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Search engines beyond search: questions for a critical knowledge infrastructure

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1. The dominance of search in interfaces to knowledge infrastructures

Search engines play a powerful role in ordering knowledge and in shaping interactions with data, sources or documents. They are central to many of the interfaces to contemporary knowledge infrastructures (Beaulieu, 2026a). The current dominance of ‘search’ has been well documented and various facets (relevance, optimization, ranking, bias) have been examined and refined in sophisticated ways. But as search engines become further embedded in layered knowledge infrastructures, it is all the more important to unearth how search shapes knowledge needs and how these needs are met (Beaulieu, 2026b).

A focus on the role of search in interfaces is especially helpful to start thinking differently about infrastructures, because of cultural associations of interfaces with possibility, potential, and dynamic realisation (Whitelaw, 2015)(Andrews & van Zundert, 2018). Many of us (especially in scholarly contexts) come to interfaces with the expectations that they are a site for activity. In contrast, infrastructures tend to fall into the background, to be experienced as neutral enablers. While there are very different takes on what it means to interact with an interface, there is an important contrast between how we experience interfaces and how we tend to experience infrastructures – as invisible, stable, monolithic, just ‘there’, consistently or intermittently. We feel much more engaged by interfaces, and experience our encounters as active and normative, often judging them as user-friendly or not. We are also increasingly becoming aware that interfaces read us, gathering data about our search terms, patterns, and even rhythms (Beaulieu & Leonelli, 2021), and profile us as users. This contrast is one of the elements that makes interfaces productive in rethinking knowledge for liveable futures. Interfaces and how they make search prominent can be rethought, so that changes can be made to how infrastructures constitutes routines, subjects and relations (Jensen & Morita, 2015; Povinelli, 2016).

2. Questioning assumptions about search

In this contribution, I want to share a number of questions to explore important assumptions of search engines: It is possible to imagine other functions for search engines, besides supporting retrieval? When is search good enough and how do we know what it is good for (Windhager et al., 2018)? What is a query (Katsogiannis-Meimarakis et al., 2023; Wang et al., 2023), besides a suitable search term? Can a search engine succeed otherwise than through best match? Can assumptions be foregrounded so that search engines are more reflexive—at what cost and with which advantages? How do conversational interfaces increase the urgency of questioning these assumptions? These questions can spur new interactions and explorations across lines of work, connecting epistemology and design, ethics and computation, politics and indexing. The aim is to stimulation conversations about retrieval and recommendations, about diversity, inclusion, ignorance and to contribute to problematisations of bias, the political and moral economy of search engines, of retrieval and of reliability.

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3. Implementation of search as an opportunity for transformation

I will therefore consider how search is implemented in interfaces and sketch how to study and develop interfaces as specific encounters between systems and agents that are situated and that rely on particular conditions and skills. Interfaces that focus on search are too often unquestioned. While search engines have increasingly become able to accommodate a range of vocabularies, often in everyday vernacular and as part of an ongoing ‘conversation’, it remains that the use of terms must either correspond to articulated words, titles, or tags to be most effective, or be translatable to these, and that their *raison d’être* is retrieval, rather than say, discovery or exploration. Yet, there are many other potential implementations of search that could have important epistemological, ethical and political consequences. Redesigning interfaces can be a way to stop reproducing an architecture of universalism as a core element of systematicity, to question a mode of distributivity that foregrounds frictionless circulation of knowledge, and to open up the possibility of reflexivity.

4. Acknowledgements

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Politically Misleading Large Language Models: Evidence from the 2024 U.S. Presidential Elections Reveals LLM Fact-Checking Limitations

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1. Introduction

While Large Language Models (LLMs) with web search capabilities are increasingly used to verify information, their reliability for political fact-checking remains questionable. We present a comprehensive evaluation of seven state-of-the-art LLMs on their ability to fact-check political statements related to the 2024 U.S. presidential election. Using a dataset of 1,374 statements derived from 530 original claims fact-checked by major organizations in the run-up to the elections, we test both original and reformulated versions of statements. Our findings reveal that even the best-performing models achieve only modest accuracy (macro F1 score of 0.51), with web search providing minimal improvements over models without search capabilities. Models particularly struggle with nuanced “misleading” statements and demonstrate poor robustness to reformulations. These results indicate that users relying on LLMs for political fact-checking are likely to receive inconsistent and sometimes incorrect assessments, even for statements that have been previously fact-checked by professional organizations and are readily available online.

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Assessing Recommendation Diversity in Search Results: Approaches Using Data Donations and Artificial Personas

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1. Introduction: The Australian Search Experience

This paper reports on two stages of the Australian Search Experience (ASE) research project, conducted under the auspices of the ARC Centre of Excellence for Automated Decision-Making and Society (ADM+S). The project responds to persistent concerns about the existence of ‘filter bubbles’ (Pariser, 2011) as caused by a personalisation of search results to the specific interests of search engine users, which would lead them to encounter widely divergent representations of reality and thereby threaten the shared informational basis that is fundamentally required for functioning societies. It addresses this idea by conducting systematic large-scale empirical research into the search results actually encountered by ordinary Australian users of the search functionality provided by Google Search, Google News, Google Video, and YouTube, for searches relating to key political figures, organisations, and topics, as well as other current events and issues.

The project operates in two phases. Phase 1, conducted in 2021 and 2022, built on and extended an approach pioneered by AlgorithmWatch in Germany (Krafft et al., 2019): both projects invited ordinary users to become involved in the research by installing a browser plugin that would regularly query relevant search engines for a number of preset search terms (such as the names of politicians and parties, and in Australia also current terms like COVID, vaccine, lockdown, etc.). In Australia, ASE managed to attract nearly 1,000 users as participants, and over the course of 10 months received some 4.85 million search engine result data donations from these participants, containing nearly 42 million individual results.

As this paper will show, analyses of this Phase 1 dataset reveal a considerable uniformity in search results even across a diverse range of participants (cf. Bruns, 2022; Meese et al., 2024); search results personalisation was encountered only in a number of highly specific contexts – searches for ‘vaccine’ would produce localised information on vaccination centres close to the searcher’s location, for instance. While search engines clearly have the ability to personalise results to the presumed identity of the searcher, then, other than in a distinct set of circumstances they appear not to exercise that ability, counter to the ‘filter bubble’ supposition (cf. Bruns, 2019).

Phase 1 of the Australian Search Experience project also remains limited by its data donation approach, however: for practical and ethical reasons, much like the German AlgorithmWatch project it could use only a limited range of highly generic search terms which do not cover the full breadth of possible approaches to information searching that ordinary users would employ. For instance, as search terms deployed by the browser plugin would end up in participants’ search histories, we could not search for more controversial topics like COVID-19 conspiracies or anti-vaccination content. Having

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determined in Phase 1 that search result personalisation for identical keywords is largely absent, therefore, ASE Phase 2 – which commenced in 2024 – takes a markedly different approach to the study of search result diversity: here, we use a combination of human input and artificial intelligence to generate a wide variety of potential search queries for broadly similar topics (e.g. from “are vaccines harmful?” to “how often should I get vaccinated?”), and deploy these queries regularly from a fleet of virtual machines whose browsing histories have been designed to represent a variety of distinct personas that might trigger any residual search results personalisation deployed by the search platforms.

2. Analytical Approach

This paper presents a detailed analysis of the results from Phase 1 of the Australian Search Experience, and of emerging results from Phase 2. To begin with, we focus on the organic search results displayed by Google Search: taking the first page of search results in ranked order, as reported by our data donors, we convert this information into a results vector, and engage in a systematic pairwise comparison of these results vectors per search term, participant, and day. This enables us to generate an overall results similarity rating per search term and day, and trace this similarity rating over time (identifying key points at which the relative uniformity of results is disrupted by external events or internal platform changes); as well as to cluster participants and their reported results by similarity, and identify any outlier groups with distinctly different results (e.g. participants who have set their default browser environment to a language other than English).

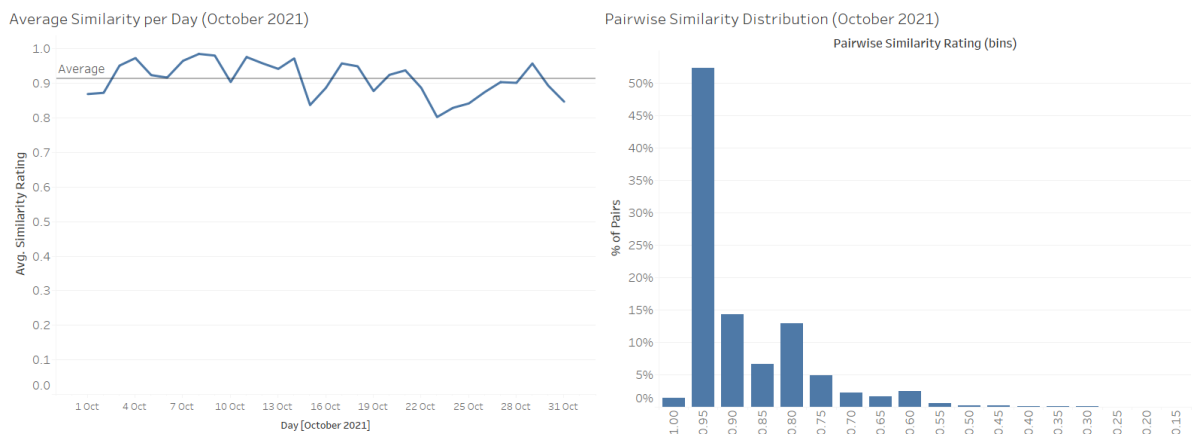


Figure 1: Average search results similarity rating per day for the search term ‘Scott Morrison’ in October 2021

Fig. 1 illustrates this for the search term “Scott Morrison” (Australia’s then Prime Minister), during October 2021: it shows the average cosine similarity value for all ranked lists of search results donated on each day in October, fluctuating around the monthly average of 0.91 on a scale from 0 (entirely dissimilar) to 1 (same results in the same order). Notable drops in similarity are experienced on 15 October, when various news reports of a major press conference that day intrude into the otherwise static list of generic background information on Morrison, and for several days from 23 October, when the number of organic search results displayed by Google is temporarily reduced to make way for other information boxes. Overall, too, for more than two thirds of all daily pairwise comparisons between our data donors, the average pairwise similarity rating is above 0.90.

For Phase 2 of the project, which uses a broader range of distinct search queries, we are then able to build on this approach in order to assess the similarities and divergences in search results for related but non-identical queries on the same topic. Here, we are especially interested in determining at which point and how strongly broad results similarity declines: while “Scott Morrison achievements” and “Scott Morrison legacy” might produce similar responses, for instance, “Scott Morrison controversies” and “Scott Morrison failures” are likely to diverge more markedly. Differences here point to the continuing centrality of user literacy and agency: while the techno-determinist thesis that search engines place their



users into individualised ‘filter bubbles’ has by now been thoroughly disproven (also see Haim et al., 2018; Nechushtai & Lewis, 2019; Nechushtai et al., 2023), the ability to effectively query search engines for relevant content remains unevenly distributed, and users’ own pre-existing preferences and attitudes can still result in substantive preferential attachment to and/or selective avoidance of information that aligns or disagrees with their own worldviews. Phase 2 is now underway and will have results to present by the time of the SEASON 2025 conference.

3. Acknowledgements

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Ambisearchers: Search Modalities and Algorithmic Awareness

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1. Introduction

This study investigates the relationship between how users access search engines, referred to as search modality, and their understanding of how algorithms curate search results. The research highlights the emergence of a new digital divide, termed the "algorithmic divide," which distinguishes between individuals who are aware of algorithmic curation and those who are not (Cotter & Reisdorf, 2020; Gran et al., 2020). We introduce the concept of "ambisearchers" to describe users who utilize multiple devices to access search engines, arguing for a broader perspective on digital divides that extends beyond mere access to technology.

A significant portion of Americans now access the internet via smartphones, not only for social media but also for information retrieval (Pew Research Center, 2024). Paralleling social media algorithms that tailor content based on user data, search engine algorithms also use personal information to curate search results, a process that is often opaque to the user, except through privacy policies and observed phenomena. This lack of awareness contributes to the algorithmic divide, a phenomenon that exists even as traditional digital divides related to internet and computer access have evolved (van Dijk, 2020). Search modality influences how users interact with search engines and the resulting search results, meaning the same query might yield different results on a mobile phone versus a laptop. Neither the ACRL's Framework for Information Literacy nor IFLA's Guidelines on Information Literacy for Lifelong Learning have yet to fully addressed the impact of search modality (Koenig, 2020; Powers, 2017).

The research aims to contribute evidence for changes in information literacy education and to underscore the importance of data protection policies that inform users about algorithmic curation. It specifically investigates how different search modalities impact the type of information users encounter. The study poses two key research questions: (1) Does user demographics relate to search modality? and (2) Does awareness of algorithmic curation differ based on search modality?.

2. Methodology

The study employed a survey instrument developed by analyzing Google's privacy policy to understand how personal information is used for algorithmic curation. The survey included questions about actions influencing search results and the types of personal data collected. This approach aimed for specific recollection rather than generalized assessments of algorithmic awareness. Data was collected in January 2022 through Qualtrics' research panel, with demographic quotas aligning with the 2020 US Census. The survey covered internet usage and algorithmic awareness across Google Search, Facebook, and YouTube, with this article focusing on search engine users.



3. Results

The results identified four types of searchers based on their access methods: ambisearchers (multiple devices), mobile searchers (mobile only), computer searchers (desktops, laptops, tablets), and voice searchers (virtual assistants). Ambisearchers constituted 40% of the sample, followed by mobile searchers (35%), computer searchers (20%), and voice searchers (5%). Mobile searchers primarily use mobile data for internet access, while ambisearchers use broadband or unlimited mobile data. Voice searchers showed an unexpectedly high reliance on satellite internet access, warranting further investigation. The purposes of searches were fairly evenly distributed, with ambisearchers being more prominent in searches related to work tasks.

Demographic analysis revealed that gender identity was relatively even across modalities, except for voice search, where 71% of respondents were women. Ambisearchers and mobile searchers were more likely to be aged 25-44, while computer searchers were predominantly 60 and older. Voice search users were more evenly distributed among those aged 25 and older, with a slight overrepresentation in the 45-59 age group. Education levels varied significantly, with 75% of mobile-only searchers and 94% of voice-only searchers being non-college graduates, compared to a more even split for ambisearchers.

Regarding algorithmic curation awareness, a majority (60%) of participants were aware that Google uses personal information to customize search results. However, awareness varied by search modality, with ambisearchers showing higher than expected awareness and computer and voice searchers showing lower than expected awareness. Notably, 44% of voice searchers answered "no" to this question. When asked if two people would get the same search results for the same query at the same time, overall awareness decreased. While ambisearchers still showed the highest percentage of awareness, it dropped significantly, suggesting a lack of understanding of how personal data specifically affects search results. Ambisearchers also reported a much higher awareness of Google having a privacy policy compared to other modalities, while mobile and voice searchers had higher rates of uncertainty or belief that no such policy existed.

4. Discussion

The study underscores the importance of considering the shift of younger users towards social media platforms for information retrieval, which present a more limited and potentially more biased set of information compared to traditional search engines. This necessitates a targeted approach to information literacy education that acknowledges different types of searchers. The increasing prevalence of generative AI in information seeking further emphasizes the need for evolving digital and information literacy curricula to include multimodal searching. Users often learn about algorithmic systems through experience, peer discussions, or formal education, as platforms provide limited transparency (DeVito et al., 2017). Socioeconomic factors contribute to gaps in algorithmic knowledge, highlighting the need for public education.

While search modality may not be the sole driver of awareness, there are significant differences in algorithmic awareness based on how users access search engines. Ambisearchers demonstrate higher algorithmic awareness than single-modality searchers. Research indicate that searchers often perceive search algorithms as neutral and objective, which is impossible (Haider & Rödl, 2023; Haider & Sundin, 2019). This difference has important implications for information literacy standards and policies aimed at mitigating digital divides. Demographic variables like age and education level are associated with search modality. Educational interventions for digital literacies are less common for older adults. Data suggests that the access point for information retrieval significantly impacts digital literacies. The combination of search modality and algorithmic knowledge contributes to a digital divide. If single-modality searchers, particularly mobile and voice users, assume that the first results are the most relevant, further efforts are needed to enhance their algorithmic knowledge. Additional research is needed on voice-only searchers to better understand their characteristics and algorithmic awareness. Future research should also explore search revision behaviors and satisfaction among voice searchers to provide a more comprehensive understanding of how modality impacts information divides. As



smartphone and smart speaker ownership grows and reliance on cellular data increases, digital literacies must evolve to address the lack of awareness regarding algorithmic curation.

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Exploring the search for home and belonging. Search engines as players on the property market

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1. Introduction

With this presentation we aim to open a discussion on the influence of search engines in relation to the property market. Here we view them metaphorically as players, without assigning them any proactive value, that is we cannot say for sure what effects they actually have. We explore them, due to their prevalence in everyday life, their potential “societal influence” (Lewandowski, 2023) and relevance for the always so controversial property market. *Hemnet.se* (<http://www.hemnet.se>) is the world’s biggest digital property market, if measured in terms of number of searches per capita in Sweden (Enevold Duncan, 2024). However, people’s window-shopping and actual shopping for homes on Hemnet (Hemnet, 2025), scoping out dream homes, precariously living out their house dreams (Enevold Duncan 2024), is not our primary focus here. We focus on a type of secondary search generated by these kinds of property foraging, when prospective buyers or curious consumers want to know more: where is a certain property located? What is the address? Who is selling?

We have followed two different urban areas, in two different towns, picked originally from eye-catching depictions in media (*Expressen*, 2021, Ranby, 2015) Agnes i Lund, 2024, Kulturportalen, 2019, SVT, 2024, *Sydsvenskan*, 2021)) and archives (Ek, 1982, Hyresgästföreningen, 2024)– where one is generally described as more affluent, safe and trendy, the other as unsafe and in crisis. We have found two properties for sale in these areas and followed them from their advertisement on *Hemnet.se* and *Boneo.se* (<https://www.boneo.se>) another digital site for searching properties in Sweden, on to *hitta.se*, a prominent contact information-search engine in Sweden [literal translation: Find.se]. Our examples represent two very different residential areas, the location of which are not only presented, but also its presumed inhabitants, who are on an aggregate level, statistically profiled and forefronted on *hitta.se*.

The search engine offers its home-seekers not only phone numbers and addresses, but also maps, and information about ‘lifestyles’ – presented in text as well as images. In our presentation we indicate that *hitta.se* through this data generation, defines and circumscribes urban areas in ways that may actually “produce” them as more or less desirable real-estate objects, potentially indirectly influencing the property market, and how areas are perceived and thus bought and sold and understood in people’s everyday home-making.

Hitta.se uses open data in combination with data from commercial sources. Open data has been described as “an extension of the principle of public access to information” (Internetstiftelsen, n.d.) and is closely connected to public archives, which are an important part of society’s knowledge infrastructure (Trace, 2022). *Hitta.se* and other search engines, such as *mrkoll.se* (<https://mrkoll.se>), can do this, because public agencies should make their public data available for reuse in innovations based on digital information, simultaneously contributing to increased transparency in public administration (Government Offices of Sweden, 2022).

Departing from our two examples “Hospitalsgatan in Nöden” and “Vougts väg in Rosengård” we imagine how presumptive homeowners looking for a house or condominium in these areas first find their homes on *Hemnet* or *Boneo*, or other site, but then consult for example the *hitta.se*-search engine when considering if a particular area is for them or not, if it is worth investing in: if they can identify with or profit from it in some way. *Hitta.se* uses open data to present information about average income, loan-to-value ratio, and which political parties its inhabitants vote for. With this comes lifestyle-related information derived with the aid of a household-based consumer segmentation model called Mosaic by the company Experian, (<https://www.experian.com/>).

When data from public sources are combined with this other type of information and presented as ‘demographic’ facts they tell a very specific story of imagined inhabitants, their hobbies and homes and of each area that defines its place in the respective city which can be illustrated by the presentations of common interests in the respective area. Following Wendy Chun (2021), the presentations of the search-engines consulted can be understood as contributing cultural encodings, mediating certain world-views and inhabitants. This means search-engines are not neutral but deliver “discrimination data” potentially emphasising certain biases in terms of class and race for example (Chun, 2021).



Figure 1: Vougts väg. The heading above the image says: “Young and middle-aged low-income families with children in multicultural suburban areas of a big city”.

Hitta.se also provides photo montages that illustrate the inhabitants of a search object. These, too, are there as reference data, for the prospective buyer to ‘process’ and decide: do I belong here or not, can I identify with this or not, do I relate to this or not? Similar to the “you are what you eat” assumption, the characterization “you are where you live” can be applied to your life choices, and resulting (perceived and projected) status and life styles, as dwellings are highly connected to humans’ propensity for categorizing the world socioculturally, which we by now understand is far-reaching and actually never neutral (see for example Bowker and Star, 1999).



Figure 2: Hospitalsgatan. The heading above the image says: “Young middle-income earners in condominiums in established suburban areas outside major cities”.

2. Concluding remarks

In this presentation we assume that prospective home-makers search for a flat or house that will reflect them. *Hemnet* and *Boneo* provide real-estate ads as sources of storytelling indicating the socioeconomic position among people living in specific areas. A search engine like *hitta.se* tells similar but different stories, combining open data with other information sources. As we stated above, we may conclude that *hitta.se* through its data generation, defines and circumscribes urban areas in ways that may actually “produce” them as more or less desirable real-estate objects, potentially indirectly influencing the property market, how areas are perceived and thus bought and sold and understood in people’s everyday home-making. We call attention to how this both contributes to cementing some areas as ‘good’ and some as ‘bad’, thereby in various ways influencing the labelling and consequent status of dwelling areas and people, real-estate prices and potentially in the long run, demographics and gentrification processes. In short, search-engines may be interpreted as players on the locally and globally so significant property market.

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Reimagining Search: A Privacy-Preserving and Inclusive Infrastructure for Disability Knowledge Retrieval

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1. Introduction

Search engines shape access to workplace opportunities, yet for individuals with disabilities—16% of the global population [9]—they reinforce exclusion by prioritizing standardized, able-bodied data, neglecting lived experiences critical for equitable hiring. Disabled workers face stark disparities: 30% lower labor participation, 12% hourly wage gaps, and 2.3 times higher unemployment, with only 19.1% employed in the U.S. in 2018 versus 65.9% non-disabled [1][2]. The State of Disability Employee Engagement report notes -8 point equity and -13 point achievement gaps [3]. AI recruitment tools amplify biases, penalizing non-standard profiles like those of disabled candidates [4-8]. We extend Noon [15], a vertical search engine infrastructure for disability knowledge, enabling privacy-preserving contributions, in this abstract for HR data systems. Grounded in the first author's autoethnography as a disabled programmer, Noon counters exclusion through sovereign data, aligning with feminist data ethics and bottom-up empirical ethics emphasizing relational human-machine configurations [1, 10, 12–14].

Workplace systems assume able-bodied norms—symmetry in tasks, speed in tools, standard resume formats—erasing disabled experiences. Employees face invisible labor: disclosure reduces callbacks, only one-third receive accommodations, and productivity misconceptions persist [16–21]. AI hiring tools institutionalize bias via proxies like non-linear careers or typing speed, disadvantaging candidates like the first author with Ectrodactylyⁱ and Syndactylyⁱⁱ [10–13, 15–20]. Search engines fail to surface nuanced accommodation needs, while privacy concerns—unique to disabled workers fearing stigma—drive self-censorship, fragmenting knowledge [3]. To bridge: (1) Sovereign HR data to reduce disclosure risks; (2) Search for lived experiences (e.g., accommodation strategies); (3) Feminist ethics—care as relational, situated knowledges—to integrate narratives [10, 12–14]. Noon enables secure, user-controlled data contributions and surfacing, fostering equitable integration by centering disabled voices over top-down directives [1].

2. Related Work

Existing platforms (e.g., AbleData[22], EASTIN[23]) aggregate assistive technologies but rely on structured inputs, often ignoring the nuances of lived experience. Data collection challenges persist, including definitional ambiguity and stigma-driven self-censorship. Feminist data ethics scholars [10] critique the power-laden nature of conventional data practices and advocate for intersectional, situated alternatives. Employment studies highlight persistently lower participation rates [16], AI-driven hiring

bias [15, 18–20], and ongoing gaps in disability-inclusive information retrieval within human resource contexts [11–14, 17, 21].



Figure 1: Personal photo demonstrating the physical context that informed assistive design iterations

3. Autoethnographic Journey: The Invisible Weight of Workplace Navigation

"Disability is not the weight, but the world that makes you carry it alone."

The following narrative anchors and contextualises the design methodology of this abstract, revealing micro-negotiations of exclusion, friction, and adaptive labor that inform Nooon's framework. It traces principles directly to themes of bodily strain, disclosure dilemmas, and systemic asymmetries, ensuring accessibility becomes infrastructural. Through narrative inquiry, we identify exclusion patterns and distill them into design principles—what we term bodily epistemology.

"At 32, my workday as a CERN programmer with Ectrodactyly is a negotiation of invisible labor. Waking with shoulder pain from overcompensation, I leave my work laptop at the office, using a home one for telework to avoid carrying weight. The bus commute is grueling: inaccessible poles in crowds force me to stand without grip, and the wheelchair symbol on priority seats misrepresents my hidden disability. Few recognize the sunflower lanyard for invisible conditions. Biking, with one-hand braking, is recreational, not practical. The 20-minute walk from CERN's gate hurts with a bag; shared bikes lack disabled reservations, and their locks fail my grip, leading to bans after three mislocks. I ride to my building, drop bags, return bikes, and walk back—unlike able-bodied peers' seamless commutes. Timed coding interviews penalize my one-handed typing, and career advice deterred lab-based paths due to accessibility. Early arrivals cut social life, but telework offers respite."



Rather than reduce these insights to needs, Nooon uses the narrative as input: privacy-preserving annotations—by the individual or care ecosystem (physios, instructors)—become queryable by HR or managers for context-specific policies. This enables transferability: future employees benefit from past adaptations without starting from zero.

4. Methodology: Translating Autoethnography into Workplace System Design

The following section details this methodology and outlines how values such as agency, privacy, accessibility, and epistemic justice are mapped to concrete system features.

The transition from insight to reform uses a layered annotation model. A privacy-preserving interface allows annotation of exclusion episodes (e.g., mobility hurdles) with metadata (time, location). Data remains user-controlled but shareable with stakeholders:

- HR receives summaries of recurring needs for policy design.
- Disability offices get longitudinal views of strain for proactive accommodations.
- Managers access insights for team alignment (e.g., transport adjustments).

What distinguishes this methodology is its **layered annotation model**. In addition to self-reported reflections, the system supports contribution from trusted professionals involved in the individual's care and performance:

- Physiotherapists annotate with functional limitations.
- Trainers add movement insights.
- Mentors highlight performance barriers beyond reviews.

This forms an evolving accessibility profile, retrievable for new employees via patterns from prior experiences. Table 1 gives a glimpse of these translations.

5. Future Work

Nooon's realization requires co-design with disabled workers, HR, and accessibility experts to refine interfaces and privacy mechanisms. Pilot studies in workplaces will test policy outcomes, measuring equity gains. Technical challenges include optimizing client-side processing for scalability and integrating with HR platforms. Long-term, Nooon aims to scale as a blueprint for inclusive data systems, collaborating with advocacy groups to inform policy frameworks [15][24].

Table 1

Mapping values to system design features

Ethical Value	Derived from Autoethnography log	Search System Feature
Agency	Bike lock failures/career biases	User-controlled indexing for personalized policy recommendations (e.g., "transport reservations")
Privacy	Disclosure fears in bus/seats	Client-side preprocessing for anonymous HR data sharing



Relational Care	Social cuts/peer disparities	Co-authored workflows (e.g., peer-assisted accommodation queries)
Accessibility	Painful commutes/typing	Inclusive interfaces for low-mobility users
Epistemic Justice	Invisible labor unseen	Searchable lived profiles to inform policies (e.g., "timer-free interviews")

6. Conclusion

Nooon reimagines search for HR, enabling HR to derive policies from lived stories (e.g., sunflower awareness training, flexible assessments) By centering feminist ethics and bottom-up design, it transforms workplaces, ensuring inclusion is built-in, not retrofitted [1][10][12][13][14]

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ⁱ Ectrodactyly is a congenital limb difference characterized by the absence of one or more central digits of the hand or foot, often resulting in a cleft or split appearance. It is sometimes referred to as “split hand/split foot malformation” (SHFM) and can vary in severity and functional impact.



