Exploring Pathways to Address Bias and Ethics in Information Retrieval

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E·S·R·C
ECONOMIC & SOCIAL RESEARCH COUNCIL

Bias and Ethics (Examples)

Trust bias due to ranking (Joachims et al. SIGIR 2005)

Demographic bias due to profiling (Kleinberg et al. 2016)

Incorrect health decisions possible due to **user and system bias** (White SIGIR 2013)

Privacy intrusions (Horvitz E. 2016); potential **"chilling effect"** (Tene. O. 2008)

Hate Speech in Recommender Systems (e.g. see Tufecki Ted talk)

Possible **human rights concerns** (Article 19 United Nations UDHR 1948)

Today

Hate Speech Classification – Lessons Learned

Nudging and Boosting – Possible solutions to the problems

Early Results – Nudging towards privacy in health search

Initial research goal: Understanding **deep learning** and the task of **hate speech classification**

Wasseem Hovy 2016 = 74.0 F-1

SUM(embeddings [Godin 2015]) + logistic regression = -4.6 F-1

Baseline: embeddings + CNN [Kim 2014] = +1.5 F-1

Method: ensemble [Hagen et al.] + vary CNN weight initializations = +4.7 F-1

99% confident that ensemble will beat baseline 98% of time

Similar results on SemEval Twitter sentiment task

Full details: "Improving Hate Speech Detection with Deep Learning Ensembles" In LREC Proceedings 2018

Lessons Learned

Identifying best features is difficult

Wasseem/Hovy used time consuming feature engineering [e.g. gender]

They say what features are most important!*

Not so easy when taking the magical mystery tour of deep learning

*possibly important for GDPR

Reproducibility is difficult

Why do I pull out my hair?

Researchers rarely provide enough details!!! [Fuhr 2017]

Defining hate is difficult

Facebook

- An **attack**, such as a degrading generalization or slur.
- Targeting a "**protected category**" of people, including one based on sex, race, ethnicity, religious affiliation, national origin, sexual orientation, gender identity, and serious disability or disease.

Waseem/Hovy 2016

1. uses a sexist or racial slur.
2. attacks a minority.
3. seeks to silence a minority.
4. criticizes a minority (without a well founded argument).
5. promotes, but does not directly use, hate speech or violent crime.
6. criticizes a minority and uses a straw man argument.
7. blatantly misrepresents truth or seeks to distort views on a minority with unfounded claims.
8. shows support of problematic hash tags. E.g. "#BanIslam", "#whoriental", "#whitegenocide"
9. negatively stereotypes a minority.
10. defends xenophobia or sexism.
11. contains a screen name that is offensive, as per the previous criteria, the tweet is ambiguous (at best), and the tweet is on a topic that satisfies any of the above criteria.

Annotation is difficult

"White men are assholes."

Would this statement meet Facebook's criteria for hate speech?

"White men are assholes."

Would this statement meet Facebook's criteria for hate speech?

YES

"I'll never trust a Muslim immigrant… they're all thieves and robbers."

Would this statement meet Facebook's criteria for hate speech?

"I'll never trust a Muslim immigrant... they're all thieves and robbers."

Would this statement meet Facebook's criteria for hate speech?

NO

"I'll never trust a Muslim immigrant... they're all thieves and robbers."

Would this statement meet Facebook's criteria for hate speech?

NO
WTF !?!?

To see explanations and full quiz...

Search for: "new york times facebook hate speech quiz"
https://www.nytimes.com/interactive/2017/10/13/technology/facebook-hate-speech-quiz.html

To better understand the difficulties...

Read: "Measuring the reliability of hate speech annotations: The case of the European refugee crisis" [Ross et al. 2017]

Evaluation is difficult

Waseem and Hovy 2016 performed 10-fold cross validation and reported F-1 measure

So what's the problem?

Waseem and Hovy 2016 performed 10-fold cross validation and reported F-1 measure

So what's the problem?

Researchers compare results with different evaluation methods (or even worse different data)

Are their claims actually better?

