimum of two hours per day with 34.1% saying that they use it for more than eight hours each day. Of course, the participants for this survey were recruited online, but the figures reported are only slightly higher than Pew's longitudinal Internet access survey, which report 96% of 18 - 29 year olds, using the Internet each day in 2015[32]. The majority, 94.1%, also own a smartphone with 78.5% saying that they browse the Internet for a minimum of one to two hours per day on it. This is higher than the two thirds adoption rate for the population as a whole but this is likely due to the younger age profile and economic demographic[33].
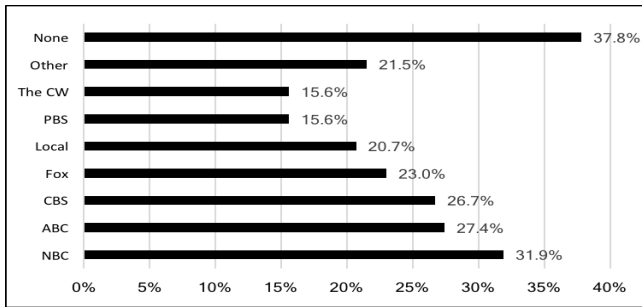
Figure 5: Television Station Viewership of Participants

5.4 News Access Habits

When asked to select via multiple choice which mediums they use, 99.3% selected Online. TV and Radio News access was low, as expected for the age category of respondents, at 46.7% and 29.6%. Just 17% selected Print Newspapers. Only one participant or 0.7% selected "None", showing that, overall, the participants have a strong interest in current events. 1.5% selected "Other". Although results will be skewed due to the fact that participants were sourced from an online marketplace, the extremely low print news readership demonstrates the continuing decline of the industry.

Participants were also asked, via multiple-choice, which TV stations they regularly access, Fig. 5. This was asked in order to establish if there was a correlation between participants who access conservative or liberal stations and their perception of bias.

Newspaper readership was examined via multiple-choice for the same reason. Readership results are displayed in Fig. 6. The Participants were asked this question to determine if there was any correlation between conservative and liberal newspaper access and the perception of bias.
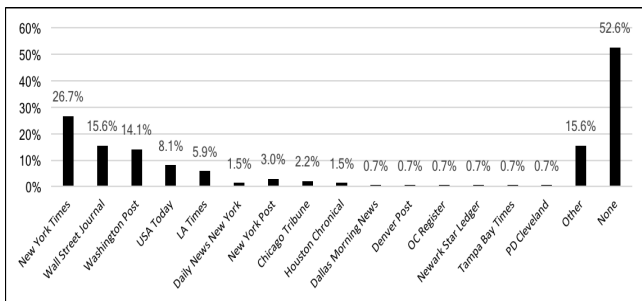

Figure 6: Newspaper Readership of Participants

Several methods have been used to determine the Conservative / Liberal position of TV and Newspapers. One is that of Groseclose and Milyo who compute scores based on how often each publication cites liberal or conservative think tanks and policy institutes and then compares it with how often conservative and liberal members of congress cite the same groups [16].

6 PERCEPTION OF BIAS

A two-way repeated measures ANOVA was conducted to ascertain the effect of the distortions on each webpage on the perception
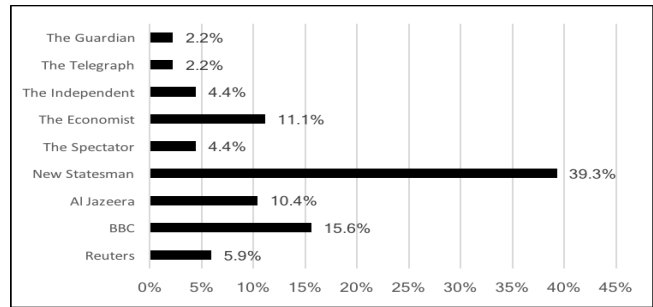

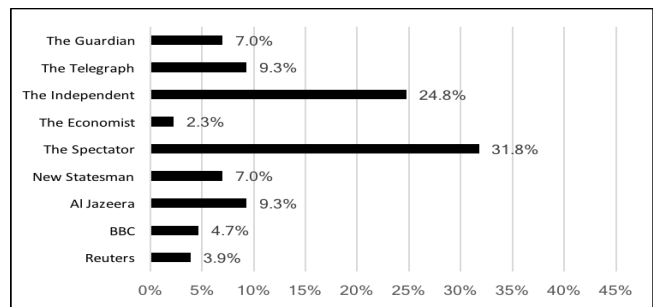**Figure 7: Participants choice of the most Positively Biased Websites**