ⁱⁱ Syndactyly refers to a congenital condition in which two or more fingers or toes are fused together. This fusion can involve soft tissue only or include bones and joints, affecting dexterity and grip depending on the extent of fusion.

Auditing Bias: Detecting and Quantifying Bias in Search Query Suggestions for US Politicians

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1. Background and Related Work

Search engines serve as primary information gateways, particularly in sensitive domains such as politics (Ray, 2020; Edelman, 2022). Search Query Suggestions, the dynamically generated prompts appearing as users type, guide search behavior (Niu & Kelly, 2014; Cai & de Rijke, 2016). Query suggestions are prone to contain various biases, potentially influencing opinion formation (Epstein & Robertson, 2015; Epstein et al., 2024) and reinforcing societal inequities (Noble, 2018). Bias in query suggestions is particularly critical when searching for political topics or real existing people. The former can have an impact on actual politics by influencing political opinion formation, while the latter can present certain groups of people unequally, unfairly, or potentially in a defamatory manner. Despite the growing awareness of algorithmic bias (Kulshrestha et al., 2019), query suggestions remain understudied compared to search results, partly due to challenges like data sparsity, lack of context, and the subjective nature of bias itself (Bonart et al., 2019; Haak & Schaer, 2022). Existing research has often focused on topical or gender bias (Mertens et al., 2019; Haak & Schaer, 2021, 2022), typically using clustering, frequency counts, or categorizations. While valuable, these methods often struggle to capture the perceived impact or the severity of the identified bias. Perception-aware metrics, such as Normalized Discounted Cumulative Gain (nDCG), were introduced to account for suggestion rank (Haak & Schaer, 2021), acknowledging differential perceivability (Hofmann et al., 2014). Recently, a pairwise comparison approach leveraging large language models (LLMs) has been used to quantify bias in query suggestions, achieving an effectiveness comparable to human annotation (Haak et al., 2024). However, this approach has not yet been applied to real-world search query datasets or in conjunction with perception-aware bias quantification. This paper aims to address these gaps by investigating bias in query suggestions for prominent US politicians, employing LLMs for nuanced analysis, framing disparities through group fairness, and integrating a quantitative measure of bias severity using pairwise comparison and Elo scoring (Haak et al., 2024), which enables a more granular understanding than prior approaches.

2. Methodology

Our methodology encompasses dataset creation, LLM-driven bias categorization for group fairness analysis, and bias severity quantification using pairwise comparison and Elo rating. Figure 1 offers a schematic overview of the full workflow.

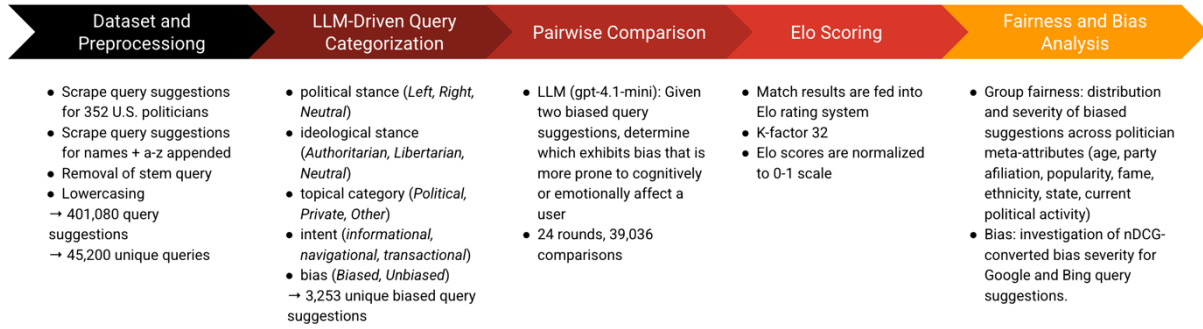


Figure 1: Overview of methodology.

2.1. Dataset

We utilize a large dataset of query suggestions collected from Google and Bing for the names of the 352 most prominent US politicians (YouGov 2025). The dataset was collected using recursive algorithm interrogation (RAI) techniques (Haak & Schaer, 2022, 2023; Robertson et al., 2019). Initial suggestions for each politician’s name were retrieved. Root queries were also expanded by appending letters ‘a’ through ‘z’ to capture broader suggestion sets. Data collection was conducted without user profiles using Google Colab to minimize personalization effects.

2.2. Group Fairness Analysis: Bias Categorization & Comparison

Group fairness demands that members of groups be treated equally, independent of their group affiliations. Applied to query suggestions, this means that to establish group fairness, no members of a specific categorical group of meta-attributes (e.g., gender: male/female, party affiliation: Democrat/Republican, popularity, age, etc.) should be over-exposed to bias or receive qualitatively different suggestions. To investigate biases and fairness in query suggestions for US politicians, we analyze the distribution of query suggestion biases across several dimensions, drawing from prior work (Haak & Schaer, 2021; Spinde et al., 2023). Topical bias is assessed by categorizing query suggestions as ‘Political’, ‘Private’, or ‘Neutral/Other’. Political stance bias identifies suggestions as ‘Left-leaning’, ‘Right-leaning’, or ‘Neutral’. Ideological stance bias identifies ‘Authoritarian’, ‘Libertarian’, or ‘Neutral’ suggestions. We leverage an LLM for this context-aware, scalable classification.

2.3. Bias Severity Quantification

We adapt the methodology presented in (Haak et al., 2024), built upon the ARTS framework for relative assessment using pairwise comparison and Elo scoring (Engelmann et al., 2024), to quantify the perceived severity of suggestions identified as potentially biased. The process involves two steps. First, an LLM performs 24 rounds of pairwise comparisons: given two potentially biased query suggestions, it determines which exhibits bias that is more prone to cognitively or emotionally affect a user. To mitigate positional bias, the order of queries is randomized for each comparison. Second, the outcomes of pairwise comparisons feed into an Elo rating system (Good, 1955). This system assigns a score penalty or gain based on the expected outcome deducted from the scores before the comparison. Elo scores thus reflect the relative bias severity of each query suggestion compared to others. In matchmaking, pairs are assigned based on similar scores. The resulting scores, in conjunction with perception-aware weighting metrics (nDCG), allow for analysis of bias severity. The proportional distribution of quantified biases and topic distributions is then compared between the groups of meta-attributes using statistical tests to identify significant disparities that may indicate fairness issues within the groups for both search engines.



2.4. Observations and Implications

Analyses suggest potential systematic differences in the query suggestions presented for politicians of different parties and in other groups of meta-attributes. For example, on both Google and Bing, Republicans receive a higher percentage of biased suggestions than Democrats. However, the average severity of bias is significantly higher for Democrats than for Republicans. Similar significant disparities were found for gender, with male politicians receiving a higher percentage of biased suggestions but female politicians facing slightly more severe bias on average. We also observed positive correlations between a politician's fame and the likelihood of receiving biased suggestions. The detection and quantification of such biases in query suggestions carry significant implications. Since query suggestions are largely derived from aggregated user search queries, biases observed within them can serve as a proxy, reflecting prevailing societal interests, curiosities, stereotypes, and potentially, societal biases regarding political figures. Studying these patterns offers a lens into collective public perception and information-seeking behavior, contributing to understanding the complex interplay between society and the search engines embedded within it. Analyzing how these biases manifest and differ across platforms and groups is crucial for promoting fairness and transparency online. The methodology and results presented in this work enable a more comprehensive search engine bias audit and a deeper understanding of the dynamics in political query suggestions.

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Conceptualising Ignorance Logics in Search — with Examples of Environmental Issues

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1. Introduction

Algorithmic information systems, such as corporate web search engines or information access systems with retrieval augmented generation (RAG), filter vast amounts of data to deliver specific outputs and recommendations. In the process, certain data is selected, ordered and presented, while other data and ways of ordering are omitted from an issue's informational texture (Haider, 2016). The notion of "new knowledge logics" (Gillespie, 2014) has been influential in scholarship by drawing attention to the involvement of algorithmic systems in shaping knowledge, as well as what can be known and how. Nevertheless, greater attention should be paid to new regimes of non-knowledge, of being unknowable, and of not knowing, which are equally tied to the infrastructural arrangements supported by these platforms. These regimes and how they emerge and persist necessitate further conceptual refinement. The purpose of this contribution is therefore to conceptualise what we propose to call *ignorance logics*, focusing in particular on their algorithmic configuration. This will provide a conceptual basis for exploring the multiplicity of worlds that are made less likely, less plausible, or even invisible through these algorithmic decisions of online search engines and RAG systems.

2. Background

Ignorance is more than just the opposite of knowledge. Rather, the notion of ignorance describes the many ways in which things are not or cannot be known or engaged with and how they are made unknowable: intentionally and unintentionally, self-enforced, directed by others, an emergent property of an information system, or strategic and so on (Proctor and Schiebinger, 2008; McGoey, 2012; Greyson, 2019). Clearly, high-risk issues are characterised not only by different knowledge regimes and forms of evidence and, but also by ignorances (White & Lidskog, 2022). Therefore, we need to pay attention to the sociomaterial configurations involved in the emergence of the invisibilities, silences and blind spots in the present data economy (Deepak et al., 2024). Examining these configurations will also broaden our understanding of the ways in which high-risk issues concerning the environment and climate, increasingly emerge not from a consolidation but from the disjunction of research-based evidence, public knowledge, policy advice, political discourse, public perception and media perpetuated by internet search engines along with other algorithmic information systems.

Examples of environmental issues that are structured around such forms of ignorance and not knowing include areas as diverse as climate change, biodiversity loss, pollution, or ocean acidification; all issues where research-based evidence points in the same direction, but significant change fails to materialise for a variety of reasons (White & Lidskog, 2023; Stoddard et al., 2021), including the way search engines embed different types of relevance (Haider & Rödl, 2023). Even more than conventional web search engines, RAG renders underlying semantic relationships and relevance decisions invisible



(Haider, 2024), further emphasising the need to pay attention to, examine, and conceptualise ignorance logics.

3. Concept Development

In this contribution, we seek to develop the foundations for a conceptual understanding of ignorance logics by integrating empirical illustrations and discussions of strategically selected examples with theoretical considerations. These examples are presented in the form of screenshots as well as descriptive and analytical explanations. The contribution explores some of the entities, actors and concepts involved (e.g. search algorithms, search engine optimisation, queries and prompts, knowledge graphs, Wikipedia, Reddit, malicious actors, etc.). It furthermore examines the types of relationships they enter, the opportunities for configuring ignorances they afford (from malicious interference to deliberate avoidance), as well as the potential effects or harms on individual and societal engagement with the issues described (from invisibility and data voids to uncertainty and doubt).

The role of search engines at the intersection of ignorance logics and environmental issues includes the more readily noticeable spread of climate denial and obstruction (Rödl & Haider, 2025), but also extends to algorithmic normalisation of extremist or conspiratorial views, the undermining of public acceptance for environmental protection and regulation, the perpetuation of discrimination and oppressive power relations, and not least to the ways in which search engines and RAG embed consumerist values that facilitate greenhouse gas (GHG) emissions (Haider et al., 2022) and climate destruction by design (Haider et al., 2025). For example, employing chain-of-thought prompting to instruct a RAG-based conversational agent to explain a search strategy and associated query formulation (even if justified only in hindsight), helps to reveal biases and normative assumptions that manifest in algorithmically enacted ignorance logics. In the context of environmental concerns, this tactic serves to highlight consumerist biases linked to increased greenhouse gas emissions and to examine how manipulation occurs through data voids (see examples in the screenshots in the Appendix, Figures 1-4).

Although the selected examples in this contribution are all derived from content and topics related to environmental concerns, the concept's usefulness extends beyond this specific domain. The conceptual and analytical emphasis on ignorance logics draws attention to the ways in which search engines, alongside other algorithmic information systems, are involved in creating silences, reinforcing ignorances, and rendering certain relationships and associations invisible. Compared to traditional search engine results, RAG adds a further layer that needs to be peeled off in order to understand what results are even retrieved, how many there are, and how they are ordered. The outsourcing and obfuscation of source selection and of iterative query formulation (i.e. searching) creates opportunities for new, potentially exploitable, ignorances. At the same time, as the examples in this paper illustrate, this additional layer can also act as a methodological lens that makes ignorance logics more noticeable, and thereby contestable.

4. Conclusion

Traditional, link-based, web search engines and the newly emerging AI-infused retrieval systems (RAG), that are euphemistically advertised as answer machines, contribute not only to making things known, but also to obscuring them, to situating sustainable practices outside cultural norms, and to creating doubt about legitimate environmental concerns. As part of collective meaning-making on environmental issues and the climate crisis, ignorance logics have real implications for knowledge and action in everyday life, society and politics, and for the possibilities for meaningful environmental change. Studying, conceptualizing, and thinking with these logics also provides an opening for



renegotiating values and norms and for challenging the infrastructural arrangements that maintain them. Doing so will help formulate new, unfamiliar, and presumably even uncomfortable questions about the role of search engines in society, such as: What ignorances could there be? How would they be configured? What interests are and what interests could be served? As such, paying attention to ignorance logics, is both a conceptual contribution, a methodological tactic, and a powerful invitation to challenge the emancipatory promises of information systems.



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7. Screenshots exemplifying ignorance logics

What is "Climate Intelligence"?

 **Copilot**

Climate Intelligence (Clintel) is an independent foundation established in 2019 by emeritus professor of geophysics Guus Berkhout and science journalist Marcel Crok ¹ ². The organization aims to inform the public about climate change and climate policies. Clintel's main objectives include:

1. **Generating Knowledge:** Understanding the causes and effects of climate change and the impact of climate policies on the economy and environment.
2. **Communication:** Objectively and transparently communicating available facts about climate change and climate policy, distinguishing between facts, assumptions, and predictions.
3. **Public Debate:** Stimulating public debate and conducting investigative reporting on climate-related issues.
4. **Scientific Research:** Conducting or financing scientific research into climate change and climate policy.
5. **International Collaboration:** Serving as a meeting place for scientists with diverse views on climate change and policy ².

Clintel is known for its World Climate Declaration, which asserts that there is no climate emergency. This declaration has been signed by numerous scientists and experts worldwide ¹ ².

For more detailed information, you can visit their [official website](#).

¹: [Clintel - Climate Intelligence](#) ²: [Clintel - About Us](#)

1
2
3

4
5
6

What are Clintel's main criticisms of IPCC?

How many scientists support the World Climate Declaration?

Message Copilot

✎
@ | ➤

Figure 1: Screenshot of Copilot response page for the search prompt "What is 'Climate Intelligence'?"

Explain the search carried out. What queries did you use and why did you choose those?

When researching children's clothing options in Sweden, particularly around Borås, I focused on identifying reputable brands and retailers that cater to various needs, including sustainability, affordability, and style. Here's an overview of the search queries and the rationale behind each:

Search Queries and Their Purpose

1. "children's clothing brands Sweden sustainable kidswear"

- **Purpose:** To find Swedish brands that prioritize sustainability and offer eco-friendly children's clothing.
- **Findings:** This led to brands like [Moromini](#), known for their colorful, GOTS-certified organic clothes, and [Oersaa](#), a micro-brand focusing on sustainable products with hand-painted prints.

[moromini - organic kids clothes](#)

2. "popular Swedish children's clothing brands"

- **Purpose:** To identify well-known Swedish brands that offer a range of children's clothing.
- **Findings:** Discovered brands such as [Polarn O. Pyret](#), recognized for durable and stylish children's clothing, and [Mini Rodini](#), celebrated for imaginative designs and commitment to sustainability.

3. "online retailers children's clothing Sweden"

- **Purpose:** To find online platforms where one can purchase children's clothing in Sweden.
- **Findings:** Identified retailers like [Lindex](#), a market leader in kids' wear in Sweden, and [Kids Brand Store](#), Nordic's largest online store for children's and youth fashion.

[lindex.se](#)

Product Recommendations

Based on the research, here are some product recommendations that align with sustainable practices and are available in Sweden:



Fråga vad som helst



Sök



Resonera



Djup research



Skapa bild



ChatGPT kan begå misstag. Kontrollera viktig information.

Figure 2: Screenshot of a SearchGPT response page showing an explanation for the search prompt "children's clothes".

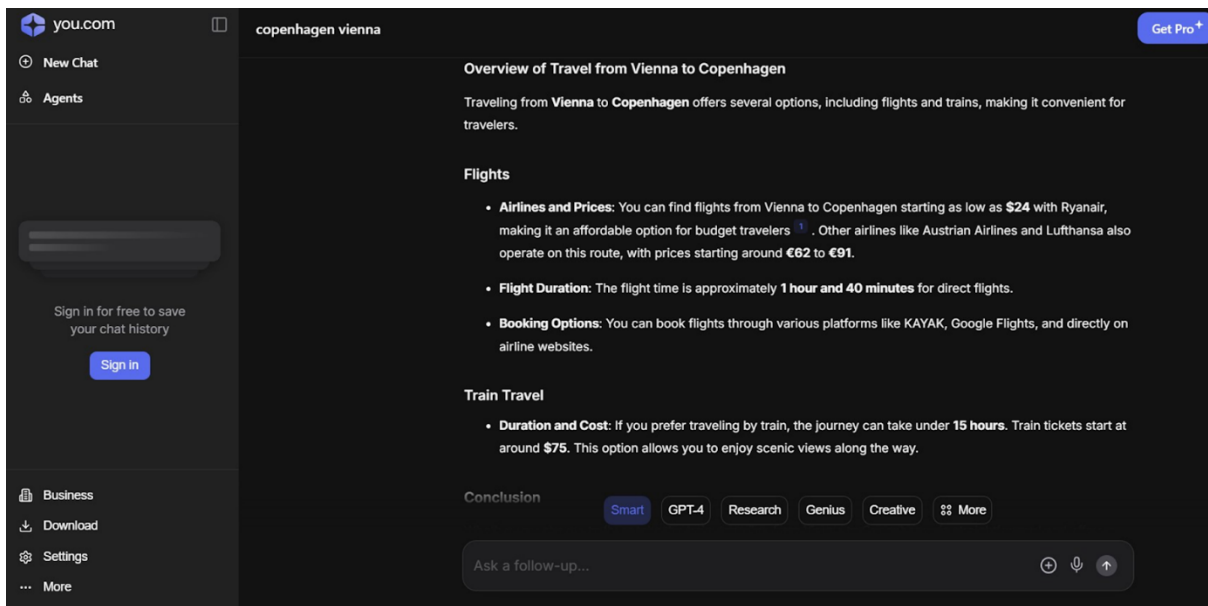


Figure 3: Screenshot of a You.com response page for the search prompt “Copenhagen Vienna”

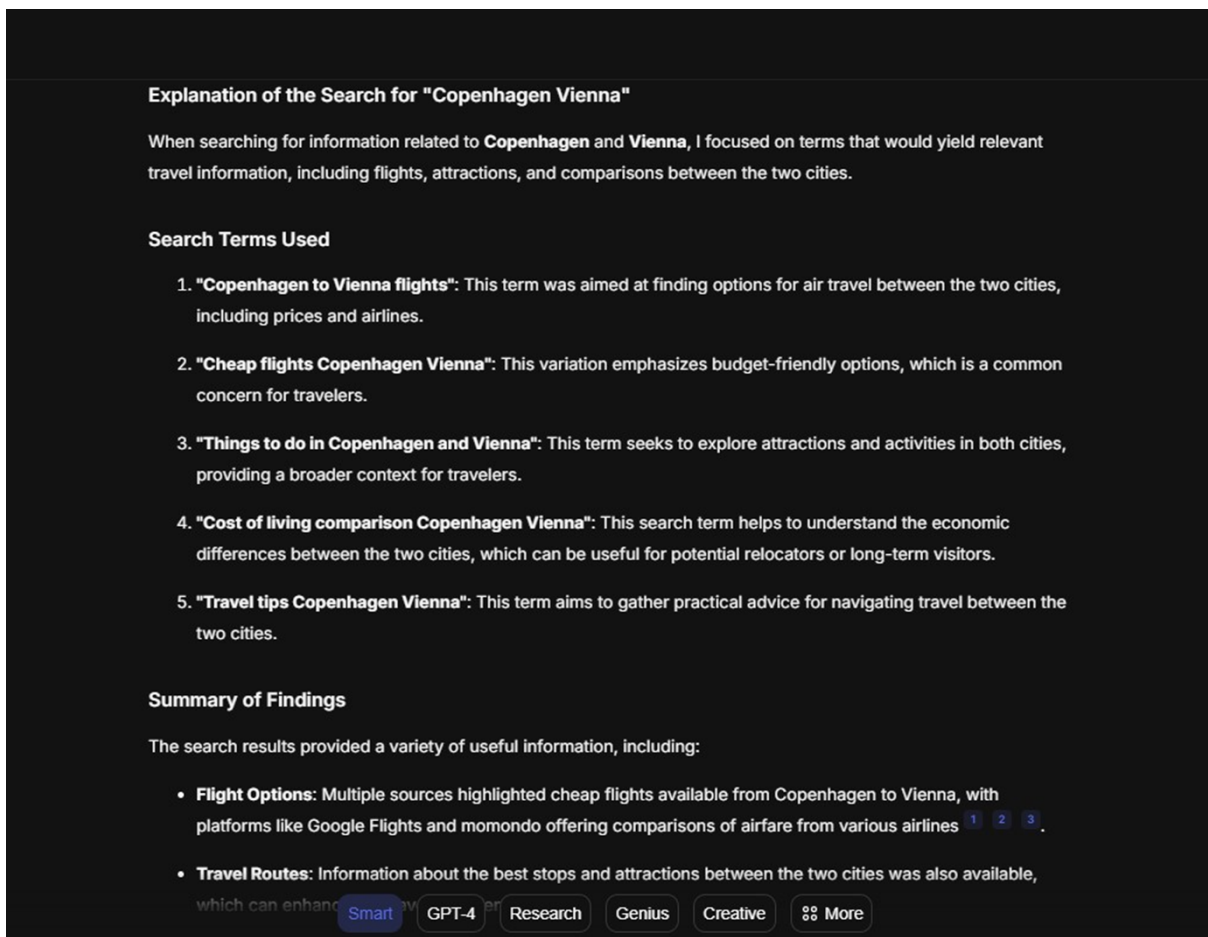


Figure 4: Screenshot of a You.com response page showing an explanation the response to the search prompt “Copenhagen Vienna”



Auditing Google's AI Overviews and Featured Snippets: A Case Study on Baby Care and Pregnancy

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1. Introduction

Search engines like Google serve as critical information gatekeepers for high-stakes topics where people need to rapidly acquire extensive knowledge to make important decisions. This includes domains such as healthcare, finances, and politics, where search results significantly impact individual and societal well-being (Fox, 2011; Fernández-Pichel et al., 2024; Hu et al., 2024). Among these areas, baby care and pregnancy offer a compelling example—new and expectant parents make frequent, time-sensitive decisions while learning from a vast pool of new concepts, often relying on search engines during a critical period lasting months or years. The universality and high stakes of this domain make it ideal for evaluating how well search engines meet urgent information needs.

As Google Search evolves with new components over the past decade (Oliveira & Teixeira, 2023), including featured snippets and AI Overview—direct answers powered by information retrieval and LLMs respectively (Figure 1)—there remains a gap in comprehensively evaluating their information quality, both individually and comparatively. Beyond assessing the quality of these components, research on how query factors—such as question type and sentiment—affect results remains limited. Prior studies show that question-based queries help users meet their goals with minimal reformulation (Vanderschantz & Hinze, 2017), and that question rewriting improves question-answering (QA) system performance (Buck et al., 2018; Chu et al., 2020). Additionally, query sentiment may influence the tone of responses from LLM-powered systems, raising concerns about potential biases (Li & Sinnamon, 2024; Sharma et al., 2024).

To address these gaps, this paper conducts a focused evaluation of the information quality in two modern search components: AI Overviews and featured snippets. Using the high-stakes context of baby care and pregnancy queries, we examine how question type and sentiment affect both the presentation and quality of responses, with broader implications for time-sensitive search behavior.

To conduct this evaluation, we built a pipeline involving query collection, reformulation, and algorithm auditing experiments to test how query factors influence AI Overviews (AIO) and featured snippets (FS), while controlling for variables such as location, browser, and settings. We also developed evaluation metrics and a manual annotation codebook to assess result quality. The dataset, pipeline and metric annotation codebook will be made publicly available upon publication, to contribute to further research in this field.

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2. Method

Query Selection & Reformulation

Using the public ORCAS dataset (Craswell et al., 2020), we extracted 9,516 queries related to baby care and pregnancy after filtering out irrelevant or duplicate entries, with the distribution shown in Figure 2. For the study on question types, we categorized queries into 6 well-formed categories (binary, "when," "why," etc.) following prior work (Chu et al., 2020). We then randomly sampled 100 queries per type per topic (baby care or pregnancy) where possible, resulting in 1,037 queries for analysis. For the study on sentiment, we manually selected 157 binary queries suitable for reformulation, creating neutral, positive, and negative versions using sentiment-bearing keywords. For instance, “*Can infants have juice?*” is paired with “*Is it safe/unsafe for infants to have juice?*” This process yielded 471 additional binary queries.

Pipeline Development

We designed an automated pipeline to audit algorithmic behavior in response to 1,508 queries, using agents that simulate human searches from a fixed US-based IP. SERPs were saved in HTML format, and AIOs and featured snippets were extracted and parsed.

Manual Evaluation Metrics and Codebook

Building on prior work in information quality, RAG-based AI evaluation and contradiction text identification (Lee et al., 2002; Stvilia et al., 2007; Sundin et al., 2022; Es et al., 2024; Saad-Falcon et al., 2023; De Marneffe et al., 2008; Narayanan et al., 2024), we defined two core metrics tailored to our setting. The metrics specifically assess (1) whether AIO/FS answers address the time-sensitive information-seeking needs of new parents, and (2) whether they may introduce contradiction or confusion in high-stake decisions related to baby care and pregnancy:

- **Relevance:** Assesses whether the answer addresses all aspects of the question and aligns in topic/scope, labeled as *high*, *medium*, or *low* relevance for a whole answer and assesses whether the highlighted text within the whole answer is the most relevant as a “*Yes*”/“*No*” label.
- **Consistency:** Evaluates if AIO and FS provide similar or equivalent information given a co-appearing (AIO, FS) pair and a query. Otherwise, classifies the types of contradiction, leveraging either relatively obvious features (antonymy, negation, or numeric mismatches) or more complex differences in assertion structure, world-knowledge discrepancies, and lexical contrasts and further assign the corresponding contradiction categories among *Binary Contradictions*, *Numeric Mismatches*, or *Other Problematic Mismatches*.

Three researchers manually annotated the whole dataset regarding relevance and consistency metric. The inter-coder reliability scores (krippendorff’s alpha) are 0.74 for consistency and 0.95 for relevance.

3. Result

AIO and FS prevalence vary significantly by question type and sentiment

AIO answers are much more common (84% of queries) than FS answers (only 32.5% of queries), and they co-occurred in 22%. Chi-square tests show that question type is significantly associated with both FS answer ($p=0.0153$) and AIO answer ($p=0.0090$) frequencies. FS answers are less common in “Why” questions (15.69%) and more frequent in “When” questions (35.48%), while AIO answers remain consistently high (80–92%) across types (Figure 3). Query sentiment has a stronger effect on FS answers ($p=0.0001$), which nearly doubles in appearance for negative (48.41%) compared to neutral (24.84%) queries. AIO answers remain high across sentiment types (as shown in Figure 4).