Some Suggestions for Researchers

Publish significance of findings [Sakai 2016, Fuhr 2017]

Include all details of your neural network configurations [Fuhr 2017]

Make your code available

Hate Speech: discuss and agree upon evaluation and annotation methods

That said, hate speech is just one possible concern...

Additional Problems

Additional Problems

Misleading headlines

Advertisement

Opinion piece

nhs funding

All   News   Images   Videos   Shopping   More   Settings   Tools

About 102,000,000 results (0.49 seconds)

Top stories

NHS proposes to stop funding 17 "unnecessary" procedures

The BMJ
3 days ago

Fuel and alcohol duty freeze to be lifted to help fund NHS boost

Sky News
2 days ago

How should the NHS be funded to ensure its survival?

Sky News
1 day ago

→ More for nhs funding

Additional Problems

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Opinion piece

14 Trackers

13 Trackers

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Nudging and Boosting:
Possible approaches

Nudge vs Boost

Nudges apply **libertarian paternalism** for desired outcomes (Thaler and Sunstein 2008)

      Example: Default in UK is contribution to pension

      Key points: Low cost but problem addressed returns after removal of Nudge

Nudge vs Boost

Nudges apply **libertarian paternalism** for desired outcomes (Thaler and Sunstein 2008)

    Example: Default in UK is contribution to pension

    Key points: Low cost but problem addressed returns after removal of Nudge

Boosts foster competencies to produce desirable outcomes (Grüne-Yanoff & Hertwig, 2016)

    Example: Your current pension contribution → No trips abroad during retirement

        Increase your pension by X → 2 trips abroad per year during retirement

    Key Points: High cost but competencies remain after removal of Boost

Nudges and Boosts in IR

A **study comparing the fat content** performed in which subjects were found to prefer the fattier recipe; users could be **nudged** towards healthier options. (Elsweiler et al. SIGIR 2017)

Information nutrition label is proposed (Fuhr et al. SIGIR Forum 2017)

Mock search engine (SERP) to **understand biases** (Novin et al. CHIIR 2017)

Dashboard to **educate users** about **"expert" search behavior** (Batemen et al. SIGCHI 2012)

Research Assumptions

It is in the interest of society and the individual to:

- **Minimize consumption of misleading information**

- Allow for **exposure to multiple perspectives**

- **Maximise our personal privacy**

Research Questions

1. To what extent is user [**cognitive load increased / satisfaction decreased**] when presented a **nudge or boost**?

2. To what extent do user behaviors change (e.g. decisions) when presented a **nudge or boost**?

3. To what extent would users choose alternative presentations (e.g. filtering) of information in order to address their biases when presented a **nudge or boost**?

4. To what extent **does personality type play a role** in users' acceptance of the proposed **nudge or boost**?

Mock SERP Nudges and Boosts

Nudge Example 1 (Stoplights)

climate change 🔍

Advanced Example: hello world not:earth start:01/09/2015 end:30/09/2015

10505 results returned.

Your information consumption relative to your peers and friends

S ubjective

Explain these colors

Green = Mostly Objective.
Yellow = A mix.
Red = Mostly Subjective!

Climate change news
Antinuclear
Brazil and Germany take lead in tackling climate change. Brazil and Germany, the two largest national economies within their respective continents, are taking the lead in tackling climate change through outstanding policies and bilateral relations, according to experts. http://www.dailyclimate.org/t...

S

Climate change consensus extends beyond climate scientists
EnvironmentGuru.com
About EnvironmentGuru EnvironmentGuru.com is the largest online Social Network that offers a place for environmental professionals around the world to collaborate, find, and distribute environmental information. Collaboration for the future from social, news, universities, government agencies, and...

S

Energy & climate change (0)
Confederation of British Industry
The latest on engagements with local political representatives - and the chance for members to input into draft responses. Find out the latest on new employment bill, employment tribunal reform, review of further education, DETI's Strategic Energy Framework......

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Mock SERP Nudges and Boosts

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Ⓢ

Nudge Example 2 (Filtering)

climate change 🔍

Advanced Example: hello world not:earth start:01/09/2015 end:30/09/2015

6748 results returned.

