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Unveiling Patterns in Search Autocomplete: Auditing Search Suggestions by Search Engines Across the Gender Spectrum

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Abstract:

This study investigates the patterns present in search autocomplete suggestions generated by two widely used search engines when queried with gender-related terms: female, male, lesbian, gay, bisexual, and Transgender. By auditing the top autocomplete suggestions for each term across both platforms, the research aims to identify how gender and sexual identity are represented in algorithmically generated search prompts. A comparative analysis is conducted to examine overlaps, divergences, and potential framing differences between the two search engines. The findings highlight the need for comprehensive gender education, active efforts to challenge stereotypes, and balanced representation across sectors. Furthermore, the study emphasizes the responsibility of search engines to improve algorithmic transparency, detect and mitigate bias, and promote a more equitable information ecosystem. Addressing these challenges demands proactive, multi-dimensional efforts that extend beyond digital spaces into the fabric of society itself—through education, cultural transformation, balanced representation, and sustained research to promote a genuinely inclusive future.

Keyword: *Bing, Bisexual, Female, Gay, Google, Lesbian, Male, Transgender*

1. Introduction:

Search engines are now essential tools in modern life, deeply embedded in how individuals seek, access, and engage with information. Beyond casual browsing, they shape education, decision-making, and political discourse. Their integration into daily routines often goes unnoticed, yet they play a pivotal role in organizing knowledge and mediating information flow. Search engines have become foundational infrastructure for both personal and public information access, fundamentally transforming how we search, learn, and interact with the world (Haider & Sundin, 2019).

The development of search engines dates back to the early 1990s, beginning with Archie in 1990, which indexed file listings on FTP sites. As internet use expanded, tools like Gopher, Veronica,

and Jughead emerged to help users locate specific files. In 1993, W3Catalog became the first structured web search engine. This was followed by the rise of Yahoo! and AltaVista, leading to Google's launch in 1998, which revolutionized the field with algorithmic innovations. These advances laid the groundwork for today's powerful search engines, central to navigating the modern web (Seymour, Frantsvog & Kumar, 2011).

A major shift occurred in 2004 when Google introduced Google Suggest, an autocomplete feature that offered real-time query suggestions. This innovation quickly spread across major platforms and individual websites, making searches faster, more intuitive, and personalized (Ward, Hahn, & Feist, 2012). Google and Bing now generate suggestions based on factors like trending topics, user behavior, location, language, and search history. Google, for example, draws from real user queries and web content to predict intentions and filter inappropriate suggestions, aiming for a positive and efficient search experience (Google Search Help, 2025). Bing similarly uses predictive algorithms and behavioral data to surface relevant suggestions (Microsoft Support, 2025).

However, autocomplete features are not without drawbacks. Because they reflect popular and past user queries, they can mirror and reinforce existing societal biases. These biases, embedded in billions of daily searches, influence the search suggestions users see and ultimately affect the information they engage with. Autocomplete can guide user perceptions subtly but powerfully—especially in areas tied to politics, race, and gender—potentially skewing opinion formation and reinforcing harmful stereotypes (Haak, Engelmann, Kreutz & Schaer, 2024).

Several studies and campaigns have exposed such bias. A 2013 UN Women ad campaign highlighted harmful autocomplete results like "women should stay at home" (Mahdawi, 2013). Sandvig et al. (2014) found that searching for phrases like "why are Black people..." often returned harmful, stereotypical suggestions. Leidinger and Rogers (2023) observed that age and gender-related suggestions often reflect negative sentiments and stereotypes. Noble (2018), in Algorithms of Oppression, documented how search engines propagate racist and sexist content, particularly against Black women. Epstein and Robertson (2015) demonstrated that Google's autocomplete could influence political attitudes by suggesting biased phrases, such as "Obama is a Muslim," during U.S. elections, promoting misinformation. Lin et al. (2024) further revealed that biased suggestions related to gender and immigration can influence hiring decisions, underscoring the real-world consequences of algorithmic bias. The lack of context and ambiguity in short suggestions only deepens these concerns.