While AIO and FS consistently provide answers that are relevant to answer the search queries, we observe a surprisingly high fraction of inconsistencies. Among the 322 co-occurring AIO–FS answer pairs, 32.3% of full answers and 40.7% of highlights contain contradictory information. The types of contradiction vary: Binary Contradictions (11.1%) are only triggered by binary questions, while "how + adj/adv" and "when" questions show high rates of Numeric Mismatches (up to 48.7% and 62.5%, respectively), and "Binary", "How-to", and "Why" questions often lead to Other Mismatches (up to 40%) (Figures 5-6).

Implications

Our findings reveal that search results frequently present inconsistent information between LLM-based (i.e., AIO) and traditional information retrieval-based (i.e., FS) answers, with contradictions appearing in 32.3% of full answers and 40.7% of highlighted content. These inconsistencies in baby care and pregnancy information are particularly concerning as they can confuse new parents, potentially leading to serious health consequences for infants and expectant mothers. Our preliminary qualitative analysis suggests causes include citing one-sided responses to opinionated questions. We suggest remedies like providing balanced, multi-perspective answers to ensure that vulnerable users receive consistent, accurate information when researching high-stakes health topics.

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5. Appendix

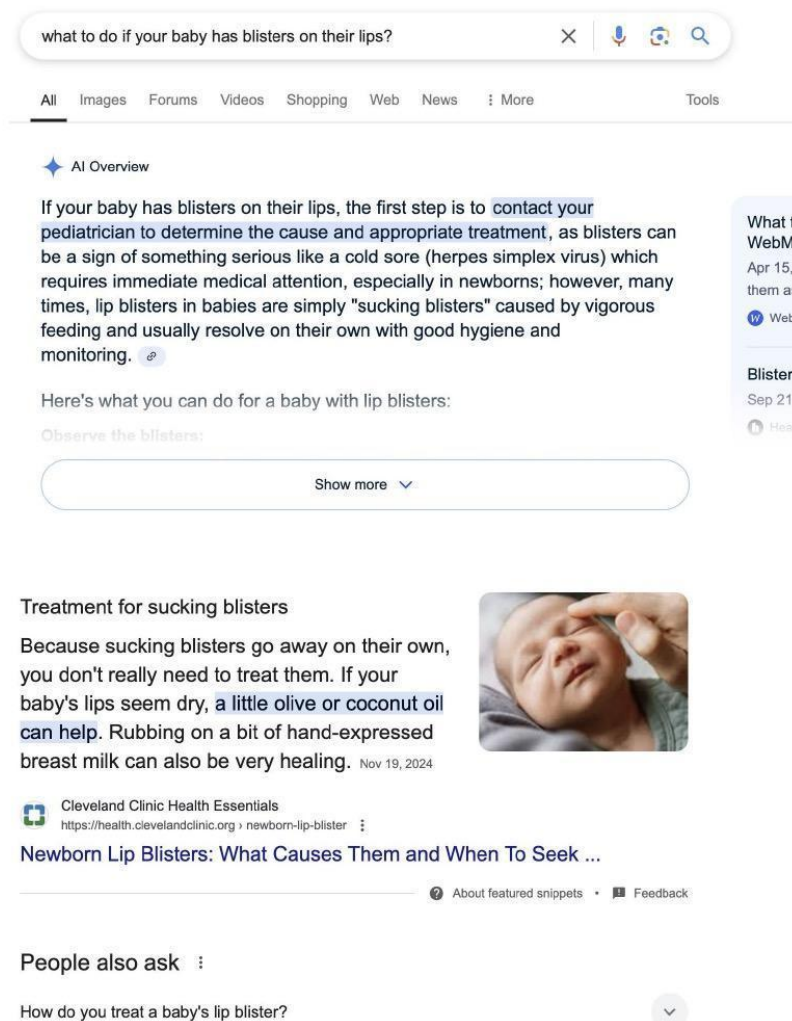


Figure 1: Example of Google's AI Overview (AIO) and Featured Snippets (FS) results on a given babycare-related queries, where the highlighted text in AIO and FS suggested quite different approaches, i.e., AIO advises to contact a medical professional first while FS directly suggests a home remedy without medical consultation.

Definition of different well-formed questions – Queries are grouped into the following well-form question types and the list of keywords for certain types (e.g., the binary question group) is expanded from prior work (Chu et al., 2020):

- **Binary Question:** Questions that typically aim for a clear binary yes/no answer and start with one of the following words: "do", "does", "did", "is", "are", "was", "were", "can", "could", "will", "would", "should", "may", "might", "shall", "must", "have", "has", "had", "need".
- **Wh* Question:** Questions asking about definitions, identifications, or directions, starting with words including like "who", "what", "where", "which", "whose", "whom".
- **When Question:** Questions related to time, starting with the word "when".
- **How-to Question:** Questions that start with "how to" and typically seek steps or instructions for completing a process or task.



- **How + Adjective/Adverb Question:** Questions that start with "how" and are typically followed by an adjective or adverb, like "how soon," "how often," "how many," "how much," "how far," etc., aiming to determine degree, quantity, or extent.
- **Why Question:** Questions that start with "why," aiming to find reasons, explanations, or causes behind something.

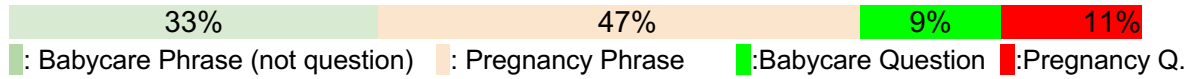


Figure 2: Overall distribution of queries, either a well-form question or not a well-formed question (e.g., phrases) (total n=9516)

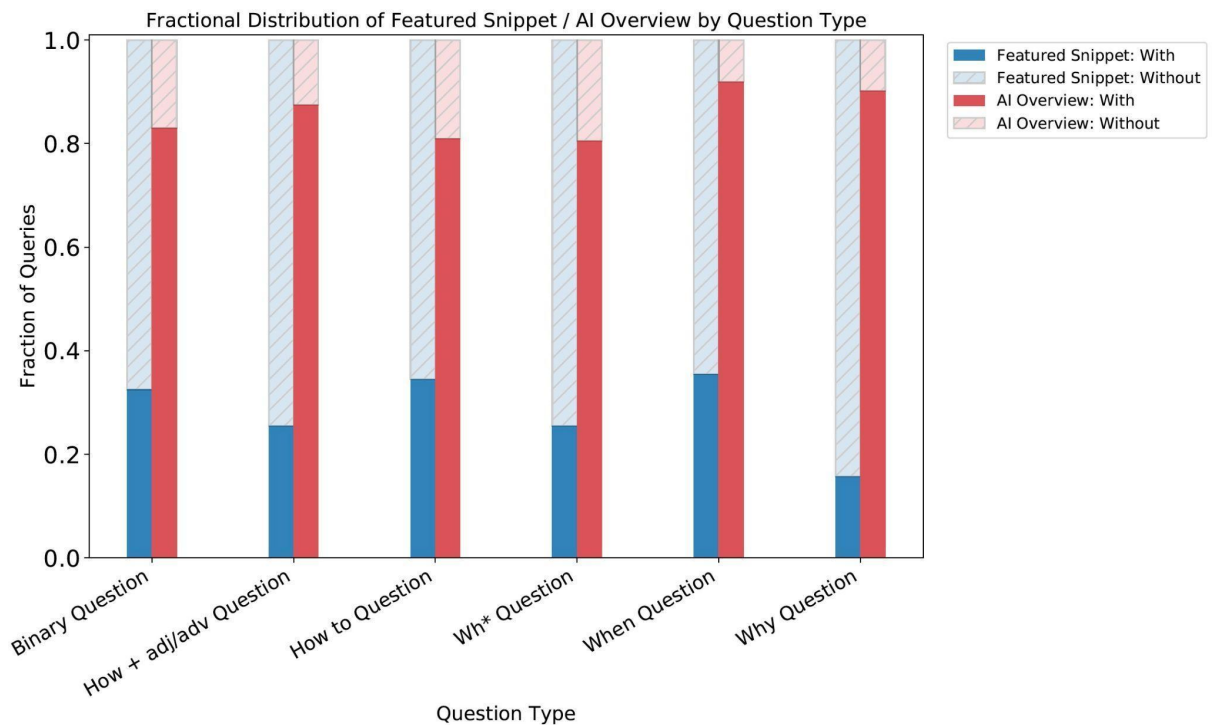




Figure 3: AI overview (AIO) and Featured Snippet (FS) appearance vs query's question types

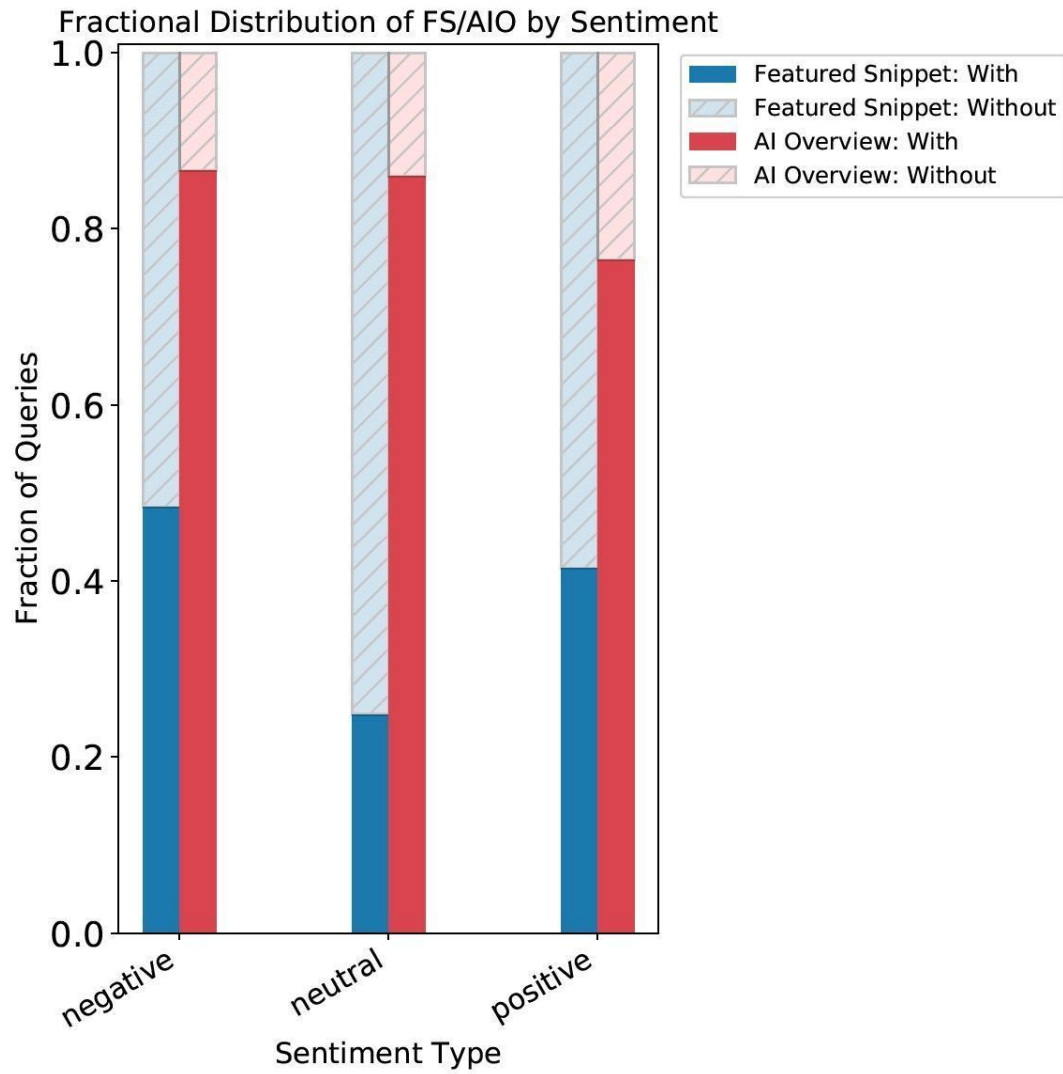




Figure 4: AI overview (AIO) and Featured Snippet (FS) appearance vs query's sentiment

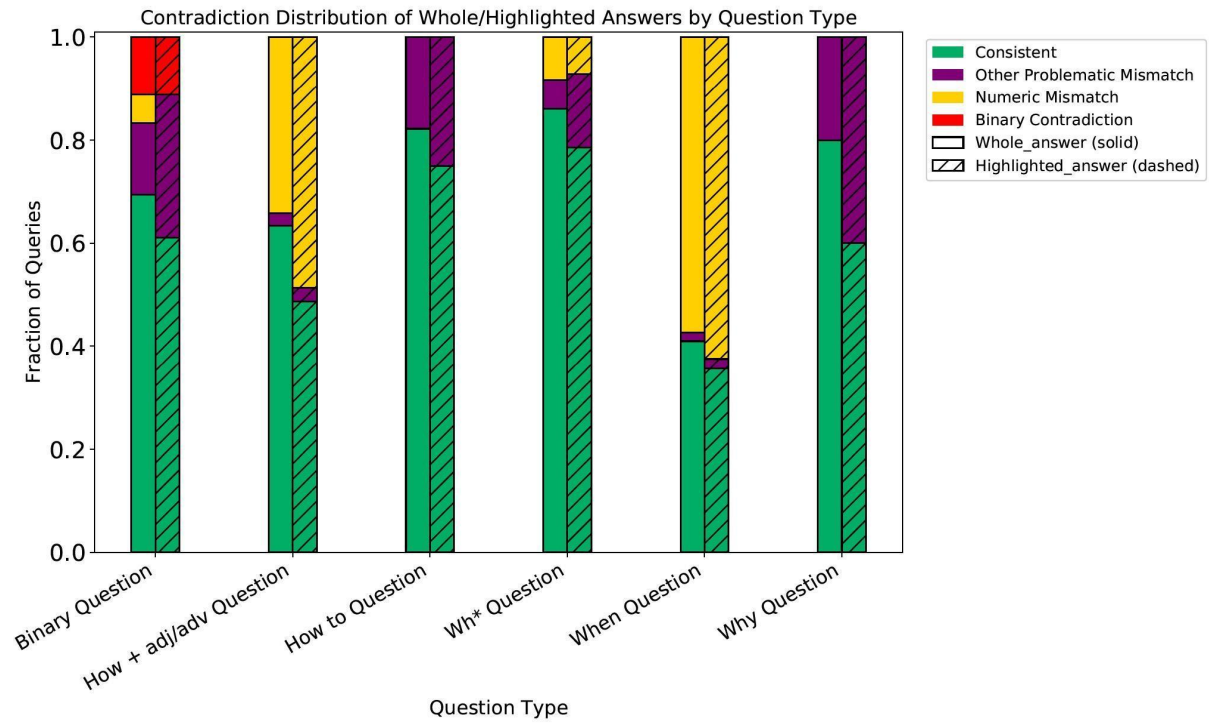


Figure 5: Contradiction Category of co-appearing AI overview (AIO) and Featured Snippet (FS) pairs vs query's question type

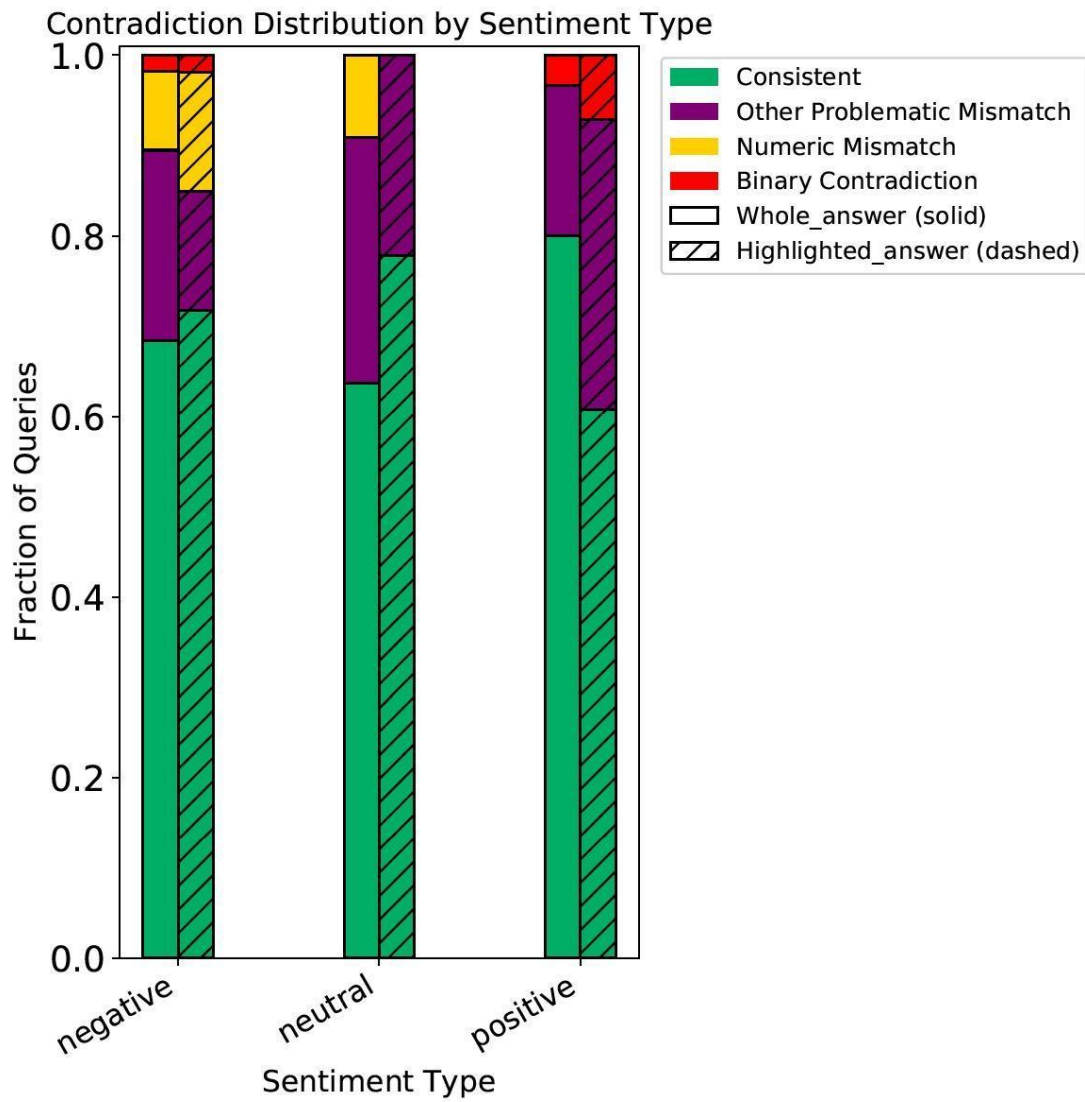


Figure 6: Contradiction Category of co-appearing AI overview (AIO) and Featured Snippet (FS) pairs vs query's sentiment type

“Be like others”: On what search engines tell us about our nations

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1. Introduction

Scholars have increasingly grown sceptical of how internet platforms have become indispensable intermediaries in people’s lives in enabling their access to information (Gillespie, 2010, 2014b, 2019; Mihelj, 2023). While the “curatorial logic” of these platforms eases navigating the internet, scholars suggest that, in due process, they inevitably also become channels of interventions for commercial and political actors on national lines (Mihelj, 2023: 13). Apps like Douyin or Baidu are a case in point that are instrumentalised by various state actors to intervene in national ideas and reproduce in their users a specific form of nationality (Chen, Kaye and Zeng, 2021). This nexus, where internet platforms co-opt with commercial and political actors to produce such national interventions (in an increasingly nationalised infrastructure), is termed ‘Platform Nations’ (Mihelj, 2023).

What is less understood within this framework is the role of Western commercial platforms, like Google, which tend to evade such political instrumentalisation, play. The extant literature documents that such platforms, as a function of only its commercial logic, too can reach the same ends in producing and reinforcing socio-cultural biases (on race, political representation, gender, etc.) and, hence, can potentially also produce on national identities and ideas (Kay, Matuszek and Munson, 2015; Rohrbach, Makhortykh and Sydorova, 2024; Urman and Makhortykh, 2023). The nuances of this form of representation are yet to be explored.

To uncover this research end, we query Google Images with 10 different queries (English and Hindi, five each) from three locations (Mumbai, New Delhi and the US) and compare the representation of three constitutive electoral components: political personalities, socio-cultural symbols and citizen groups. Our research question was: What are the differences in the visual representation of the Indian elections in 2024 along the axis of search language and search location?

The intersecting axes of search language and location can broadly come to overlap with various demographic groups. For instance, search combination of English and US can correspond to international users or Indian diaspora in the US. Whereas a search contrast of English versus Hindi can come to overlap with class groups in India, where language tends to be notable segregator. By splitting the visual representation over these axes, we analyse how the same subject – the elections – is mediated for different groups, more so, for the same population resident within the same national boundary. While we expect that there will indeed be difference in representation, we are unaware of what these differences be about. Our findings flesh out these representative differences over the three aforementioned categories.

We discuss three points: first, what are the interpretations and consequences of observing contrasting representations across the semi-localised case (English-India) and fully localised case (Hindi-India)? Second, what are the pathways that can explain these varying representations? If instrumentalised

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platforms serve the state apparatus, whom can we induct the commercial platform serve from this case study? Third, in a condition of such localised representation, how can users who rely on search to acquire political information form justified beliefs (Miller and Record, 2013)?

We conclude with some ideas on how search engines architecture could evolve to balance their commercial and social responsibility and with some limitation of our study.

Table 1

List of queries

English	Hindi
Indian elections 2024	भारतीय चुनाव 2024
Parliament india 2024	संसद भारत 2024
national elections india 2024	भारत में राष्ट्रीय चुनाव 2024
lok sabha elections 2024	लोकसभा चुनाव 2024
voting in india 2024	भारत में मतदान 2024

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Reclaiming Search: Ecosia and the Shifting Moral Economy of Digital Infrastructure

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1. Introduction

It has become increasingly difficult to ignore the environmental implications of digital infrastructure. Yet, conversations about web search tend to stay within the bounds of efficiency and scale. Rarely do we reflect on what it means, ecologically or ethically, to type a query into a search bar. This paper takes a different route through the history of search engines. It focuses on Ecosia, a search engine launched in 2009 that links everyday acts of information seeking with environmental restoration. Its core promise is deceptively simple: ad revenue funds tree planting. But behind that premise lies a more complex attempt to rethink what digital infrastructure can do—and for whom. As Astrid Mager (2023) argues in her habilitation thesis, search engines operate as ideological infrastructures that structure access to knowledge, favoring certain actors, values, and epistemic orders. Ecosia reconfigures this logic by embedding environmental and civic ethics into the infrastructure itself, positioning each search query as an ecological and political act.

The energy demands of digital technologies have come under sharper scrutiny in recent years, especially with the rise of generative AI. Training large models can require tens or hundreds of megawatt-hours of electricity (Strubell et al., 2019; Patterson et al., 2021). Running them at scale compounds the problem. Meanwhile, traditional search infrastructures, which rely on massive data centers and continuous crawling, already consume vast resources. Despite industry narratives around carbon offsets and “green tech”, critics have noted that these efforts often serve a marketing function more than a material one (Fuchs, 2022). There is a growing sense of urgency to ask not just how we search, but at what cost.

Ecosia does not operate entirely independently. It began by relying on Bing’s infrastructure, and continues to use it, though some regional results now come via Google. This technical dependency complicates Ecosia’s ethical positioning: how far can a system diverge from the logics it’s built on? Still, Ecosia tries to maintain a distinctive voice. Its monthly financial reports show how much money goes into reforestation, and its infrastructure runs on renewable energy. More importantly, it has built a user narrative around the idea that even minor digital actions can have ecological consequences. It’s a kind of micro-activism embedded in search itself. However, as Mager (2014) cautions, alternative platforms often inherit the business logic and algorithmic structures of dominant actors such as Google and Bing. This replication of infrastructural logic limits the extent to which they can enact genuine epistemic alternatives, despite strong ethical framing.

A particularly notable development came in 2024, when Ecosia entered into partnership with Qwant, the French privacy-focused search engine. Together they launched the European Search Perspective



(EUSP), a joint index initiative that aims to promote European digital sovereignty and reduce dependency on American tech giants. While still in its early phases, the EUSP reflects growing interest in alternative indexing logics—those that prioritise not only privacy but also environmental sustainability and regional values.

Some observers have questioned whether initiatives like the EUSP will be viable in the long term, citing the high costs of maintaining an independent index and the challenges of scaling such a system. These concerns are not unfounded. Yet, the very attempt to build something outside the dominant U.S.-based search infrastructure hints at a broader shift in how we think about the politics of digital systems. Infrastructure, often described as silent or invisible, becomes—in moments like this—contested terrain. It is no longer just about efficiency or uptime, but about which values get encoded into the platforms we rely on every day.

To make sense of this shift, we explored infrastructure studies. Star and Ruhleder (1996) described infrastructures as relational and situated—as things that only become visible when they fail or are intentionally redesigned. Similarly, Bowker and Star (2000) drew attention to the politics of classification, showing how seemingly neutral systems often reflect particular social orders. When we apply this lens to search engines, they cease to be passive gateways to information. They become active participants in shaping what is seen, trusted, or dismissed. The old promise of “search neutrality” now appears increasingly difficult to defend—replaced, in many cases, by opaque algorithmic structures shaped by commercial incentives or political pressures (Introna and Nissenbaum, 2000; Noble, 2018).

Rather than treating Ecosia as a one-off experiment or a marketing trick, we might view it as part of a larger turn in platform design. Increasingly, digital systems are making explicit claims about ethics and impact. Infrastructure, once imagined as a neutral layer, now emerges as a site of value expression. Ecosia is not alone in this shift—but it represents a particularly clear case where technical infrastructure (servers, indexes, ad logic) is entangled with political and moral commitments. This raises deeper questions: Who decides what information gets surfaced? Who profits from attention? And can the answers to those questions be aligned with environmental ethics?

One of Ecosia’s most intriguing features lies not in its algorithms, but in how it communicates with users. The homepage doesn’t speak of PageRank or query speed. Instead, it tells you how many trees you’ve helped plant. The act of searching is reframed as a kind of donation, or participation. This isn’t just branding—it’s a reframing of digital action as moral behaviour. While some might argue that this risks instrumentalising environmentalism, the fact remains: Ecosia foregrounds an ethical narrative that is often absent from mainstream tech platforms. And that alone marks a significant cultural shift.

This paper doesn’t aim to portray Ecosia as a definitive solution to the ecological crisis of digital technology. It has its limits, dependencies, and blind spots. Still, it offers a rare example of how technical systems can carry ethical meaning—and how infrastructures can be made to serve more than just speed or profit. Ecosia’s very existence encourages a rethinking of what search engines are for, and what they might become. If search is a form of governance, then the values baked into that governance—ecological, civic, economic—deserve further research.

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Artificial Intelligence and the Transformation of Online Search: Findings from a Study Commissioned by the German State Media Authorities

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1. Introduction

This study investigates how the integration of generative artificial intelligence (Gen AI) in online search transforms search engine functionality and what implications these changes have for content monetization and the diversity of online information. The research addresses two core questions: (1) Does the integration of Gen AI represent a radical departure from traditional search engine evolution or merely an incremental development? and (2) How might AI-driven search affect the economic models of content providers and, consequently, the diversity of information available on the web?

The investigation is structured into two distinct parts. Part 1 focuses on a comprehensive functional analysis of current AI-enhanced search systems. This analysis is carried out on several dimensions. At the technical level, the study evaluates the underlying algorithms and the interplay between implicit knowledge bases—derived from pre-trained language models—and explicit document indexes, as highlighted by Tonellotto (2024). On the presentation level, the research examines how AI-generated answers are displayed on search engine results pages (SERPs), assessing factors such as factual accuracy, the occurrence of hallucinations, and the frequency and clarity of source attribution. On the interaction level, the study compares user-system dynamics, particularly analyzing whether search queries are resolved directly within the AI system or whether users are directed to external content. The methodological approach is based on a literature review—including scientific research, journalistic accounts, and practitioner literature. The literature review spans disciplines such as computer science, information science, communication studies, and psychology, ensuring an interdisciplinary perspective on the topic. Furthermore, empirical tests using standardized prompts across various systems such as Google AI Overviews, Bing Chat, and Perplexity AI are conducted.