Climate change consensus extends beyond climate scientists
EnvironmentGuru.com
About EnvironmentGuru EnvironmentGuru.com is the largest online Social Network that offers a place for environmental professionals around the world to collaborate, find, and distribute environmental information. Collaboration for the future from social, news, universities, government agencies, and...

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Climate Change Truth (Cartoon)
John Hawkins' Right Wing News
Climate Change Truth (Cartoon) 25 Sep, 2015 by A.F. Branco Print this article Font size -16+ Email http://comicallyincorrect.com/2015/09/24/climate-change-truth/ Also see... The Liberal Vision For The Poor Vs. The Conservative Vision For The PoorApr 21, 2015 | By John Hawkins When liberals look at t...

California's climate change revolt

Mock SERP Nudges and Boosts

Boost Example (Conceptual)

Color bar with <u>absolute</u> counts

Highlight concerning language

Educational tool tip

<u>Transparent explanation of</u> subjectivity score

climate change 🔍

Advanced Example: hello world not:earth start:01/09/2015 end:30/09/2015

10505 results returned.

Total subjective results read today:

Subjective

Learn more

You have set your personal limit to 5 highly subjective articles.

The more subjective articles you read, the more likely you will be misled.

We have highlighted sentences that our model identifies as likely to be subjective.

Yellow = 5+ highly subjective articles consumed

Red = >8 highly subjective articles consumed
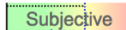
Climate change news
Antinuclear
Brazil and Germany take lead in tackling climate change. Brazil and Germany, the two largest national economies within their respective continents, are taking the lead in tackling climate change through outstanding policies and bilateral relations, according to experts. http://www.dailyclimate.org/t...

Likelihood result is: Subjective

Climate change consensus extends beyond climate scientists
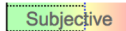EnvironmentGuru.com
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Likelihood result is: Subjective

Climate Change Truth (Cartoon)
John Hawkins' Right Wing News

Data Collection

User decisions collected for **search tasks** → More about this soon

User surveys to understand concerns and personalities

Click information to understand **user search behavior**

Cognitive load measures, such as time to complete task (Kelly et al. ITCIR 2015)

Additional questionnaires for development of new measures → And to guide future work

Study 1: Comparing Nudges

Study type: <u>Within group</u> using graeco latin squares on interfaces and topics

Goal: Determine most **effective** (precision / recall) and **efficient** (cost in time) **Nudge**

Comparison: 4 interfaces: Nudge free interface + 3 interfaces with varying Nudge

Tasks, evaluation data and recruitment: Adapt (Pogacar et al. ITCIR 2017)

| Baseline SERP (No Nudge) | SERP (Nudge 1) | SERP (Nudge 2) | SERP (Nudge 3) |
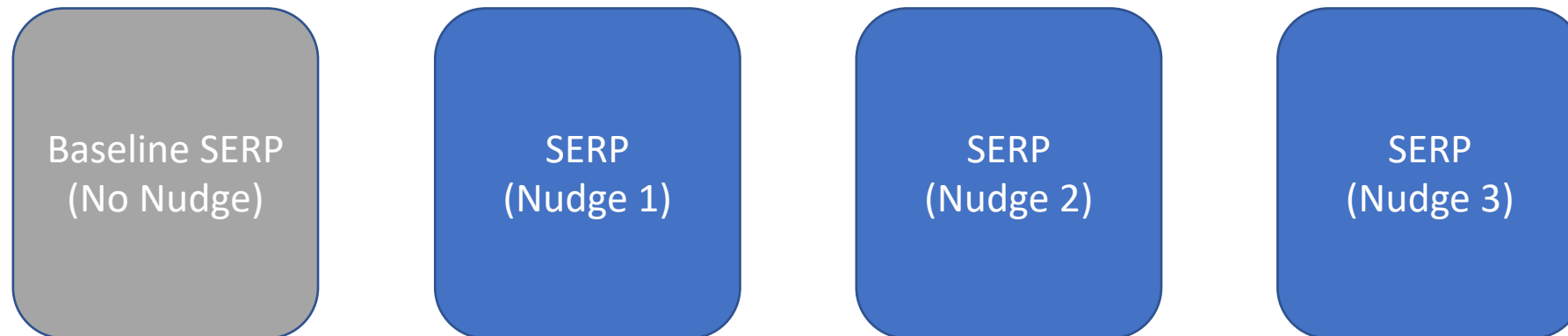
Study 2: Comparing Boost

