Searching For Bias

> *Search engines serve as the reference librarians of the web. Individuals and organizations would be ill-served if the world shared the same librarian. Similarly, they would be ill-served by a search engine monopoly*

-A Mowshowitz, A. Kawaguchi 2002
Information Processing & MGMT

> *75% of all desktop/laptop & 87% of all mobile search performed using Google*

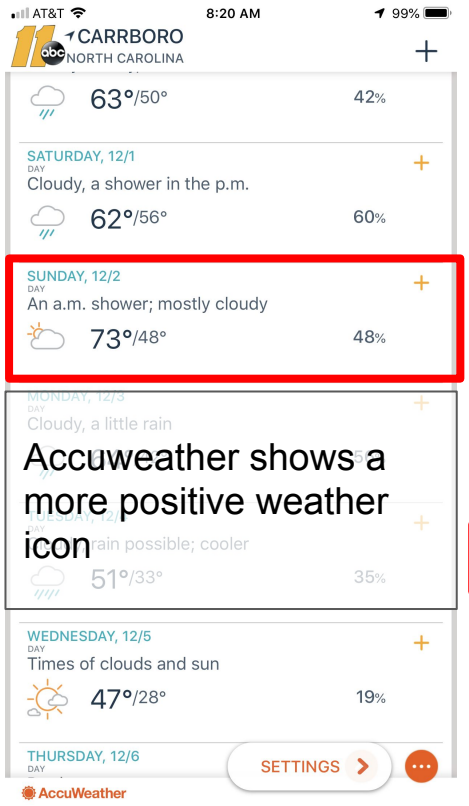
NetMarketShare.com, November 2018

Jon Clancy, Eden Andes, Teresa Phan

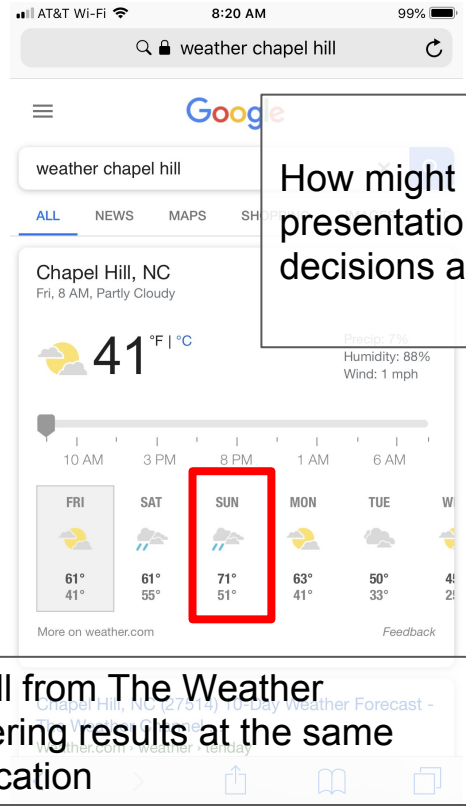
Our assumptions

- The internet is navigated primarily via IR systems
- Users trust results from these systems as though from newspapers, libraries, and phonebooks
- Much of the information that exists on the internet is unstructured, not vetted, and when it is indexed it is often indexed by the creator
- The makers of successful IR systems earn money somehow
- When errors occur with IR systems, the companies are rarely transparent about cause or fix

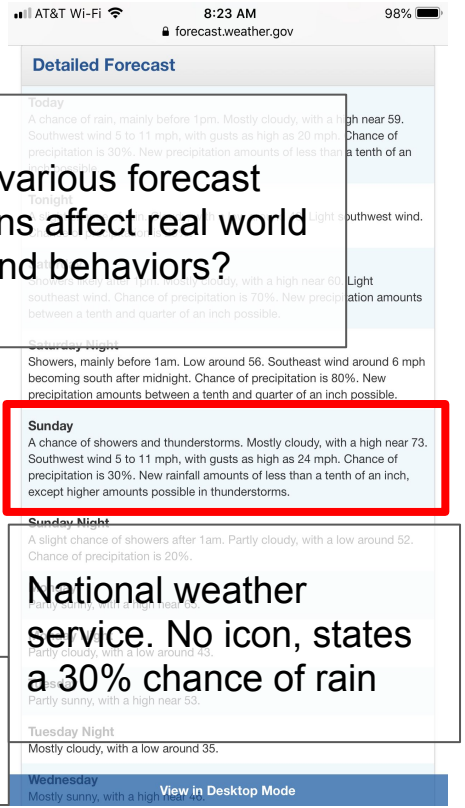
4 Different Weather systems showing the ‘same’ forecast



Accuweather shows a more positive weather icon



How might various forecast presentations affect real world decisions and behaviors?



National weather service. No icon, states a 30% chance of rain

Google and Apple both pull from The Weather Channel, yet provided differing results at the same time and from the same location

Bias is disproportionate weight in favor of or against one thing, person, or group compared with another, usually in a way considered to be unfair.

- From Wikipedia

- Anchoring: The first piece of information given is usually prefered
- Patternicity: We want to see patterns
- Attribution: ‘I have my reasons, but you, you’re just a bad person’
- Confirmation: ‘I knew it!’
- Framing: Your solution sounds better when you define the problem
- Association: Linked to polarizing figure
- Self serving bias: We like info that makes us feel good about ourselves
- Status Quo: Resisting change
- **Conflicts of Interest**

Gender and Racial Bias

Where does the bias originate?

Society?

Developers?

Is search engine bias even possible?

