

Biases in Information Behaviour: Making (better) online choices

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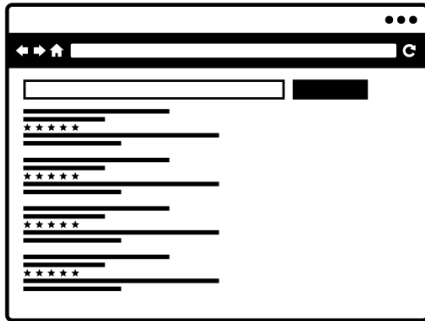
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Decision Making in Two Contexts

- ▶ Decisions relating to search results



- ▶ Choosing online recipes



Three main claims

Online decisions are subject to many biases

The biases are context-dependent

If you understand biases in play they can be avoided or exploited to promote desired behaviours

Why study bias in search?

- ▶ Evidence in the literature that people (especially those with little knowledge or no strong opinion) will end up thinking that what they find when searching [Epstein2015; Pogacar,2017; Allam, 2014; Draws, 2021]
- ▶ Mostly users are unaware of this [Ghenai, 2020]



what does it mean to have a really bad headache?



All Images Videos Shopping News More Tools

About 286.000.000 results (0,81 seconds)

In some cases, headaches can result from a blow to the head or, rarely, a sign of a more serious medical problem. Stress. Emotional stress and depression as well as alcohol use, skipping meals, changes in sleep patterns, and taking too much medication. Other causes include neck or back strain due to poor posture. 14 Sept 2022

<https://www.webmd.com> > ... > Reference

[Headaches - Types, Causes, Symptoms, Diagnosis, Treatment](#)

About featured snippets Feedback

People also ask

When should you be concerned about a headache?

Can headaches mean something serious?

What should I do if I have a severe headache?

How long is too long for a headache?

Feedback

<https://www.nhs.uk> > conditions > headaches

Search results can be biased in numerous ways

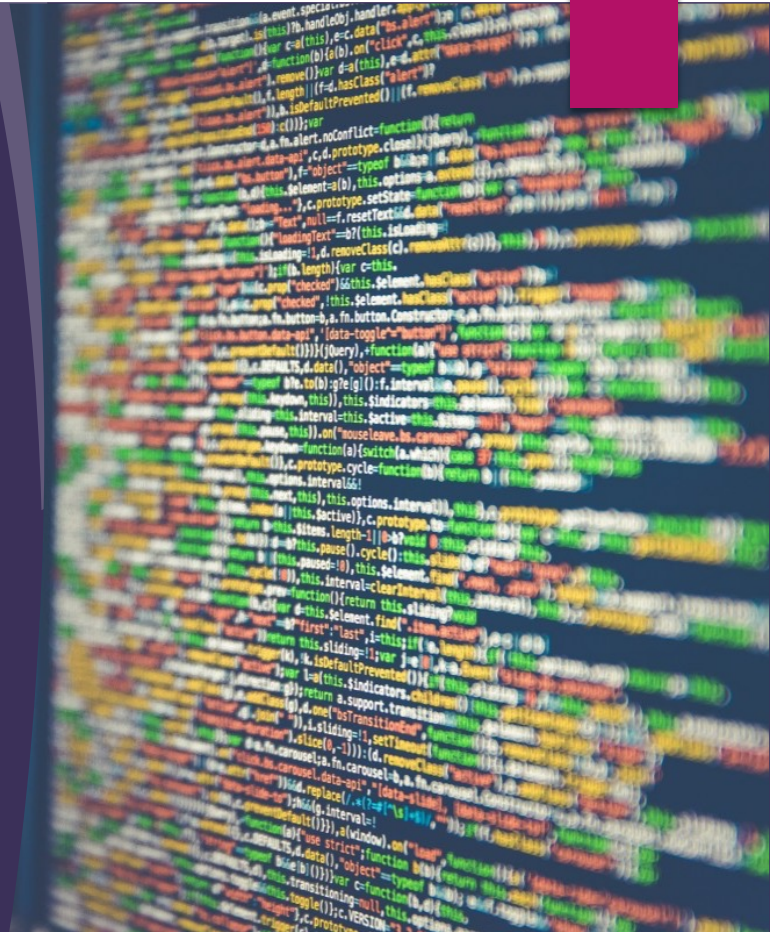
... in favour of particular viewpoints

[Puschmann 2019; White, 2013]

... towards groups of people

[Otterbacher, 2017]

... certain subtopics [Gao, 2020]



User
behaviour is
biased too

- ▶ Position bias [Joachims, 2007]
- ▶ Majority viewpoint [Draws, 2021]
- ▶ Anchoring [Bates, 1989; Shokouhi, 2015]
- ▶ Confirmation Bias [Klayman, 1987; Nickerson, 1998; Rieger, 2021]

