

Algorithmic Bias? An Empirical Study into Apparent Gender-Based Discrimination in the Display of STEM Career Ads

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Plan for today

- Research on bias in Algorithms (Consumer Protection)
- Some thoughts about Algorithms for pricing (Competition Policy)

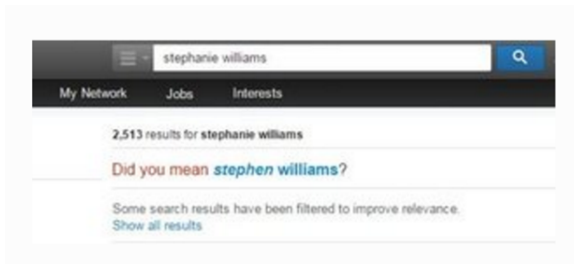
Research Question

What may make an ad serving algorithm appear biased?

Motivation

- Privacy debate has moved to a question of privacy harms:
- Papers in CS have documented empirical pattern of apparently discriminatory ad serving behavior (Sweeney, 2013; Datta et al., 2015)
- But they are not focused on understanding why

Why might algorithms be biased?



Why might algorithms be biased?

- People who write the algorithm are biased (white guy in tech theory)
- The training set used to train the algorithm is biased
- The algorithm learns bias while optimizing from biased behavior
- And ??

What we do

- Field Test data on STEM ad across 190 countries
 - Set up as gender neutral
 - But shown to men more than women

Why does this matter?

- First paper to explore the why of apparent algorithmic-bias
- We find that apparent algorithmic bias may not be intentional but instead the result of completely separate advertiser actions
- Emphasizes that privacy online is not an individual issue. Instead it may be a complex mass of intertwined decisions.

EU citizens might get a 'right to explanation' about the decisions algorithms make



Ethan Chiel

7/05/16 3:27pm · Filed to: REAL FUTURE ▾



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Getty Images

Algorithms [discriminate](#). It's not their fault, they're strings of math, but

Figure: Policy Implications

The FTC is worried about algorithmic transparency, and you should be too



Policy Implications

- Not much support in our findings for ‘Algorithmic Transparency’ being a solution
 - Perhaps auditing algorithmic outcomes is a better approach.
- If regulating privacy in online advertising is hard, regulating the potential for algorithmic discrimination or bias may be even harder

Outline

Methodology
Field Test

Field Test

Empirical Evidence

Results

Do men indeed see more STEM ads than women?

Implications

Brief Thoughts about Algorithms and Pricing

Origin of the Test

Desktop Right Column



STEM Careers

Information about STEM Careers

Figure: Sample Ad

This was a very straightforward field test

- All that varied was the country it was targeted at
- 191 countries
- Ensured that in each country the ad was shown at least to 5000 people

Location	People who live in this location ✓
	United States ✓
Age	18 - 65 ✓
Gender	All Men Women ✓

Figure: Ad Targeting Settings - Ad intended to be shown to both men and women aged 18-65.

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Really, this paper doesn't need any complex analysis

Table: Raw Data reported

Age Group	Male Impr.	Female Impr.	Male Clicks	Female Clicks
Age18-24	746719	649590	1156	1171
Age25-34	662996	495996	873	758
Age35-44	412457	283596	501	480
Age45-54	307701	224809	413	414
Age55-64	209608	176454	320	363
Age 65+	192317	153470	307	321

Table: Raw Data Reported as an Average per Country

Age Group	Male Impr.	Female Impr.	Male Clicks	Female Clicks
Age18-24	3909	3401	6	6
Age25-34	3471	2597	5	4
Age35-44	2159	1485	3	3
Age45-54	1611	1177	2	2
Age55-64	1097	924	2	2
Age 65+	1007	808	2	2

Three obvious patterns in the data

- Men see more impressions of the ad than women.
- Particularly in younger ad cohorts
- Clicks appear similar

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Do our results reflect the fact that women were less likely to click on the ad?

Do women spend less time on social media?

- No.
- At least every piece of recorded data says no.

Do our results reflect cultural prejudice or labor market conditions for women?

Do our results simply reflect competitive spillovers?

Does price matter?

Across all campaigns, the average cost per click was nearly identical for men and women (\$0.09)

But maybe we just were not bidding high enough to reach women. So we went out and collected some more data.

In General, Women Are More Expensive To Advertise To On Social Media And The Competitive Spillover From Other Advertisers' Decisions May Explain Our Finding

Why Are Women Such a Prized Demographic?

To investigate this, we looked at additional data about the purchasing of consumer items as a result of a social media campaign. We found they are more likely to be profitable if the click.

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Limitations

- Single field test.
- Descriptive paper
- Just look at gender
- Big (non-economist) questions are not tackled - Should we think of this as bias? Should we think of this as discrimination?

Punchline

- Cross-national field test suggests that an ad which is intended to be gender-neutral may not be allocated in a gender-neutral way by an ad-serving algorithm
- We show that women are shown fewer STEM ads than men NOT because of an algorithm responding to click behavior or local prejudice
- But instead because women's desirability as a demographic and consequent high price means that an algorithm trained to be cost effective avoids showing ads to them.
- Apparent algorithmic bias may be an unintentional consequence of external behavior

Implications for Practice

- Managers can't assume an algorithm will neutrally deliver ads.
- In our case, can be easily solved by managing two separate campaigns for men and women and paying more for women.
- But what about cases where the algorithm does not neutrally distribute ads with respect to harder-to-address factors such as economic marginalization or race?

Implications for Policy

- Difficult to see how algorithmic transparency would help here?
- Emphasizes the need for nuance in algorithmic auditing policy

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Two Concerns

- Pricing by Algorithm will enable collusion
- Pricing by Algorithm will enable behavioral price discrimination

Pricing by Algorithm will enable collusion

- Not clear that anything is really different when there is an algorithm
- Theory predicts algorithms more likely to take us to marginal cost
- Still would have to be human agency

Pricing by Algorithm will enable behavioral price discrimination

- Not clear that anything is really different when there is an algorithm
- Classic Dynamic vs Static Welfare Question
- Ignores the role of Competition. (My Classic Story)

Thank you!

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- Datta, A., M. C. Tschantz, and A. Datta (2015). Automated experiments on ad privacy settings. *Proceedings on Privacy Enhancing Technologies 2015*(1), 92–112.
- Sweeney, L. (2013). Discrimination in online ad delivery. *ACMQueue 11*(3), 10.