Study type: <u>Within group</u> using graeco latin squares on interfaces and topics

Goal: Determine most **effective** (precision / recall) and **satisfying** (user preference) **Boost**

Comparison: 4 interfaces: Boost free interface + 3 interfaces with varying Boost

Tasks, evaluation data and recruitment: Adapt (Pogacar et al. ITCIR 2017)

| Baseline SERP (No Boost) | SERP (Boost 1) | SERP (Boost 2) | SERP (Boost 3) |

Study 3: Comparing Boosts and Nudges

Study type: <u>Between and within group</u> using latin squares on topics

Goal: Compare chosen **Boost** and **Nudge** approaches. Upon removal of these, **Group A** is expected to **consume significantly more subjective material** than **Group B**

Tasks: 6 total → 5 tasks for manipulated interface + 1 task for normal interface

Tasks, evaluation data and recruitment: Adapt (Pogacar et al. ITCIR 2017)
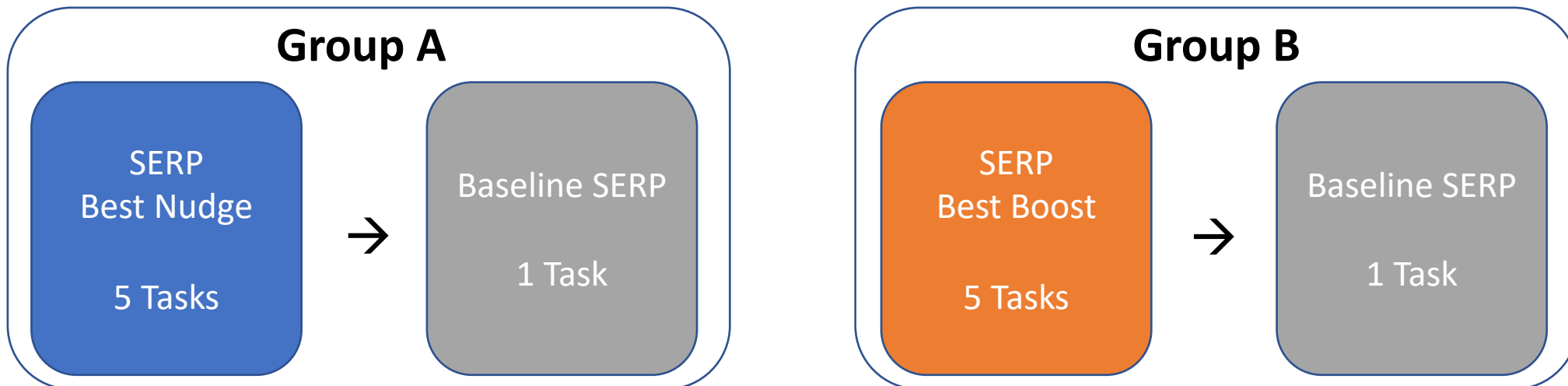
Nudging Towards Privacy
Early Findings

Why Privacy?

Privacy is a fundamental research area of the HRBDT project

Approaches to address privacy concerns (either through regulation or personal choice) have the **potential to change** an individuals **encounters with information**

Encounters with **different information** may lead to **different decisions**

Different decisions have **different consequences**

Therefore, **we better understand the potential impacts** of any approach

Measuring Privacy Threats

We used **3rd party tracking** metrics (from Ghostery) as the proxy for privacy concerns

3rd Party Tracking, is only one area of privacy concern, having **many plausible threats**

Example: HIV test at Mayo Clinic → Google Analytics is one of several sites collecting data

