Tailoring heuristics and timing AI interventions for supporting news veracity assessments

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Fake News

- Fabricated, misleading information that is intended to deceive (Jang & Kim, 2018)
  - Misinformation: false or inaccurate information
  - Disinformation: false information that is intended to mislead

Fake News Detection

- AI tools to detect or approximate the veracity of news articles
  - Mostly utilizing text analysis (Baly et al., 2018; Cruz et al., 2019; Hosseinimotlagh & Papalexakis, 2018; Bozarth & Budak, 2020).
  - Broad range of machine learning algorithms used
  - Require ground truth assessment
- Gap:
  - the focus of these approaches is on the performance of the algorithm and not on its impact on news consumers

Heuristics in News Consumption

- Heuristics are rules of thumb for forming a judgement
  - E.g. recognition heuristic, take the best heuristic
- In prior News literature, heuristics examples are:
  - Opinions of significant others (which we term social heuristics)
  - Cues concerning the content and source
  - Self knowledge/experience (which we term cognitive heuristics)

Research question

- How can heuristics be incorporated to increase the effectiveness of AI advice in news veracity assessment?

- Study 1: what are common heuristics?
  - Exploratory qualitative study
- Study 2: impact of heuristics on news veracity judgements
  - Experiment

Methodology

- Data collected on Amazon Mechanical Turk (AMT)
- Ten different articles covering two everyday news topics – climate change and vaccinations
  - Different ground truths were included (true and false articles)
- Nine more articles on COVID

Table 4
Articles used.

Everyday News		
Source	Title	Ground Truth
Natural News	Climate change HOAX has literally convinced a member of Congress that "the world is going to end in 12 years"	Not Credible
Freedom Bunker	Fight illness with this ancient immune booster	Not Credible
Jew World Order	Greenpeace Founder: Global Warming is a Hoax Pushed by Corrupt Scientists 'Hooked on Government Grants'	Not Credible
The Gateway Pundit	NOAA Ruins Assertions by Unhinged Democrats that Global Warming Has Caused Increase in Hurricane Activity	Not Credible
Natural News	World Health Organization declares *anti*-vax movement to be a top "global health threat" just like the climate change hoax … the vaccine deep state grows desperate	Not Credible
BBC	'Completely avoidable' measles outbreak hits 25-year high in US	Credible
NPR	Climate Change Was the Engine That Powered Hurricane Maria's Devastating Rains	Credible
Chicago-Sun Times	Kentucky governor exposed his kids to chickenpox instead of getting vaccine	Credible
NPR	New U.S. Measles Cases Break 25-Year-Old Record, Health Officials Say	Credible
Fortune	U.S. Carbon Emissions Soared in 2018. Here's Why	Credible

Emerging News Source	Title	Ground Truth
The New York Times	Open Windows. Don't Share Food. Here's the Government's Coronavirus Advice.	Credible
Reuters	World Faces Chronic Shortage of Coronavirus Protective Equipment: WHO	Credible
The Guardian	Can a face mask stop coronavirus? Covid-19 facts checked	Credible
Breitbart	Hillary Clinton Falsely Claims to Jimmy Fallon That Trump Called Coronavirus Outbreak a 'Hoax'	Not Credible
Natural News	Vitamin C infusions being studied in China as possible treatment for coronavirus-related pneumonia	Not Credible
Natural News	Spirulina found to boost the body's type 1 interferon response to fight RNA viral infections "including coronavirus," new science finds	Not Credible
The Russophile	CORONAVIRUS HOAX: Fake Virus Pandemic Fabricated to Cover-Up Global Outbreak of 5G Syndrome	Not Credible
The Russophile	CORONAVIRUS SPECIAL REPORT: Worldwide Outbreaks of 5G Syndrome and 5G Flu Driving Pandemic	Not Credible
The Liberty Daily	Coronavirus: Chinese Espionage Behind Wuhan Bioweapon?	Not Credible

Ground truth determination

1. we first found sources that were labeled as reliable and unreliable by Media Bias/Fact Check (MBFC)
2. found topic specific articles from those sources (climate change and vaccination; COVID)
3. selected articles that have been fact checked by a 3rd party journalistic organization, such as Snopes, PolitiFact, FactCheck.org, Washington Post Fact Check, or AP Fact Check

Survey instrument

- General demographics
  - gender, age, education
- News consumption habit
  - primary and secondary channels, frequency, social media sharing habits, trusted news sources
- Do you believe the article?
  - 1 – definitely not; 3 – might or might not; 5 – definitely yes
- Why (or why not)?
  - Open text

Analysis – Heuristics Elicitation

- Mostly based on the everyday news responses
- We did not see any significant additions or removals in emerging news but have yet to analyze it completely
- We are currently looking deeper into differences in justification language using text analysis

Heuristic	Example from text
Personal belief alignment	I believe climate change is happening and we are running out of time to try to save our planet
Personal experience alignment	I believe it because I use the oil and it works. There are studies that show it works.
Previous knowledge alignment	It contradicts things I know are facts
Supporting evidence provided	The article doesn't give any reputable sources and I am skeptical when I can't find a link from an actual medical site.
Bias perception	this information or news seems very biased against left wing members or news.
Accuracy perception	It seems accurate. I believe it because it seems factual
Coherent Story	I believe the information in the article because it presents logical arguments. Each person is important and changing ourselves is often the first and best way to enact any kind of change.
Writing Style	It is written poorly and very emotionally and full of hyperbole
Trusted Source	NPR is a great source and I have always trusted content from them I am not sure of how reliable the source is.