This article aims to audit autocomplete suggestions from major search engines across the gender spectrum. It investigates whether platforms like Google and Bing reproduce societal norms and stereotypes in their suggestions, not only regarding male and female identities but also terms

related to queer and non-binary genders. The study seeks to uncover patterns of bias and evaluate how such features may contribute to the perpetuation of gender-based stereotypes online.

2. Literature Review:

Lin et al. (2023) analyzed autocomplete bias in major search engines across gender, race, and sexual orientation. Using over 106,000 suggestions and toxicity scores, they found higher negative bias toward marginalized groups, varying by topic. The study highlights how such bias shapes public discourse.

Haak et al. (2024) developed a method using large language models, and Elo scoring to detect bias in political autocomplete suggestions across Google and Bing. Their framework accounts for context and subjectivity, offering a new way to assess politically sensitive bias.

Haak & Schaer (2022) proposed a recursive suggestion tree method to detect nuanced biases in sparse autocomplete data. Applying it to person-related political queries revealed how topical group bias manifests in search engines.

Kulshrestha et al. (2019) created a framework to quantify political bias in search results, distinguishing between data and ranking influences. Analyzing the 2016 U.S. primaries on Twitter and Google, they found both input and algorithmic sources of bias, suggesting better user awareness tools.

Epstein et al. (2024) studied the effects of suppressing negative search suggestions on voter behavior. Across five experiments, they showed that such suppression can shift voter preferences dramatically, with implications for election integrity.

Bonart et al. (2020) examined search suggestion bias on Google, Bing, and DuckDuckGo before Germany's 2017 federal election. Analyzing 629 politicians' names, they identified biases by gender, party, and age, emphasizing how suggestions can influence perceptions.

Haak & Schaer (2021) built on Bonart et al.'s work by introducing perception-aware metrics to better detect subtle topical biases in sparse query suggestions, improving accuracy in bias identification relevant to user experience.

3. Research Gaps:

Although numerous studies have examined search suggestions or autocomplete features offered by various search engines across different domains such as politics and from diverse perspectives,

including race, gender, and female representation, there remains a gap in the literature. Specifically, there is a lack of comprehensive comparative analyses that explore the representation of all identities across the gender spectrum within these algorithmic outputs.

4. Objectives of the Study:

The objective of this research is to conduct a comparative analysis of search engine autocomplete suggestions-

(i) To compare how different gender identities across the full gender spectrum are represented.
(ii) To identify patterns, disparities, or biases in the representation of these identities.

5. Methodology:

For this study, six search queries across the gender spectrum namely the gender terms female, male, lesbian, gay, bisexual, and transgender were taken, then those queries were typed into the search engine and the ten search suggestions provided for those queries were noted down. This was done every day for six months, from March to September of 2023, in a freshly installed web browser that was just used for this purpose and so that the search suggestions were not dependent on user behaviour or past searches. Then those data collected over six months were analyzed with the help of spreadsheets to find out whether there is any trend or pattern or bias.

6. Findings:

The difference in the search suggestions provided by the two search engines i.e the variations in the top suggested terms likely reflect the distinct algorithms and user bases of the two search engines. They also provide insights into the immediate information needs of users.

6.1 Comparative analysis of the two search engines:

Based on the analysis of the search suggestions, there are observable overall differences between the search suggestions provided by search engines Google and Bing. While both engines cover the same core search terms related to gender, they exhibit distinct patterns in the types of suggestions they prioritize and the frequency with which those suggestions appear.

(i) Google often leans towards informational searches, including definitions, etymology, and social/political contexts (e.g., "meaning," "Gay marriage in India," "male female ratio in India"). In contrast, Bing frequently provides entertainment-related searches, such as movies, series, songs etc.
(ii) Google provides a broad range of suggestions and sometimes more specific search suggestions; Bing tends to offer more general terms. When it comes to LGBTQ+ terms, Bing

often seems to focus more on identity-related searches (e.g., "Gay men," "lesbian couples") and community symbols (e.g., "flag," "pride flag") compared to Google.