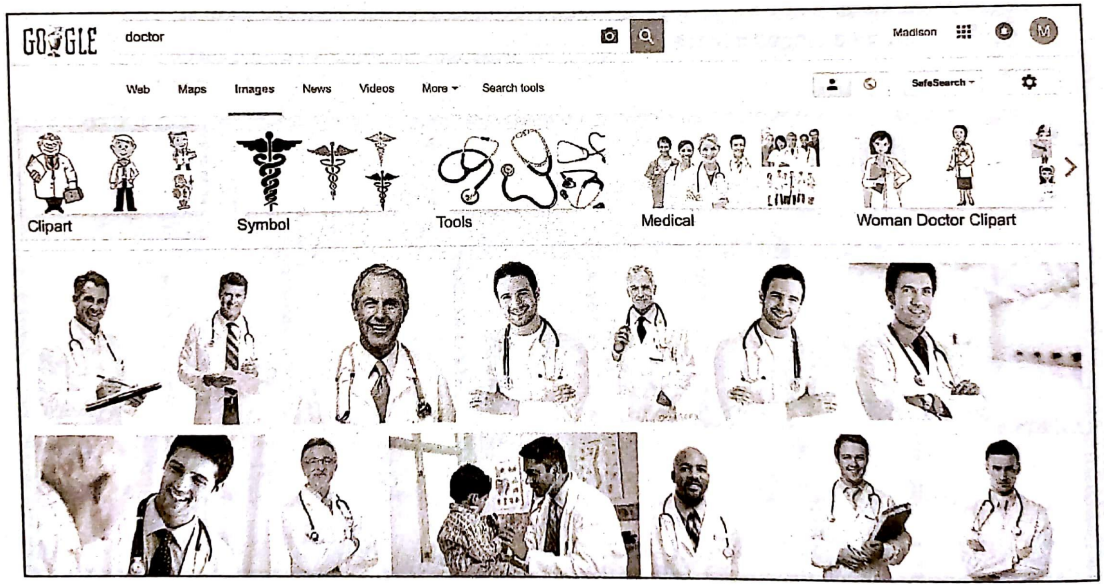


Figure 2.14. Google Images search on "doctor" featuring men, mostly White, as the dominant representation, April 7, 2016.

It definitely exists… **now what?**

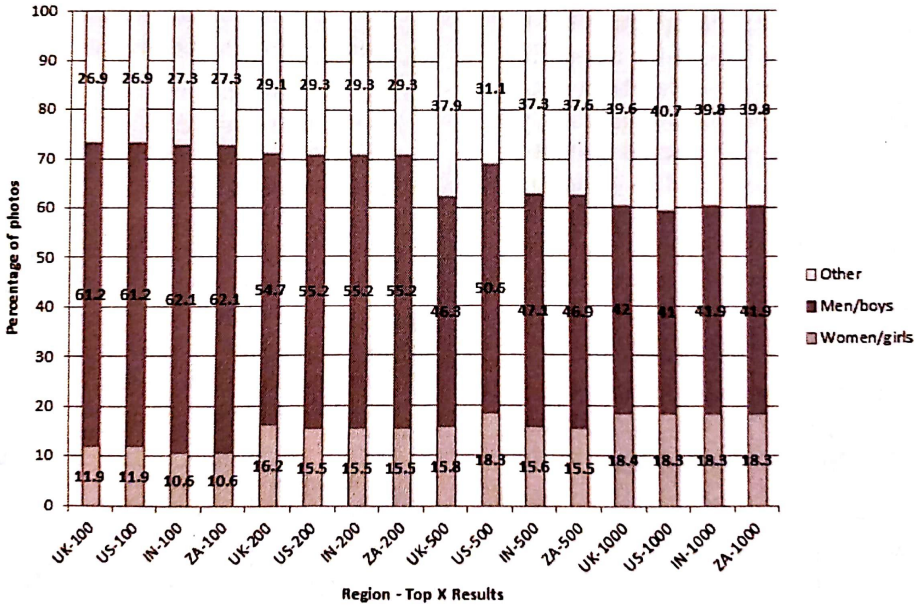


Figure 2: Gender distribution in photos retrieved for "person."

What is a "person"?

- Image results for first 100, 200, 500, 1000 results for query "person"
- No significant difference in region
- Discrepancy in top results
- "Person" retrieves twice as many photos of men as women
- Retrievability bias

Otterbacher, 2017

Figure 1.6. Google autosuggest results when searching the phrase “why are white women so,” January 25, 2013.