Effects of Confirmation Bias on Credibility Judgements



- ▶ “is a tendency to search for or interpret information in a way that confirms one’s preconceptions”
- ▶ 105 participants judged credibility of 8 search results for 3 controversial topics
 - ▶ Is a vegan diet healthy?
 - ▶ Are autonomous vehicles safe?
 - ▶ Should cannabis be legalised?
- ▶ Experiment designed to identify biases
 - ▶ Confirmation Bias
 - ▶ Knowledge Bias

Kattenbeck, M., & Elweiler, D. (2019). Understanding credibility judgements for web search snippets. *Aslib Journal of Information Management*.

Bias in judgements

Vegane Ernährung - Bessere Haut, bessere Figur, bessere Laune ...

www.sueddeutsche.de › Wissen ▼

06.03.2014 - Die vegane Ernährung gibt mir die Möglichkeit zurück, jederzeit so viel zu ... Vorteile bringt - was ist dann das größte Hindernis für eine vegane ...

Im Gespräch: Antje Gahl: „Wir empfehlen vegane Ernährung nicht“ - FAZ

www.faz.net › Rhein-Main ▼

23.01.2013 - In Frankfurt hat nun ein Laden für Veganer eröffnet. Im Gespräch äußert sich Antje Gahl von der Deutschen Gesellschaft für Ernährung über...

Hey Veganer, eure Ersatzprodukte sind chemisch und ungesund ...

der-artgenosse.de/hey-veganer-eure-ersatzprodukte-sind-chemisch-und-ungesund/ ▼

Vegane Fleischersatzprodukte aus dem Chemiebaukasten sind chemisch und voller Chemie! Außerdem: Chemie! PUR!

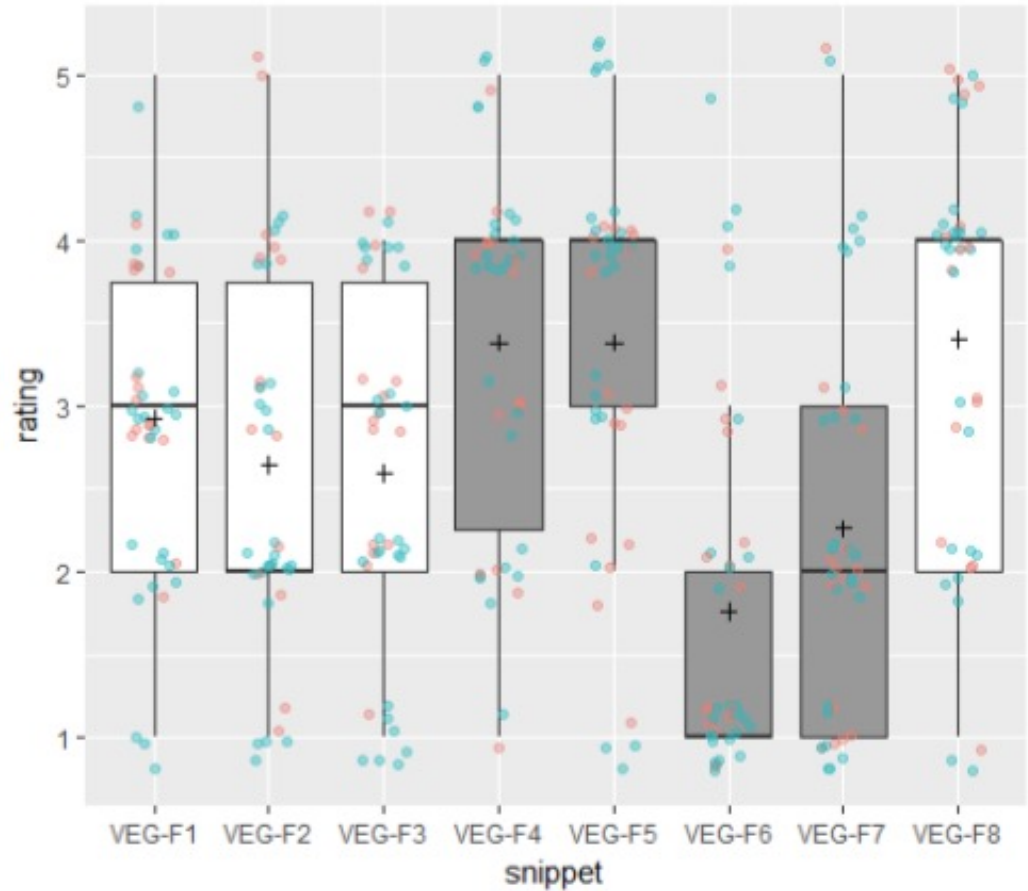
Ernährung: Veganer bringen ihr Herz in Gefahr - WELT

<https://www.welt.de> › Gesundheit ▼

07.07.2011 - Wer in der Ernährung auf alle tierischen Produkte verzichtet, dem ... mit ihren vegetarischen Aktionen bloß von ihren ungesunden Burgern ...