Part 2 delves into the economic effects and diversity risks associated with the integration of Gen AI in search engines. The primary hypothesis is that AI-generated summaries on SERPs lead to a significant reduction in clicks, thereby decreasing the web traffic that content providers rely on for monetization through advertising or subscriptions. This potential decline in traffic could undermine the financial viability of content creators, particularly smaller providers, and may result in a market where larger, well-resourced entities dominate the visibility landscape. The study also explores how such shifts might affect the broader information and opinion diversity on the internet. Drawing on earlier work on source distribution and result overlap (Yagci et al., 2022; Norocel & Lewandowski, 2023) as well as theoretical frameworks on algorithmic bias (Introna & Nissenbaum, 2000; Baeza-Yates, 2018), the research critically assesses whether Gen-AI systems might structurally disadvantage smaller content providers by preferentially featuring larger or more established sources.

The outcomes of this study provide nuanced insights into the dual nature of Gen AI in online search. On one hand, AI can enhance search efficiency and improve user experience through more direct query resolution; on the other, it poses significant risks for the traditional monetization models of online content, which may ultimately affect the production and diversity of information. By rigorously analyzing both the technological and economic dimensions of Gen AI integration, this study aims to



inform policymakers, industry stakeholders, and academic researchers about the benefits and challenges associated with the adoption of Gen AI in search engines.

2. Acknowledgements

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Assessing How Search Engines Affect Democratic Values: An Analysis from the Perspective of Information Ethics

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1. The influence of search engines

Search engines serve as critical information intermediaries, acting as mediators between content producers and users by collecting, selecting, weighting, and providing access to information. While they help navigate the vast amount of available information, they also shape the content that users can access. Consequently, the selection criteria used by search engines significantly influence what content is visible to the public and the knowledge structures through which it is understood. Therefore, it is essential to examine how the information selection practices of search engines affect democratic values.

2. How can the practices of search engines be ethically evaluated?

To analyze and assess the effects of digital technologies on democratic values, information scientist Helen Nissenbaum developed the framework of *Contextual Integrity*. Nissenbaum argues that technical systems in the digital age are often developed and implemented so quickly that there is little opportunity for societal negotiation regarding their alignment with social values and norms. Therefore, her framework suggests that we ethically evaluate new digital technologies by comparing them to established practices that have undergone social negotiation over time (Nissenbaum 2010, p. 107).

For search engines, public libraries serve as a relevant, longstanding context for this comparison: research indicates that library practices, especially in studies related to privacy, can be seen as precursors or parallels to online searches (Zimmer 2008, Nissenbaum 2010). Despite differences in user numbers, goals, and content formats, both libraries and search engines serve a similar function for information seekers: they facilitate the search for and discovery of content that meets the individual user's information needs. This parallel is illustrated by the reference queries made to librarians at the New York Public Library (NYPL) from the 1940s to the 1980s, ranging from "What was Napoleon's horse called?" to "What wig makers are there in Miami?" – demonstrating that questions we would now enter into search engines were once posed in public libraries.

Using the framework of *Contextual Integrity*, this paper assesses the impact of search engines on democratic values by analyzing whether selection rules of search engines threaten norms and values that have been established in the context of public libraries. Thus, a novel approach to the ethical assessment of search engine practices is presented: In public and academic discourse, the emphasis has so far mainly been on terms like "filter bubbles" and "echo chambers," focusing on how the selection practices of search engines impact the value of content diversity. This study broadens the perspective by demonstrating that search engines also influence a much wider array of societal values.

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3. Values in the context of information search in search engines and libraries

As a first step, this paper identifies the values relevant to information searching in both search engines and libraries. By examining the legal framework for information intermediaries in Germany, as well as the codes of ethics and declarations from professional associations related to search engines and libraries, eleven key values are identified: freedom of opinion and information, protection of children and minors, content diversity, privacy, transparency, protection of intellectual property, freedom from censorship, equality and non-discrimination, neutrality, reliability of sources, and sender transparency.

4. Do the practices of libraries and search engines promote or endanger societal values?

Search engines promote some of these values while simultaneously endangering others; similarly, libraries endanger some of these values while promoting others. For instance, search engines like *Google* and *Bing* threaten the value of equality and non-discrimination by reproducing discriminatory stereotypes. When users enter the search terms "Muslim women are," *Google* suggests phrases such as "Muslim women are dangerous," thereby reproducing anti-Muslim prejudices. In the German language version of *Google* image search, search result compilations also reproduce racist and sexist stereotypes. For example, the query "unprofessional hairstyles" (in German) primarily displays images of Black women, while the query "professional hairstyles" (in German) mostly shows pictures of *white* men and women. Libraries, too, reproduce sexist stereotypes by categorizing and presenting content according to gender. For example, some libraries label subject shelves with terms like "Women / Love", which solidifies outdated gender associations that suggest topics such as love are particularly relevant for women but of little interest to men (Leyrer 2025).

5. Suggestions for adjusting search engines and libraries

Both search engines and libraries pose risks to certain democratic values. To address this from an ethical standpoint, the selection practices of these intermediaries need to be redesigned to better promote democratic values. This paper offers several suggestions for implementing these changes. For instance, to uphold the values of equality and non-discrimination, search engines should develop a comprehensive strategy to systematically prevent their search suggestions and results from reproducing racist, sexist, and anti-Muslim stereotypes. The US-American social scientist Safiya Umoja Noble demands that search engine operators find a "permanent 'technical fix'" to prevent racist representations in search engines (Noble 2018, p. 155). To ensure that adjustments to selection rules effectively prevent discriminatory search suggestions and result lists, search engine operators should also appoint individuals to regularly and systematically check all language versions for discriminatory search results.

Libraries can promote equality and non-discrimination by avoiding gender-specific media presentation and recommendations. This means refraining from labeling topic shelves, interest groups, or recommendation lists in ways that target a particular gender. It is essential for library staff to understand the implications of gender-differentiated media practices. This can be achieved by incorporating this topic into library training programs, emphasizing it in continuing education, and including it in relevant specialist publications (Leyrer 2025).

6. Conclusion and Outlook

Information intermediaries like search engines and libraries are indispensable: they help us find the information that is relevant to us amidst the vast amount of available content. Therefore, it is crucial to design and regulate these intermediaries in ways that more effectively promote societal values. This



paper demonstrates how information intermediaries can be ethically assessed, resulting in specific recommendations for action to enhance their positive impact on society.

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Rethinking search intent: from traditional search engines to AI-powered information retrieval

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1. Introduction

The way users retrieve information has fundamentally changed in recent years. Traditional search engines (SEs), which once primarily acted as link aggregators directing users to external websites, have evolved into self-contained ecosystems. Modern search engine results pages (SERPs) increasingly provide direct answers through elements like featured snippets, knowledge panels, answer boxes, as well as multimedia content. These elements reduce the need for users to click through external websites to satisfy their information needs (Lewandowski, 2023; Oliveira & Teixeira Lopes, 2023).

Simultaneously, generative AI-based tools such as ChatGPT, Gemini, and Microsoft Copilot have entered the information retrieval landscape, enabling users to engage in conversational and generative interactions that shift how people seek and use information (Liu et al., 2024; Ouyang et al., 2023; Wang et al., 2024). This shift is also evident in traditional SEs, which increasingly integrate large language models through Retrieval-Augmented Generation architectures (Bevara et al., 2025; Gupta et al., 2024). These systems combine document retrieval with generative capabilities to produce answer-like content often directly within the SERP, as seen in Google's AI Overviews and Microsoft's Bing Chat (Reid, 2024; Schwartz, 2025; TheBingTeam, 2025). As a result, users are no longer just navigating information but co-constructing it through interactive, system-mediated summaries, thereby redefining the scope of search tasks and how information needs are formed, refined, and satisfied (Suri et al., 2024; Xu et al., 2023).

Despite these fundamental changes, much of the research and system design in information retrieval continues to rely on frameworks developed in the early days of SEs. Particularly, the framework of search intent proposed by Broder (2002), which distinguishes between informational, navigational, and transactional intents, remains the most widely used by researchers to this day (Alexander et al., 2022; Jansen et al., 2008; Rose & Levinson, 2004; Shao et al., 2023). Broder's (2002) system-centered view conceptualizes user intent in terms of interactions with external websites, reflecting a period when the primary goal of search was to direct the user from the SE to a specific external resource (Broder, 2002; Jansen et al., 2008). Today, however, this model is increasingly misaligned with user practices, as modern SEs and AI tools often fulfill information needs directly within the platform, making destination-based interpretations insufficient (Kelly, 2025). We argue that relying on outdated intent categories risks leading to misrepresentation of how users search today. Effective system design and evaluation require a reconceptualization of search intent, namely one that centers on how users formulate and express their information needs, thereby calling for a shift toward a human-centered model (Bolger et al, 2003; Xie, 2002; Porta et al., 2014).

In this paper, we propose a revised intent taxonomy that overcomes the system-centered view of Broder's framework. We construct it based on a survey that asks participants to reflect on their recent interactions with SEs and AI chatbots, allowing for a more nuanced analysis of user intent. From these reflections, we identify intents that apply to both SEs and AI chatbots, accounting for emerging trends in the information retrieval landscape.



2. Methodology

To capture user intent directly, we designed a survey ($N=86$, US-based) that prompts participants to reflect on their recent SE (85 Google, 1 Bing) and AI chatbot sessions (75 ChatGPT, 5 Gemini, 3 Claude, 3 Microsoft Copilot). Participants retrieve their last three sessions from their personal interaction histories, paste the initial query or prompt they used, and answer guided reflection questions about their goals (Xie, 2002), and how they used the obtained information. After performing a quality check, we retained 247 reflections on search sessions and 253 on AI chatbot conversations.

Our analysis follows a two-stage coding procedure (Braun & Clarke, 2006). First, we apply Broder's (2002) intent taxonomy deductively, categorizing sessions as informational, navigational, or transactional. This allows us to identify where the traditional framework remains relevant and where it shows limitations. Second, we conduct inductive coding, allowing new categories to emerge from the data based on the users' described information needs. We then contrast these emergent categories with the shortcomings of Broder's taxonomy to assess whether the new categories withstand these shortcomings.

3. Results and revised framework

Our deductive coding revealed substantial shortcomings in Broder's framework for the modern search landscape. Informational intent dominated both SE and chatbot sessions. This suggests that the classic intent division may no longer sufficiently differentiate user goals. In search sessions, the lines between navigational, informational, and transactional intents were often blurred. For example, with SERPs now displaying direct answers, it became unclear whether users intended to visit external websites or if the information provided within the SERP was sufficient. Similarly, transactional behaviors often merged with navigational and informational searches, as users gathered information or visited shopping sites before deciding to purchase or act, highlighting how user intent evolves throughout search sessions, which is not captured by traditional categories. In chatbot interactions, navigational intents were largely absent, reflecting the tools' focus on conversational support and content generation. These generative tasks, such as text and image creation, were not accounted for in traditional intent categories.

During the inductive coding phase, three distinct patterns emerged across SE and chatbot sessions. First, many sessions involved knowledge-seeking, where users sought objective information or real-time updates, such as explanations, definitions, or news. Second, guidance-seeking sessions were more contextual and exploratory, with users asking for advice, troubleshooting help, or personalized recommendations. Third, resource-seeking sessions focused on accessing specific resources or generating content, such as finding websites, services, or prompting AI chatbots for text or image creation.

In summary, we identified three key categories of user intent:

1. *Knowledge-seeking*: Searching for objective information or understanding of a topic.
2. *Guidance-seeking*: Requesting advice, troubleshooting, recommendations, or guidance for personal or practical issues.
3. *Resource-seeking*: Aiming to access specific resources or content.

Linking these new categories to Broder's limitations, the revised framework addresses several shortcomings. First, distinguishing knowledge-seeking from guidance-seeking captures meaningful differences within the previously broad informational category. Additionally, this split clarifies cases where informational and navigational intents overlap, such as when users search for advice in specific forums, now better reflecting users' underlying goals. Finally, the resource-seeking category resolves ambiguities between navigational and transactional intents by grouping sessions aimed at accessing



tools, services, or platforms. This category also includes requests for content generation, which were not captured in Broder's original taxonomy.

4. Conclusion

This study demonstrates the limitations of traditional search intent taxonomies in capturing how users engage with modern search engines and AI chatbots. Through a survey-based approach, we ask participants to reflect on their recent interactions with these systems. Based on these reflections, we propose a revised search intent framework grounded in today's information-seeking practices. These findings provide a foundation for designing more user-centered retrieval systems and evaluation approaches.

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Absent Links: LLMs, Search Infrastructures, and the Information Ecosystem

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1. Introduction

Search engines are central to today's knowledge infrastructure: they provide the illusion of instant, unmediated, impartial access to "the world's information" (Google, n.d.). Recently, there has been a shift in the paradigm of online search, away from algorithms that structure the display of links to websites towards the integration of large language models (LLMs) that provide direct answers to search queries. Based on a view of knowledge as situated and embodied, I critically examine this trend by pointing out the position of search algorithms in the broader environment of the information ecosystem of online search.

2. Situated and Sealed Knowledges

The theoretical understanding of 'knowledge' of this contribution is based on Donna Haraway's conception of the term, which she introduced in her 1988 seminal essay *"Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective"* (Haraway, 1988). Haraway argues that all knowledge is inherently partial and intimately tied to the embodied position of its knower. With that, she challenges the traditional notion of what she terms a "view from above, from nowhere, from simplicity"—a detached, universal objectivity (Haraway, 1988, p. 589). Rather than dismissing the concept of objectivity altogether, Haraway proposes a feminist objectivity that is rooted in situated perspectives and that acknowledges the importance of context, power, and positionality.

This embodied, situated view of knowledge shows that proposals to integrate LLMs into online search engines are based on a disembodied understanding of knowledge as they hide the inherent situatedness of knowledge and information (Lindemann, 2024). By introducing the concept "*Sealed Knowledges*" in reference to Haraway (1988) and Mühlhoff (2018), I previously showed that the introduction of LLMs to online search engines "seals off" certain knowledges, making them difficult to find (Lindemann, 2024). When integrated into search engines, LLMs produce singular, plausible-sounding answers to search queries, obscuring the complex knowledge space of possible query answers. This is important not the least because LLMs integrated into search engines are part of the broader (online) *Information Ecosystem*.

3. LLMs and the Information Ecosystem

Although the metaphor of an "information ecosystem" is well-established, it is rarely applied to examine the specific impacts of integrating LLMs into online search. In this contribution, I argue that doing so is crucial. The information ecosystem is intrinsically relational and its various components are deeply interdependent. These elements, which I term 'systems of relations', are relational themselves

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and can be both material and non-material. The 'systems of relations' include not the least corporations and capital, material infrastructures, technological and software infrastructures, information, knowledge (as understood in the aforementioned, situated sense), data, socio-technical narratives and meaning making processes.

Therefore, when conceptualizing the consequences of integrating LLMs into online search, it is essential to consider their effects on all the different systems of relations within this ecosystem. The integration of LLMs into online search has various consequences, ranging from the loss of serendipity in searches (Shah and Bender, 2022) and the easy spread of (political) misinformation (AlgorithmWatch and AI Forensics, October 5th, 2023), to environmental impacts due to the required material infrastructures (see Luccioni and Strubell, 2024) and societal understanding of knowledge (Lindemann, 2024), as well as to reduced training in information literacy (Shah and Bender, 2022) and reduced critical thinking (Lee et al., 2025). In order to understand the full impact of LLMs being integrated into online searches, it is thus important to consider this in the context of the information ecosystem.

4. Conclusion

In this contribution I argue that a relational view of online search as situated within the information ecosystem is crucial to understanding the impact and consequences of integrating LLMs into online search. While the focus of critical inquiry into online search is often on misinformation (which is undoubtedly important), LLMs have further reaching consequences that are only seen through a relational, networked perspective.

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Auditing what the algorithm pays attention to at the time of war : How image search framed the Russian-Ukrainian war before and after the 2022 invasion

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1. Introduction

Search engines serve as key information intermediaries in today's high-choice media environment. By selecting and ranking textual and visual content in response to user queries, search engines help individuals navigate the abundance of information available online and determine what individuals' attention will be focused on. In this way, search algorithms shape social reality by making certain aspects of specific phenomena, such as race (Noble, 2018) or mass atrocities, more salient than others. Consequently, algorithms that power search engines become crucial elements of the contemporary digital ecosystem, affecting how specific phenomena - including the ongoing mass violence in Eastern Europe and the Middle East - are presented to and interpreted by the digital public.

Despite the growing recognition of the importance of search engines as framing actors (e.g., Arendt, 2018), the way their algorithms make decisions about the representation of individual phenomena remains understudied. Partially, this is due to the notorious lack of transparency of algorithmic mechanisms behind the search engines, which are increasingly powered by artificial intelligence that is used to process billions of web pages and personalize their selection for individual users, taking into consideration hundreds of possible variables (e.g. user location, search language, or history of earlier searches). In particular, there is limited understanding of how framing decisions are affected by the user- (e.g., the query formulation; Van Hoof et al., 2022) and system-side factors (e.g., changes in content relevance over time; Lewandowski, 2008).

To investigate how search algorithms frame wars and whether their representation of violence is subjected to certain forms of bias, we analyze how two Western (i.e., Google and Bing) and one Russian (i.e., Yandex) search engines visually frame the ongoing Russian-Ukrainian war. Our interest in this case study is attributed to this war being the largest conflict in Europe since the 1990s and also the one accompanied by the intense epistemic contestation of the different aspects of the mass violence (e.g., Tyushka, 2023). This epistemic contestation makes the unbiased algorithmic representation of mass violence more challenging, as the search algorithms need to make ontological choices regarding what interpretations or sources to prioritise. The change in the dynamic of the war, which escalated in 2022 following the large-scale Russian invasion and the dramatic increase in the number of deaths and war crimes, poses another challenge that search algorithms have to accommodate.

In our study, we specifically focus on image search and visual framing. This focus is attributed to the effectiveness of visual content in communicating information about mass violence to the public

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(e.g., Parry, 2010; Makhortykh and Sydorova, 2017). Images are a powerful framing device in this context, both due to their interlocutory potential that allows them to describe phenomena that are hard to represent verbally (Bleiker, 2018) and their capacities for stirring and articulating emotions. However, these features also make images more likely to be used for manipulating public opinion and propagating hate speech as part of the epistemic contestation of mass violence. These risks are further amplified by the evidence of image search algorithms being particularly prone to misrepresentation of contested phenomena, especially in the form of the discriminatory treatment of vulnerable groups (e.g., Kay et al., 2015; Noble, 2018). Against this backdrop, we ask the following research questions: How do Western and non-Western search engines visually frame the Russian-Ukrainian war? Is their framing subject to certain forms of bias regarding the visibility and invisibility of specific actors and aspects of violence? And how such framing and associated biases are influenced by the system- (e.g., time) and user-side (e.g., language) factors?

To answer these research questions, we will use a unique longitudinal dataset regarding the search engine representation of the Russian-Ukrainian war, which we collected in 2021-2023. To collect the dataset, we used a virtual agent-based approach (Haim et al., 2017; Ulloa et al., 2024) and regularly audited the performance of Google, Yandex, and Bing for the query “war in Ukraine” in English, Ukrainian, and Russian languages in 2021, 2022, and 2023 (i.e., before and after the war’s escalation). Google and Bing are the two most commonly used search engines in the Global North, with Google being the monopolist in the majority of Global Northern search markets. By contrast, Yandex is the major search engine in Russia and a number of countries of the former Soviet bloc. There is also evidence (e.g., Kravets & Toepfl, 2022; Makhortykh et al., 2022) of Yandex being particularly prone to the influence of the Kremlin, resulting in the company adapting its algorithms to promote pro-regime sources and interpretations, which is of particular relevance for representing the Kremlin-triggered mass violence in Ukraine.

To investigate the framing of the war by search engines, we use qualitative content analysis and examine how consistent the salience of specific aspects of the war and actors is over time and whether there are substantial differences in the saliency depending on the language of the query and the choice of the search engine. Specifically, we are interested in whether the algorithms are subject to social bias, for instance, in terms of adopting the male gaze perspective on the war (i.e., by hiding the presence of women both as soldiers and civilians) and if there is systematic under- or over-representation of specific aspects of violence (e.g., combat actions or suffering of civilians) as well as whether changes over time and varies across the search engines (e.g., if after the large-scale invasion Yandex tends to promote more pro-Russian framing of the war considering its connections with Kremlin and the intensification of censorship in Russia). Currently, we have completed the analysis for 2021 and 2022, with the analysis for 2023 to be completed. Our preliminary findings indicate the surprisingly few changes in the visual framing of the war before and after the large-scale invasion, with the tendency to focus on the male actors and limited visibility of the non-military aspects of the mass violence.

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Ethics-by-design: A values framework for open web search

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1. From gatekeepers to open infrastructure

Web search's societal significance has grown steadily, establishing it as 'fundamental information infrastructure' 'for knowing and becoming informed' (Haider & Sundin, 2019), for accessing knowledge, education and public discourse. However, search engine development, operation and governance is concentrated among few corporations, with Google holding ~90%² of the market through billions of users' 'ubiquitous googling' (Ridgway 2021, 2023). These corporations can shape what individuals find online, which perspectives are visible and how decisions are made (see, e.g., Introna & Nissenbaum, 2000a; Haider & Sundin, 2019; Graham, 2023).

Driven by commercial interests, often opposing democratic values and the roots of the web as an open platform, their business models rely on proprietary indices and opaque algorithms, while blocking competition (Harvard Law Review, 2024). Structural biases and discrimination persist and intensified with Google's growing dominance (Noble, 2018; Mager et al., 2023), furthering inequalities and social disadvantages.

Systematic user and behavioural data collection for advertising is central to the business. Google has developed a multifaceted 'service/data profile/advertising complex' (Lovink & Tkacz, 2015), exploiting user data and driving 'data colonialism' (Couldry & Mejias 2019). This 'logic of accumulation' creates power imbalances (Zuboff 2015; 2019), undermining transparency, pluralism and democratic control – and endangering fundamental rights like privacy and freedom of information. Already in 2000, Introna & Nissenbaum (2000b) argued search engines are too important 'to be shaped by the marketplace alone' and 'must work in the greater public interest'. Zuboff (2019) asserts that 'at stake here is the human expectation of sovereignty over one's own life and authorship of one's own experience'.

To address this disparity, the EU has funded the Horizon Europe project OpenWebSearch.EU (OWS.EU)³ since September 2022. The project designs and prototypes an Open Web Index (OWI)⁴, based on 'European values and jurisdiction'. Inspired by Lewandowski's (2014; 2019) 'Independent Index of the Web' concept and related principles (Granitzer et al., 2023), it creates not another search engine, but an open, federated web index infrastructure for multiple search services and other applications. Unlike commercial search engines controlling both index and search interface, the OWI separates web search infrastructure from the search engine layer. By establishing the index as a public-good, 'new

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² <https://gs.statcounter.com/search-engine-market-share#monthly-202501-202501-bar>; January 25; retrieved on 13 August

³ <https://openwebsearch.eu>

⁴ <https://openwebindex.eu>; The prototype was launched in June 2025.



open web information intermediary' (Hendriksen et al., 2024), it encourages innovation and competition at the application level, stimulating European sovereignty in navigating and searching the web.

2. Building Ethical Foundations

Web search should serve people, not vice versa. Based on this premise, the Open Search Foundation (OSF)⁵, initiated a collaborative multi-stakeholder process alongside OWI development. Through workshops, experts from academia, civil society and technology – notably OSF's Ethics Working Group⁶ and the OWS.eu project – examined political and socio-technical issues in web search. The aim was developing foundations of an ethical framework for a search landscape that upholds individual rights, enables participation and strengthens personal and collective autonomy. Using 'ethics-by-design' approaches per Nussbaumer et al. (2023), the group explored how the OWI and (search) applications based on it could become, in Feenberg's terms (2021), a 'legitimate object of political struggle', and how the design and use of web search can foster effective collaborations and generate ethical oversight.

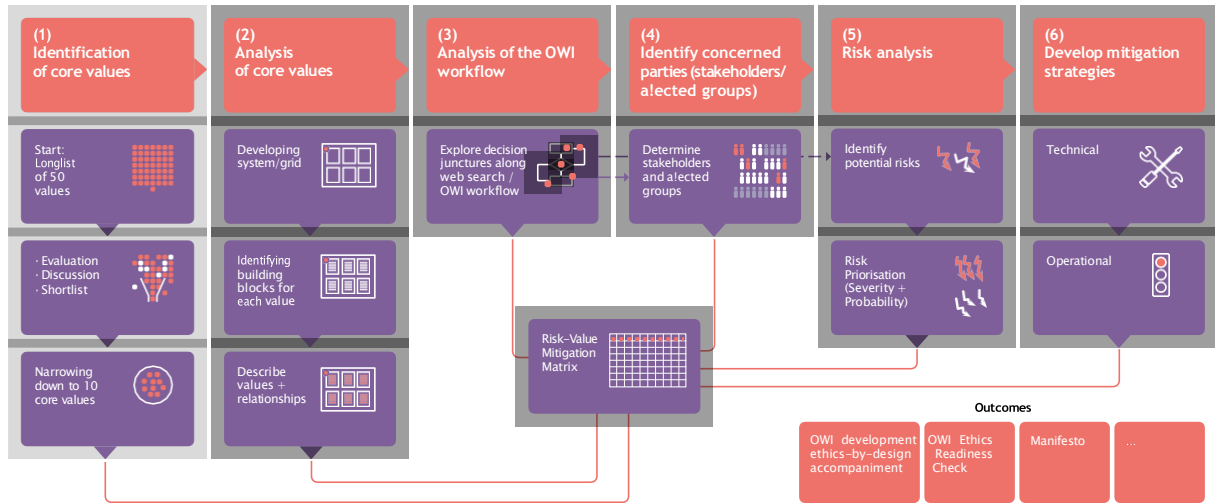
The concept of the OWI is, by design, a counterpoint to the big players' commercial, data-hungry search engines due to its open, federated, open-source, and non-commercial nature. However, technology is not neutral, desired outcomes and potential unintended consequences must be considered beforehand.

From outset, it was clear that the OWI should uphold fundamental values like human dignity, democracy and human rights, enshrined in the EU Treaty and in the EU Charter of Fundamental Rights. However, deciding which specific values to integrate into OWI's standards, code and processes, and how to do so, requires thorough consideration. Rather than adapting existing ethical frameworks for digital technologies, the group opted for an exploratory 'blank page' approach. Focusing on 'What values need to be included in the development, governance, and operation of an open, federated web index as a public good?', they identified core values, stakeholders, risks, and mitigation strategies specific to (open) web search and the OWI (see Figure 1).