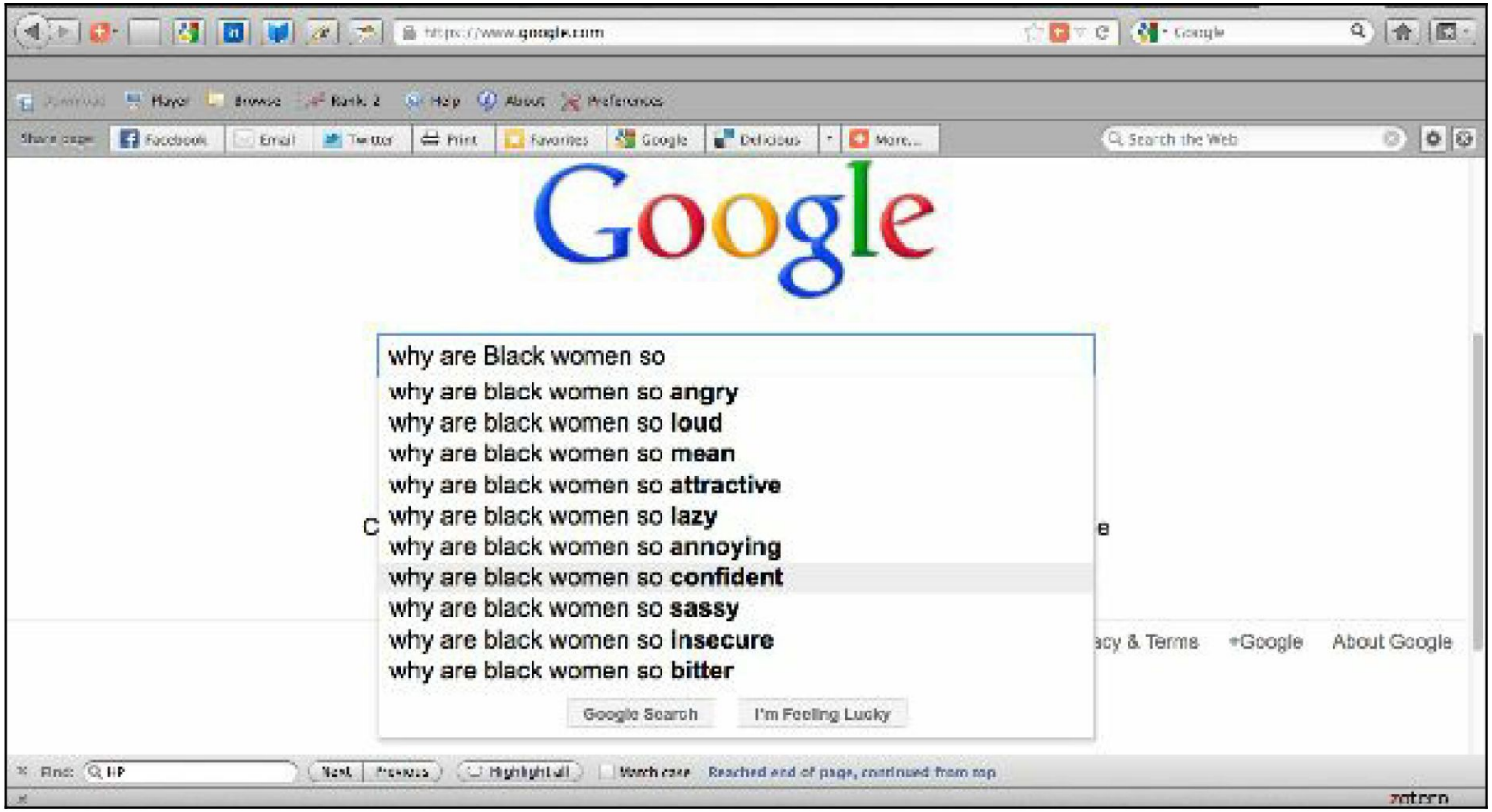


Figure 1.5. Google autosuggest results when searching the phrase “why are black women so,” January 25, 2013.

It definitely exists… **now what?**

Real-world implications

- Societal Stress
- Reinforcing stereotypes
- False data
- Cultivation Theory

Figure 2.16. Tweet about Google searches on "unprofessional hairstyles for work," which all feature Black women, while "professional hairstyles for work" feature White women, April 7, 2016.

Solutions?

- Address society as a whole
- Make people aware of how algorithms work, what's behind search engines
- Inform developers of their cognitive biases and train them to recognize and correct them in their code

Where does the bias come from?