Bias in judgements

- ▶ White: web page judged to be credible by objective judges
- ▶ Black: web page judged to be non-credible by objective judges
- ▶ Blue: participant believes vegan diet to be healthy (before experiment)
- ▶ Pink: participant believes vegan diet to be unhealthy



Qualitative Analysis

- ▶ Employed a think-aloud protocol
- ▶ Transcribed the audio recordings and analysed the data qualitatively.



- ▶ We identified 10 high-level categories of cues that biased judgements
- ▶ Same cue can have different influence

Domain

The image features a central illustration of a hand in a dark suit sleeve pointing towards a computer monitor. The monitor displays a website layout with a yellow and red header and several lines of text. Surrounding the monitor are various icons: a cloud, a magnifying glass, a speech bubble containing code, a smartphone, and several gears of different sizes. The background is a solid dark teal color.

“ **SZ** that is Süddeutsche Zeitung, listings relating to the Süddeutsche will always have a credibility bonus for me.

(111, CAN_sueddeutsche)”

“ **FAZ** now we have the FAZ again. That page is ok. I know it.

(114, VEG_faz)”

“ **n-tv** ntv is basically trustworthy.

(114, CAN_ntv)”



Domain
(positive)

“ **part. 114** and then you have the classical welt.de that is exactly like FAZ or very well known.

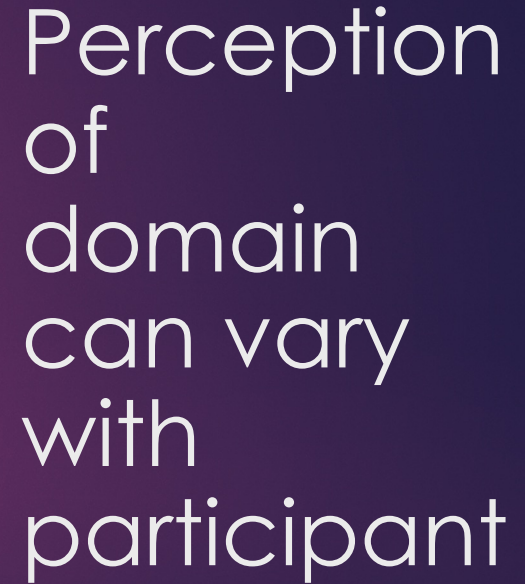
(114, VEG_welt) ”

“ **part. 112** so welt.de, as far as I know, that belongs to “Bildzeitung” (tabloid newspaper), so I would view that as rather non-credible.

(111, VEG_welt) ”

“ **part. 115** yeah, the orientation, die Welt, is rather a conservative paper and therefore the view on veganism can be problematic.

(115, VEG_welt) ”



Perception
of
domain
can vary
with
participant

“ **part. 112** Then kath.net, I find that very I mean well, catholic site, I know that coincidentally, that it is a larger site for Catholics. I would click on that because I assume that it has to do with ethical discussions and questions.

(112, AV_kath) ”

“ **part. 113** because of ethics. because if I think about this topic and I want to get to grips with autonomous vehicles then ethics would be a question that I would want to consider.

(113, AV_kath) ”



Domain
(context
sensitive)

“ “Better skin, better figure, better mood”, that seems as if only positive things are described and absolutely nothing negative or any comparison drawn. It seems that only positive aspects are mentioned and not the disadvantages or consequences that these can have. Not everyone who is vegan nourishes themselves appropriately and that can have consequences for their health.

(108, VEG_sueddeutsche)”



Down-
weighting
credible
sources

Key Points from study 1

- ▶ Credibility judgements biased by different factors
- ▶ Biases vary across users + situations

Impact of biases on Search Outcomes

- ▶ Investigated the influence of (biased) featured snippets in opinion forming search tasks
- ▶ Does the stance and logic of argumentation of the snippet influence:
 - ▶ the opinion participants form?
 - ▶ the way they argue for them?



Bink, M., Schwarz, S., Draws, T., & Elsweller, D. (2023). Investigating the Influence of Featured Snippets on User Attitudes. In ACM SIGIR Conference on Human Information Interaction and Retrieval

Search

Should students wear school uniform?

