The Impact of Ad-Blockers on Product Search and Purchase Behavior: A Lab Experiment

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Motivation

Ad revenue in Europe
$55 billion

Ad revenue in the US
$107 billion

Ad blocker users
615M (~25%)

Internet users

Ad-blockers vs.

[Icons and symbols representing the comparison areas]
Effectiveness and usability of ad-blockers

- Impact on ad content removal [4,5], battery life[6], CPU and memory usage [7,8], usability [9], etc.


Prior research

• Effectiveness and usability of ad-blockers
  – Impact on ad content removal, battery life, CPU and memory usage, usability, etc.

• Effectiveness of advertising
  – Impact on business revenues and market structure (sales, prices, competition, market concentration, etc.) [10-13]


Our study

• Research question:
What is the effect of ad-blocking deployment on consumers’ product search and purchase behaviors and the resulting outcomes?

• Between-subject lab experiment
• 2 conditions: with and without an ad-blocker
METHOD
Variables

- Expenditures (prices of chosen products)
- Search time
- Satisfaction
  -- in “short” term -- immediately after purchasing
    • browsing experience
    • product choice, price, and expected product quality
  -- in “long” term -- after the product has been delivered
    • product choice, price, and actual product quality

If the role of advertising:

H1 Ad blockers increase or decrease the price of chosen products

H2 decrease or increase searching time

H3 decrease or increase consumer satisfaction in short term (with the product choice and browsing experience)

H4 decrease or decrease consumer satisfaction in long term (with the product choice)
Experimental design

- Screening survey
- Lab experiment
- Consent
- Instructions
- Choices
- Purchase
- Exit survey
- Order confirmation
- Expected delivery
- Follow-up survey
Participants

• CMU participant pool, Craigslist, flyers
• 212 participants
• 52% female
• Age: mean=26, min=18, max=72
• Bachelor’s degree and higher 59%
RESULTS
Table 1: Participants’ responses (in %) to the exit survey question: “Indicate how much you agree or disagree with each of the following statements?”

<table>
<thead>
<tr>
<th>Online advertising...</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>... is necessary to enjoy free services on the Internet</td>
<td>26.88</td>
<td>15.57</td>
<td>57.55</td>
</tr>
<tr>
<td>... saves money</td>
<td>45.75</td>
<td>21.70</td>
<td>32.55</td>
</tr>
<tr>
<td>... saves time</td>
<td>47.17</td>
<td>20.75</td>
<td>32.08</td>
</tr>
<tr>
<td>... helps me find products that match my personality and interests</td>
<td>33.97</td>
<td>17.92</td>
<td>48.11</td>
</tr>
<tr>
<td>... helps to buy the best product for a given price</td>
<td>47.64</td>
<td>20.28</td>
<td>32.08</td>
</tr>
<tr>
<td>... is intrusive</td>
<td>15.57</td>
<td>17.45</td>
<td>66.98</td>
</tr>
<tr>
<td>... is distracting</td>
<td>11.79</td>
<td>11.32</td>
<td>76.89</td>
</tr>
<tr>
<td>... is disturbing</td>
<td>32.54</td>
<td>21.23</td>
<td>46.23</td>
</tr>
<tr>
<td>... persuades to buy the products</td>
<td>44.34</td>
<td>18.40</td>
<td>37.26</td>
</tr>
<tr>
<td>... is informative about the available products, their prices, or discounts</td>
<td>27.83</td>
<td>9.91</td>
<td>62.26</td>
</tr>
<tr>
<td>... creates brand awareness</td>
<td>10.85</td>
<td>9.43</td>
<td>79.72</td>
</tr>
</tbody>
</table>
PRICES
Prices

- No sig treatment effect on prices

Table 6. Linear mixed model regression on price_log with random individual effects.

<table>
<thead>
<tr>
<th>Block condition</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-0.00388</td>
<td>-0.00705</td>
<td>0.000493</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-0.10,0.10]</td>
<td>[-0.10,0.09]</td>
<td>[-0.10,0.10]</td>
<td></td>
</tr>
</tbody>
</table>
Prices

- No sig treatment effect on prices
- **Experienced (home) ad-blocker users** chose products **10-11% cheaper** than non-users

**Table 6.** Linear mixed model regression on price_log with random individual effects.

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<td></td>
</tr>
<tr>
<td></td>
<td>[-0.10,0.10]</td>
<td>[-0.10,0.09]</td>
<td>[-0.10,0.10]</td>
<td></td>
</tr>
<tr>
<td>Home computer ad blocker user</td>
<td>-0.111*</td>
<td>-0.111*</td>
<td>-0.104*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-0.21,-0.01]</td>
<td>[-0.21,-0.01]</td>
<td>[-0.21,-0.00]</td>
<td></td>
</tr>
</tbody>
</table>
SEARCH TIME
Search time

- **No sig treatment effect** on search time ($t(1682)=-0.85$, $p=.40$) and number of inspected search results ($t(1682)=.24$, $p=.81$)

Table 7. Linear mixed model regression on searching time (in minutes) with random individual effects.