These differences indicate that the algorithms, user bases, and data processing methods of the two search engines are not identical. This leads to variations in the search suggestions they provide for the same gender-related keywords. While both search engines cover similar themes, they often show distinct priorities and variations in the frequency of specific search terms. This suggests differences in their underlying algorithms, user bases, or how they process and rank search suggestions.

6.2 Comparative analysis of Search Suggestions by Google (SG) and Search Suggestions by Bing (SB) for each gender identity term:

Table 1. Comparison of Search Suggestions for Each Gender Identity Term

Search Suggestions for the word	Differences between the Search Suggestions	Similarities Between the Search Suggestions
Female	SG includes more searches about "female dog names". SB has a broader focus on anatomy, signs, and symbols. SB shows a higher frequency for "condom" searches, suggesting a potentially different user base or algorithm that prioritizes this topic.	Both SG and SB prominently feature "female reproductive system" and "condom," indicating a strong interest in biological and contraceptive aspects. Both SG and SB also include disturbing terms like "foeticide" and "infanticide".
Male	SG includes searches related to "male female ratio in India" and "male to male massage," which are absent or less frequent in SB. SB focuses more on symbols, signs, and general terms, with "Maldives" being a prominent search term.	Both SG and SB include "reproductive system" as a frequent search term. Search Suggestions also include "male dog names" as a search term.
Lesbian	SG primarily includes symbols and flags, while SB has a focus on dating apps and general references like "books" and "romance". SG emphasizes the definition and visual representation (flag, symbol, emoji) of "Lesbian". SB leans towards practical aspects like dating apps and broader themes like romance and series.	Both SG and SB show a strong interest in the meaning of the word "Lesbian". Both SG and SB reflect interest in media (movies, series) related to the term.
Gay	SG shows a unique interest in "Gay-Lussac's law" and "Gay marriage in India," while SB focuses more on general terms like "flag," "love," "Gay	Both SG and SB prominently feature searches for the "meaning" of "Gay". Both SG and SB share

	men". SG includes scientific and legal references, indicating a wider range of informational searches. SB is more centered on identity ("Gay men"), relationships ("love," "couple"), and symbols ("flag").	common interests in "movies" and "series".
Bisexual	SG includes "flower" and "flower examples," which is an unusual association, while SB has a broader interest in "people," "quiz," and "meaning in Tamil". SG has some unique and less common search terms like "flower" and "meaning urdu". SB seems to explore the identity and understanding of bisexuality from different perspectives, including language ("meaning in Tamil," "meaning in Hindi") and self-assessment ("quiz," "test").	Both SG and SB prioritize searches for the "meaning" of "Bisexual". Both SG and SB show interest in "flag emoji" and "pride flag," indicating a focus on symbols of bisexuality.
Transgender	SB strongly emphasizes "act 2019," "flag (Pride flag)," and "symbol," while SG includes searches related to "body," "chromosome," and "portal". SG shows a mix of searches related to the biological aspects ("body," "chromosome") and social aspects ("portal," "couple") of being transgender. SB focuses more on legal/legislative ("act 2019"), symbolic ("flag," "symbol"), and identity-related ("man," "male," "female," "girl") terms.	Both SG and SB include searches for "meaning," "in India," and "flag". Both SG and SB share an interest in "surgery" and "pregnancy," reflecting concerns and questions related to transitioning and related issues.

6.3 Key Findings:

Based on the analysis of the search suggestions, there are observable overall differences between the search suggestions-

(i) **Differences Across Search Engines:** Notable differences in specific search suggestions and their frequencies were observed between the two search engines. These differences may stem from algorithmic variation or differences in user demographics and behavior.

(ii) **Variation Across Genders:** There are observable differences in the nature and frequency of search suggestions associated with different gender identities. This variation suggests differing public interests and perceptions based on gendered terms.