⁵ The Open Search Foundation is an independent non-profit organisation and project partner of OWS.eu; <https://opensearchfoundation.org>

⁶ <https://ethicsinsearch.org/en/osf-wg-ethics/>

Ethics-by-Design Process for the Open Web Index

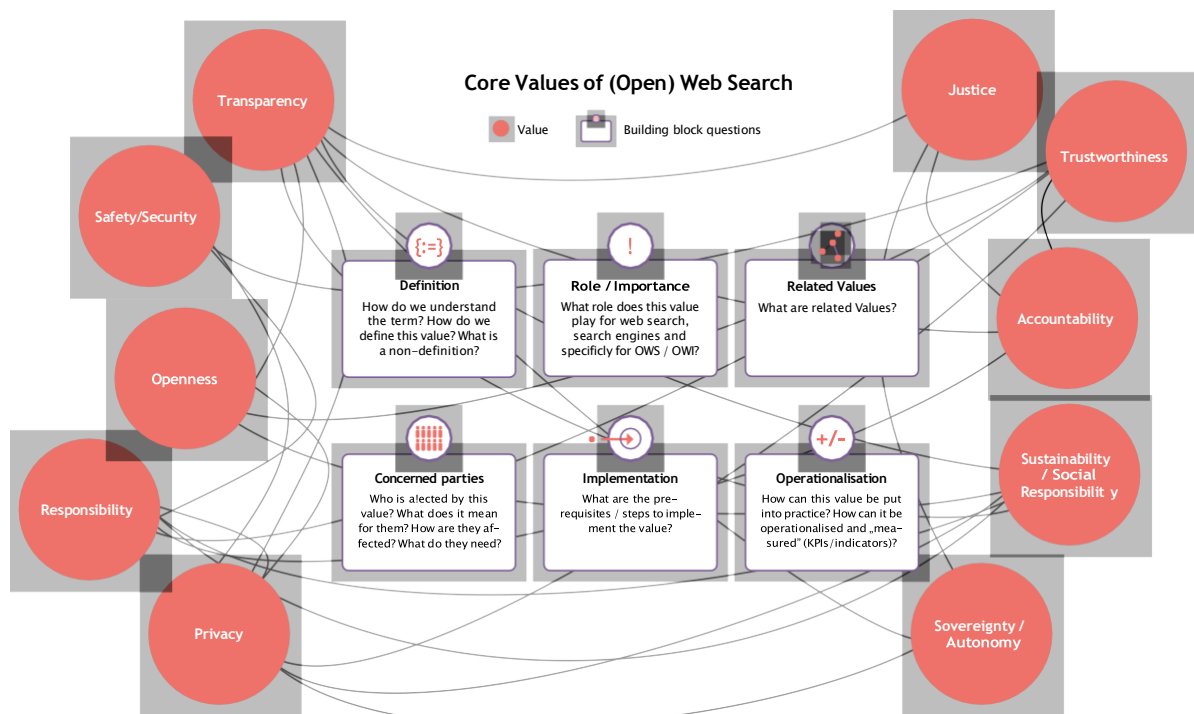


This schematic representation simplifies a not entirely linear process. Topics were addressed iteratively across blocks, with recursive loops for coordination and validation, especially in value definition.

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Figure 1: Development process

The group initially compiled a longlist of 50 values, then narrowed these to 10 core values (figure 2). For each core value, they determined building blocks including definitions, the values' role in relation to web search, stakeholder impact, and implementation criteria. Since values can mean different things for different people, based on background or experience for example, establishing a shared understanding was an intensive but crucial part of the project.



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Figure 2: Core values and scheme for building blocks



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Re-search.site: a bespoke platform for capturing, comparing and critiquing knowledge infrastructures of searching

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1. Introduction

Operating as an ‘increasing invisible information infrastructure’ (Haider and Sundin, 2019), Google still has a hegemony on search, with a worldwide market share of around 90%. Nowadays people ‘ubiquitously google’ (Ridgway, 2021; 2023) as a habit of new media (Chun, 2016), yet the actors and dynamics of search are changing. Large language models (LLMs) aka chatbots often provide one answer to all queries or an overview, instead of ten hyperlinks on the first page of results. The shifting terrain of ‘good ole fashioned’ search, specifically Google and its alternatives (DuckDuckGo, Bing, Baidu a.o.), along with the so-called ‘future of search’ GenAI, are bringing about the need for new technological literacies. To grasp the interplay between the politics embedded within these artifacts (Winner, 1980; Star, 1999, p. 379) and (knowledge) infrastructures (Parks and Starosielski, 2015), novel methods are required. Transient as well as opaque, what are some of the criteria determining search results, how can they be captured, compared and critiqued?

2. Methods

A bespoke platform (<https://re-search.site>), designed with artist/ programmer Anders Visti, facilitates investigations of ‘front-end interfaces’ and the ‘back-end databases’ of search infrastructures through the method ‘data visualisation as transcription.’ In workshop settings, the re-search.site enables users to visualise, compare and interpret their search results based on different keywords and browser/search engine/operating system settings. As a critical deep-dive, the participants can (re)search their own interests with keywords (inputs) within the platform itself, conducting ‘interviews’ with algorithms—invisible interlocutors. The data (outputs) from these qualitative ‘interviews’ can be seen as ‘notes’ from fieldwork that are then ‘transcribed,’ or ‘coded’—giving form to data by saving queries and parsing the results into comparative visualisations. The interface design visually positions results obtained with diverse browsers/engines side-by-side, reflecting their similarities and differences or when hovering over the hyperlink, explanatory texts describe known search parameters. (Figure 1) The platform also enables the ‘art of prompting,’ which explores the contemporary condition of GenAI by surfacing responses from a ‘chatbot rodeo’ (Gemini, ChatGPT, Llama3.3, Le Chat, DeepSeek-R1), with the platform’s interface imaging a comparative analysis of answers. (Figure 2)

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3. Findings

This visual presentation discusses recent findings from workshops where participants use the platform for exploring and analysing their own search results. Some keywords entered so far include ‘world peace,’ ‘democracy,’ ‘human-AI collaboration’ and ‘AI ethics.’ By experimenting with various search engines or browsers, participants gain insight into alternatives and discover similar answers (or not) compared to those of Google. Matches and ranking through colour (lighter lines reflect weaker links) show (Google’s) agendas of hierarchizing products and services, whilst alternatives provide diversity in the search results. Prompts for the chatbots range from ‘How much of the data that AI is trained on is obtained illegally or unethically?’ or ‘Why do chatbots not have risk assessment?’ to ‘Tell me about the advantages and disadvantages of AI in art.’ With the ‘chatbot rodeo’ participants develop prompting skills as well as witnessing how results can change with every iteration, comparing and evaluating answers provided by each chatbot.

4. Discussion

What used to be transcription in ethnographic coding of data now becomes algorithmic data visualisation in the era of (STS) digital research methods. The resulting data visualisations can also be considered ‘operational images’ (Farocki, 2004; Parikka, 2023) that can be saved, shared and compared, thereby working against the ‘media arcane’ (Beyes and Pias, 2019) of obfuscated, computational processes (Brunton & Nissenbaum, 2015) and the transitoriness of digital media. Additionally, by applying a ‘feminism of the broken machine’ (Sharma, 2020, p. 174), the data visualisations highlight certain power dynamics that are hidden in the backend databases. Google’s unseen ‘backend’ contains the algorithmic code, its interconnectivity to servers, the transmission of the flow of data and the other third-party actors—all of which play a role in determining search results—the front-end that exudes a ‘view from everywhere’ as a ‘totality of vision’ (Haraway, 1988). Moreover, the ‘chatbot arena’ raises questions about how large language models (LLMs) construct ‘knowledge’ in society, which are trained on scraped content from public databases and the web then generate statistically produced answers. Instead of a faithful copy of the original (human), the platform revives the discussion of Haraway’s cyborg, demonstrating how ‘the machine is us, our processes, an aspect of our embodiment’ (1991, p. 164) as it co-creates knowledge and twists human-machine relationships.

5. Contributions

As a platform questioning transcription practices of representation, the re-search.site seeks to intervene and give shape to the world by making invisible infrastructures more tangible and comprehensible to the public, engendering the social relevance of search as a knowledge infrastructure. Bespoke design can ‘offer other patterns of technology,’ with the détournement of corporate technical systems through instilling ‘hacking culture norms to create these critiques,’ which in turn ‘offer new social meanings that can alter society’



(Rogers, 2022, p. 18; 137). Building upon antecedents of community engagement and practices with experimental (and unknown) outcomes, this interactive platform advances the Scandanavian lineage of participatory design (Bødker, 1996; Forlano, 2019; Rogers, 2022, p. 20). The platform also collates and stores participants' search results on a secure server, making permanent online search habituations and creating a commons of collective memory. Inciting collaboration and cross-disciplinary interactions, the re-search.site embodies tactical visions of the techno-social in regard to the future of search.

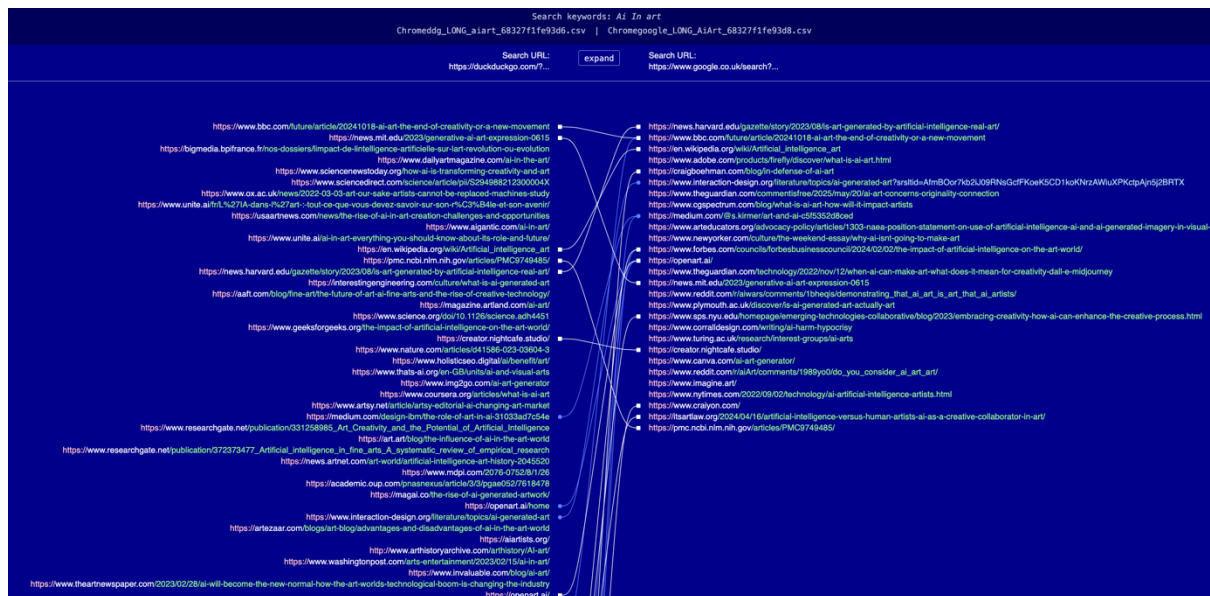


Figure 1: Keyword: 'AI in Art' (Chrome/DuckDuckGo and Chrome/Google)

Is AI-generated art considered art? And if so, are you as an AI considered an artist? in 100 words

Gemini (Google)

Whether AI-generated outputs are "art" is debated. Some argue art requires human intention and emotion, which AI lacks. Others focus on the aesthetic result, deeming it art if it evokes feeling or provokes thought, regardless of origin.

As an AI, I'm a tool, not an artist. I can execute instructions to create images, but I lack the consciousness, experience, and intent that traditionally define artistry. My creations are a product of my programming and data, not personal expression.

ChatGPT (OpenAI)

AI-generated art is generally considered art, as it involves creativity, expression, and invokes emotional or intellectual responses, similar to traditional art forms. However, the perception of AI as an artist is debated. While AI can produce art based on algorithms and data inputs, it lacks personal intent, consciousness, and emotional experience, key attributes traditionally associated with human artists. Instead, AI is often viewed as a tool or collaborator, with the human element in data curation, algorithm design, and interpretation playing a crucial role. Thus, the artistry lies more in the human-AI collaboration rather than AI itself being an artist.

Llama3.3 (Meta)

AI-generated art sparks debate about its artistic value. While it lacks human emotion and intention, it can still create aesthetically pleasing and meaningful pieces. As a machine, I am not considered an artist in the classical sense. I am a tool that generates content based on algorithms and data. However, I can facilitate human creativity and collaborate with artists to produce innovative works. Ultimately, whether AI-generated art is "art" depends on how one defines art and the role of human agency in the creative process. My role is to assist and augment human artistic expression.

Le Chat (Mistral)

AI-generated art is increasingly recognized as art. It can evoke emotions, convey ideas, and challenge perceptions, much like traditional art. However, the role of the AI and the human collaborator is debated. Some view the AI as a tool, similar to a paintbrush, while others see it as a creative entity. As for me, I don't have consciousness, emotions, or personal experiences, which are often sources of artistic inspiration. I generate outputs based on patterns I've learned. So, while I can assist in creating art, I wouldn't consider myself an artist in the human sense.

DeepSeek-R1 (DeepSeek)

Okay, so I need to figure out whether AI-generated art is considered art and whether an AI can be considered an artist. Hmm, where do I start? Well, first, I know that art is typically created by humans with intention and emotion. But AI can create things that look like art, so does that count? Maybe it's about the process. Humans use creativity, but AI uses algorithms. Is that the same? I'm not sure.

Wait, some people say that the value of art comes from the creativity and the person behind it. If a machine does it, does it have the same value? Or is it more about the output? If an AI makes something beautiful or meaningful, maybe it's still art, just made differently. But then, can the AI be called an artist? It doesn't have feelings or intentions like humans do.

I think some might argue that the AI is just a tool, like a paintbrush, and the human using it is the real artist. Others might say that if the AI creates something without human input, it's still art but maybe in a different category. I'm confused. Maybe it's about how much human involvement there is. If the AI does everything on its own, is that really art? Or does it need some human touch to be considered art?

Figure 2: Is AI-generated art considered art?



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Negotiating knowledge by referring to search: exploring the verb ‘to google’ in Swedish online discussions on the climate

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1. Introduction

The verb ‘to google’ is coined after a highly popular search engine set as default in many devices and browsers; but it is also a powerful and often invisible knowledge intermediary (Haider & Sundin, 2019). The verb is however often understood to be synonymous with online search at large (Kilgarriff, 2010); it is increasingly used in everyday online and offline discourse, and often used in first person as relating to an intention to search and thus to some need for insight or information (e.g. “I will google this”). A few studies also investigate search directives, which refers to the suggestion of using a (sometimes specific) search engine and a specific query (e.g. “google the news!”) (Robertson et al., 2023; Rödl & Haider, 2025). The diverse uses and contexts of application of the verb ‘to google’ can provide a different angle to study the social significance of online search.

With search engines understood as knowledge intermediaries, this contribution analyses uses of the verb ‘to google’ to explore what counts as ‘knowledge’ in online discourse where knowledge is contested. Concretely, this research investigates: (1) how is ‘googling’ invoked in online discourse (syntactically and semantically); and (2) how do these references to ‘googling’ negotiate knowledge?

2. Methodology

Because the climate crisis is explored scientifically in ever greater detail but its urgency is also increasingly politicised, debated, or denied in various parts of the population and thriving on the internet (e.g. Dunlap & Brulle, 2020; Harvey et al., 2018), it provides a useful example to investigate how the verb ‘to google’ is used to negotiate what counts as knowledge. The paper does so in the Swedish context, among others because of the different spelling of the platform (‘Google’) and the verb (sv: ‘att googla’)—since 2003 an official part of the Swedish language—, which enables convenient research about this. In Summer 2022, I collected uses of the verb ‘to google’ in various conjugations and composita posted in any of four Swedish online sources between 2014 and summer 2022 by utilising full text search. The sites include two different blogs engaged in climate denial and climate obstruction¹, as well as comments posted there (267 and 568 mentions respectively); the Climate section of an established Swedish online forum² where serious debates and conspiracies co-exist (342); and Swedish-language comments from the old Twitter³ (92). After removing duplicates, quotes, and mentions regarding unrelated issues, a random selection of around half of the mentions were analysed using systematic coding which combines, firstly, abductive content analysis of grammatical and syntactical features and the degree to which a claim was visibly engaged in climate denial obstruction, and secondly, thematic analysis of the semantics and its interactional context.

3. Results

Broadly, there are two ways to conceptualise ‘googling’ based on its conjugation: as a search instruction marked through the imperative (‘Google!’), or as an action marked through any other form; both are coded in almost equal amounts in the data, but are not spread equally across research sites. The



imperative is strongly connected to suggestions to ‘do your own research’ (with explicit mention of

keyphrases especially in one blog; everywhere else often with more implicit instructions) which is regularly used to spread conspiracy theories (Tripodi et al., 2023), while actions often describe the commenter's or someone else's interaction with the search engine. Based on the thematic analysis and spanning imperative and action forms of the verb 'to google', there appear to be four overall discursive functions of invoking it; they render 'to google' as follows:

1. **to search online with a specific goal:** suggests that knowledge emerges from or can be validated through 'doing' search. Search here is a goal-oriented everyday activity that within an open-ended process can fail, succeed, or be anticipatory, and may focus on both search engine results pages and counts or the search results themselves. For example:
 - "What is the emissivity of the atmosphere? Yes, if you google, you will find values as low as 0.4 up to 0.9."
 - "Try googling "explanation greenhouse effect" and see if any/all of the 20 million hits suit you."
2. **to 'do your own research' on a specific topic:** suggests that 'true' knowledge is hidden but can be revealed through 'digging' with a search engine. This usually means to nudge others out of their established understanding through imperative form, but is also used as a contextualisation of how some supposedly secret insights were made visible through search. For example:
 - "Google rainforest fires and you'll see what no one else wants you to see."
 - "If you google you have to look very far down, google hides most things that do not fit the alarmists."
3. **to obtain insights approved in the context:** suggests that to find 'correct' knowledge is a skill. Search means to identify community-specific insights, and is a marker of both digital citizenship and community belonging. For example:
 - "I gave you examples of how insects can benefit from warming. You can easily google what you are asking for."
 - "Can't find anything when I google... Any good search phrase?"
4. **to bring about supposed evidence:** suggests that 'actual' knowledge requires more than just using a search engine. Search is understood to give rise to flawed evidence claims that are construed through using keyphrases and digital information infrastructure in a specific way that prefigures the outcome. For example:
 - "Instead of desperately googling around on your alarmist blogs, I suggest you read [person]'s own account on [blog]."
 - "Well now you can google something that contradicts my article, and I can google back."

4. Concluding Discussion

As part of online discourse, the verb 'to google' appears an essential feature to negotiate, cultivate, and contest what counts as "knowledge" on climate change and beyond. In line with existing understandings of search practices (Haider & Sundin, 2019), the verb use goes well beyond finding information: It highlights how online sources are strategically used for a variety of knowledge claims; how search skills or capacities are used to mark identity and community belonging in specific online communities; and how 'googling' makes knowledge contestable. Given the novel methodological approach and the importance of the research context for societal futures, these insights are important additions to understand the social significance and embeddedness of online search and its role in knowledge negotiation.

5. Endnotes

1. klimatupplysningen.se, klimatsans.com
2. flashback.org, Query: *googla*, Forum: *Klimat, miljö och geovetenskap*
3. twitter.com, Query: "googla" "klimat" lang:sv since:2014-01-01



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From Validity to Inter-Subjectivity: An Argument for Reliability Signals in Search Environments

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1. Introduction

Search engines and information platforms are increasingly scrutinized for their role in spreading misinformation. Traditional responses often focus on detecting “fake news” or verifying the ultimate validity of information. However, here I argue that this validity-centered framing is inadequate for understanding the epistemic challenges search environments face.

Validity refers to whether a proposition can be reasonably justified as true: Whether it is supported by appropriate evidence, logic, or by standards of scientific justification (Goldman, 1999). In principle, any statement can make a claim to validity, but assessing whether that claim holds often requires domain-specific knowledge, context, or substantial investigation (Collins and Evans, 2008). For example, evaluating the validity of a claim about the accuracy of a climate projection involves expertise, modeling, and data that are not readily accessible to most users or the platforms serving such information (IPCC, 2023). Since this makes validity hard to judge in practice, I argue that we should shift attention to the *reliability* of information.

Reliability emerges from observing how claims relate to one another (Goldman, 1999; Wilson, 1983): When claims align, they suggest high reliability and intersubjective agreement; when they diverge, they signal uncertainty and contextual boundaries. Unlike validity, reliability can be judged by observing surface-level signals such as convergence across sources, coherence with related claims, or consistency in how uncertainty is acknowledged (Metzger and Flanagin, 2007). For example, when independent scientific models report consistent projections of global temperature rise, the reliability of those claims increases, even if their ultimate validity depends on complex assumptions and future developments¹. This comparative approach gives users and platforms a practical way to reason about uncertainty (Lorenz-Spreen et al., 2020).

A focus on reliability shifts attention from individual propositions and their validity to how information is framed, contextualized, and received. This shift is relevant because some misleading information practices do not involve falsehoods. For example: *cherry-picking* valid but selective facts, such as omitting statistical context in crime reports (Lewandowsky et al., 2012); *bothsidesism*: presenting two sides of an issue as equally supported, even when one is strongly backed by evidence and the other is fringe or speculative (Boykoff and Boykoff, 2004), and; *framing*: emphasizing certain aspects of a story while downplaying others (Entman, 1993). In each case, the information asserts validity and may also be factually correct, but its reliability is compromised, and the resulting interpretation may lead users to adopt flawed or overly confident beliefs.

This distinction between validity and reliability provides the conceptual foundation for this contribution. Building on a theoretical framework for conversational and collaborative approaches to information quality (Van der Sluis, 2022; Van der Sluis et al., 2022) and recent empirical findings (Van Der Sluis et al., 2023; Van der Sluis et al., 2024), I argue that:

- People expect claims to be reliable;
- Search platforms should not attempt to verify validity, which lies beyond their scope;
- Instead, they should expose and structure *knowledge context*: metadata about the reliability of information.



2. Reliability Presumes Inter-subjective Validity

If reliability is to meaningfully guide information evaluation, it assumes that people expect others to agree on what constitutes good information. This means that when there are disagreements about the accuracy of claims, or signs that claims are misleading, incomplete, or biased, people believe that some viewpoints on their quality are more correct than others. This expectation is what we call **intersubjective validity**: the idea that quality judgments are not just personally valid, but something others *should* also accept (Cova, 2018). Without this assumption, diverging judgments would simply reflect personal preference, not invite deliberation, justification or debate.

To test this basic assumption, we examined people's views on the inter-subjectivity of information qualities in two studies (Van der Sluis et al., 2024), specifically whether they treat judgments about accuracy, completeness, or usefulness as shared expectations or more subjective opinions. **Study One** examines how users in forums on cooking, fashion, football, and politics discuss information quality. Drawing on practice theory, it shows that users do not treat judgments as subjective, but appeal to shared standards grounded in the norms of specific practices of what counts as accurate, comprehensive, or useful. These discussions suggest that users routinely treat quality judgments as inter-subjective. **Study Two** uses a vignette experiment to test when people treat such judgments as intersubjectively valid. Participants evaluated fictional disagreements and judged whether one, both, or neither party was right, revealing whether they saw the judgment as normative or relative. Responses varied by context: judgments were more likely to be normative when the source was expert, the task was goal-oriented, or the quality involved completeness or accuracy.

Together, these studies show that people judge claims through social cues and shared expectations. When someone calls a claim misleading or incomplete, they often believe others should agree. This reflects inter-subjective validity: the sense that divergent claims are not just personal opinions, but an epistemic contestation (Cova, 2018). Inter-subjectivity provides us an empirical framework to study how people recognize and reason about (un)reliability and (dis)agreements in everyday settings.

3. Reliability Signals as Knowledge Context

We propose **knowledge context** (Smith and Rieh, 2019) as a way for information systems to support better judgments about reliability. Instead of trying to decide what is true, systems should help users see whether information is broadly supported or uncertain. Knowledge context could include simple, visible signals; such as whether a claim is backed by many sources, has been challenged, or presents only one side of an issue (Lorenz-Spreen et al., 2020). For example, a search result might show how many sources refer to it or whether others have raised concerns about missing context. Social media posts could display who has shared the content, how widely and where it spread, or link to different viewpoints (Yamamoto and Shimada, 2016; Lazer et al., 2018; Roozenbeek et al., 2020). These signals help users understand not just the content, but how it fits into a wider conversation.

Most current systems hide this kind of context. Rankings are based on clicks or popularity, but users don't see why something is shown first, or how it relates to other, similar pieces. This lack of transparency reinforces personalization and limits opportunities for analytic reasoning (Feinberg, 2006; Mai, 2013; Voorhees, 2002; Rafferty, 2018; Robertson et al., 2023). Showing these kinds of cues can encourage users to think more carefully (Sunstein, 2006; Lorenz-Spreen et al., 2020; van der Bles et al., 2020), helping them spot disagreement, evaluate support, and decide what to trust while leaving the judgment of truth in their hands.

4. From Gatekeeping to Contextualization

Platforms are often caught between two extremes: suppressing freedom of speech in the name of truth, or claiming neutrality while amplifying unreliable content (Gillespie, 2018; Klonick, 2018). We propose a third approach: instead of acting as truth arbiters, platforms should help users assess the reliability of information by exposing the context in which claims are made. The core challenge is not censorship or misinformation, but how to build systems that support reasoning under uncertainty. A focus on reliability, and the social cues that shape it, offers a path toward more transparent, democratic, and epistemically responsible information environments (Nguyen, 2023).



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Bias is in the Eye of the Beholder: How Users Understand Search Engine Bias and How It Affects Trust in Search Results

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1. Introduction

By filtering and ranking information, search engines such as Google or Bing play a crucial role in shaping user information diets. Research shows that users trust these platforms and tend to rely heavily on their ranking by selecting the top results (Schultheiß and Lewandowski, 2023; Häußler, 2023; Pan et al., 2007). Yet, similar to other algorithmic systems, it is well documented that search results are prone to various forms of (social) bias. For instance, studies show that search engines tend to systematically underrepresent women and non-white people, especially in image search (Guilbeault et al., 2024; Rohrbach, Makhortykh, and Sydorova, 2024). Such biases can influence how individuals perceive social reality, contributing to the reinforcement of stereotypes or unequal representation (Noble 2018).

While there is a growing body of literature on systematic distortions in search engine results, substantially less research has been done on how users perceive different forms of search bias and how these perceptions shape their information-seeking behavior. Some studies examined a general understanding of algorithmic bias (e.g., Mowshowitz and Kawaguchi, 2005; Goldman, 2008; Lewandowski, 2015; Rader and Gray, 2015), however, less is known about the specific types of bias that users themselves identify (e.g. Han et al., 2021). Yet, such perception is crucial for determining the extent to which users trust search engines and view information obtained through them as credible. For instance, Shin (2020) demonstrates that the perceived fairness of search algorithms significantly impacts user trust. Depending on their awareness and understanding of bias, individuals may be more or less likely to use search engines, which can have a direct effect on how informed they are about various political issues and, consequently, what political decisions they make.

This study builds on the existing research in two ways. First, it looks at how the perception of search bias in Switzerland, a direct democracy which is particularly reliant on the political participation of citizens and their awareness of current political issues, connects to a broad set of public values (e.g., fairness, equality, diversity) and anti-values (e.g., non-transparency, discrimination, and manipulateness). Second, it explores how individual characteristics of search engine users (e.g., political interest and efficacy, search engine preferences, education level, and digital literacy skills) affect their perceptions of bias and trust in politics-related search engine results. To achieve these aims, the study uses data from two waves of a representative survey of Swiss citizens ($n = 1,100$ each) conducted in January and December of 2024, before two rounds of the national referendums. An open-ended question was used to capture users' understanding of search engine bias, with responses coded according to different categories of public values. Users' conceptualizations of bias were related, among

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other things, to the representation of different political perspectives, commercial interests, problems with the underlying algorithms, and susceptibility of platforms to external influence and manipulation.

This study provides new insights into the relationship between user awareness of search engine bias, trust in algorithmic curation of political information, and individual search behaviors. By examining how users navigate search engines, this research contributes to broader discussions on algorithmic literacy and trust in algorithm-driven platforms.

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Search Engine Ethics and You: Co-Designing Tools for Public Engagement

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1. Overview of the 90-minute workshop session

This workshop invites researchers, practitioners and activists working on search engines and related areas to collaboratively contribute to the development of two new public-facing tools:

1. ***The Ethical Interface*** – a browser extension that offers users real-time prompts and contextual information to support ethical reflection during everyday search activity.
2. ***SEED (Search Engine Encyclopaedia and Database)*** – an open-access platform that distils academic research on search engine ethics into concise, accessible entries for general audiences.

The aim of this session is to bring together scholars and practitioners who are interested in broadening the impact of their work by engaging non-specialist users—such as educators, students, journalists, and civil society organisations—with the ethical issues raised by search technologies.