<table>
<thead>
<tr>
<th>Block condition</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.192</td>
<td>0.197</td>
<td>0.263</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-0.45,0.84]</td>
<td>[-0.45,0.85]</td>
<td>[-0.24,0.76]</td>
<td></td>
</tr>
</tbody>
</table>
Search time

- No sig treatment effect on search time
- Experienced (home) ad-blocker users did not spend less or more time on product searching \((t(1682)=-.86, p=.39)\), but inspected more search results \((t(1682)=2.34, p=.02)\).
Search time

- Participants who chose the products from sponsored Google shopping listings spent less time on their searching than those, who chose the products following organic links (ANOVA: \( b = -1.64, \ p = 0.00 \)).

<table>
<thead>
<tr>
<th></th>
<th>Organic links</th>
<th>Sponsored Google Shopping links (top)</th>
<th>Sponsored links (bottom)</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>NoBlock</td>
<td>4.36</td>
<td>2.69***</td>
<td>4.72</td>
<td>6.1</td>
</tr>
<tr>
<td>Block</td>
<td>4.27</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(+ \ p < 0.1, \ * \ p < 0.05, \ ** \ p < 0.01, \ *** \ p < 0.001\)
Browsing satisfaction

• Satisfaction with browsing:
  – overall pleasure from browsing experience,
  – speed of web page load,
  – relevance of the search results to the query,
  – selection of the products on the visited websites,
  – quality and professionalism of the visited websites,
  – ease of navigation on the visited websites,
  – technical functioning level (broken links, distorted elements).
Browsing satisfaction

- **Satisfaction with web page loading speed** was higher in the **NoBlock** condition (68% satisfied in the NoBlock vs. 46% satisfied in the Block; *p*=.00)
  - Ad-blocker uses additional computational resources [13] (use of multiple ad-blockers may have amplified the effect) → Slower webpage loading speed
  - Reduced satisfaction, but not searching time

Index of satisfaction with browsing (Cronbach’s $\alpha = .85$)

- No sig treatment effects
- lower among experienced (home) ad-blocker users ($p=0.01$)

**Table 8.** Linear fixed effect model regression on the index of overall browsing satisfaction.

<table>
<thead>
<tr>
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<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block condition</td>
<td>0.0878</td>
<td>0.0752</td>
<td>0.0189</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-0.16,0.33]</td>
<td>[-0.17,0.32]</td>
<td>[-0.22,0.25]</td>
<td></td>
</tr>
<tr>
<td>Home computer ad blocker user</td>
<td>-0.337**</td>
<td>-0.334**</td>
<td>-0.262*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-0.58,-0.09]</td>
<td>[-0.58,-0.09]</td>
<td>[-0.50,-0.02]</td>
<td></td>
</tr>
</tbody>
</table>
SATISFACTION
- products -
Product satisfaction

- No sig treatment effect
- Experienced (home) ad-blocker users are less satisfied with product choices

Table 9. Ordered logit regression on overall satisfaction with the chosen products, measured immediately after the experiment (ex-ante), with robust standard errors.

<table>
<thead>
<tr>
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<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block condition</td>
<td>0.121</td>
<td>0.114</td>
<td>0.169+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-0.05,0.29]</td>
<td>[-0.06,0.28]</td>
<td>[-0.02,0.35]</td>
<td></td>
</tr>
<tr>
<td>Home computer ad blocker user</td>
<td>-0.193*</td>
<td>-0.189*</td>
<td>-0.131</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-0.36,-0.02]</td>
<td>[-0.36,-0.02]</td>
<td>[-0.31,0.05]</td>
<td></td>
</tr>
</tbody>
</table>

(ex-post), with robust standard errors.

<table>
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<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block condition</td>
<td>0.0344</td>
<td>0.0730</td>
<td>-0.0756</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-0.52,0.59]</td>
<td>[-0.50,0.64]</td>
<td>[-0.67,0.52]</td>
<td></td>
</tr>
<tr>
<td>Home computer ad blocker user</td>
<td>-0.476</td>
<td>-0.483</td>
<td>-0.882*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-1.07,0.12]</td>
<td>[-1.09,0.13]</td>
<td>[-1.56,-0.20]</td>
<td></td>
</tr>
</tbody>
</table>
Types of search ads

• Products chosen from sponsored Google shopping listings:
  – Lower prices (on 10% level of significance: $b=-1.32$, $p=.06$)
  – Shorter search time ($b=-1.64$, $p=.00$)
  
  BUT:
  – Lower price satisfaction ($b=-.33$, $p=.04$)
  – Lower quality satisfaction (short term) ($b=-.68$, $p=.00$)

• Products chosen from top sponsored links:
  – Higher prices ($b=2.84$, $p=.01$), but no effect on satisfaction

• Products chosen from bottom sponsored links:
  – Lower product choice ($b=-1.05$, $p=.049$)
  – Lower quality satisfaction (short term) ($b=-1.01$, $p=.03$)
Conclusions

• The use of privacy- and security-enhancing ad-blockers do not harm consumers’ purchasing behaviors in terms of prices paid, product searching time, and satisfaction with products, their prices, and quality.

• Ad-blockers may negatively affect satisfaction with webpage loading speed, but not eventual searching time.

• Experienced ad-blocker users tend to:
  • Choose cheaper products
  – Inspect more search results before making purchasing decision
  – Be less satisfied with browsing experience and product choices.

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