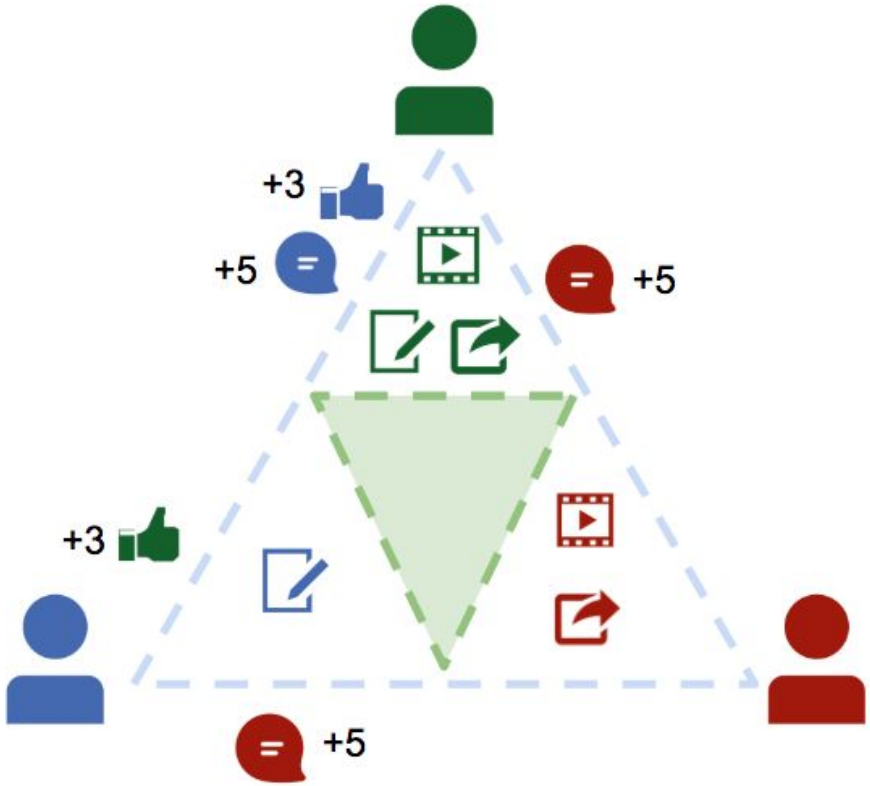
Facebook's EdgeRank Algorithm

$$\sum_{edges\ e} u_e w_e d_e$$

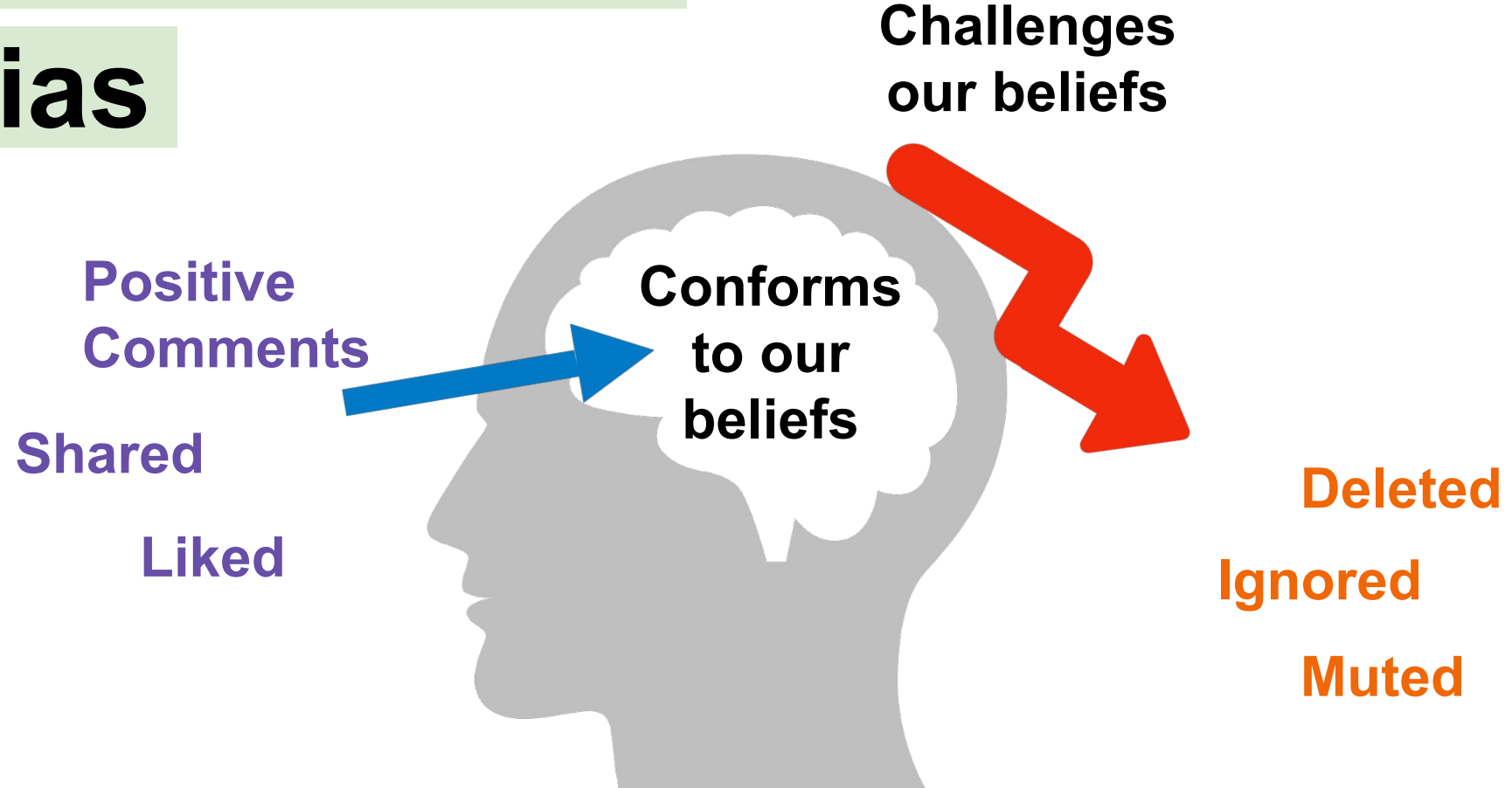
u_e Affinity score between user and edge creator

w_e Weight for this edge type (create, connect, like, tag, etc.)

d_e Time decay factor based on how long ago the edge was created



Confirmation Bias



Possible Solutions

- Minimize the bad effects and improve the good effects of this technology instead of trying to get rid of it all together
- Go from purely algorithmic approach to include human curators to help determine trends
- Create an algorithm that will inform us of who and where the information is coming

Bias on the web

Data bias:

- Geographic
- Economic
- Age
- Gender
- Language

Sampling bias
Algorithmic bias
Selection bias
Activity bias
Presentation bias

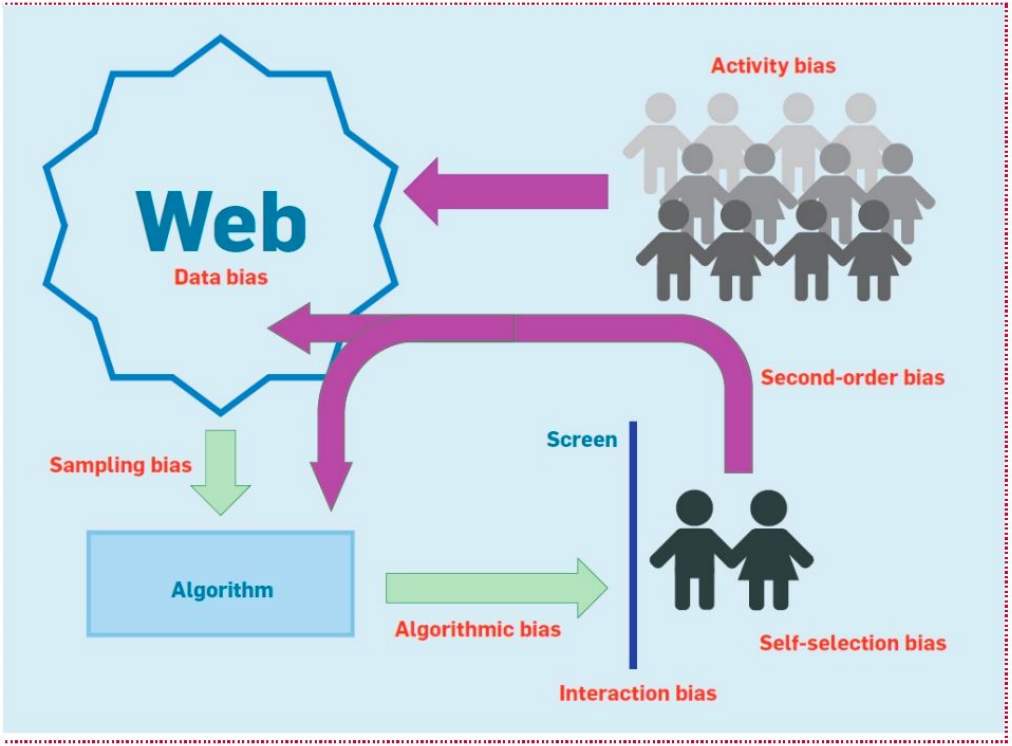
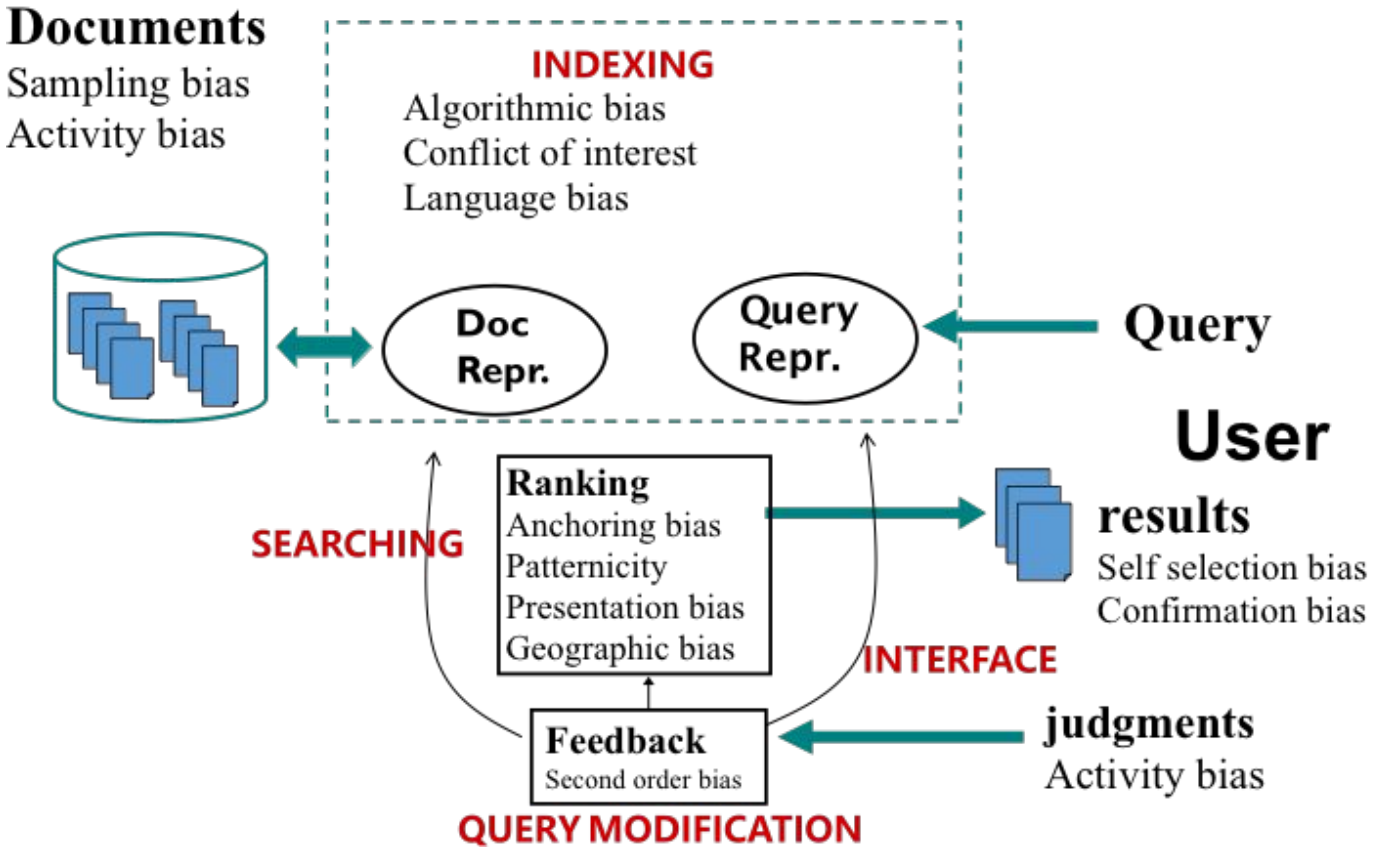