The study by Family Kids and Youth revealed fascinating insights into how **uniform helps to reduce children's anxiety about their appearance and fitting in with their peers**, as one Year Nine student told the researchers: "With uniform, you can't be judged. Without uniform, everyone would be competing about what the style is, what the trend is, what you need to wear. I think there'd be more bullying as well and it would be more stress in the morning."

<https://schoolwearassociation.co.uk> › [highlighting-uniforms-contribution-to-childrens-wellbeing](#)

Highlighting Uniforms contribution to children's wellbeing

[?](#) About featured snippets [Feedback](#)

<https://www.theguardian.com> › [commentisfree](#) › 2020 › sep

Britain's obsession with school uniform reinforces social ...

But **uniforms** prevent bullying, we are told – though for every study claiming this, there is another that concludes that **school uniforms** have no direct negative effect on behaviour, and some have ...

<https://www.counselling-directory.org.uk> › [blog](#) › 2018 › 09

[How school uniforms impact mental health - Counselling ...](#)

Featured Snippet

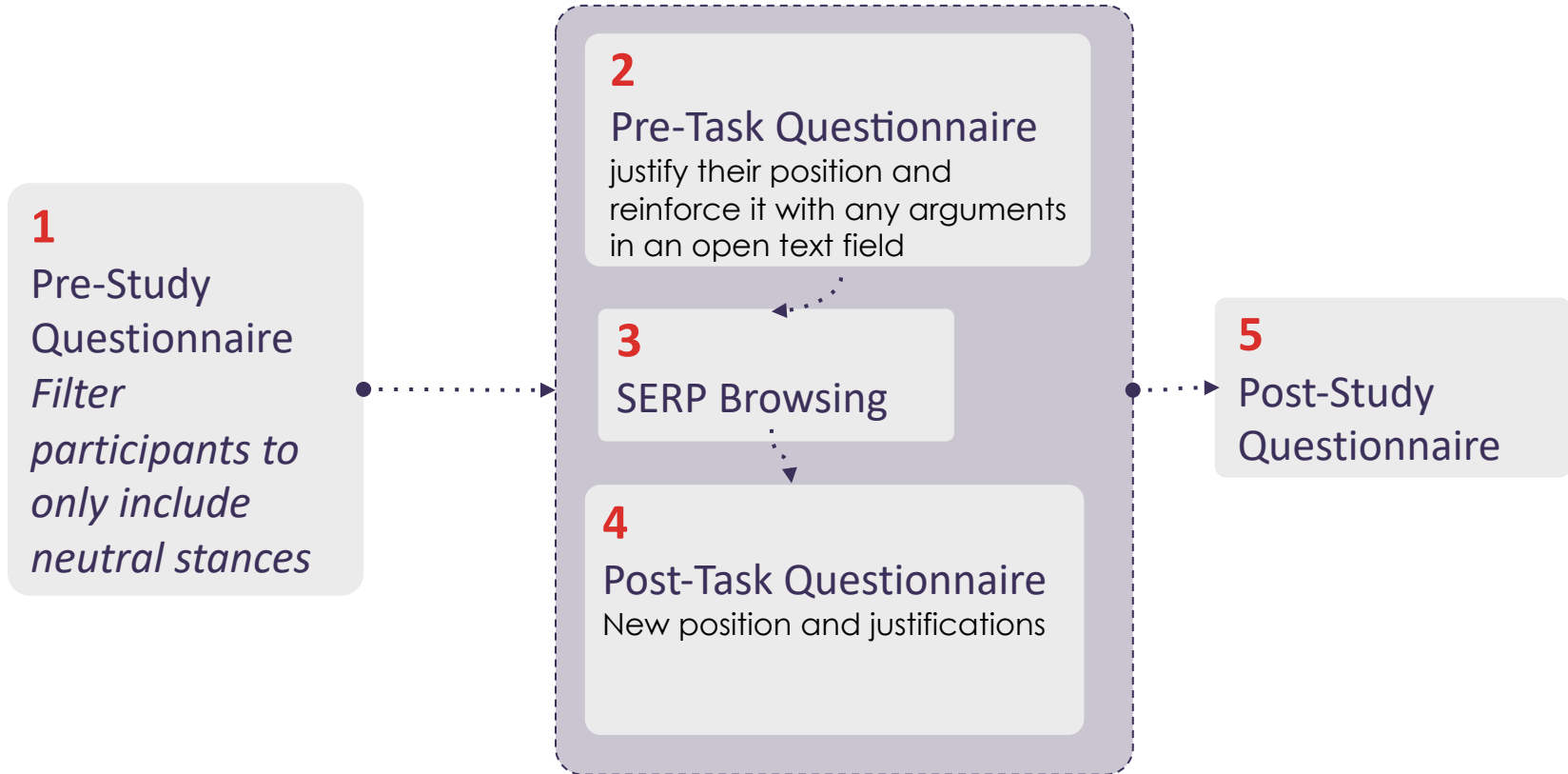
Rest of the
Search Results

Experimental Conditions

Table 1. Featured Snippet variations that were used in the study. Each topic has featured snippets that are either in favor or against as well as incorporate different logics that are present in the featured snippets' answer.