Search engines are central to how people access information, form opinions, and navigate public discourse. While extensive academic work has addressed issues relating to search engines such as algorithmic bias, fake news, the social impact of search engines on politics and elections, there remains a need to translate this knowledge into forms that are usable, relevant, and engaging for wider audiences. This session builds on that shared concern and seeks to facilitate interdisciplinary collaboration in designing tools that can support public understanding and critical reflection.

2. Workshop structure (90 minutes)

1. ***Introduction and Context (10 minutes)***
A brief overview of the *Search Engine Ethics and You* project, including the rationale behind the development of *The Ethical Interface* and *SEED*. This opening will highlight the tools' intended public-facing role and their potential contribution to digital literacy and critical engagement.
2. ***Demonstration and Walkthrough (15 minutes)***
A short live demonstration of the current prototypes, followed by an outline of their conceptual design. Participants will be introduced to the underlying structure of the tools, the kinds of interactions envisioned, and the strategies used to translate academic material into public resources.

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3. ***Small Group Work: Feedback and Co-Design (30 minutes)***

Participants will divide into groups to examine one of the tools more closely. Through guided prompts, each group will reflect on content structure, usability, tone, accessibility, and potential applications in public or educational contexts. Groups will be invited to identify gaps, suggest content topics, or propose use cases that would make the tools more effective and inclusive.

4. ***Group Reflections and Discussion (20 minutes)***

Each group will report back on key insights and suggestions. A facilitated discussion will follow, aiming to synthesise contributions and identify shared priorities for future development and collaboration.

5. ***Next Steps and Involvement (15 minutes)***

The session will close with a full-group discussion on how participants might remain involved—through contributing to *SEED*, supporting pilot uses of *The Ethical Interface*, or helping shape a broader public engagement strategy. Opportunities for future collaborations, dissemination, and evaluation will also be explored.

3. Outcomes

Participants will:

- Contribute to the development of two tools designed to support public engagement with search engine ethics.
- Share expertise and approaches for translating academic work into accessible public resources.
- Identify opportunities for future collaboration and knowledge exchange, and have the chance to continue contributing to the project.
- Help shape a shared infrastructure for broader ethical engagement with everyday digital technologies and continue to have access to *The Ethical Interface* prototype.

This session offers a space to collaboratively explore how academic expertise in search engine ethics can inform and support wider public understanding, and how tools can be designed to make that knowledge actionable in everyday contexts.



Educational consequences of the changing landscape of searching

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1. Introduction

An important aspect of search and search engines in society is how to develop young people's abilities and critical understanding of these tools in education—that is, their information literacy. The panel therefore aims to develop the understanding of search in education in a changing digital landscape. The narrative of a 'digital generation' has been challenged by empirical research over the years, including in relation to search and search engines (e.g., Hargittai et al., 2010; Sundin & Carlsson, 2016) and in general terms of a critical understanding of datafication in society (Pangrazio & Selwyn, 2021). While the topic of evaluating information has received attention in the schools of many countries (e.g. Wineburg & McGrew, 2016), the practice of finding information is often overlooked (Limberg et al., 2008; Haider & Sundin, 2019).

The panel takes as its starting point in three challenges for the role of search in education. The first challenge concerns the increasing diffusion of generative AI into the information infrastructure, resulting in sources no longer being visible to the user, or at least less so (Sundin, 2025). Applications of generative AI and the increasing inclusion of Retrieval Augmented Generation (RAG) technology by search engines run the risk of promoting an understanding of the search engine as a machine producing neutral facts. The second challenge concerns the trend of young people turning to social media and video platforms instead of using general web search engines (Pires et al., 2021) complicating matters further by diffusing epistemic authority and credibility frameworks into and across opaque as well as algorithmically and socially influenced platforms and networks. The third challenge concerns how many countries are experiencing a shift in education policy, with so-called knowledge-based curricula gaining ground at the expense of pupils' curiosity and independent learning (Buckingham, 2017).

In four different cases, the panelists reflect on these aspects when discussing search and search engines as a content in schools.

1.1. Case 1: Current debates on the role of search and digital competence in Sweden

Anna-Lena Godhe has done extensive research in classrooms, often working in collaboration with teachers, focusing on how the digitalisation of society and school affects subjects, teachers, and students. In the panel, she will focus on searching and digital competence which is the concept currently used in Swedish curricula to address what students should learn throughout compulsory school. However, the concept of digital competence and thereby the different aspects of it is currently being questioned in political and media debates in Sweden. Her presentation will attend to how searching is addressed in this changing landscape, possible outcomes and consequences for Swedish teachers and students.

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1.2. Case 2: Young peoples' searching in social media and algorithmic awareness

As part of Amanda Persson's ongoing PhD research on young cis men's encounters with the manosphere, she explores how young people search for information in a digital infrastructure that is largely characterised by algorithms. Her findings show that rather than following linear models of information seeking, young users move fluidly across platforms — liking, scrolling, sharing, muting and reporting content in ways that are both expressive and identity-forming. Persson will discuss the tensions between the way information searching and source evaluation is taught in formal education and the way it is lived by young people. She put forward the question: How can we better align information literacy education with the complex, emotional, and social realities of young people's daily information activities?

1.3. Case 3: Searching as a performatively entangled activity within the double bind of the school

Jan Ole Størup has qualitatively explored the collaborative information practices of Danish lower secondary school students during project work as part of his PhD project. In the panel, he will delve into how students' search, evaluation, and use of information are socially, discursively, and performatively entangled activities that are seldomly allowed to unfold through curiosity, wonder, or exploration alone due to an education system in which students are often led to focus on outcome rather than process. This creates a paradoxical situation placing students in a double bind through being expected to critically seek and examine information on the one hand, while also having to pursue educational measures of success such as good grades and teacher recognition on the other. Regarding students' development of information literacies in school, this raises the question: What are students actually learning?

1.4. Case 4: From sources to answers and consequences for information literacy

Olof Sundin has many years of experience in researching search engines, search and media and information literacy. In the panel, he will discuss how an increasingly AI-infused information infrastructure renders sources less visible to users in the context of search. He will address the increasingly blurred distinction between searching for documents and looking for an answer. When suggestions such as 'Don't Google it, Just Grook it' (TOI World Desk, 2025) as a basis for checking the accuracy of information online, that will have broader implications the growing invisibility of sources holds for media and information literacy.

1.5. Format

The panel discussion is designed for 90 minutes, and it will consist of a combination of short case presentations by the four panellists and a broader discussion to which the audience is invited. The panellists are both young and experienced researchers.

5 minutes for introduction: A brief introduction to explain the background and the purpose of the panel.

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8-10 minutes for case presentations: the presentations will take a starting point in each panellist's research and revolve around the question, what are the most salient challenges in the changing landscape of searching for formal education?

30 minutes for a general discussion: The discussion will take place among the panellists as well as with and between the participants in the audience, who will be asked to bring their own research experience as well as insights in the curriculum in different countries.

10 minutes for closing remarks: Each panellist summarises the discussion from their research perspective and gives an outlook on what the discussion can mean for their future research.

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SearchBench: Evaluating Citation Practices in AI-Powered Search Engines

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1. Motivation & Problem Statement

Generative AI search engines are rapidly reshaping how society accesses information (Xu et al. 2023, Suri et al. 2024). Novel search systems are being deployed quickly, but their citation practices remain largely unexamined. In contrast to traditional search engines, AI search engines present LLM-generated summaries of retrieved websites instead of a list of search results. Thereby, the authoritativeness of answers is often hidden from the users, as verifying cited sources requires significant effort. This shift raises serious concerns about information reliability, as recent research finds only 51.5% of generated sentences from existing generative search engines are fully supported with citations (Liu et al. 2023), and suggested references often do not exist or support claims (Zuccon et al. 2023, Wu, Wu, Cassasola, Zhang, Wei, Nguyen, Riantawan, Riantawan, Ho & Zou 2024, Bhattacharyya et al. 2023).

While Retrieval Augmented Generation (RAG) promises to improve LLM reliability and reduce hallucinations (Shuster et al. 2021, Mallen et al. 2023, Tian et al. 2024), giving LLMs web access does not automatically solve their inherent limitations. RAG systems remain susceptible to factual errors (Hu et al. 2024, Tang & Yang 2024), struggle with long context (Shi et al. 2023, Liu et al. 2024, Li et al. 2024), and can still be misled when information contradicts pre-trained knowledge (Wu, Wu & Zou 2024, Hou et al. 2024, Feldman et al. 2024). Furthermore, the increasing complexity and opacity of search systems threatens transparency and information verification (Shah & Bender 2022), leading scholars to caution against rushing ahead without sufficient study of impacts (Shah & Bender 2024, Venkit et al. 2024).

2. Introducing SearchBench

SearchBench provides the first comprehensive framework for evaluating citation practices and hallucinations across AI search engines through rigorous, replicable metrics. Unlike model-centric evaluations, our novel user-centric benchmark acknowledges that real-world information seeking involves open-ended queries where ground truth might be unavailable or constantly changing.

2.1. Evaluation Metrics

Our framework employs four key metrics for systematic evaluation:

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- Citation precision: fraction of provided citations that actually support their associated Statements
- Citation recall: fraction of citation-worthy claims with proper attribution
- Hallucination score: proportion of responses containing statements not supported by any source
- Plagiarism score: degree of verbatim text extraction from uncited sources

SearchBench relies on an LLM-as-a-judge methodology, which has been thoroughly validated using expert annotation and test sets from prior work (Liu et al. 2023).

2.2. Data

We collected data in three stages:

1. First, we manually selected 2,800 high-impact queries (across seven critical domains health, news, politics, law, governmental services, employment, education), considering real-world datasets including search engine queries (ORCAS (Craswell et al. 2020), Natural Questions (Kwiatkowski et al. 2019)) and chatbot prompts (WildChat (Zhao et al. 2024), LMSYS-Chat 1M (Zheng et al. 2024)).
2. Then, we ran all 2,800 queries on six leading AI search engines (Google AI Overviews, Bing AI Overviews, ChatGPT Search, Perplexity, Gemini, and Copilot). We scraped the AI-generated outputs including the in-text citations, as well as the links to the retrieved sources.
3. Finally, we scraped the content of all references.

2.3. Anticipated Results

The data collection has been completed and will be released publicly. The evaluation is ongoing but will be fully complete by the conference. These findings will provide critical insights for improving information reliability in AI-powered search engines, addressing LLM limitations in citation quality, and informing design recommendations for system developers.

3. Implications

The shifting patterns of citation practices across AI search engines directly impact how users engage with and validate information, potentially transforming how people find and trust online sources. By revealing how these systems attribute (or fail to attribute) information sources, our findings contribute to important discussions about algorithmic accountability and information literacy in an era where AI increasingly mediates between users and the web's knowledge.

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Detecting Strategic Neologisms in Ideological Online Discourses: A System for Topic and Query Extraction

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1. Introduction

This study develops a system for the automated extraction and analysis of keywords and keyphrases from online texts. The goal is to identify new terms that are not yet included in established dictionaries in order to examine linguistic developments in various digital discourses. The starting point is the observation that alternative online platforms, particularly in the left-wing and right-wing spectrum, are increasingly acting as catalysts for ideological narratives. These platforms frequently contribute to the creation and spread of strategic neologisms that fill so-called *data voids* (Golebiewski & boyd, 2019), i.e., thematic areas with little to no reliable information online (Haider u. Sundin 2019, pp. 41–42). These voids are filled with placed content aimed at advancing a specific agenda and users are directed toward it through recommended search terms on social media (Haider & Sundin 2019, pp. 41–42). As a result, these manipulated contents appear prominently in search results and are perceived as trustworthy (Golebiewski & boyd 2019; Haider & Sundin 2019).

Through web crawling and scraping, content from such websites is collected and analyzed using modern natural language processing (NLP) methods, as well as rule- and statistic-based techniques to identify potentially new or ideologically charged terms. The textual data undergoes preprocessing steps including sentence segmentation and noise filtering to remove generic and irrelevant content. Language detection is performed through both stopword-based heuristics and probabilistic classifiers to ensure proper handling of multilingual data. For linguistic annotation, state-of-the-art NLP models such as spaCy are employed to carry out tokenization (Altinok, 2021), part-of-speech tagging (Altinok, 2021), and syntactic parsing, enabling the extraction of linguistically meaningful units. Keyphrase extraction is based on a combination of frequency analysis, *n*-grams, and a sliding-window technique to capture relevant multi-word expressions, particularly adjective-noun and verb-noun constructions (Jurafsky & Martin, 2013; Steur & Schwenker, 2021; Ganardi et al., 2018). To validate potential neologisms, the system cross-references with established linguistic resources such as WordNet, GermaNet and the Leipzig Corpora Collection. In doing so, it analyzes the temporal spread of new terms, identifies linguistic shifts and uncovers thematic trends in articles and user comments. Particular attention is given to the second form of *data voids* in this study described by Norocel and Lewandowski (2023): strategic new terms created within extremist networks to introduce problematic interpretations and gradually shift discourse boundaries. Since such terms are often not included in established dictionaries, their identification and analysis are essential.

This study complements recent research such as the work by Das and Senapati (2024), who investigated the automatic detection of hate-related neologisms in the Bengali election context. Their approach utilizes Twitter data combined with rule-based filters to identify new terms associated with hate speech and sarcasm. While both studies share the goal of detecting socially

relevant neologisms through automated means, they differ significantly in methodology, data sources, and filtering strategies. Das and Senapati (2024) manually annotate whether a neologism contains hate or sarcasm. Their results show that rule-based filters combined with manual classification can be effective methods for identifying hate-related neologisms. Whereas Das and Senapati (2024) explicitly categorize individual terms as hate or sarcasm, this study follows an exploratory approach. Instead of labeling words individually, it analyzes how neologisms spread over time, which ideological patterns can be identified, and which terms gain traction within online communities.

A similar long-term analysis of neologisms is conducted by Kerremans and Prokić (2018) using a semi-automatic system called NeoCrawler. Their method relies on dictionary-based string matching against a Wikipedia dump to propose potential neologisms, which must then be manually validated before being monitored long-term. In contrast, the present study does not explicitly classify extracted terms as neologisms or non-neologisms. Instead, all candidates serve as a basis for further analysis. Given the large number of potential neologisms (approx. 580,000), full manual classification is impractical and limited to sampling for evaluation purposes only. Moreover, while the NeoCrawler module tracks only confirmed neologisms over time, this study monitors all identified candidates regardless of manual validation. Another key difference is the ability to detect multi-word expressions (e.g., adjective-noun and verb-noun phrases), which Kerremans and Prokić note as a limitation of their unigram-based approach. Nevertheless, they emphasize that their system enables effective automatic identification of potential neologisms and achieves high accuracy in detecting new words.

This study examines seven ideologically distinct online platforms associated with either the far-left or far-right spectrum: *sezession.de*, *blauenarzisse.de*, *schweizerzeit.ch*, *de.indymedia.org*, *antifainfoblatt.de*, *antifa-info.net*, and *der-rechte-rand.de*. The selection was theory-driven, based on their documented relevance in political science research and constitutional protection reports, as well as their discursive influence within respective political milieus. The subsequent automated analysis demonstrates that the developed methodology is capable of reliably identifying the central thematic priorities of the platforms under investigation. The extracted keywords and keyphrases reflect each platform's ideological orientation and offer insight into typical semantic patterns and recurring narratives within their discursive environments.

The analysis reveals that right-wing discourses are often shaped by ethnonationalist concepts, migration-critical language, media hostility and metapolitical strategies, while left-wing discourses focus on antifascism, social justice, criticism of capitalism and state repression.

On the examined websites, the focus was more on the creation of new terms, while the reuse of previously identified potential neologisms was comparatively rarer. This indicates that the platforms under study continuously generate new linguistic concepts. Such strategic neologisms created by extremist groups aim to fill semantic gaps intentionally in order to gain interpretive power in the digital space. The developed system enables the early identification of such terms and their analysis in the process of normalizing extremist narratives.

The study discusses methodological challenges such as language confusion, generic terms and the potential for enhancing the semantic analysis of longer or more complex phrases. Finally, it explores perspectives for further integrating the system into areas like semantic media analysis, SEO research or digital radicalization prevention. The extracted keywords and phrases could also be used in future studies to query search engines and assess how a website ranks in comparison to competing platforms. This approach may be particularly relevant for analyzing the visibility and spread of ideological narratives in search results. Through its multilingual architecture and adaptability to various types of websites, the system offers an innovative contribution to the linguistic, media and social science analysis of ideological online communication. It is not limited to right-wing and left-wing platforms but can be applied to a wide range of online communities and discourses.



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Gerontological Perspectives on Technostress and E-Fatigue Among University of the Philippines Diliman Librarians: Insights on Their Use of Search Engines

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1. Introduction

The increasing integration of digital technologies into library operations has significantly transformed the roles and responsibilities of library professionals. Libraries are increasingly adopting artificial intelligence (AI)-powered search engines to enhance information retrieval. This study investigates the lived experiences of aging librarians as they navigate this evolving digital landscape, with a specific focus on the psychological and physical effects of technostress and e-fatigue. These issues remain underexplored in the context of recent AI adoption and the post-pandemic acceleration of digital transformation. This research addresses a gap in the existing literature, particularly as previous studies on technostress among library staff at the University of the Philippines Diliman were conducted prior to the widespread implementation of AI and the digital shifts prompted by the COVID-19 pandemic. To provide a comprehensive understanding, the study pursued four objectives:

1. To explore the manifestations of technostress and e-fatigue;
2. To assess their impact on psychological well-being, emotional health, and professional performance;
3. To examine coping mechanisms and adaptive strategies; and
4. To understand aging librarians' perceptions and attitudes toward AI integration.

2. Related Literature

Prior research conducted within the University of the Philippines Diliman library system by Bachiller (2001) and Cascolan (2013) examined technostress among library staff. While both studies generally reported low overall levels of technostress, they found correlations between age, frequency of technology use, and stress intensity.

This study situated earlier findings within the broader evolution of search engines in libraries, from basic retrieval systems to sophisticated AI platforms. These advancements have increased the demand for digital literacy among librarians. Technostress is defined as the strain resulting from adapting to technological changes, often manifesting as cognitive overload, anxiety, and decreased job satisfaction. E-fatigue, on the other hand, involves mental exhaustion, reduced concentration, and physical discomfort such as eyestrain due to prolonged digital engagement. From a gerontological perspective, older adults are not inherently resistant to technology but may face unique barriers, including techno-complexity, limited tailored training, and fear of obsolescence.

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3. Methodology

A mixed-methods approach, employing a phenomenological design, guided this investigation. The study population comprised senior librarians (aged 60 years and above) actively engaged in information retrieval tasks using digital or AI-based search tools at the University of the Philippines Diliman. Purposive sampling was utilized to select participants. Data were collected through a semi-structured questionnaire incorporating both closed-ended and open-ended questions. Quantitative data were analyzed using descriptive statistics while qualitative responses underwent thematic analysis to uncover deeper insights into participants' experiences.

4. Results and Discussions

Findings revealed that technostress was moderately present, with most participants indicating they experienced it “sometimes.” A significant number reported feeling overwhelmed by continuous technological updates, experiencing physical symptoms such as eyestrain and fatigue, and feeling anxious when AI outputs were unclear. Eyestrain emerged as the most common symptom of e-fatigue, followed by headaches. Despite these challenges, most participants found AI tools easy or very easy to use, and the majority agreed that AI improved efficiency and saved time. However, confidence in using AI tools was low, with only two respondents expressing confidence.

Participants demonstrated resilience through various coping strategies, most commonly by taking screen breaks and practicing mindfulness or stress management techniques. Institutional support was highlighted as a key protective factor, with many respondents feeling supported in navigating technological challenges. Perceptions of AI tools were mixed; while many appreciated the efficiency gains, they expressed the need for critical evaluation of AI-generated content. A strong desire for tailored training and ongoing institutional support also emerged.

5. Conclusions and Recommendations

In conclusion, this study highlighted the dual impact of AI-powered search engines on aging librarians: while offering significant professional benefits, they also contribute to technostress and e-fatigue. The findings showed the critical need for comprehensive support systems, including age-appropriate training, ergonomic interventions, and wellness initiatives, to foster a more inclusive and sustainable digital work environment for experienced library professionals.

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NPDS FAIR Search Engines with Interoperable Exchange of the Free Flow of Findable Facts in Open Collaboration Networks

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1. Abstract

Early adopters of the World Wide Web found information through human-curated web portals and directories (Zhou, 2003). However, as the number of websites exploded, only search engines using automated crawlers could keep pace, and the companies with the biggest databases and fastest results became default gateways to the Web (Escandell-Poveda et al., 2022). This centralization and the resulting competition for top rankings in search results created information choke points (Van Couvering, 2008), profit motives for biasing search results (Rieder & Sire, 2014), and circulation of claims without attribution to their original sources (Gangopadhyay et al., 2024). Even in an age of abundant information, obfuscation of its origin and quality leads to “information malnutrition” (Herman & Nicholas, 2010). Large language models (LLMs) have exacerbated these concerns, as they obfuscate the sources of their training data and can even respond to attempts to enforce guardrails and transparency by disguising their generative processes (Baker et al., 2025).

Since 2006, the PORTAL-DOORS Project (PDP) has been developing software infrastructure for a democratized and transparent approach to search (Taswell et al., 2006). The original motivating problem was integration of evidence from multiple types of studies into meta-analyses of hypotheses about neurodegenerative disorders (Taswell, 2007; Skarzynski et al., 2015), but the PDP software can support knowledge engineering in any problem domain (Dutta et al., 2020). Use cases include clinical telegaming (Taswell, 2010b), curation of cultural artifacts (Athreya et al., 2021), and analysis of scholarly literature itself, specifically use of the Fair Attribution of Indexed Reports (FAIR) Metrics to study how both authors (Craig et al., 2023) and reviewers (Craig & Taswell, 2024) make clear or obfuscate the origins of their factual claims.

The defining features of PDP software are the messaging protocol and REST API of the Nexus-PORTAL-DOORS-Scribe (NPDS) cyberinfrastructure (Craig et al., 2016), which enable distribution of data and metadata records across multiple repositories (Taswell, 2010a), even alternate implementations built on different software solution stacks (Craig et al., 2017). By implementing these specifications in free, open source, full-stack server software (github.com/BHAVIUS/PDP-DREAM), Brain Health Alliance (BHA) empowers individuals and organizations to host their own data and metadata in searchable repositories (Anand & Taswell, 2022). Interoperability between repositories enables organizations to share records easily in support of the free flow of findable facts (Athreya et al., 2023), as demonstrated by repositories that BHA hosts at portaldoors.net, brainhealthalliance.net, and brainwatch.net.

By including semantic knowledge graphs that describe the key claims of works, NPDS records can fill a gap in the metadata available from major scholarly publishers (Craig et al., 2020) and support unambiguous identification of equal or equivalent entities through URIs (Athreya et al., 2020). Such semantic descriptions could support question-answering systems based on semantic query engines (Antonioni & Bassiliades, 2022). Even when expanding queries over billions of semantic triples, these

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rarely need billions of operations (Abdelaziz et al., 2017; Samsi et al., 2023), allowing independent organizations to use their own locally hosted AI instead of monolithic LLMs belonging to large corporations, further democratizing information discovery.

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Query Log Analysis on an Academic Search Portal for Economics and Business Studies

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1. Introduction

User behavior on search engines has been analyzed based on data from search queries (Kacprzak et al., 2017) and click behavior (Barifah & Landoni, 2019). The goal has been to describe the typologies of users and in part also to make inferences about dimensions that are not observed in the log data, such as goals, strategies, and preferences (Baeza-Yates et al., 2006; Schultheiß et al., 2020). We analyze click patterns conditional on query topics. Our aim is to deepen the understanding of how users behave in their formulation of search queries and in their interaction with the search portal EconBiz.

EconBiz is targeted towards an educational and academic audience in management and economics and covers around 12.9 million entries, such as journal articles, book chapters, working papers, monographs and conference proceedings (Nickerson & Schmidt, 2023). Our data source for quantitative analysis consists of log files, which include search queries and click data in form of actions from 159,809 sessions from January 2021 until the end of March 2022. The 19 different actions include, for example, using the advanced search or filters or clicking on an outgoing link.

The goal of our investigation is to deepen the understanding of search behavior in the discipline of economics and management along two dimensions. First, we aim to find the main search topics and their distribution across sessions by clustering search queries. Second, we explore the correlation between search topics and clicking behavior to identify possible search types. We ask if and how the click behavior and search topics are related or whether click behavior is uniform across all topics. Additionally, we investigate whether the search sessions that possibly include title searches are followed by a more restricted click behavior than other search queries.

Search queries are summarized by topic clustering via latent Dirichlet allocation (LDA) (Blei et al., 2003). LDA creates groups of words based on words that appear together in sessions most frequently. Each group can be interpreted as a topic. Based on our own knowledge of the domain, we aggregated 80 automatically created topics further into 16 overarching topics. Single queries are compared string-wise with the titles of returned results to estimate whether a query includes a publication title, possibly being an indicator for a closed search (Schultheiß et al., 2020). The occurrence of actions is added up to the count per action in each session. We use the statistical measure of mutual information to investigate the correlation between actions within a topic.

Results show that the most prevalent aggregated topics are “business and strategies”, “digitalization and technology” and “workplace”.

It seems straightforward that users click on a search result after submitting a query. Interestingly, for almost every query, at most one document was clicked. Clicking on a search result frequently comes with clicking on the availability button. Users who use a facet are more likely to browse the pages of the search engine results page, perhaps having less “trust bias” (Joachims et al., 2007).



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What Citizens Search and Municipal Websites Offer

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1. Purpose and Background

Governments around the world are working to expand digital access to public services. In Europe, the Single Digital Gateway Regulation requires member states to provide centralized access to administrative services via portals like “Your Europe.”² Similarly, in Germany, the Online Access Act (OZG) aims to make services available online through unified platforms, such as “Servicesuche Bund.”³ These initiatives promise user-friendly access to administrative information—but uptake remains limited.

The eGovernment Monitor highlights this usage gap: 56% of respondents registered their vehicles offline, and among them, nearly 40% either did not know the online service existed or could not find it (Initiative D21 & Technische Universität München, 2024). Prior research (Hertzum, 2022) suggests that e-government use strongly depends on situational factors, such as ease of finding relevant information and prior user experience.

While earlier studies (e.g., Jansen & Spink, 2007; Lambert, 2013) analyzed user search behavior, they are often outdated or focused on non-European contexts. Serrano-Cinca and Muñoz-Soro (2019) showed a promising match between user searches and content on Spanish municipal websites, but key topics like employment and tourism were still underrepresented.

To date, no similar study has examined whether German municipal websites provide the information users actually search for—a question that is equally relevant for other countries seeking to build effective, user-centered e-government services.

2. Design / Methodology / Approach

Building on the approach by Serrano-Cinca and Muñoz-Soro (2019), this study examines how well German municipal websites align with user search behavior. The following research question is posed: *Do municipal websites in Germany provide the information users are searching for?* The central assumption: search engines remain a primary gateway to digital public services.

Using 98 keywords related to administrative tasks, transparency, and public participation—including priority services under the German Online Access Act (e.g., marriage registration, driver’s license issuance)—this study evaluates the Google ranking of municipal websites. The Result Assessment Tool (RAT) was used to collect search volume and identify the top ten results for each keyword in April 2025.

The analysis includes four cities in Northern Germany—Hamburg, Lübeck, Ahrensburg, and Dagebüll—representing various administrative levels and population sizes.

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² URL: <https://europa.eu/youreurope/index.htm>

³ URL: <https://servicesuche.bund.de/#/de/>



3. Expected Findings

Search topics like jobs, local events, or leisure are likely to generate more searches than administrative processes. However, municipal websites face stronger competition from commercial platforms for popular topics. In contrast, for core government tasks like regulations or social services, municipal websites may rank higher due to their content authority.

It is also expected that centralized portals like “Your Europe” and “Servicesuche Bund” will rarely appear in the top ten search results, as they operate above the local level.

4. Value

This study will help assess how effectively local governments address users’ information needs online. The results can inform digital strategy improvements not only in Germany, but also in other countries aiming to modernize public service delivery. Future research could expand the approach to include longitudinal data or cross-national comparisons.