Qualitative insights

Heuristic Categories in Everyday vs. Emerging News									
Do you believe the information in this news article?	Belief alignment	Experience alignment	Knowledge alignment	Supporting evidence	Bias	Accuracy	Coherent story	Writing style	Trusted source
Everyday News	29%	3%	22%	11%	12%	6%	6%	11%	14%
Emerging News	30%	1%	26%	13%	4%	11%	16%	11%	18%
Heuristic type	Self/Cognitive			Content					Source

Outcomes of study 1

- Identified the set of heuristics that are employed by news consumers to decide whether or not they believe a given article.
  - mix of the self/cognitive heuristics (e.g. personal belief), content heuristics (e.g. bias and accuracy) and the source heuristic.
- Cognitive heuristics are more prominent in people's decisions.
- The identity of the source is an important heuristic as well (aligns with previous literature, e.g. Pornpitakpan, 2004).
  - Source heuristic was more prominently used in positive news judgement. In negative judgements, people relied more heavily on other heuristics, such as writing style, perceived bias, and misalignment with prior beliefs.

Incorporating Heuristic Cues in AI advice

- Question: how should we present the AI advice to be most effective?
- Challenges to AI advice: people rely heavily on belief and knowledge alignment. This is strongly related to the concept of *confirmation bias.*
  - Confirmation bias means seeking or interpreting evidence in ways that agree with existing beliefs and expectations (Nickerson, 1998).
  - Minas et al., (2014) show that individuals tend to disregard information that challenges their pre-existing views and pay greater attention to supporting information.
  - Due to confirmation bias, beliefs that are based on cognitive heuristics can be difficult to change as individuals may overlook and undervalue information that refutes their beliefs (Metzger and Flanagin, 2013).

Study 2: Hypotheses

- Prior research has shown that confirmation bias is strong when prior beliefs or knowledge are strong (Park et al., 2013) and when one has high confidence in their decision ability (Rollwage et al., 2020).
- In emerging news situations, news consumers face extreme uncertainty concerning the evolving situation, accompanied by information overload and increased prevalence of rumors, conspiracy theories and disinformation (Starbird et al., 2020).
  - ***H1:*** *the effectiveness of algorithmic advice will be higher in emerging news situation than in everyday news situations*

Cont'd

- Prior studies have shown that AI advice with explanation performed better in shaping users' opinions than AI advice without explanation (Horne et al., 2019b)
- formatting advice to present source information in different ways affected the believability of articles (Kim et al., 2019; Kim and Dennis, 2019).
  - ***H2:*** *the effectiveness of algorithmic advice will be higher when the advice is tailored to specific heuristics as opposed to a generic advice*

Study 2: Design

- 2x4 full factorial design
- Everyday vs. emerging news
- Four specific AI tailoring conditions:
  - *No AI*: only the articles were presented to respondents who were then asked to make their judgement (as we did in study 1).
  - *Generic AI*: at the top of the page we presented one of the following two statements: “Our smart AI system believes this article” or “Our smart AI system does not believe this article”.
  - *AI Source*: at the top of the page we presented one of the following two statements: “Our smart AI system indicates this is a trusted news source” or “Our smart AI system indicates this is a not a trusted news source”.
  - *AI Content*: at the top of the page we presented one of the following two statements: “Our smart AI system rates this article as accurate and reliable” or “Our smart AI system rates this article as inaccurate and unreliable”
- After presenting one of the above statements, we asked respondents to read the article and use the five points scale to indicate whether they believed the information in the article (the scale ranged from “definitely yes” to definitely not”).

Method

- We employed the same approach for data collection using the articles described previously
- Analysis:
  - Articles were first coded as true or false based on their ground truth
  - Responses to the scale question of “do you believe this article?” were coded as binary agreement with the ground truth using the 1-2 responses as perceiving the article as false and the 4-5 as true. We conducted multiple tests of proportions on agreement rates.
  - P is the proportion of respondents who agreed with the ground truth of the article

Results

Everyday News					
Comparing		p_1	p_2	z stat	Sig.
No AI	Generic AI	84%	82%	0.50	0.31
No AI	AI Source	84%	83%	0.25	0.40
No AI	AI Content	84%	84%	0.11	0.46
Generic AI	AI Source	82%	83%	(0.28)	0.39
Generic AI	AI Content	82%	84%	(0.37)	0.36
AI Source	AI Content	83%	84%	(0.11)	0.45
Emerging News					
Comparing		p_1	p_2	z stat	Sig.
No AI	Generic AI	72%	84%	(2.04)	0.02
No AI	AI Source	72%	93%	(3.59)	0.00
No AI	AI Content	72%	93%	(3.65)	0.00
Generic AI	AI Source	84%	93%	(1.74)	0.04
Generic AI	AI Content	84%	93%	(1.79)	0.04
AI Source	AI Content	93%	93%	(0.04)	0.48