Plausible Threats:
- Advertising → Your house mate gets an ad for HIV testing because of same IP
- Insurance coverage decisions → Decline coverage because company sold your data
- Social Scoring like China? → If you haven't heard of this, have a look at "Big data meets Big Brother as China moves to rate its citizens"(Wired October 2017, R. Botsman)

Methods

User decisions collected for **health tasks** (Pogacar et al. ITCIR 2017)

Participants given **10 medical search tasks** to determine effectiveness of treatments

Cochrane Medical Reviews are used as **the gold standard** (White and Hassan 2014)

Using Graeco-Latin Square design assign 2 medical questions to different search interfaces

Search Task

Is a particular medical treatment "**Helpful**", "**Not Helpful**" or "**Inconclusive**".

Example: Is Echinacea effective at treating colds?

Users have access to **a static corpus** (Podacar et al. 2017) → Which **we expanded**

Participants do not have to **enter a query**, they are **asked to "imagine" they are searching for results** to make the decision.

Making a Decision

Experiment progress: ▮▮▮▯▯▯▯▯▯▯

MEDICAL QUESTION 1: Does traction help low back pain?
HEALTH ISSUE: back pain – The spine is a column of bones (vertebrae) held together by muscles, tendons and ligaments and cushioned by shock–absorbing disks. A problem in any part of your spine can cause back pain. *Source: Mayo Clinic*
TREATMENT: traction – a pulling force exerted on a skeletal structure (as in a fracture) by means of a special device *Source: Merriam–Webster*

Decision Definitions:

helpful: The medical treatment **helps** if the treatment is effective and has a direct positive influence on the specified illness.

inconclusive: The effectiveness of a medical treatment is **inconclusive** if medical professionals are still unsure if the treatment will have a positive, negative or no influence on the specified illness.

does not help: The medical treatment **does not help** if the treatment is ineffective and either has no effect or has a direct negative influence on the specified illness.

Please make your decision about this treatment

Helpful   Inconclusive   Does not Help

Baseline SERP

MEDICAL QUESTION 1: Does traction help low back pain?

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You can click on links below

Make Decision

helpful: The medical treatment **helps** if the treatment is effective and has a direct positive influence on the specified illness.
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does not help: The medical treatment **does not help** if the treatment is ineffective and either has no effect or has a direct negative influence on the specified illness.

24 results returned.

Lumbar Traction Offers No Benefit for Back Pain
https://www.verywellhealth.com/
Does Traction Really Work for Low Back Pain? A study confirms that using lumbar traction with exercise for low back pain does not offer improved outcomes when compared to physical therapy exercises alone.

Does Spinal Decompression Really Work in Treating Low Back Pain?
https://www.verywellhealth.com/
A Questionable Treatment Spinal decompression may help treat low back pain, but this popular treatment isn't a sure thing. Advertising for spinal decompression targets people with degenerative disc disease, bulging discs, herniated discs, or spinal stenosis.

Traction Therapy for Chronic Low Back Pain
http://www.barclayphysicaltherapy.com/
The cost of health care is rising every year in the United States. And part of that economic burden is the management of chronic low back pain (CLBP).

Traction for Low Back Pain With or Without Sciatica: An Updated Systematic Review Within the Framework of the Cochrane Collaboration
https://www.researchgate.net/
Systematic review. To determine if traction is more effective than reference treatments, placebo/sham traction, or no treatment for low back pain (LBP).

Filtering for Privacy

MEDICAL QUESTION 2: Does traction help low back pain?

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13 results returned.

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Low back pain
http://www.ebm-guidelines.com/
Sufficient time for the survey of the history and for the physical examination of the patient Early recognition of serious causes of back pain and of nerve root compression

TRACTION ("SPINAL DECOMPRESSION THERAPY") DOESN'T HELP LOWER BACK PAIN
http://torontophysiotherapy.ca/
The latest available clinical data does not support the use of traction (either manual traction or machine-based "non-surgical spinal decompression therapy") for treating patients with lower back pain with or without sciatica, other than for providing temporary pain relief. Lower back pain is a major source of disability, work absenteeism and health care expenditure worldwide.