Topic	Stance	Logic	FS Excerpt
Intellectual Property Rights	In favor	economic	Intellectual property (IP) contributes enormously...
Intellectual Property Rights	In favor	civic	Intellectual property is important to our daily lives...
Intellectual Property Rights	Against	moral	This is why around 100 countries, led by India and...
Intellectual Property Rights	Against	economic	Open and non-exclusive licensing unleashes the...
School Uniforms	In favor	popular	The study by Family Kids and Youth revealed...
School Uniforms	In favor	inspired	There's a number of reasons why most schools...
School Uniforms	Against	moral	Uniform policies reinforce gender and racial...
School Uniforms	Against	inspired	Picking out my own clothes and being free to...
Obesity	In favor	functional	Calling obesity what it is, "a disease," can help direct...
Obesity	In favor	ecological	Which brings me to the second point: Once...
Obesity	Against	civic	"We cannot say just because you are obese you ...
Obesity	Against	inspired	Doctors should be required to tell patients a blunt...

Procedure



Participants

- ▶ 256 participants from the Prolific platform (reduced to 182 after we removed people who only had strong views).
- ▶ 69 female, 113 male
- ▶ 18-66 years old ($M = 28.91$, $SD = 9.10$)
- ▶ Majority highly educated (80 hold Bachelor, 38 Master, 1 PhD degree)

RESULTS: SIGNIFICANT EFFECTS FOR BOTH STANCE + LOGIC

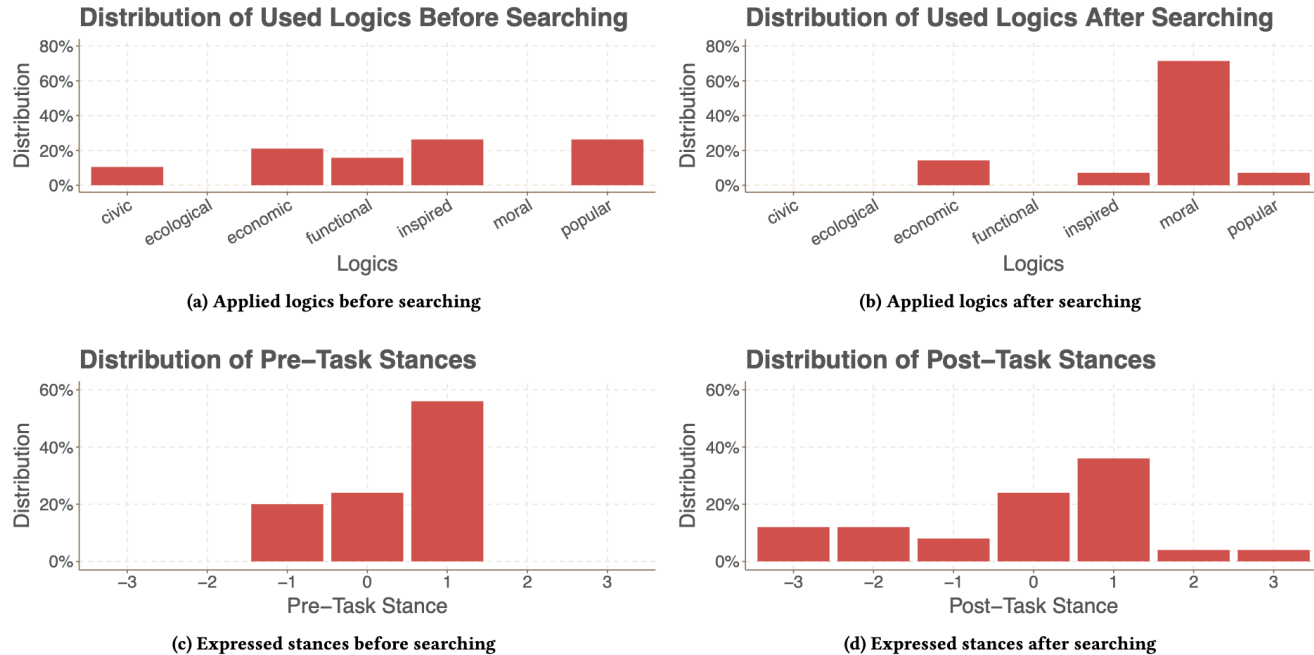



Figure 4: Distribution of logics and stances before and after participants were exposed to a SERP showing a featured snippet containing a moral logic that is against the presented topics (Intellectual Property Rights and School Uniforms, see Table 1).