Results

- Compared with readers of everyday news, readers of emerging news are:
  - Less likely to identify fake news
  - More likely to accept the advice of the AI (supporting H1)
  - Especially when the advice is tailored to specific heuristics rather than presented generically (partial support for H2)

Qualitative follow up

- **Everyday news confirmation bias**: many of the respondents who relied on cognitive heuristics under this condition often relied *solely* on those:
  - *I don't believe that global warming is made up, the scientific consensus is very strong that it is happening and is caused by human behavior and carbon emissions. The fact that the author is calling into question this basic principle makes me question a lot of their other assertions, including the fact that Greenpeace has been "hijacked by the extreme left."*
    - a respondent who correctly did not believe an article which we flagged as False noted

Another example

- *Global warming and climate change are lies. These lies have been promoted since the 1800's. NONE of their predictions have panned out. NONE of their predictions will ever pan out. What happened to the ozone hole crisis? What about the melting ice caps? They've grown back to be thicker than ever in recorded history. How about those rising oceans that have been predicted over and over and over and over again? Shouldn't there be actual evidence of claims made since the 1800's?*
  - respondent who *did believe* an article which we flagged as False

Emerging news objective assessments:

- ***Supporting evidence:*** *The article makes many claims but offers no evidence of these claims. The frequent unnecessary capital letters are a big hint, and so is the lack of sources or an author's first and last name. It is written poorly, and is meant to scare, not meant to inform. It just has an obvious fake tone to it, and makes ridiculous claims.*
- ***Writing style:*** *The language used and style of writing give the impression the article was not written by a highly educated or scientific person. Although there are some technical words used, the overall impression of the article is "amateur".*
- ***Accuracy and source****: I believe the news article because it seems credible and factual. I know that there have been shortages of PPE, so it seems legitimate. Reuters is usually reliable and accurate, so I trust it.*

Weak confirmation bias

- Another indication of the lesser role of confirmation bias in this condition are comments from unsure respondents. For example:
  - *I really do not know enough about chemistry or biology or whatever field of science this is to know if it is true or not.*
    - *respondent said they probably not believe the article that we marked as False*
  - *There have been so many potential coronavirus rumers about ways to limit or cure the virus that I doubt them all. Until one has proven to be effective I will continue to be doubtful which is how I answered the question above.*
    - *respondent said they probably not believe the article that we marked as False*
  - *I mean at this point anything is possible.*
    - *respondent said they might or might not believe the article that we marked as False*

Cont'd

Even when cognitive heuristics are used, justifications are not as elaborate as in the Everyday News condition, indicating that even when respondents relied on cognitive heuristics, their prior knowledge and beliefs were not very strong:

- *I believe in the information because it has been believed for many years that Vitamin C is amazing for colds and flus and it is what we take when we get sick*
  - *respondent said they definitely believed the article that we marked as False*
- *I believe that the trials are happening and I have heard something about Vitamin C boosting the immune system.*
  - *respondent said they probably believed the article that we marked as False*

Conclusion

- Hypothesis 1 about the greater effectiveness of AI advice in emerging news situation was supported, highlighting the need to act early in shaping correct judgements of news.
- Hypothesis 2 about the greater effectiveness of tailored (vs. generic) AI advice was also partially supported
  - when respondents were open to accepting algorithmic advice, the tailored advice was more effective than the generic one.
- Our qualitative provides evidence to support the literature that the use of cognitive heuristics aligns with strongly held beliefs.
  - This, in turn, reduces willingness to “listen to” the advice of the algorithm.
- When respondents are unsure about a topic, they turn to other heuristics, namely content and source.
  - In this case they are more willing to accept the AI advice.

Contribution to news veracity interventions

- This study is among the first study to explicitly consider the timing (in terms of novelty) of news veracity interventions.
  - Our work demonstrates that there is an important window of opportunity for providing algorithmic advice and for that advice being accepted.
  - Future studies can fine tune this window of opportunity and further explore the long-term impact of interventions in terms of the spread of fake news.

Contribution to the heuristics literature

- we identify the set of heuristics that are used in the specific news veracity context.
  - This can help media outlets present news to their readers in a more convincing ways, it can help in creating news tags and taxonomies, and it can help consumers to share news on social media more responsibly.
- we demonstrate that tailored advice that builds on specific heuristics is more effective than generic advice.
  - the AI in itself is not as strong of a heuristic as are attributes of the content and source of the article.
  - Future research can narrow in on other specific heuristics and understand how to further tailor the advice of AI under different contingencies.

To the literature on confirmation bias

- Highlighted the trade-off between cognitive heuristics and more objective heuristics such as content and source.
  - Future study should further explore the role of uncertainty in this trade-off

For practitioners

- Due to information overload, fact-checking organizations often fact check information that has already been highly engaged with.
  - Our findings suggest that efforts could be more effective if focus was shifted to novel, emerging topics.
- Similarly, the findings of this work imply that the continued development of methods for early detection, warnings, nudges, or other information veracity interventions are of high importance.

Questions?