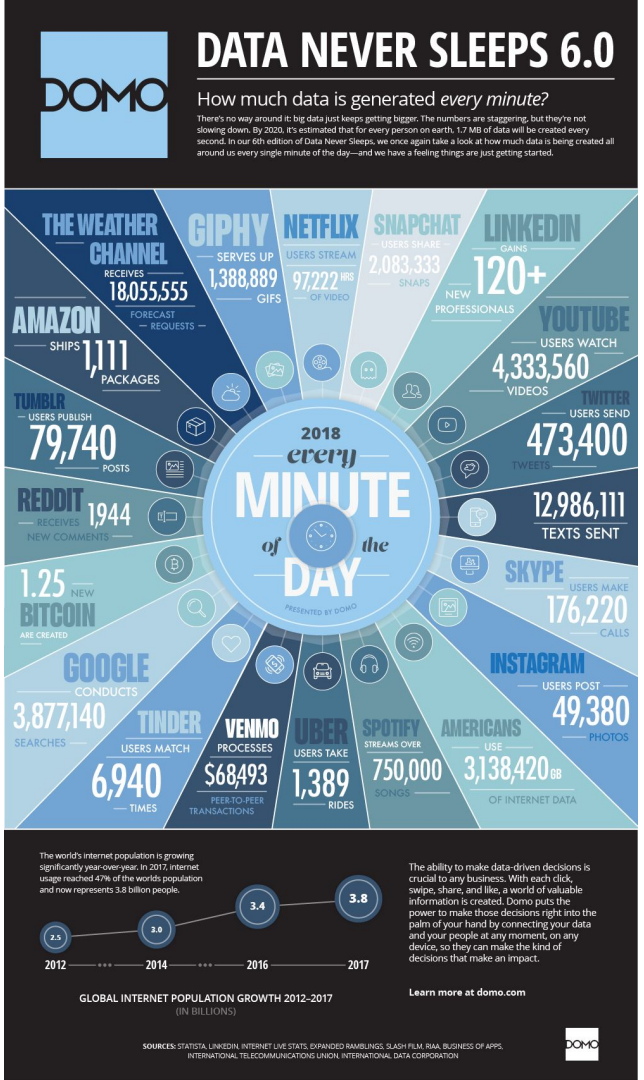
Figure 1. The vicious cycle of bias on the Web.

Potential for bias in a typical IR system



Data bias

- 90% of existing data was generated in the past 2 years (as of 2017)
- Most new data is unstructured
- There is so much data that no human could possibly interpret it all



Activity Bias online

4% of users provide 50% of Amazon reviews (including paid reviewers)

7% of Facebook users contribute 50% of the content

0.05% Of Twitter’s most popular users attract 50% of all users

0.04% of registered Wikipedia editors posted half of Wikipedia’s original content

Sarcasm is a microcosm for
Garbage-In Garbage-Out

- Sentiment analysis and natural language processing are particularly challenged by sarcasm.
- Fortunately, Twitter offers the #sarcasm as a way for systems to assess tweets
- A high recall & precision systems still misses ~15-20% of sarcastic sentiment

Word cloud generated from 5-star reviews of Haribo Sugar-free Gummy Bears on Amazon

Algorithmic Bias

Motivations behind the behaviors and results ranking of IR systems:

- Precision/recall
- Spam filtration
- Speed
- Sales
- Popularity
- Usability

Decision by algorithm can reflect biases inputted

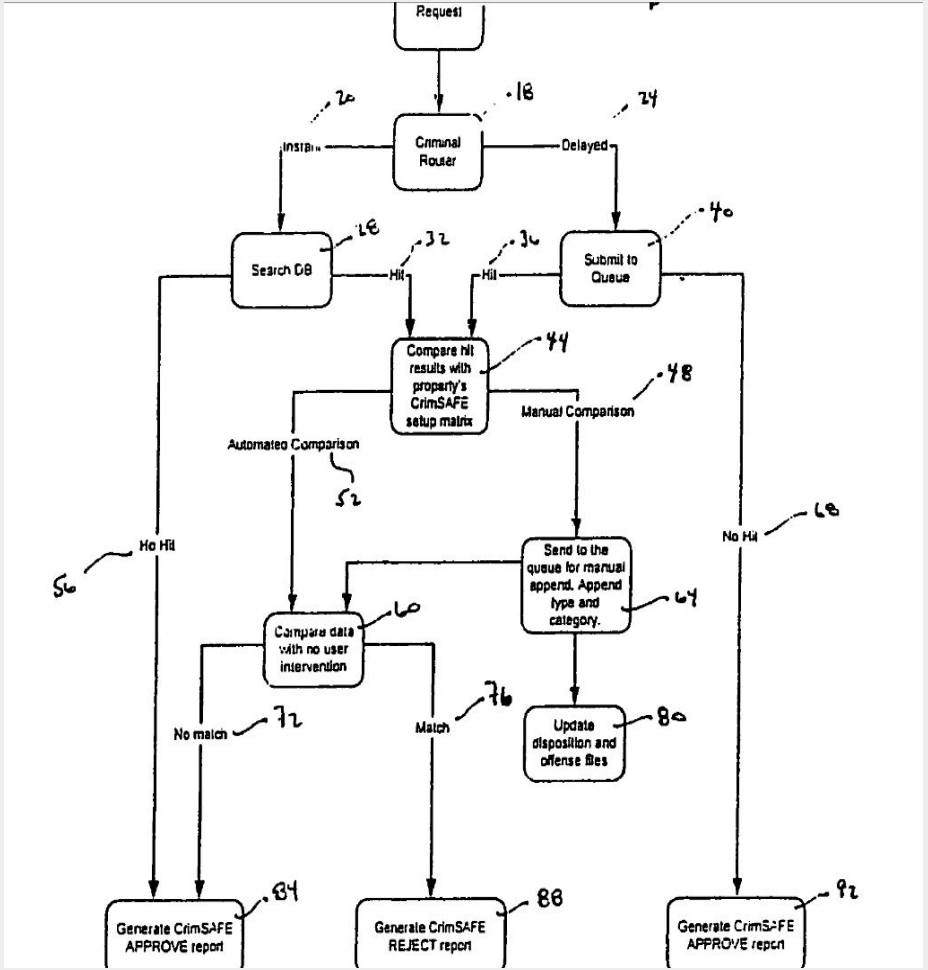
Patent #US20060195351A1:

Internet-based system and method for leasing rental property to a prospective tenant based on criminal history