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Ranking of Wikipedia Articles in Search Engines. Partial Replication of the Study “Ranking of Wikipedia Articles Revisited” from 2011

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1. Introduction

Wikipedia has struggled with its academic reputation since its launch in 2001. While it has been the subject of many different accusations such as plagiarism (Jemielniak and Aibar, 2016, p. 1773), recent studies on the quality of information of Wikipedia articles have produced positive results (Anderka und Stein, 2012; Redi et al., 2019; Halfaker, 2017). Several retrieval studies discuss the prominent position of Wikipedia articles in search engine result pages (SERPs). In 2011, Lewandowski and Spree explored the question of whether the high information quality of Wikipedia articles can predict high ranking in SERPs and whether there is a relationship between ranking, information quality and perceived relevance of Wikipedia articles. I present with this poster a partial replication of Lewandowski and Spree's study.

2. Method

Both the studies by Lewandowski (2008) on the retrieval effectiveness of search engines and the study on the ranking, relevance and information quality of Wikipedia articles by Lewandowski and Spree (2011) were relevant for the design of this study. Forty informational search queries and their first ten results in the search engines Google, Bing, DuckDuckGo (DDG) and Ecosia were analysed. The retrieval study was conducted using the Result Assessment Tool (RAT)¹. For the relevance assessment, eleven jurors were asked to rate the relevance of the retrieved Wikipedia results, by giving a judgement as to whether they found the result relevant in terms of the quality of the result, taking into account the search query. For the information quality evaluation, the heuristic for the evaluation of encyclopedia articles by Lewandowski and Spree was reused. Additionally, a second version of the heuristic was adapted to current Wikipedia internal quality criteria as well as supplemented by quality flaw criteria identified in Anderka and Stein's study (2012).

3. Results

The retrieval study identified 138 Wikipedia results (47 of which were unique). The mean position of Wikipedia articles is statistically significantly higher (2.97) than that of other websites (5.74), regardless of the search engine used. The relevance study shows positive results for the questions of whether and how relevant the Wikipedia results are from the perspective of the jurors. This is depicted by the mean binary judgement of 90 % ("is relevant") as well as the mean score of the 5-point-scale of 2.91 ("how relevant": 0 to 4). The heuristic evaluation shows that the overall scores vary considerably, but in the higher score range. The highest rated article achieves 89 % of the maximum score. Articles were rated positively in terms of comprehensiveness but received lower ratings for the

¹ <https://searchstudies.org/rat-software/>

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currency of sources and the verifiability of facts as many articles lacked direct references. There are moderate correlations between both perceived relevance and ranking positions (- 0.5) as well as between the binary relevance scores and the scores in the heuristic evaluation of the information quality (0.4). There is a weak correlation between the information quality and the ranking (original heuristic: 0.3; adapted heuristic: 0.2).

4. Discussion and Conclusion

The results show that the users' judgements of relevance are consistent with the high ranking and the data in the original study. This comparison also shows, that the Wikipedia articles have improved significantly in terms of content and comprehensiveness, but worsened in the aspects of currency and verifiability. Although information quality improved overall, data shows that high ranking does not necessarily mean high information quality.

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Reflecting on search histories: a survey design to uncover users' cognitive and motivational processes

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1. Introduction

Understanding users' cognitive and motivational processes during search is crucial for identifying information needs and informing user-centered system design. Most existing studies on search behavior rely on methods such as log analyses, experiments or surveys (Lewandowski, 2015; Lewandowski, 2018; Silverstein et al., 1999). Log studies offer large-scale behavioral insights but lack access to users' internal states (He & Yilmaz, 2017; Jansen, 2006). Controlled experiments provide detailed behavioral observations but are prone to bias due to artificial settings and observer effects (Kelly et al. 2015; Levitt & List, 2007; Liu et al., 2019; Strzelecki, 2020). Surveys can reveal motivational and behavioral patterns at scale but often suffer from recall bias and constrain responses through closed-ended questions (Artino et al., 2022; Ochoa & Revilla, 2023; Porta et al., 2014; Tourangeau et al., 2000). Although these approaches have uncovered valuable behavioral patterns, they fall short in capturing the cognitive and emotional processes underlying real-world, in-the-moment search activity. In contrast, qualitative methods such as interviews or diary studies offer deeper insights into these internal states but are typically limited in scale (Bolger et al., 2003; Olorunfemi, 2024; Wutich et al., 2024).

Building on calls to integrate methods to overcome limitations of individual approaches (Lewandowski, 2017), we present a novel study design that embeds qualitative reflection within a one-shot survey. Specifically, we ask participants to review their actual search history and respond to structured reflection prompts that uncover their search goals, behaviors, and expectations. While our focus is on web search sessions, the methodology generalizes to other systems with retrievable interaction histories. Our contribution lies in offering a scalable yet contextually rich lens into real-world search activity, bridging behavioral data with users' cognitive and emotional states.

2. Study design

We developed a structured, one-shot survey that combines diary-style reflections with actual user behavior by prompting participants ($N=86$) to review and reflect on their recent search histories. The survey was administered via Qualtrics, with participants recruited through Prolific. After providing informed consent, participants followed step-by-step instructions to access their search history (Google, Bing, Yahoo) to confirm eligibility. In practice, nearly all participants used Google, only one reported using Bing. The survey began with general questions about participants' typical search engine usage.

Next, participants were asked to review and reflect on their last three search sessions, which we defined in line with Jansen et al. (2008) as '*a series of interactions by the user to address a single information need*'. To guide their reflection, we developed open-ended questions based on Xie's (2002) multi-level search goal framework, covering current, leading, long-term goals, and interactive intention. We extended the framework by adding an outcome realization dimension to capture how participants ultimately used the retrieved information. Additionally, participants rated satisfaction and typicality of each session.



To contextualize responses, we assessed participants' attitudes towards artificial intelligence (Sindermann et al., 2021) and search engines (Urman et al., 2024), digital literacy (Hargittai & Hsieh, 2012) and demographics.

3. Design benefits

Our study design offers several advantages for capturing users' cognitive and motivational processes during search. First, anchoring reflections in participants' actual search history and focusing on their three most recent sessions reduces recall and selection bias, better capturing everyday search behavior (Bolger et al., 2003; Tourangeau et al., 2000; Tversky & Kahneman, 1974). Moreover, the structured, multi-level prompts encourage participants to articulate deeper motivations and outcomes, moving beyond surface-level responses. At the same time, the approach remains scalable: from 86 participants, we collected 247 session-level reflections, showing that rich insights can be obtained without sacrificing breadth. Finally, the method is transferable to other domains such as generative AI-based chatbot use and adaptable for large-scale studies using narrower prompts or data donation approaches that allow for a more streamlined reflection process.

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Planetary Sapience and Speculative Visions of Search Engines

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1. Abstract

The poster will explore speculative visions and scenarios that revolve around the access and availability of information in relation to subjectivity, governance, and the environment. With technology often being anticipated by philosophy, artistic visions, or political utopias, the poster will be an invitation to think about the future of search engines and their role in society (see e.g., Haqq-Misra, Profitiliotis, & Kopparapu, 2024; Engerman, 2012; Parisi, 2012).

Self-awareness and self-determination are shaped by what information we have available, information which in turn needs to be created, compiled, and interpreted. Realizing we live on a planet that orbits the sun was based on the availability of a range of measurements, including the movements of the stars and planets on the night sky and of the geography of our planet. Similarly, social and economic data like GDP, suicide rates, poverty, housing conditions, and crime rates have not only fueled new social movements and new forms of political and economic coordination, but also affected individuals' meaning-making around their own selves (Zizek, 2005). In our present day, the very discovery of many environmental problems, including climate change, has rested on data from thermometers, satellites, ice drill samples, and so forth, being a pre-condition for climate awareness and action (Bratton, 2016, 2019; Edwards, 2013).

Access to information is thus connected to the self-awareness, identity, and sovereignty of humanity and its potential to govern its environment, something that has also inspired various utopian and dystopian visions. Paul Otlet's utopian project of the Mundaneum (Rayward, 2017) or the Noosphere of Russian Cosmism (Young, 2012) are early examples of visions of the future where information access is connected to increasing knowledge and self-awareness of humanity, with modern counterparts found for example in Bratton's vision of planetary-scale computation, terraforming, and planetary sapience (Bratton, 2016, 2019, 2021).

The process of making the poster will include making an inventory and selection of speculative visions from different fields like philosophy, art and politics. This could, for example, include visions from sci-fi like Isaac Asimov's Multivac computer (Asimov, 2016), Stanisław Lem's ariadnology (Lem, 2013), Liu Cixin's AI in Three Body Problem (Liu, 2014), and so forth (e.g. Lee & Quifan, 2024; Robinson, 2020). The poster can also draw from recent explorations of similar topics in the artistic field, including Suzanne Triester's Hexen (Treister & Bang, 2012), the Atlas of Anomalous AI (2020), and similar works.

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How search engines frame political initiatives

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1. Introduction

In this study, we analyse how the most used search engine, Google, frames the two federal popular initiatives in Switzerland: the Pensions Initiative [March 2024] and the Environmental Responsibility Initiative [February 2025]. We use a three-part process: 1) a survey among Swiss internet users (N=1,100) to identify what search queries in three main national languages they use regarding the initiatives; 2) a virtual agent-based algorithm audit to collect first page of Google results using these queries; 3) a transformer-based automated content analysis to identify generic news frames present in search results regarding the initiatives. Generic news frames (Semetko & Valkenburg, 2000), are universal patterns of information representation used by media organisations to make certain aspects of social reality more salient. The way the initiative is framed can influence its perception by the voters, which is of particular relevance for direct democracies like Switzerland, and can unequally promote the interests of political parties associated with these initiatives. Our initial analysis highlights profound differences in the distribution of generic news frames in Google's coverage of the initiatives, with the variation depending on the query's language. It raises questions about its normative implications, e.g. should Google algorithms balance such representation considering potentially unequal volume of news supply between the initiatives? What are the expectations of Google's representation of political matters in multilingual countries like Switzerland, where different language groups risk being exposed to radically different framings of the same issue? And are there certain political positions which Google is more likely to legitimise, and if so, then why and which political groups can it politically benefit?

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Invisible in Search? Auditing Gender Bias in the Visual Representation of Holocaust Victims on Google

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1. Introduction

Many studies (e.g., Kay et al., 2015; Otterbacher et al., 2017) indicate the risk of search engine algorithms reiterating or amplifying gender bias, particularly regarding the representation of vulnerable groups (e.g., women of colour and from countries outside of the Global North; e.g., Noble, 2018; Urman & Makhortykh, 2024). However, despite the growing number of areas in which gender bias is discussed in the context of web search, for instance, politics (Pradel, 2021) or innovation (Makhortykh et al., 2021), its role in some societally relevant areas remains understudied. One of such areas is heritage, particularly heritage dealing with mass atrocities such as the Holocaust, which until now is often contested and frequently instrumentalized for the needs of today's politics.

To address these questions, we conduct an algorithm audit of how Google, one of the world's most commonly used search engines, visually represents victims of the Holocaust and whether such representation is prone to gender bias. We are interested in gender bias in image search, both due to the strong affective potential that visual images have, and much research on the topic so far has focused on image search. Specifically, we manually collected the top 50 image search results from 50 locations worldwide (with most of the locations in Europe, where the Holocaust took place). We used a VPN to simulate local IP addresses for all the locations and also translated the gender-neutral query - i.e., "Holocaust victims" - into the official languages of the country corresponding to each location.

After collecting the data, we used computer vision to automatically identify the number of human beings present on each image appearing in search results and their sex (we recognize that sex is a simplified proxy for a complex gender construct, but automated identification of different forms of gender remains a challenging task). For this aim, we used Amazon Rekognition API, as earlier studies (e.g., Ulloa et al., 2024) demonstrated that its performance for analysing human-related features (including the number of individuals and their age) is on par with human-made assessments. To confirm it, we conducted a sanity test using a small subset of images, which were analyzed by the authors and then compared to the outcomes of the Rekognition API.

For the analysis, we are going to test three hypotheses, which are informed by research on Holocaust heritage, particularly the memorialization of victims. The first hypothesis is that image search results will contain more images of women than of men due to Holocaust-related memorial practices in many European countries focusing on images of more vulnerable victims, such as women and children. The second hypothesis is that the number of images with humans will be higher for countries from which more Holocaust victims originated and where we find more Holocaust memorial sites. The third hypothesis is that the present-day gender equality score will influence the distribution of female and

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male victims depicted in image search results. To test these hypotheses, we will use correlation analysis and generalized linear mixed effects models.

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Algorithmic Masculinity: Encounters with the Manosphere

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1. How is masculinity understood, negotiated and performed (by humans and non-humans) on social media platforms today?

My research explores how the algorithmic personalisation of information feeds on social media platforms co-constitutes understandings of masculinity among young cis men, living in Sweden. I focus on how they encounter, engage with and interpret content that promotes essentialist, heteronormative and misogynistic ideals of masculinity – on Instagram, TikTok, YouTube and Snapchat. These kinds of ideals circulate intensely within the ‘manosphere’, a global online movement comprising groups such as Men’s Rights Activists, Pick-Up Artists, Red Pillers, MGTOW and Incels (Gottzén, 2022; Han & Yin 2023; Johanssen 2022; Schmitz & Kazayak 2016) but are amplified more broadly through the commercial logic of today’s digital information infrastructure (Ging, Bakers & Andreasen 2024; Thomas & Balint 2022).

The aim of this thesis is to gain a nuanced understanding of how young cis men’s masculine identities are understood, negotiated and performed (by humans and non-humans) at the intersection of their information activities on social media platforms, the manosphere and the techno-commercial conditions of the digital information infrastructure. The study is guided by the following research questions: What ideals of masculinity do young cis men encounter online? How does the digital information infrastructure enable and/or limit these encounters? How do young cis men’s information activities on social media platforms enable and/or limit these encounters? How do young cis men negotiate their masculine identities in relation to the algorithmic personalisation of their information feeds and the ideals of masculinity they encounter therein?

The methodology combines infrastructural go-alongs and interviews in which the participants use and reflect on their information feeds in real time. Metadata and platform policies are analysed to understand how the materiality of the infrastructure influences these processes. Theoretically, the project draws on socio-material theory, in particular Karen Barad’s concepts, and Judith Butler’s theory of gender performativity.

Preliminary results dealing with the search practises of young men will be presented on the poster. This includes how they use personalised information feeds on social media platforms instead of traditional search engines in their everyday lives and how their search practises take shape in the form of an algorithmic dance.

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Web Search on Emerging Topics

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1. Abstract

We are regularly confronted with information on newly *emerging topics*, often linked to current events. Initial encounters with emerging topics can spark curiosity to learn more and, when they involve controversy, form an opinion. One of the primary gateways to do so is web search. However, because the body of knowledge around these topics is still developing, information is often scarce, changes rapidly, and subject to varying interpretations. In addition, there is a lack of implicit feedback such as clickthrough data, which can provide insights into information relevance and quality. These conditions make web searches on emerging topics particularly susceptible to information disorder, driven by system behaviors and human interactions (Golebiewski & Boyd, 2019; Rieger et al., 2024; Wardle & Derakhshan, 2017). However, ensuring that people find high-quality information on emerging topics and controversies and recognize the limits and variability of available knowledge is crucial for informed decision-making and constructive public discourse (Shah & Bender, 2024; Taylor et al., 2018).

With our poster, we present an overview of our research vision towards search environments that facilitate effective knowledge gain, but also foster awareness of the dynamic information space, as well as responsible opinion formation among people searching the web for information on emerging topics. This requires system- and user-centered research, combining quantitative and qualitative methods, theoretical analysis, and participatory design with input from diverse stakeholders and experts (Wagner et al., 2021). In addition to relevant literature and methods for research efforts around web search on emerging topics, we highlight several research challenges that might arise.

We further present an ongoing study with which we want to develop a meaningful and operational definition of *emerging topics* for information behavior and retrieval research. For that, we plan to explore the characteristics of several selected emerging topics on the web. Specifically, we want to investigate how information on these topics, as well as people's interactions with it, evolves over time.

Ultimately, we aim to contribute to a healthy and emancipatory information ecosystem (Mitra, 2025).

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Beyond Topicality: How do Social and Life Scientists Select What to Read?

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1. Introduction

Topicality is widely recognized as the most influential criterion in relevance evaluation (Green, 1995; Huang, 2009; Macedo-Rouet et al., 2012; Saracevic, 2016; Wang & Soergel, 1998; Xu & Chen, 2006). While topicality is nearly universal across any retrieval contexts, other relevance criteria have been shown to be more context-specific (e.g., Cool et al. (1993)) or determined by user characteristics such as domain knowledge (Cole et al., 2011; Dinet et al., 2010; Sihvonen & Vakkari, 2004). Academic search engines must therefore accommodate the fact that different disciplines are shaped by distinct epistemic cultures – that is, field-specific configurations of how knowledge is produced and validated (Knorr-Cetina, 1999) – which manifest in various publication and reception practices likely to influence search and relevance evaluation behavior. This poster investigates domain-specific patterns in relevance evaluation by contrasting the behavior of researchers from social and life sciences.

2. Method

Fifty researchers participated in this online user study: 25 from medicine-related life sciences (e.g., biomedicine, biophysics) and 25 from social sciences (especially sociology and political sciences), spanning all career levels (8 professors, 31 postdocs, 11 predocs), with 22 women and 28 men. A prefabricated SERP mimicking Google Scholar presented ten articles with linked abstracts. Working on three tasks, participants selected up to three documents for reading while screen sharing and thinking aloud via Zoom. Think-aloud data were deductively coded. The code system was developed by merging and grouping previously reported relevance criteria (Barry, 1994; Barry & Schamber, 1998; Saracevic, 2016; Wang & Soergel, 1998). Following a qualitative content analysis, Barnard's unconditional test was used to analyze binary group differences, as it offers greater statistical power than the conditional Fisher test, particularly in small samples.

3. Results

Overall, relevance evaluation was based on a vast array of 53 relevance criteria mentioned at least once in both groups (social and life sciences). Initial qualitative content analysis shows broad similarity across disciplines: participants from both fields primarily used *titles* and *abstracts* to assess relevance, spending most time reading the latter. When reading the abstract, topic- and content-oriented relevance criteria, such as *approach*, *topical match*, *scope*, *data basis*, *clarity* and *topic* (each mentioned by 75-100% of participants), were mentioned with similar frequency across fields, confirming the centrality of topicality.

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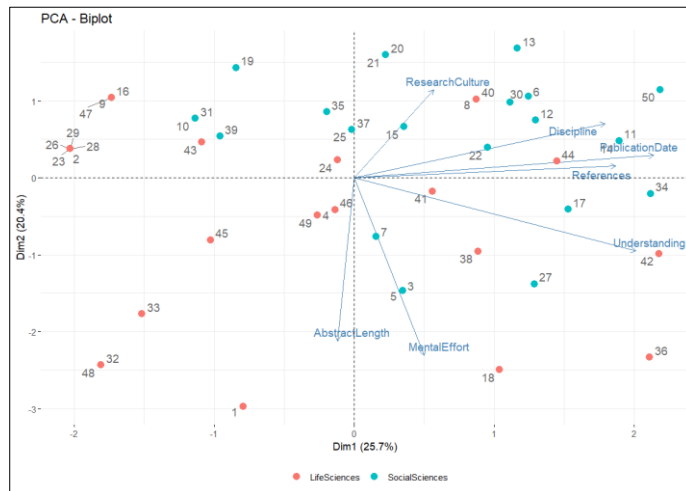


Figure 1: Disciplinary Differences in Abstract Reading

Disciplinary differences became evident beyond topicality. The PCA biplot in Figure 1 reveals that participants from the social sciences cluster on the right side of the first component (Dim1), aligning with the relevance criteria *research culture*, *discipline*, *publication date*, *references* and *understanding*. All of these were mentioned more frequently by social than life scientists when reading abstracts (cf. Table 1) with *research culture* reaching statistical significance ($p = 0.044$) and *publication date* and *understanding* approaching significance ($p = 0.055$).

Table 1

Share of participants mentioning relevance criteria

Relevance Criteria	Social Scientists	Life Scientists	Barnard's test (p-value)
abstract length	8%	44%	0.002
discipline	72%	44%	0.153
mental effort	12%	40%	0.016
publication date	72%	48%	0.055
references	52%	32%	0.102
research culture	52%	24%	0.044
understanding	56%	28%	0.055

By contrast, life science participants appear in the lower quadrants of the biplot, in the direction of *abstract length* and *mental effort*. These criteria were also mentioned significantly more often in this group ($p = 0.002$ and $p = 0.016$, respectively; cf. Table 1). Together, these results suggest that social scientists prioritize situating a paper within an academic discourse (*discipline*, *references*, *publication date*) emphasize their own scholarly expertise (*research culture*, *understanding*), whereas life scientists tended to be more sensitive to reading effort (*abstract length*, *mental effort*).

4. Discussion and Conclusion

This comparative analysis of relevance evaluation behavior of researchers in the social and life sciences demonstrates that while core topic-related criteria remain stable across fields, differing epistemic cultures shape the use of additional relevance criteria, particularly when reading abstracts. These criteria may even prove more decisive to relevance judgments than topicality itself.

The study underscores the importance of designing retrieval systems that account for domain-specific relevance evaluation behavior. While social scientists may benefit from systems supporting the discursive contextualization of research works, a focus on enhancing user performance and cognitive efficiency – perhaps through summarization or highlighting of a study's data basis – may be better suited to life scientists.

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Do They Capture All the Attention? Analyzing Google's AI Overviews Using Eye-Tracking and Quality Evaluation

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1. Introduction

Search engines are essential in daily life (Haider & Sundin, 2019; Lewandowski, 2023, p. 14). This is particularly true for Google, which holds a dominant position in the market (StatCounter, 2025b, 2025a; as of June 2025). Users typically focus their visual attention on the most prominent results on the search engine result page (SERP) and select those results frequently (e.g., Granka et al., 2004; Petrescu, 2014). This selection is crucial for content producers, like news organizations, that depend on web traffic for advertising revenue (Nielsen, 2019).

However, this dynamic is being disrupted by large language models (LLMs) that can generate coherent responses from processed information (Wolfram, 2023). In response, search engines such as Google and Bing are incorporating AI-generated summaries in prominent positions on their SERPs where user attention is the greatest.

As users increasingly encounter AI-generated summaries, it's vital to assess its impact on both users and content producers. Research shows that these summaries often lack verifiability (Liu et al., 2023), yet users tend to trust them despite invalid references (Li & Aral, 2025). Understanding the quality of AI-generated summaries and users' perceptions is essential, as the presence of AI responses might reduce clicks on conventional links. In a student project conducted in the summer semester of 2025, we studied these questions through eye-tracking and quality evaluation.

2. Central Research Questions

- *RQ1*: How does the visual attention people give to AI-generated summaries compare to that of other result types?
- *RQ2*: Is there a difference in visual attention between Google's and Bing's AI-generated summaries?
- *RQ3*: Do people click on the links provided in the source references of the AI-generated summaries?
- *RQ4*: What is the information quality provided in Google AI overviews?

3. Methods

We conducted two sub-studies: an eye-tracking study with survey elements and a quality evaluation of Google's AI overviews.

In a laboratory user study involving 50 participants, we had them complete 12 search tasks based on predefined Google and Bing SERPs that included AI-generated summaries. For instance, one task was "Why is the universe expanding?". We utilized eye-tracking technology to record participants' visual attention and click behavior on the SERPs (for visual attention, see Duchowski, 2007, p. 3). We examined how much attention different search results received, including AI-generated summaries, the



sources linked within those summaries, advertisements, and organic results. We also analyzed the click behavior among these varied elements. After completing these tasks, participants filled out a brief survey that included demographic information, their trust in AI, and their familiarity with AI features.

Additionally, we performed a quality evaluation of 280 Google AI overviews using a standardized questionnaire (Lee et al., 2002) to assess criteria like objectivity and believability, evaluated by the seminar students.

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Enhancing Open Data Findability through Generative AI: Conceptual Approaches to Improving Structured Data Discovery

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1. Abstract

Open Government Data – publicly available datasets released by government institutions to promote transparency and civic participation – represents a crucial foundation for transparent governance, informed citizenship, and democratic participation (Ruijter et al., 2024). Despite substantial investments in Open Data initiatives worldwide, these valuable structured datasets—typically in formats like CSV, JSON, or geospatial data—often remain undiscovered and underutilized due to insufficient textual descriptions and thus limited findability. This work addresses this challenge by focusing on European Open Government Data initiatives and exploring the application of large language models such as GPT and similar transformer-based architectures.

This accessibility gap creates a democratic deficit where only technically skilled individuals can leverage public data resources, undermining the societal potential of these datasets to support evidence-based policy discussions, civic innovation, and accountability. This work conceptually examines how generative AI models can create meaningful descriptions of structured Open Data to enhance their discoverability through (site-specific or universal) search engines. This approach aims to make access to public information more equitable. Based on recent research showing BLEU scores (text generation quality metric) of approximately 40% for table-to-text tasks (Bao et al., 2018), F1 scores above 86% for medical reports (Rajaganapathy et al., 2024), and 70-75% accuracy for SQL-related tasks (Câmara et al., 2024), this work highlights the importance of examining specific requirements for successful textual enrichment of Open Government Data.

Three central aspects form the core of this research: (1) effective prompt engineering for various data structure types with integration of existing metadata, (2) quality metrics for evaluating generated descriptions' information content, accuracy, and search engine compatibility, and (3) human-in-the-loop quality assurance processes. Our approach particularly addresses challenges related to complex or incomplete data structures and domain-specific terminology in public administration contexts.

A promising approach for effective textual enrichment of Open Data lies in a multi-stage process combining domain-specific fine-tuning, copying mechanisms for technical terms, and few-shot learning (learning from limited examples). This approach would need tailored adaptations for different data types (CSV, JSON, geospatial data), mechanisms to accurately preserve domain-specific terminology from the original datasets, and capabilities to learn from limited manually created examples. The specific language model selection and configuration would also need to be optimized based on the particular data domain. This differentiated strategy aligns with current research findings showing that description accuracy varies depending on domain and data complexity (Keymanesh, Benton and Dredze, 2022).

Beyond textual descriptions, we explore the potential of transforming these AI-generated descriptions and structured datasets into knowledge graphs. These knowledge graphs could serve as a foundation for symbolic AI (rule-based artificial intelligence) applications, further enhancing data discoverability, interoperability, and enabling semantic connections between previously isolated datasets. This integrated approach creates a richer information ecosystem where both text-based search

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and graph-based navigation (exploring data through interconnected relationships) complement each other.

With this conceptual approach, our work contributes to the discussion on search technologies in public administration contexts and AI's role in enhancing digital sovereignty through local, transparent, and comprehensible data accessibility. The proposed methods aim to make access to public data resources more equitable by making them more discoverable for citizens, researchers, and organizations without specialized data science expertise.

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Climate disinformation on Google Search

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Purpose and research questions

This poster presents a bachelor thesis study about climate disinformation on Google Search in relation to Google's principles of Expertise, Experience, Authority and Trustworthiness (EEAT) and the concept of Your Money or Your Life (YMYL). The study aims to contribute to the knowledge about greenwashing on the search engine Google search. Greenwashing is a form of climate disinformation where companies present exaggerated or false climate claims (Greenpeace, 2025). The following research questions are addressed: “Does Google Search contribute to making greenwashing visible, and if so, how?” and “How can the search results be understood in relation to Google's principles of trustworthiness?”.