Key Points



- ▶ Decisions relating to web search are influenced by several factors (biases)
- ▶ Biases vary across users + situations
- ▶ Presentation matters



So how can we help
people make better
decisions ?

1 DO A GOOD JOB ON FEATURED SNIPPETS.

IF THERE IS A CORRECT ANSWER SHOW IT IN THE FEATURED SNIPPET.

- IF NOT, MAKE SURE THE FEATURED SNIPPET IS BALANCED

2.

PROVIDE INFORMATION TO CONTROL BIASES

NUDGE PARTICIPANTS TO USE THE CUES THAT WILL LEAD TO DECISIONS THAT REFLECT THE GROUND TRUTH (CREDIBILITY)

[Alzheimers Disease Genetics - WebMD](#)

Information on Alzheimers disease and the genetic link. ... Will you ever get Alzheimer's disease? Genetics may have the answer. The genes you've inherited carry most of the risk ...

<http://www.webmd.com/alzheimers/guide/20061101/who-gets-alzheimers-genes-hold-key>



Schwarz +
Morris (2011)

Figure 2. Search result augmented with our visualization.

2.

PROVIDE INFORMATION TO CONTROL BIASES

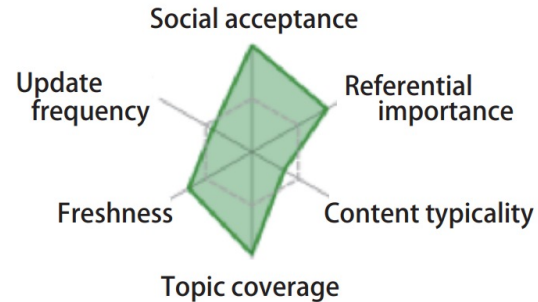
NUDGE PARTICIPANTS TO USE THE CUES THAT WILL LEAD TO DECISIONS THAT REFLECT THE GROUNDTRUTH (CREDIBILITY)



[Ménière's disease - Wikipedia, the free encyclopedia](#)

The antiherpes virus drug acyclovir has also been used with some success to treat **Ménière's Disease**. The likelihood of the effectiveness of the **treatment** was found to decrease with increasing duration of the disease, probably because ...

[en.wikipedia.org/wiki/Ménière's_disease](#) - [Cached](#) - [Similar](#)



Yamamoto +
Tanaka (2011)

WE HAVEN'T BEEN ABLE TO RECREATE EFFECT

CrediScore



<https://www.medicinenet.com/acetaminophen/article.htm>

acetaminophen (Tylenol) Side Effects (Liver Toxicity) and Dosage

Tylenol, Tylenol Arthritis Pain, Tylenol Ext, Little Fevers Children's Fever/Pain Reliever, Little Fevers Infant Fever/Pain Reliever, PediaCare Single Dose Acetaminophen Fever Reducer/Pain Reliever, Infants FEVERall, Acephen, Neopap, and others. What else should I know about acetaminophen?

[https://www.wikihow.com/Use-Minoxidil-\(Rogaine\)](https://www.wikihow.com/Use-Minoxidil-(Rogaine))

3 Ways to Use Minoxidil (Rogaine) - wikiHow

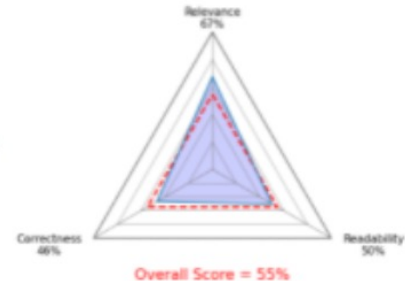
Minoxidil may be a possible solution but with several, potentially severe side effects. Rogaine is one of the brand names for the drug minoxidil, which is approved by the U.S. Food and Drug Administration (FDA) with several post launch warnings to regrow hair in men with hereditary male pattern baldness and to help hair growth in women with thinning hair with certain health warnings.



<http://www.hairlossforwomen.com/minoxidil/>

Minoxidil | Female Hair Loss Expert | Hair Loss for Women

This inspired experts to research further into its hair growth benefits as a potential solution for those suffering from hair loss. After being applied directly to the scalp, the Minoxidil solution showed excellent results, leading to the development of the topical treatments you see today.



3.

PROVIDE COMPETENCES

AUGMENT THE UX WITH INFORMATION THAT USERS CAN LEARN FROM TO MAKE BETTER DECISIONS (OUTWEIGH BIASES)

MEDICAL QUESTION 2: Does surgery help obesity?