Figure 8: Participants choice of the most Negatively Biased Websites

of bias. An examination of the studentized residuals for values ±3 standard deviations showed that there were no outliers in the data. A Shapiro-Wilks analysis ($p > .05$) of the studentized residuals showed that the majority of sample user ratings for the webpage/distortions combinations were normally distributed with the remainder approximately normally distributed. Mauchly's test of sphericity indicated that the assumption of sphericity had been violated for the two-way interaction. Consequently the Huynh-Feldt correction is reported. There was a statistically significant two-way interaction between websites and distortions, $F(40.14, 562.04) = 1.430, Huynh - Feldt\ p\ = .045$.

Each webpage/distortion combination was viewed and rated by 15 individual participants. Through the use of a Latin square in reduced form, an incomplete countermeasures within subjects design was achieved. By assigning participants to diagonal paths through the Latin square each participant experienced each webpage and distortion once. In 19 instances it was not possible to apply a particular distortion to the webpage in question due to the absence of the feature in the initial design. In each case these have been clearly labeled with N/A in the corresponding cell in Table 1. To conduct the two-way repeated measures ANOVA, nonapplicable webpage/distortion combinations were replaced with their respective control data. This was not included when conducting the simple main effects of distortions. Consequently 62 separate webpage/distortion combinations were each rated for their perceived positive and negative bias by 15 individual participants.

Table 1: Results of one-way repeated measures ANOVAs - simple main effects for distortions using the Bonferroni adjustment for multiple comparisons. The intersecting cell of each webpage/distortion combination shows the Mean bias ratings, Standard Error, F-statistic and Significance value. D0 is the control with no distortion applied. The cells in columns D1 - D8 show the results of the simple main effects comparing each to their respective controls. Scores closest to zero indicate less biased websites. N/A scores indicate the feature was not present.

	D0	D1	D2	D3	D4	D5	D6	D7	D8
Guardian	M -1.20 SE 6.977	M -6.73 SE 5.713 F.273 p .609	M -1.13 SE 8.245 F .000 p .995	M 5.20 SE 7.982 F .267 p .614	M 9.87 SE 5.643 F 1.354 p .264	M 4.07 SE 11.644 F .145 p .709	M 15.13 SE 9.166 F 1.807 p .200	M 12.67 SE 5.836 F 3.156 p .097	M -7.80 SE 6.020 F.466 p.506
Telegraph	M 0.60 SE 5.623	M -7.27 SE 4.615 F 1.175 p .297	M -2.47 SE 4.456 F 2.317 p .150	N\A	M -0.53 SE 7.866 F .011 p .917	M 21.47 SE 8.561 F 4.253 p .058	N\A	M -12.60 SE 7.822 F 1.638 p .221	M 2.80 SE 6.820 F.057 p .814
Independent	M 6.07 SE 8.190	M -16.20 SE 9.959 F 4.501 p 0.52	M -18.73 SE 10.457 F 2.719 p .121	N \A	M 1.53 SE 10.219 F .147 p.707	N \A	M 15.07 SE 9.690 F.686 p .421	M 1.33 SE 7.856 F .139 p .715	M -5.73 SE 7.651 F .897 p .360
Economist	M 12.13 SE 10.154	M 29.46 SE 6.378 F 1.745 p .208	M 20.20 SE 8.065 F .374 p .550	M 18.80 SE 9.603 F .187 p .672	N\A	M 4.53 SE 6.939 F .381 p .547	M 6.67 SE 9.886 F .143 p .711	M 36.13 SE 8.216 F 5.532 p .034	M 10.60 SE 8.327 F .015 p.904
Spectator	M -7.53 SE 9.344	M -29.93 SE 13.123 F 1.663 p .218	M -20.73 SE 8.925 F 1.567 p .231	M -16.00 SE 7.913 F 2.294 p.152	N\A	M -37.73 SE 7.662 F 5.946 p .029	M -4.93 SE 11.376 F.025 p .877	M -33.00 SE 9.571 F 3.977 p .066	M -13.87 SE 7.665 F.271 p .610
New Statesman	M 22.27 SE 11.608	M 16.07 SE 9.375 F .199 p .663	N\A	M 21.80 SE 9.117 F .001 p .973	N\A	M 28.20 SE 9.391 F .135 p .719	M 29.60 SE 8.784 F .291 p .598	M 12.47 SE 9.292 F .323 p .579	M 30.00 SE 7.526 F .282 p .604
Al Jazeera	M -0.27 SE 5.483	N\A	N\A	N\A	N\A	M 7.87 SE 7.802 F .897 p .360	M 17.47 SE 8.927 F 2.738 p .120	M 7.47 SE 5.730 F .936 p .350	M 0.20 SE 8.421 F .002 p .967
BBC	M 5.47 SE 7.123	M 18.93 SE 10.001 F 1.158 p .300	N\A	N\A	M 14.67 SE 8.617 F.582 p .458	M 21.13 SE 5.906 F 3.861 p .070	N\A	M 15.40 SE 7.792 F.885 p .371	M 10.33 SE 4.383 F .357 p .560
Reuters	M -7.73 SE 4.318	M -22.80 SE 7.145 F 3.117 p. 099	N\A	N\A	M 7.13 SE 10.540 F 1.556 p .233	N\A	N\A	M 12.60 SE 6.173 F 9.045 p .009	M 7.67 SE 9.682 F 1.866 p .193