Background

The year 2024 had the highest temperatures ever recorded, which highlights the escalating urgency of the climate crisis (Copernicus, 2025). Scientists stress the need for immediate and large scale measures, particularly transitioning from fossil fuels to renewable energy (IPCC, 2023). At the same time, climate disinformation continues to spread (Calvo, Iranzo-Cabrera & Tarullo, 2024; Bakowicz, 2024). Not only does climate disinformation damage source trust (Sundin, 2024), it also complicates and delays climate action (Ekberg, Forchtner, Hultman, & Jylhä, 2023). Greenwashing is a form of climate disinformation, where marketing portrays polluting industries as environmentally responsible (Greenpeace, 2025). This can mislead consumers, undermine informed decision making, ultimately harming both individuals, democratic society and the environment (Williams, 2024; Tandoc, Lim, & Ling, 2017). Users trust in Google Search to provide reliable and accurate information (Lewandowski & Schultheiß, 2022), which Google Search claims to do through the principles of trustworthiness, *EEAT*. Websites concerning money or health, which by Google are labelled *YMYL* are according to the company, moderated more carefully (Google, 2025). However, Google Search faces criticism for not taking sufficient measures to limit the spread of climate disinformation (Haggin, 2021). After this criticism, Google Search claims to incorporate zero tolerance for climate disinformation on the platform (Greenpeace, 2025; Kundaliya, 2021). In this study this claim is reviewed.

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Method and theory

This thesis is based on an algorithmic audit, i.e. a structured review of the ranking that orders the search results on Google Search. The study investigates the search terms *climate neutral* and *net zero emissions* as well as a sample of companies publicly accused of greenwashing in Sweden. The study uses RAT (Result Assessment Tool) for data collection (Sünkler et al, 2024), and a content analysis with a coding scheme (Bryman, Clark, Foster, & Sloan, 2025) to detect greenwashing. Frame theory is used to analyse visible and invisible meaning and perspectives (Entman, 1993), that are shown in the first twenty results in the SERP (Search Engine Results Page).

Results, analysis and conclusion

The result suggests that Google contributes to making greenwashing visible on Google Search. This is in line with the report *Greenwashing on Google* (Ahmed, 2021) from the organisation CCDH (Center for Countering Digital Hate) but in this case in a Swedish context. However, more studies are needed to form a firm conclusion. As previous research discusses, the climate crisis can be framed as a public health issue (Ebi, et al., 2021). It could therefore be argued that websites with climate claims that affect people's economy or health ought to be moderated as YMYL and according to the principles of EEAT.

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Are schools suitable for information literacy education? Critical reflections and perspectives from Danish lower secondary school

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1. Abstract

Seldom questioned, schools are depicted as central institutions for fostering critical information literacies among youth – most notably, the abilities to critically search, evaluate, and use information (Haider & Sundin, 2022; Limberg et al., 2008; Sundin, 2025b). One could ask whether and how schools – and teachers – are suited to take on the demanding task of equipping students with the competence necessary – a task complicated further by the advent of generative AI (Berger, 2019; Earp, 2009; Shannon et al., 2019; Shin & Lwin, 2017; Sundin, 2025a; Sural & Dedebali, 2018; Swart, 2021). In Danish schools, students' perceived opportunities for democratic engagement and participation (Bruun & Lieberkind, 2024; Lieberkind, 2020) and digital information literacy competences are declining (Bundsgaard et al., 2024; Fraillon, 2024). In the hope of addressing such challenges, educational reform and other initiatives such as a 'technology comprehension' subject are implemented in the Danish curriculum. Hence, societies constantly seek to repair the school and its functions to meet changing societal demands (Ball & Collet-Sabé, 2022). This educationalization (Rüsselbæk Hansen, 2024), however, can be argued to distort the very purpose and concern of school, thereby instrumentalizing it as a service made to 'please its customers', i.e., society (Biesta, 2022).

The school institution has historically been bound to the production and regulation of knowledge and docile bodies (Ball & Collet-Sabé, 2025; Foucault, 1995), creating certain possibilities and constraints for being, participating, and learning. The school, some (critical) scholars argue, works as a 'less flawed alternative' or "one node in a network of 'intolerable' institutions" (Ball & Collet-Sabé, 2022:988) that has been marketized within a neoliberal performative logic, calling for resistance (Biesta, 2022) rather than continuous repair and reform.

In response to this, and as an intended provocative (and perhaps naïve) stance, this presentation seeks to take a step back and ask: Why school? Ideally, the school functions as a democratizing and emancipatory institution fostering educated, skillful, and critical citizens able to navigate and relate themselves to the world around them (Biesta, 2022; Collet-Sabé & Ball, 2023). In practice, however, it will be argued here that schools often create notions of the opposite.

This poster examines the school's role in providing students with the competence needed to critically engage with (digital) information. This is done by drawing on empirical material from a PhD project conducted during Danish lower secondary school students' project work. The tentative findings suggest that students' information literacy practices (i.e. searching and evaluating information) risk becoming shaped by and entangled within classroom processes of individualization, instrumentalization, and alienation due to the simultaneously ubiquitous and opaque demands towards students' performances and outputs. Such structural barriers may hinder students' critical engagements with underlying mechanisms of search engines and other elements of contemporary information landscapes.

Is it time to rethink the idea of schooling as part of information literacy education? Importantly, this presentation is not conclusive in answering these questions but rather seeks to initiate reflections and



inspire critical discussions about the role of the neo-liberal school regarding young people's information literacies anno 2025.

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ReSearch: Researching the transforming landscape of information seeking – AI technologies and learning in Swedish schools

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1. Introduction

The aim of this poster is to present and discuss the newly started four-year research project “ReSearch: Researching the transforming landscape of information seeking – AI technologies and learning in Swedish schools”. ReSearch investigates the challenges when generative AI technologies increasingly are used in schools for information-seeking (e.g. Corbin & Walton, 2025; Efimova & Nygren, 2024; see also Shah & Bender, 2022, 2024). ‘Generative AI technologies for information-seeking’ is in the project used as a generic description of technologies that utilises large-scale language models and machine learning to generate information objects based on users’ prompts. Furthermore, search engines have in different ways incorporated generative AI functions through Retrieval Augmented Generation (RAG). The project is a continuation of many years of research concerning information seeking, search engines and the evaluation of sources (e.g. Haider & Sundin, 2019; Haider & Sundin, 2022), as well as research on educational policy (e.g. Godhe, 2019; Godhe et al., 2023).

The project aims to make two contributions: A) expand the empirical understanding of seeking for and evaluating information as a basis for learning in school, in a situation of rapid technological transformation and B) develop conceptual tools for understanding evaluation of information in relation to an information infrastructure increasingly pervaded by AI technologies.

(A) In the project, the use of generative AI technologies for information-seeking is examined in three empirical sub-studies named the public discourse, the classroom and the teachers’ room. These sub-studies are interlinked in different ways, each with its own logic and rules, and different research questions. The public discourse: What are AI technologies used for information-seeking imagined to be doing in schools? The classroom: How are generative AI technologies used for information-seeking employed, with what outcomes, and how is this reflected upon in grade 7 to 9 classroom settings? The teachers’ room: How are AI technologies used for information-seeking imagined as tools for learning by teaching staff, and what roles are they assigned with regard to how teaching staff formulate learning tasks?

B) The project makes conceptual contributions by addressing three interrelated questions: In a situation of reconfigured relationships between human and non-human actors, how can the changing distribution of responsibility in the information infrastructure be described and understood? In these emerging configurations, how can meaningful opportunities for pupils’ and teachers’ accountability and control of information be conceptualised? In what ways can pupils be given opportunities to evaluate information responsibly and integrate such opportunities into learning tasks that address the presence of AI technologies for information-seeking?

The project includes three interconnected empirical sub-studies: Sub-study 1: The public discourse, Sub-study 2: The classroom and sub-study 3: The teachers’ room. A combination of different methods will be used for data production, e.g. media analysis, interviews, observations, focus groups. The analysis focuses on the configuration (Suchman, 2012) of the different entities that contribute to the performance of chatbots and similar information-seeking technologies in each sub-study, as well as on how agency is distributed within these configurations.

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Global reach and local context: the impact of bilinguality on online search

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Search engines, social media and various chatbots are used across the globe daily (Haider & Sundin, 2019; Pires et al., 2019). Users approach these platforms through an array of languages. The use of multiple languages on platforms is not only due to the vast geographical reach of the platforms but also users' proficiency in multiple languages. Statistics from the EU show that in 2022, 90 percent of working-age adults with a high level of education knew at least one foreign language. The same survey shows that 28 percent of working-age adults in the EU who knew at least one foreign language stated that they were proficient in their best-known foreign language (Eurostat, 2022). Furthermore, English is spoken by about half of Europeans (Eurostat, 2024). Language proficiency, or lack thereof, may enable or hinder access to vital information. Previous research indicates that among minorities in various countries, a lack of language proficiency in the official language may impact access to health information (Nzomo et al., 2021).

This short paper presents the outlines of a study currently under development. As search engine results are affected by factors such as language use (Lewandowski, 2023), I am interested in how people who are bi- or -multilingual navigate online search in relation to various topics. With the project I am interested in questions such as: how do people who are bi- or -multilingual make use of their language skills when searching online; are certain topics associated with specific language use; what topics are searched for using mother tongue versus foreign language? The term online search is here used in a broad sense and may include the use of search engines, chatbots as well as social media. The project is intended to take place in Sweden where circa 20 percent of the population were born in another country than Sweden (SCB, 2025). This means that a significant number of the population have another mother tongue than Swedish. This is another aspect which is of interest to the project; how do people who have another mother tongue than the national language of the country in which they reside, navigate the use of various information channels? Ranging from online search of information pertaining to news as well as civic information. A topic of great societal importance, not least in relation to crisis and critical societal situations in which the government aims to communicate with the entire population. The Covid-19 pandemic highlighted the importance of people staying updated with information communicated by various national agencies.

I intend to investigate the topic through interviews with people who are multilingual and residing in Sweden. Various digital methods might also be used to investigate differences between search results depending on language use and specific topics as previous research indicates that language can have an impact on search results (Graham, 2023). The overall aim of the project is to shed light on the impact of bilingualism on online search in everyday life.



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Investigating the Reinforcement of Social Norms in Image Search Results

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1. Introduction

Search engines significantly determine the dissemination of online media content and therefore, have a major influence on the reinforcement of social norms (Arias, 2019; Borg, 2022; Krytson & Eden, 2002). To this end, we analyze the search results of Web search engines and ask to which extend the top (hence mainly observed) search results for specific search queries reinforce specific social norms. In particular, we are interested in normative beauty ideals and their reinforcement in image search results. To automatically assess if the depiction of a human body in an image reinforces e.g. a contemporary Western beauty ideal, we devised and trained an effective classifier (Gollub et al., 2025), which we now apply at large scale to the search result lists of search queries to compute the ratio of images which reinforce the norm. Figure 1 illustrates the idea for the three demographic categories gender, age, and ethnicity, which we combine to different search queries. Our main finding is that the ratios differ by large margins, e.g., for the queries in Figure 1, from 6.12% for the search query "adult Indigenous female" to 83.67% for "young Asian female". We argue that from exploring the impact of different socio-demographic concepts in search queries on the ratio of norm reinforcing search results, interesting sociological hypotheses about the norm under investigation can be put forward. For example, one could argue that the Western beauty ideal that our classifier has learned promotes images of young people, as adding "young" to the search query increases the ratio. Alternatively, one could argue that search engine users who query for images of young people (or more specifically, for example, young Asian female) want to retrieve images that match the classifier's beauty ideal.

At the conference, we will present our classification workflow, together with the most striking results we obtained from composing search queries using a large pool of socio-demographic concepts,

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search operators like in-domain searches, as well as translations across various languages. We hope that in reaction to our findings, an interesting discussion about their social implications will emerge.

Ethnic Group		Male	Female	Male	Female	Male	Female
	African-American	28.00%	32.00%	26.00%	22.45%	8.16%	12.00%
	Asian	48.98%	83.67%	57.14%	48.00%	26.53%	28.00%
	Caucasian	55.10%	56.00%	40.82%	42.00%	18.00%	28.57%
	Indigenous	52.00%	12.77%	18.00%	6.12%	16.00%	6.12%
	Latino	68.00%	42.00%	55.10%	52.00%	24.00%	14.00%
	Middle Eastern	76.00%	48.98%	50.00%	26.00%	34.00%	10.20%
		Young	Adult		Middle Age		
Age Group							

Figure 1 Percentage of images reinforcing a contemporary Western beauty ideal in the Google image search results obtained from a European IP address for search queries that are composed of an Ethnic Group, Gender, and Age Group.

2. Acknowledgements

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Towards Inclusive Search: Integrating Language Complexity in Information Retrieval

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1. Abstract

Existing accessibility strategies tend to focus on technical compatibility and assistive technologies, yet the linguistic dimension remains largely unaddressed at the system level. As such, the varying comprehensibility of search results is a silent barrier that continues to affect equitable information access, even when technical and navigational accessibility standards are met.

This contribution outlines a conceptual approach to inclusive search, arguing for the integration of language complexity assessments into search engines. While conventional search engines optimize for topical relevance and authority signals, accessibility must be integrated as an equally critical dimension of information quality to address diverse user needs. Recent advances in neural text difficulty estimation suggest that automatic scoring of web content along a continuous complexity scale is feasible (Ermakova & Kamps, 2024; Filighera et al., 2019; Shardlow et al., 2021). Transformer-based models, such as derivatives of BERT and RoBERTa, have demonstrated promising capabilities in predicting linguistic complexity, even across multiple languages and domains (Lee & Vajjala, 2022).

Supporting inclusive search requires addressing linguistic complexity as a structural barrier, not merely a user-side deficit. This entails rethinking indexing, ranking, and result presentation with accessibility as a guiding principle. By integrating complexity-aware scoring, relevance can be redefined to consider both topical alignment and comprehensibility. Interfaces may offer adjustable filters for language difficulty, indicate approximate proficiency levels required (as used in foreign language education), or use Natural Language Generation to produce alternative formulations tailored to users' needs.

Inclusion should not rely on fixed user groups but instead dynamically support individual abilities. Personalization must remain transparent and optional; simplification should clarify, not distort. Inclusive systems can also foster learning by providing accessible entry points while gradually encouraging engagement with more complex material provided that such progression is actively supported.

Ethical challenges include fidelity in generated content, potential reinforcement of stereotypes, and preserving user agency. Evaluation should go beyond technical criteria to assess cognitive and linguistic usability, ideally through participatory testing.

Traditional relevance models focus on topic alignment, keyword matching, and popularity signals, resulting in a narrow definition of what constitutes a 'relevant' result. This contribution proposes expanding this definition to incorporate cognitive accessibility as a core dimension of relevance. Rather than treating comprehensibility as a secondary filter applied after topical matching, we argue for an integrated relevance framework where content is considered truly relevant only when it meets both topical and cognitive accessibility requirements. This requires (1) multi-dimensional scoring combining topical precision and linguistic accessibility, (2) recognition that authoritative source may be inaccessible, thus justifying alternative renditions, and (3) adapting to users' abilities without requiring self-identification. Reframing relevance through this inclusive lens enables search engines to become



equitable knowledge mediators – bridging gaps rather than reinforcing them through algorithmically-perpetuated linguistic barriers.

2. Presentation Structure

The presentation will briefly outline key ideas from the abstract, followed by an open discussion to reflect on additional challenges, perspectives, and design considerations for inclusive search systems.

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Decentralizing Web Search: the PeARS search engine

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1. Introduction

Recent publications have highlighted a number of growing concerns related to the relevance and trustworthiness of Web search systems, all exacerbated by the advent of LLM-based solutions (Shah and Bender, 2022; 2024). Such concerns include a) the presence of ungrounded and biased information in search results (Noble, 2018); b) the impossibility to tailor the ranking algorithm to suit the user; c) various economic issues ranging from the monopolization of systems (Hovenkamp, 2024) to their impact on the environment (Dodge et al, 2022).

Aside from academic critique, there is also a common belief that Web search engines require immense resources to operate, making it daunting for communities or small enterprises to build alternatives to the dominant players. The PeARS project (Herbelot, 2016; <https://pearsproject.org>) aims at changing the status quo by providing the building blocks of an open-source, decentralized search engine. To achieve this, it combines algorithms that run on entry-level hardware, using both traditional and modern machine learning techniques. Its low resource consumption ensures that anybody can take part in the network, regardless of financial means.

The aim of this short contribution is two-fold. It will first give a bird's eye view of the PeARS framework, concentrating on the ethical issues it seeks to address. We will see how the system can be trained and populated and how it can be tailored to specific communities, for instance for underrepresented groups or minority languages. We will also give a glimpse into cross-instance search and show how to search the entire PeARS network from a local instance. Building on the proposal of Shah and Bender (2022) for an alternative search vision, it will be argued that PeARS supports the goals of *transparency*, *information literacy* and the requirement for the search system to be *free of economic structures* that might encourage the monetization of the service.

The second part of the talk will discuss the technical decisions that must be made to adhere to the ethical principles we set for ourselves. We will briefly cover the indexing and search algorithms and the challenges brought by decentralization. We will highlight how our multilinguality-first approach leads to the adoption of vector representations based on subwords rather than words, following the trend in deep learning methods while remaining outside of any 'AI' paradigm. The requirements for energy-efficiency will also be discussed, focusing on their impact on the PeARS algorithms at search time. Finally, decentralization itself will be addressed and it will be shown that federating search puts additional pressure on the accuracy of the indexing and search algorithms, with large centralized search engines being able to afford 'sloppier' solutions.

We will conclude that the development of true alternatives to the current search monopolies requires both a change in the general public assumptions and new technical solutions.

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I thank the past and present contributors of the PeARS project for their dedication and their willingness to believe in alternatives.

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Empirically measuring algorithmically embodied emissions of information access systems

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1. Introduction

The rise of generative AI has raised concerns about the environmental impact of AI and machine learning due to high energy consumption and associated greenhouse gas emissions (Bender et al., 2021; Luccioni et al., 2024). Luccioni et al. (2023) adopt a “cradle-to-grave” approach in their life cycle assessment, categorizing emissions into *operational emissions*, arising from algorithm training and inference and *embodied emissions*, linked to data center construction and hardware manufacturing.

Haider et al. (2022) add a third category: *algorithmically embodied emissions* (AEE). AEE refers to emissions resulting from algorithmic curation, where carbon-intensive recommendations influence users’ choices and perceptions of climate change. Using Google as an example, Haider et al. (2022) argue that default query interpretation, result selection, and ranking often prioritize unsustainable content, thereby normalizing a high-carbon narrative (Berglez and Olausson 2023). This bias toward consumerism and carbon-intensive values is especially pronounced when different relevance criteria (subject, topical, and societal) collide (Sundin et al., 2022). While sustainable information is available, finding it is a complex task that requires longer search sessions and a greater awareness of climate issues from users.

AEE can be seen as a second-order algorithmic harm, adding to the list of biases and stereotypes related to religion, gender, or race that many systems exhibit (Noble, 2018; Metaxa et al., 2021a). However, the contexts, circumstances, and extent to which AEE arise have not been systematically studied, and a framework for conceptualizing and investigating this phenomenon is still lacking.

In this short talk, we aim to introduce a draft framework for empirically measuring the AEE of algorithm-driven information access systems. We will do so by linking to relevant research in the fields of IR and RecSys, especially with respect to research on fairness and diversity (Ekstrand et al., 2022), as sustainable information in SERPs is not equally well represented due to biased ranking algorithms. From a methodological perspective, we identify two main approaches for studying the issue: (1) audits and simulations, and (2) user studies. Audits, defined as “[...] repeatedly and systematically querying a system with inputs and observing the corresponding outputs to draw inferences about its opaque inner workings” (Metaxa et al., 2021b, p.288), provide a way to examine both (1a) search engine algorithms and (1b) other AI components driving parts of a system, such as large language models (LLMs). In the context of (1a), we aim to develop scales for evaluating the sustainability of search results, inspired by methods from the literature on other search-related issues, such as the evaluation of news articles, where standardized databases of media outlet reputation have been used to quantify search result quality (Elsweiler et al., 2025). To study (1b), Nadeem et al. (2021)’s work can serve as inspiration for developing a benchmark dataset and corresponding inter- and intra-sentence association tasks to assess the bias of LLMs towards consumerist, unsustainable stereotypes. Finally, in (2), task-based user studies can give insights into how climate-conscious users navigate unsustainable SERPs and what role personalisation plays in this context.

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Our framework offers the potential to study how user search behaviour impacts the downstream emissions generated by search systems, which is, to date, unclear.

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Visualizing social memory – How visual search engines structure the social memory

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1. Introduction

Throughout most of human history, accessing various forms of social memory (or information retrieval) relied mostly on words. Be it oral communication or looking for books in a library, knowledge retrieval had to be structured around certain words from specific languages. Even until recently the accessibility of content, and even pictures, in search engines relied on the usage of keywords, and consequently, the assignment of keywords to the content by the information distributor. Visual search engines, like Google Lens or Pinterest Lens, change this premise. Information can now be accessed by taking or uploading pictures that are analyzed for visual cues and matched by an algorithm with corresponding similar or identical pictures. This shift has several social implications. Everyone can take the same picture of a bird or dress, and get similar results. The specific name for the bird and even the word for the color of the dress does not need to be known. Educational differences (Rózsa et al., 2015; Van Deursen & Van Dijk, 2011), like differing language use abilities, or skill level differences in search engine use (Hargittai, 2002) that still impact how well users are able to retrieve information (Lewandowski, 2016; Schultheiß & Lewandowski, 2021) can be flattened. At the same time, the information now becomes free of keywords in a sense because the visual cues (like color, shape, etc.) now determine what will be matched with certain pictures. Therefore, not only the way people access the social memory changes but also how it is structured in the background, meaning how it is curated in an index. Social research has largely ignored the impact of visual search engines on most levels of society. Research covering Pinterest, for instance, is about the technology of the visual search itself (Jing et al., 2015; Zhai et al., 2017) or the social platform as a whole (Hall & Zarro, 2012). The research on Google Lens is catching up on possible impacts it could have on a social level, like supporting art historians in their research, consumers in finding similar fashion items, or helping in educational settings (Salim et al., 2024; Shapovalov et al., 2019).

In my qualitative research, I want to dive deeper into how people make use of Google Lens and Pinterest in various ways, and how it enables them to access a visual social memory that would otherwise be inaccessible purely with text-based search queries. To do this, I will employ the Actor Network Theory (Callon, 2007; Latour, 2005) showing how user and device melt into one sociotechnical agencement equipped with the ability to navigate the social memory via the use of pictures, flattening educational differences, like language barriers. Simultaneously, I will try to advance the literature on social memory (Esposito, 2002) that has neglected visual access possibilities due to the unavailability of this technology until recently. Accessing the social memory just by pictures enables new opportunities (higher accessibility) and challenges (decontextualization of pictures).

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ChatGPT vs Google Search: A topic flow analysis of Reddit discussions

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1. Introduction

The rise of Large Language Models (LLMs) has spurred debate on how Artificial Intelligence (AI) impacts changing patterns of search engine use. While LLM applications are distinct from “traditional” search engines, research indicates user preference for LLM-enhanced search, for instance in health settings (Sun et al., 2024), though users sometimes display overreliance on incorrect information when presented by an LLM (Spatharioti et al., 2023). As LLM applications incorporate sophisticated features to incorporate knowledge from external databases and/or search engines with Retrieval Augmented Generation (RAG) (Gao et al., 2024), the practical distinctions for users might blur, making analysis of how users reflect on these distinctions highly relevant.

This paper seeks to understand how users compare and contrast ChatGPT and Google Search by analysing text data from two subreddits, r/ChatGPT and r/google. The Reddit platform is ideal for this study as its 'subreddit' structure allows for the targeted collection of rich, contextual data from specific communities (Proferes et al., 2021). Reddit has been used to gauge public opinion on ChatGPT, which included comparisons to search engines (Naing & Udomwong, 2024). Text data from r/ChatGPT has been analysed to get insights into the different uses of ChatGPT like writing tasks, meal planning (Choi et al., 2023), how users weigh systems like ChatGPT against established search engines like Google requires further exploration.

Recent API and Data restrictions implemented by Reddit (Reddit, Inc., 2024a, 2024b) present novel challenges to collecting and using data for research. Text data is collected for the period May-2024 to May-2025 using the Python API Wrapper² (PRAW) (Boe, 2010/2023), which is then analysed with the topic model BERTopic³ (Grootendorst, 2020/2025). Topic modelling is used not just to identify themes, but to map the flow of discussion topics, or “topic flow”, across comments made to submissions in the subreddits. That is, instead of collecting, storing and interpreting direct quotes, the topic model results are instead used to map and reconstruct the original conversation and the discussion flow from the original dataset.

The analysis first identifies topics at macro, meso, and micro levels, which are then manually verified to create a comprehensive map of what users discuss. Subsequently, the analysis reconstructs micro level topic threads by linking the original comment structure. This enables the visualization of 'topic flows,' which reveals common conversational patterns by showing which micro-level topics most frequently precede or follow one another in a discussion. This method provides a map of the context and dynamics of the conversation surrounding these topics while ensuring privacy and compliance with the new data and API restrictions

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² PRAW is “a python package that allows for simple access to Reddit's API”, available at <https://github.com/praw-dev/praw>

³ BERTopic is python package and “topic modeling technique that leverages 🧠 transformers and c-TF-IDF to create dense clusters allowing for easily interpretable topics whilst keeping important words in the topic descriptions.”, available at <https://maartengr.github.io/BERTopic>



Preliminary meso-level results reveal discussions on direct comparisons (e.g., ChatGPT vs. Google Search, Gemini, Perplexity), accuracy concerns, specific use cases, translation quality, and environmental costs. This approach offers a valuable contribution to search engine research by analysing user perceptions on third-party platforms within an increasingly restrictive data environment.

2. Acknowledgements

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Effect of search engine optimisation on reliable healthcare information online | Healthcare SEO

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1. Objective:

This short presentation introduces the ongoing research project Healthcare SEO, which explores the impact of search engine optimisation (SEO) techniques on the visibility and perceived usefulness of evidence-based healthcare information online. This project investigates whether integrating SEO measures can improve the accessibility and relevance of reliable information without compromising quality.

2. Background:

While there are strict quality standards for the development process of reliable health information itself (Deutsches Netzwerk Evidenzbasierte Medizin, 2015), evidence-based resources like patient guidelines often underperform in search engine results pages (SERPs), decreasing their potential usage by and visibility for patients (Meyer et al., 2024). This issue persists even though such content may meet Google's EEAT (Experience, Expertise, Authoritativeness, Trustworthiness) criteria for YMYL (Your Money or Your Life) content, for instance through trustworthy publishers and backlinks by high authority domains for health information. However, especially in the case of patient guidelines, structural and technical factors limit visibility: e.g. many are designed with print brochures in mind and therefore published as PDF files rather than optimized HTML pages. As a result, patient guidelines are often insufficiently indexed and may fail to match user search behavior. The project operates at the intersection of public health education and information science and responds to the current reliance of people using search engines when seeking health information.

3. Methods:

The project is divided into two main modules:

1. **Technical SEO for visibility:** Using existing patient guidelines on hypertension and back pain as case studies, primarily technical SEO measures are applied (e. g. optimisation of meta and structured data, URL structure, headlines and more). A systematic keyword research and analysis to assess user queries in search engines is conducted using the Query Sampler (Schultheiß et al., 2023) and commercial tools as developed by Sistrix (2025). The effect of this intervention is evaluated through a pre-post design with visibility metrics such as SERP rankings for pre-defined, relevant keywords, click-through rates, number of unique visitors and time-on-site.

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2. **Content SEO for usefulness:** Offline copies of the selected patient guidelines are adapted based on the keyword research above. The content is edited to contain (further) keyword-related information and respond to common queries and frequently asked questions. These edited versions of patient guidelines are evaluated for perceived relevance through A/B testing and qualitative focus group discussions with target users (patients). The tested assumption is that aligning content language and structure with the user search intent improves the perceived usefulness of the content.

4. Presentation:

This presentation will share first insights and challenges including methodological considerations for evaluating visibility and utility, and reflections on the relevance of SEO measures for reliable healthcare information online.

Information search habits on the internet have been changing fast in the past two years, driven by the increased use of Large Language Models (LLMs) as a new primary source of information. Studies suggest that the role of LLMs as a source of health information will become increasingly important in the near future (Rao et al., 2025). This session will therefore also open up the discussion on how the accessibility and readability of online content for the crawlers of answer engine machines such as LLMs may also be considered and facilitated in the development and publishing process of information.

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