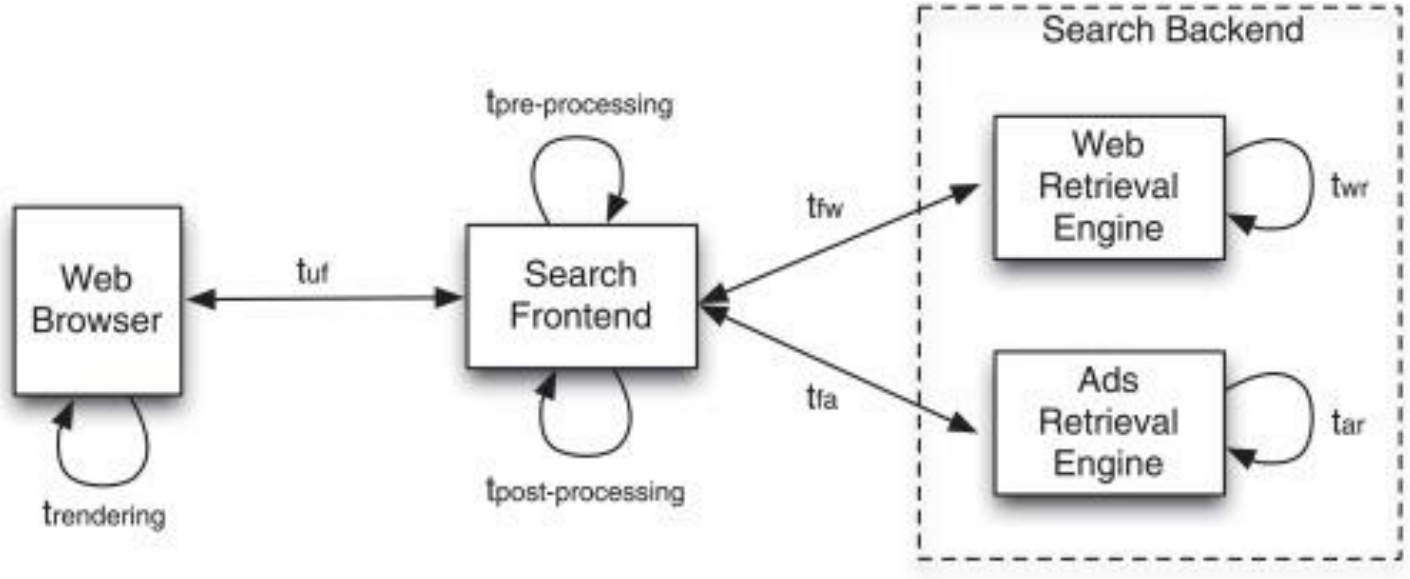
Property manager decides (by crime) whether they would approve an applicant based on specific criminal history.

If African Americans and Hispanics were incarcerated at the same rates as whites, prison and jail populations would decline by almost 40% -NAACP

Algorithms only see the data, not the underlying socioeconomic landscape that creates this disparity



A model of an Search Engine coupled with an ‘ads retrieval’ system



Google, Bing, Yahoo!, etc. must be effective to be used

Because they are effective they can sell the first result on a search to relevant advertisers

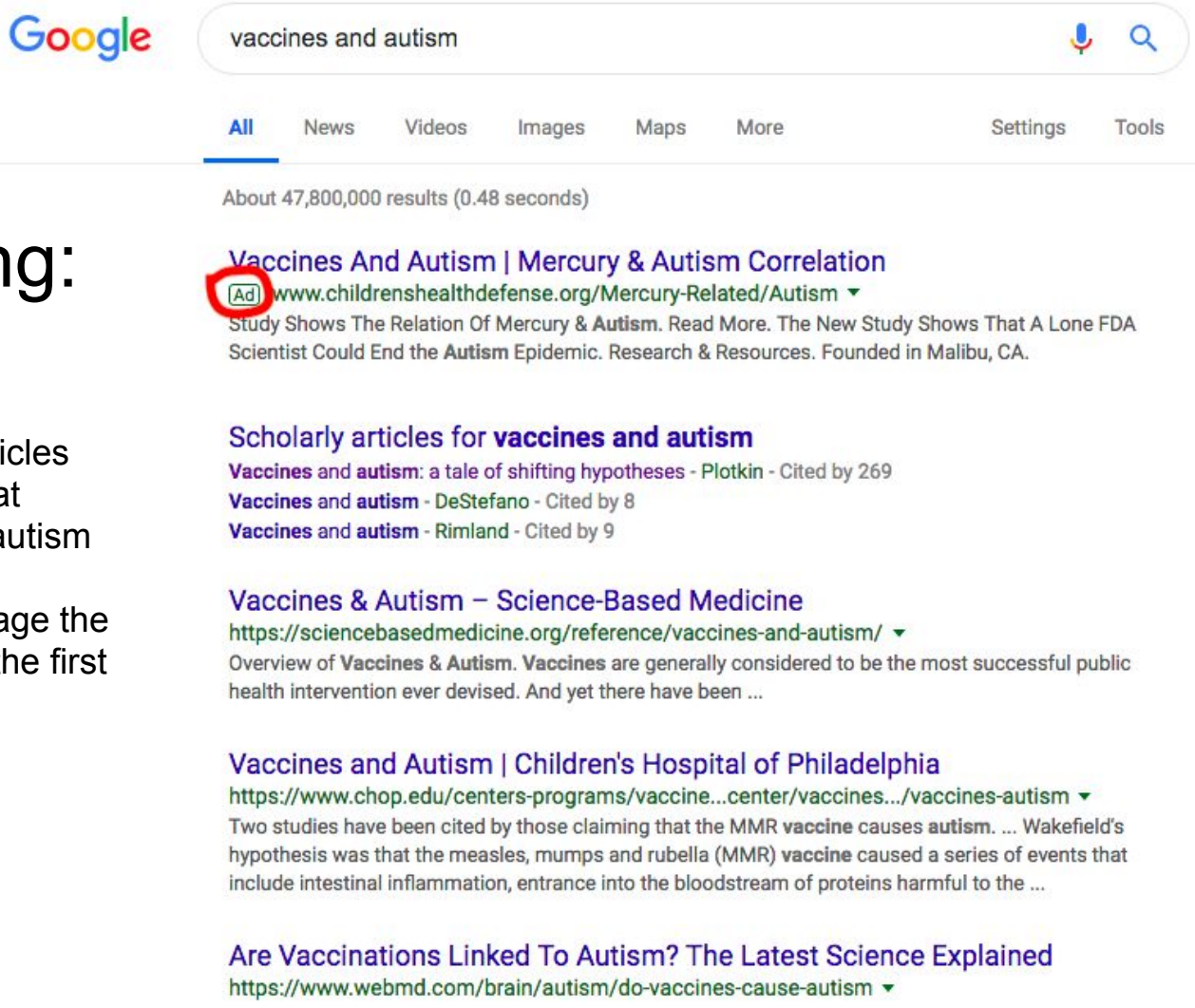
The anchoring bias (and click results) suggests that users will be heavily influenced by the first result