6.1 Experiment Results

The results of each participant's assessment of the perceived bias in each of the webpage/distortion combinations are reported in Table 1. This shows three statistically significant results from two distortions on three of the websites: The Spectator: D5, The Economist: D7 and Reuters: D7, see Table 1.

6.1.1 Simple Main Effects of Distortions. Simple main effects were conducted to establish which distortions have a significant effect on the perception of bias. To reduce the likelihood of Type 1 errors while ascertaining the effect of the distortions on each website, one-way repeated measures ANOVAs were conducted comparing the respective controls of each website (D0) to its distortions (D1-8) using the Bonferroni adjustment for multiple comparisons. Results are presented in the intersection cells in Table 1, with statistically significant results highlighted. The degrees of freedom (DF) for the factor and error were (1,14), respectively.

Two distortions had a statistically significant effect on three websites. The first, D7, involved removing article interaction facilities such as social media sharing, email and voting options. This distortion significantly increased the mean bias score of The Economist from its D0 to its D7 rating, with a mean difference of 24.0. There was also a statistically significant difference in the bias rating between the Reuters D0 and D7, with a mean difference of 20.33. It is possible that the removal of such features signifies to users that the news resource is not reputable and does not invite any interaction with its readers. This is often the practice of websites of extreme left and right perspectives perpetrating to be reputable news resources. Lastly on The Spectator, D5, the removal of promoted internal content, changed a negative mean bias rating to 30.2 positive. Promoted internal content is essentially advertisements or clickbait type links provided by third party's, which despite the name, often links to external, less reputable sources. The headlines

Table 2: Age and the Perception of Bias

Age	N%	M	SD
18 − 20	6.2	11.16	33.74
20 − 30	54.3	5.32	37.16
30 − 40	24.0	2.01	27.83
40 − 50	7.8	2.07	42.70
50 − 60	4.6	1.28	30.38
60 − 70	3.0	0.68	30.75

and image used in such can also be quite prominent and garish, thus influencing participants overall perception of the news resource.

6.2 Most Positively and Negatively Biased

At the end of the experiment, participants were shown large thumbnails of all of the webpage/distortions combinations they had rated at the same time. They were then asked to select which webpages they perceived to be the most positively biased. This was then repeated to select the most negatively biased. Results are shown in Fig. 7 and Fig 8.

A very high proportion of participants, 31.8% and 24.8% selected The Spectator and The Independent as the most negatively biased webpages. This correlates strongly with the previous results shown in Table 1. The same websites were each selected by just 4.4% of participants when asked to select the most positively biased webpage. The opposite is true of the New Statesman. This was selected by 39% of participants as the most positively biased webpage and by only 7% as the most negatively biased. The results of this also correlate strongly with the results depicted in Table 1. Considering the strength of these results and the fact that they are backed up by the results in Table 1, the underlying design is the most probable cause for such positive and negative sentiment. Just as previous work by Robins and Holmes has demonstrated a positive correlation between levels of aesthetic treatment and credibility, it appears that the underlying design of these websites is influencing users visceral perception of bias [35]. It should also be noted that previous work in the domain by Lindgaard et al. has demonstrated that users make significant judgements about webpages within just 50ms [21].

6.3 The Impact of User Characteristics on the Perception of Bias

The research revealed that participants had an overall tendency to perceive a slight positive bias in the webpages tested. N = 930, M = 4.31, SD 34.91.