HEALTH ISSUE: obesity - Obesity is a complex disorder involving an excessive amount of body fat. Obesity isn't just a cosmetic concern. It increases your risk of diseases and health problems, such as heart disease, diabetes and high blood pressure. *Source: Mayo Clinic*

TREATMENT: surgery - a branch of medicine concerned with diseases and conditions requiring or amenable to operative or manual procedures *Source: Merriam-Webster*

You can click on links below

10 results available.

Weight loss surgery - NHS

<https://www.nhs.uk/conditions/weight-loss-surgery>

Weight loss surgery, also called bariatric or metabolic surgery, is sometimes used as a treatment for people who are very obese. It can lead to significant weight loss and help improve many obesity-related conditions, such as type 2 diabetes or high blood pressure.

Obesity - Treatment - NHS

<https://www.nhs.uk/conditions/obesity/treatment>

Bariatric surgery is usually only available on the NHS to treat people with severe obesity who fulfil all of the following criteria: they have a BMI of 40 or more, or between 35 and 40 and another serious health condition that could be improved with weight loss, such as type 2 diabetes or high blood pressure

Obesity Disease and Surgery - PubMed Central (PMC)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590927>

Obesity is a medical disease that is increasing significantly nowadays. Worldwide obesity prevalence doubled since 1980. Obese patients are at great risk for complications with physical and psychological burdens, thus affecting their quality of life.

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.

Out of 100 websites visited for health & medical issues in a search engine:

How many out of 100:	.gov/.org websites	other websites
Benefits		
will share your data with ≤ 2 3rd party companies?	59	14
Harms		
will share your data with ≥ 8 3rd party companies?	11	33



3.

PROVIDE COMPETENCES

AUGMENT THE UX WITH INFORMATION THAT USERS CAN LEARN FROM TO MAKE BETTER DECISIONS (OUTWEIGH BIASES)



Privacy Info



Entertainment websites have more cookies and third parties per page than most other kinds of websites.



Privacy Info



Number of privacy points achieved through browser settings (average per visited site)

During the whole study duration: from 25.5.2020 to 15.6.2020



That means your browsing behavior is more private than that of 25% of other participants