IR and advertising:

Query: ‘vaccines and autism’

IR provides a series of scholarly articles and hospital links demonstrating that vaccines have no statistical link to autism

Ads Retrieval provides a link to a page the ‘autism epidemic’ and vaccines as the first result

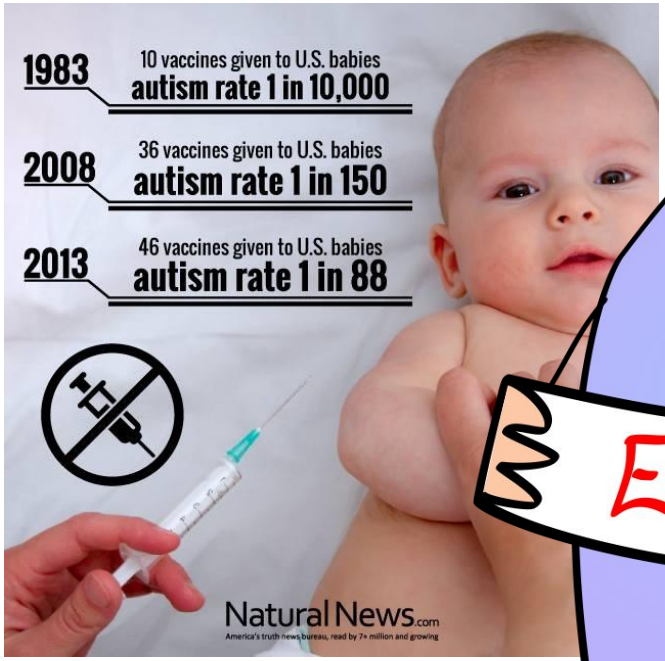


Data bias in indexing

- The 1998 retracted and debunked study regarding vaccines and autism still permeates the web and has led to refusal of the Measles, Mumps, and Rubella vaccine

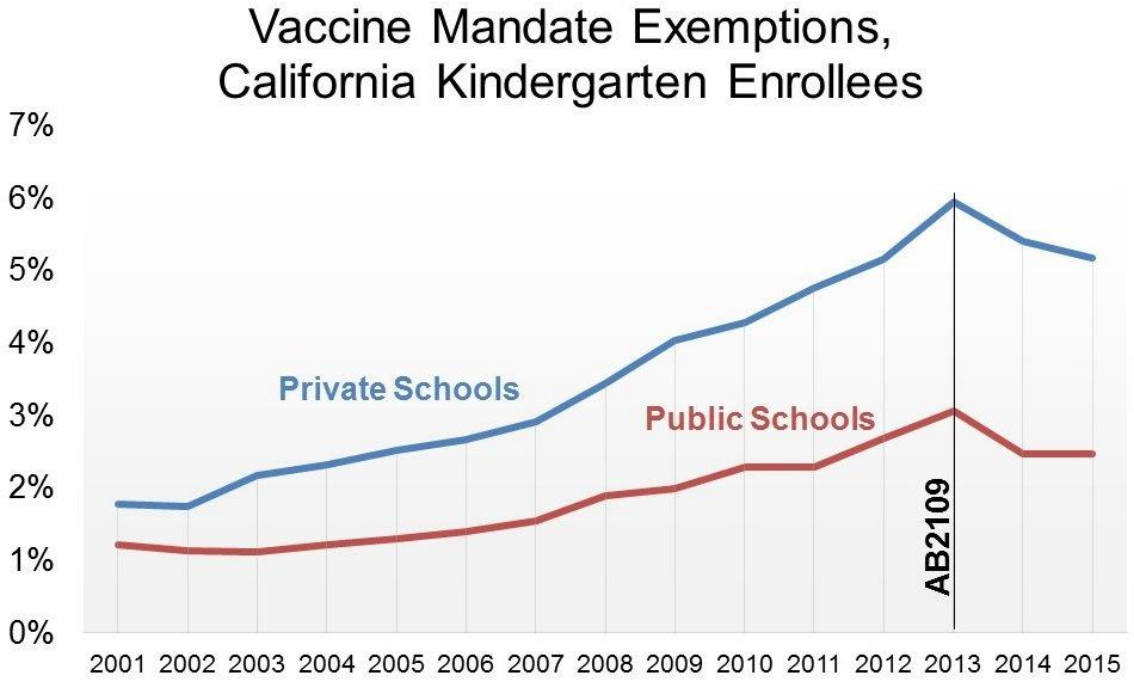
Fact selection and presentation affects decisions

Data Bias



Correlation does not equal causation

California limited the rate of increased vaccination exemptions by requiring a medical consult first - forcing people to talk to an expert



Possible Solutions

- √ More **awareness** and **education** for users and developers
- √ More **transparency** from Search Engines
- √ Better **checks & balances**
- √ Better data sampling
- √ Clearer representations of data and where it came from

¿¿¿ Ideas & Questions ???

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