6.3.1 Physical User Characteristics. There was very little difference between how women and men perceived positive and negative bias, men: N = 523, M = 3.74, SD = 35.54; compared to women: N = 407, M = 5.03, SD = 34.10. The mean bias ratings of participant's broken down by age demonstrates that the younger a participant is, the more likely they are to perceive a positive bias.

A two-tailed Z-Test, ±1.960, conducted on the mean bias rating for each age bracket revealed a significantly more positive perception of bias for those in the 18 to 20 age bracket M = 11.16, z = 2.02. While this is a smaller age breakdown a clear trend between youth and perception of positive bias is evident in the results shown in Table 2.

6.3.2 Socioeconomic. Education level did not provide any discernible trends as to how participants perceive bias. Two-tailed Z-Test, ±1.960, showed no significant results. Participant's occupation also did not impact significantly on the perception of bias though those with professional type jobs have a more positive perception of bias, a Two-tailed Z-Test, ±1.960, showed no significant results. Table 3.

Table 3: Education level and Perception of Bias

Education Level	N%	M	SD
High School	10.4	7.51	38.11
Some College	28.5	6.15	37.96
Two Years of College	6.7	0.89	38.02
Four Years of College	38.3	3.51	30.53
Some Graduate Study	6.7	7.17	39.12
MSc or Professional Degree	7.1	-2.89	35.69
Advanced Graduate or PhD	2.4	4.09	21.07

Overall income levels show some inconsistency as indicators of bias. A two-tailed Z-Test, ±1.960, conducted on the mean bias rating for each income bracket revealed a significantly more negative perception of bias for those in the $70,000 to $79,999 pay bracket, M = -22.75, z = -1.99 and for those in the $90,000 to $99,999 pay bracket, M = -22.50, z = -1.97. However, participants in the $80,000 to $89,999 pay bracket show normal levels of perceived bias. Consequently further testing is required in future to verify this outcome, Table 4.

6.3.3 Political Ideology. A surprising finding in the research is the fact that those with stronger political views, both liberal and conservative, perceive a stronger liberal bias than their less partisan peers, Table 5. When the results of the two groups are compared they are almost identical, liberals N = 55.5%, M = 3.76, SD = 34.04 and conservatives N = 21.3%, M = 3.77, SD = 34.34.

6.3.4 Party Affiliation. Combined, those identifying as Democrat and Republican had a positive mean bias ratings of N = 45.5%, M = 4.98, SD = 34.08 and N = 16.1%, M = 2.59, SD 33.31. Like the political ideology results those identifying as "Other" and "Don't"

Table 4: Occupation and Perception of Bias

Occupation	N%	M	SD
Unskilled Manual	1.5	1.14	35.36
Semi-Skilled	2.8	1.00	37.51
Skilled-Manual	4.6	-1.91	31.05
Skilled-Professional	10.5	4.43	33.76
Semi-Professional	17.1	5.94	36.68
Professional	26.6	3.89	32.81
Unemployed	19.2	6.45	31.55
Stay at Home Parent	0.9	-2.63	32.00
Other	16.8	3.68	41.27

Table 5: Income levels and Perception of Bias

Income	N%	M	SD
$10,000 or less	30.0	7.48	34.03
$10,000 - $19,999	13.3	4.60	41.30
$20,000 - $29,999	10.0	0.52	31.51
$30,000 - $39,999	15.6	5.51	33.15
$40,000 - $49,999	9.4	2.47	33.84
$50,000 - $59,999	7.3	1.85	28.74
$60,000 - $69,999	5.3	0.94	34.66
$70,000 - $79,999	0.9	-22.75	47.20
$80,000 - $89,999	2.5	1.61	27.21
$90,000 - $99,999	0.6	-22.50	40.98
$100,000 or more	5.2	4.42	42.32

Table 6: Political Ideology and Perception of Bias

Political Ideology	N%	M	SD
Strong Liberal	20.3	6.09	35.09
Not so Strong Liberal	11.6	4.23	35.49
Independent Leaning Liberal	23.5	1.30	32.38
Independents	14.0	0.18	28.90
Independent leaning conservative	8.3	4.19	34.16
Not so Strong Conservative	7.5	0.94	35.18
Strong Conservative	5.5	7.02	33.78
Other	2.8	15.15	37.97
Don't Know	6.5	15.82	49.69

Table 7: Party Affiliation and Perception of Bias

Political Party Affinity	N%	M	SD
Strong Democrat	13.0	6.43	36.25
Not so Strong Democrat	12.7	5.84	35.82
Independent Leaning Democrat	19.8	3.47	31.49
Independents	27.4	0.71	32.42
Independent leaning Republican	4.6	0.33	33.15
Not so Strong Republican	7.1	7.71	33.50
Strong Republican	4.4	-3.27	32.71
Other	4.3	6.40	39.26
Don't Know	6.7	17.35	46.99

know had raised positive perceived bias. Two-tailed Z-Test, ±1.960 showed that the above average positive perception of bias by those who answered don't know was significant, M = 17.35, z = 2.11.