Spinal Traction Treatment - Back Pain Relief Therapy
https://avazo.com/
Back traction is a form of non-invasive spinal discs decompression therapy that relieves pressure on the spine. Nonsurgical spinal decompression can be performed manually or mechanically.

Re-ranking for Privacy

MEDICAL QUESTION 2: Does traction help low back pain?

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You can click on links below

[Make Decision]

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Low back pain
http://www.ebm-guidelines.com/
Sufficient time for the survey of the history and for the physical examination of the patient Early recognition of serious causes of back pain and of nerve root compression

Spinal Decompression Traction Therapy
http://www.hopkinsclinic.com/
Do you suffer with low back pain, neck pain or carpal tunnel? Have you been told you need neck or back surgery?

Traction for Disc-Related Lower Back Pain
http://www.portobellophysio.ie/
Patients with disc- related lower back pain are usually very uncomfortable; frequently have sleep disorders and sometimes even depression as a result of their pain. Pain management techniques vary from medication to bed rest; physiotherapy to spinal surgery - but one of the most effective and non-invasive ways to address disc related lower back pain is traction, available at Portobello Physiotherapy Clinic.

Patient education: Low back pain in adults (Beyond the Basics)
https://www.uptodate.com/
All topics are updated as new evidence becomes available and our peer review process is complete. Literature review current through: Aug 2018.

Stoplights for Privacy

MEDICAL QUESTION 2: Does traction help low back pain?

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TREATMENT: traction - a pulling force exerted on a skeletal structure (as in a fracture) by means of a special device *Source: Merriam-Webster*

You can click on links below

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does not help: The medical treatment **does not help** if the treatment is ineffective and either has no effect or has a direct negative influence on the specified illness.

P Explain this

> Privacy risk where
> Red = High privacy risk
> Yellow = Medium privacy risk
> Green = Low privacy risk

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Early Findings – Decisions

Correct decision = participant made decision that matches Cochrane findings

Harmful decision = participant making decision that is opposite of Cochrane findings (e.g. Chooses **helpful** when the correct answer is **not helpful**

Independent Variables	Correct	Harmful
Baseline SERP	0.59	0.06
Privacy Nudge - Ranking SERP	0.59	0.15
Privacy Nudge - Stoplight SERP	0.54	0.11
Privacy Nudge - Filtering SERP	0.48**	0.14**
Control	0.41	0.20

Analysis: Logistic Regression where ** = $\chi^2 \ll .01$

Early Findings – Privacy

Average # of 3rd Party Trackers based on total trackers at sites for which participants clicked on

Independent Variables	Average # 3rd Party Trackers Encountered	Lower 95%	Upper 95%
Baseline SERP	6.81	5.50	8.12
Filtering SERP	1.89**	1.56	2.23
Ranking SERP	1.95**	1.47	2.44
Stoplight SERP	5.13	4.15	6.10

Analysis: ANOVA where ** = **p < .05**

Early Findings – Cognitive Impacts

Total time to complete task in seconds, is used as cognitive measure

Independent Variables	Total time (Seconds)	Delta w/ Baseline
Baseline SERP	119	N/A
Filtering SERP	102	- 17
Ranking SERP	124	+ 5
Stoplight SERP	137	+ 18

Analysis: ANOVA, however no significant differences were found

Key Messages - Filtering

Filtering is an approach that is

+ Very effective at reducing privacy impacts

- Very detrimental to good decision making

- Participants do not like this approach

Key Messages - Stoplight

Stoplights are an approach that is

\+ Most preferred by participants

? Changes to good decision making

\- Possibility of negative cognitive effects

Key Messages – Re-ranking

Re-ranking is an approach that is

+ Very effective at reducing privacy impacts

+ Has limited impacts on good decision making

- Least preferred approach by participants

Comments

- Nudging appears to be effective in reducing 3rd party privacy impacts while maintaining good decision making for re-ranking approach

- We want to look into Stoplights and Re-ranking further before choosing approach to move forward with our research

- Filtering does not look to be a viable approach

Thank You