During the last full day: 2.6.2020

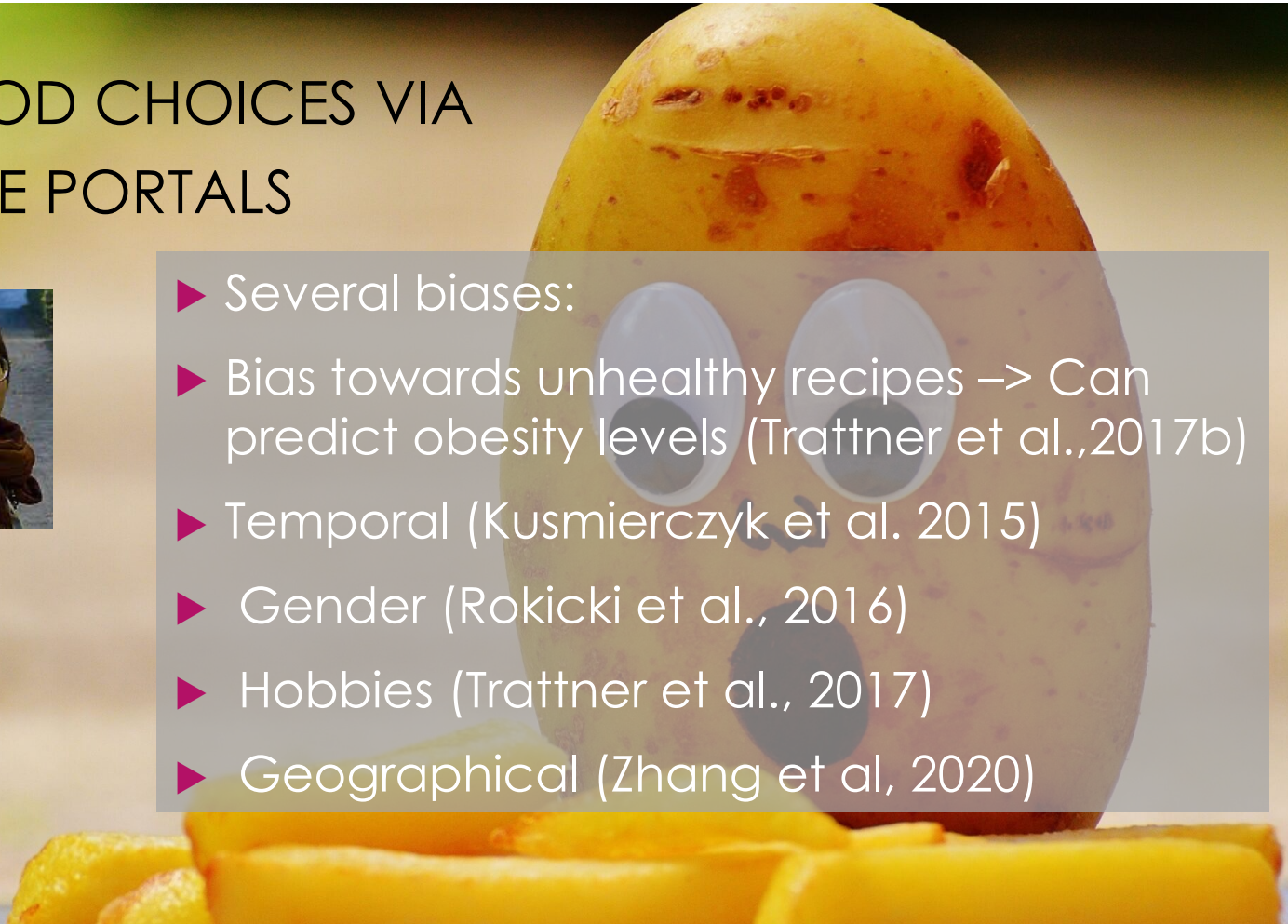


That means your browsing behavior is more private than that of 17% of other participants

STUDYING FOOD CHOICES VIA ONLINE RECIPE PORTALS



- ▶ Several biases:
- ▶ Bias towards unhealthy recipes → Can predict obesity levels (Trattner et al., 2017b)
- ▶ Temporal (Kusmierczyk et al. 2015)
- ▶ Gender (Rokicki et al., 2016)
- ▶ Hobbies (Trattner et al., 2017)
- ▶ Geographical (Zhang et al, 2020)



Honey Baked Chicken I



208 made it | 143 reviews

Easiest Oven Baked Chicken



35 made it | 110 reviews



Recipe by: MARBALET



122

"This recipe is over 27 years old. It is a classic dish and a tasty treat for your guests and you to enjoy."

Recipe by: Shirley Pope

"Delicious, moist, good-the-next-day chicken! Use as many pieces of chicken as needed. I use breasts, thighs, and legs. I have never found anyone who did not like this dish!"

Elsweiler, D., Trattner, C., & Harvey, M. (2017, August). Exploiting food choice biases for healthier recipe recommendation. In *Proceedings of the 40th international acm sigir conference on research and development in information retrieval* (pp. 575-584).

Pairwise comparison of recipe preferences

Eggplant Parmesan II



Ruth's Eggplant Caponata



WE VARIED THE INFORMATION SHOWN

Eggplant Parmesan II



- 2 tablespoons olive oil
- 1 pound Japanese or other small eggplant, cut into 1/2-inch cubes
- 1 onion, chopped
- 2 tablespoons white sugar



Ruth's Eggplant Caponata



- 3 eggplant, peeled and thinly sliced
- 2 eggs, beaten
- 4 cups Italian seasoned bread crumbs
- 1 (16 ounce) package mozzarella cheese, shredded and divided



WE HAVE ASKED DIFFERENT QUESTIONS RELATING TO PAIRS

Eggplant Parmesan II



Ruth's Eggplant Caponata



1. Which recipe they find most appealing.
2. Which recipe they believe contains most fat.
3. Which feature most informed their judgement with respect to fat content.

Take aways ...

- ▶ People are poor at judging which is fattiest (correct in 51.1% of cases, $p = 0.43$) and showed poor agreement (Kripp. $\alpha = 0.10$)
- ▶ Participants preferred fattier dishes on average (fat content one of the best predictors for choice)
- ▶ Process for estimating fat content very similar to judging credibility

Can we nudge less fatty food choices?

- ▶ Classifier with 5 low-level image features (sharpness, brightness, colorfulness, contrast and entropy) consistently predicted choices from experiments 1 and 2 (~58% acc)
- ▶ 16 new pairs (sim > 0.8, 30% difference in fat content, classifier predicts, low fat to be picked)
- ▶ The image model was able to predict the choice 65.2% of the time ($\chi^2 = 129.9$, $df = 1$, $p < 0.01$)







Key Points

- ▶ Perception of fat & attractiveness of food biased in a similar way to search results
- ▶ Emphasising some cues over others can impact decisions made

Tying up

- ▶ Decisions we make online are biased in many ways
- ▶ Similarities in decision making processes
- ▶ Different ways of influencing decisions (still have lots to learn).



THANK YOU