6.3.5 News Access Habits. Participant's choice of news mediums did not reveal any significant results. There were no correlations between which newspapers that participants read regularly and their perception of bias. There were also no significant results comparing TV station preferences and perceptions of Bias.

7 DISCUSSION

This exploratory study has demonstrated the impact on perceived bias of user characteristics, design and technical features of news websites.

Overall user characteristics showed mixed results as an indicator of positive or negative bias. As expected, participants age showed that younger participants were more likely to rate webpages as positively biased, particularly those under the age of eighteen. It should be noted however that this group is a particularly small sub section of participants. Nevertheless there is an overall perceptible positive to negative slant as participants get older. Education level also shows that those who have achieved higher qualifications, likely older responders given the age profile of the group, were also more likely to perceive a negative bias. A more conservative position is oft the natural tendency of those who have reached a high socioeconomic status due to a desire to protect their position. The results also show that those who report working in professional jobs are also more likely to perceive positive bias. However, income level proved a contradictory, and an inconsistent indicator. The results shown in Table 4 show two income categories have significantly negative perceptions of bias. Usually, but not always, professional jobs indicate a higher income. It should be noted that as the income categories are arbitrary, a slight change might have resulted in more consistent negative perception of bias for those reporting high incomes. Political ideology and political party affinity also provided mixed results. However, interestingly those identifying as "Other" and "Don't Know" perceive a strong positive bias. It is possible that

those who do not affiliate with an established political position are more likely to source their news from alternative sources and have a low opinion of established news media, thus resulting in a higher rate of perceived bias.

This study demonstrated that design has a large impact on perceived positive and negative bias. Participants were asked after the bias rating stage of the experiment to pick the most positively biased website and the most negatively biased website. Out of nine websites, 39.3% of participants selected the New Statesman as the most positive overall while 31.8% selected The Spectator as the most negative. These results closely correlate to the ANOVA results shown in Table 1, detailing the impact of distortions investigating technical features of the design. The results show that participants had an overwhelming perception of positive bias in the New Statesman, which remained even as each distortion was applied. The Spectator, on the other hand received negative bias ratings on the control and on each distortion. Just as interestingly, certain webpages did not incite strong feelings of bias. Reuters, was selected as the most positively biased and negatively biased by just 5.9% and 3.9% of participants respectively. The Guardian and Telegraph had similar low scores. These findings demonstrate that the overall design aesthetic is a major factor the perception of positive or negative bias.

Participants were also influenced by the type of website they were rating. The webpages of the traditional print newspapers were less likely to have a strong effect on the perception of positive or negative bias compared to those of news magazines or international news agencies.

The results of the two way repeated measures ANOVA show that individual features of the design can impact on perceived bias. The table shows that one distortion, D7 - the removal of article interaction features such as share, activity, send, vote etc. added a significant positive bias to both the Economist and Reuters compared to their respective controls. Another distortion D5, the removal of Promoted internal content and services increased perceived negative bias in the Spectator compared to its control.

8 CONCLUSION

Bias, in one form or another, will always be a factor in the production, dissemination and consumption of news. Our findings demonstrate that the inclusion or exclusion of certain technical features of a news websites design can impact on the perception of positive or negative bias. The research also shows that participants perceived particular websites, and categories of websites, as having an overall positive or negative bias. Lastly individual user characteristics, such as participant's age and certain socioeconomic indicators such as education and occupation also have an impact.

Bias has been shown to be an important factor in human computer interaction especially when users are reading news online. This exploratory study is the first to show that the design of a website, its features and individual user characteristics can impact upon the perception of bias. Further research is necessary to ascertain the driving forces behind the differing perceptions of bias and how news providers can better present information online so that its presentation does not impact the readers attitude towards it. Consequently it may be necessary to present the same information

differently to different users through the use of new user modelling and personalisation techniques.

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