(iii) **Consistent Emphasis on Definition and Meaning:** Across nearly all gender-related queries—such as female, male, lesbian, gay, bisexual, and transgender—there is a strong emphasis on searches seeking the "meaning" of these terms. This trend reflects a widespread need for clarification and understanding of gender identities and concepts.

(iv) **Biological Associations:** Terms like female and male are frequently associated with biological components such as the *"reproductive system"* and *"sex hormones"*. This indicates a persistent framing of gender in biological terms, especially in relation to cisnormative identities.

(v) **Blend of Social and Biological Interests:** The search suggestions reflect both biological and social interests, illustrating the complex interplay between gender identity, societal roles, and physiological characteristics in public discourse.

(vi) **Representation and Symbols in LGBTQ+ Searches:** A significant number of search queries related to LGBTQ+ identities include terms like *flag*, *symbol*, and *dating apps*, indicating the importance of visual representation, identity affirmation, and relationship dynamics within the community.

(vii) **Societal and Legal Concerns Reflected:** Search suggestions also include references to legal and societal issues, such as *"Act 2019"* for transgender individuals or *"gay marriage in India"*, indicating the relevance of these terms in broader societal and cultural discussions.

(viii) **Regionally Specific and Culturally Unique Queries:** Some terms show regional or culturally specific interests (e.g., "gay marriage in India", or "flower" for bisexual), highlighting how context influences public inquiry and discourse around gender and sexuality.

(ix) **Concerning and Sensitive Search Terms:** The appearance of disturbing terms such as 'foeticide' and 'infanticide' raises ethical concerns, pointing to deeply rooted societal issues and potentially harmful search behaviors or attitudes toward certain gender identities.

(x) **Implicit Objectification in Certain Searches:** Some suggestions, though less frequent, contain language or context that may imply objectification (e.g., *"male to male massage"*). These raise concerns about the sexualization of certain identities within search trends.

7. Conclusion:

Search engines offer a window into how society explores and understands gender-related concepts. The analysis of search suggestions reveals a blend of genuine curiosity, a need for information, and the influence of deep-seated social norms. However, the presence of biased, stereotypical, and sometimes harmful terms highlights an uncomfortable truth: search engines often mirror and even amplify societal prejudices related to gender and identity.

A comparison of platforms like Google and Bing shows both commonalities and differences in search behavior. While some terms overlap, the distinct variations in term priorities and frequencies reveal how each platform captures a unique dimension of user interest. More

importantly, both reflect existing gender biases, suggesting that societal inequalities are not only reproduced online but may be unintentionally reinforced through technology. Addressing these issues requires proactive efforts. Comprehensive education on gender, sexuality, and identity is essential, moving beyond basic definitions to tackle cultural, social, and biological complexities. Challenging gender stereotypes, ensuring balanced representation across fields, and supporting victims of discrimination are critical steps toward building a more inclusive society. Research into gender-related topics must also be encouraged to guide better policies and interventions.

Equally important is the role of search engines themselves. Developers must prioritize algorithmic transparency, regular audits for bias, diversified data sources, and meaningful user feedback mechanisms. By recognizing and correcting embedded prejudices, search engines can help create a more equitable online environment, rather than merely reflecting society's flaws.
In conclusion, while search engines reveal how people search for and understand gender, they also highlight the urgent need for critical engagement and systemic change. By combining education, responsible technological design, and user empowerment, we can work towards a more informed, equitable, and inclusive understanding of gender, both in search engine results and in society as a whole.

8. Delimitation of the study:

The delimitations of this study include a focus on auditing autocomplete suggestions from only two selected search engines. A study on a larger number of search engines would probably have provided a more comprehensive understanding of autocomplete trends across different platforms. Data collection was limited to a specific time frame, potentially overlooking changes in trends or search algorithms over a longer period. The study was also restricted to search queries in English, limiting the analysis to linguistic contexts.

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