Eye-Tracking Product Recommenders’ Usage

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http://hci.epfl.ch/
Eye-Tracking Product Recommenders’ Usage

Understanding users’ perceptions and interactions during their decision process.
«If the world's rapidly expanding digital content were printed and bound into books it would form a stack that would stretch from Earth to Pluto 10 times»
10x Earth-Pluto

• Accuracy-driven research
• How much choice do users need?

Role of RS in users’ decision process?
Aspects of RS that make decisions simpler?
Fundamental Decision Stages

- need identification
- merchant brokering
- product brokering
- negotiation
- payment & delivery
- service & evaluation

6'529 perfumes (3'969 Women - 2'560 Men)
Eau de Toilette, Eau de Parfum, Aftershave, Cologne
48'000 fixations points
7'700 areas of interest (AOI)
2363 total results for PERFUME (WOMEN)

<table>
<thead>
<tr>
<th>brand</th>
<th>price</th>
<th>quantity</th>
<th>category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chanel (42)</td>
<td>Less than 30 USD</td>
<td>Less than 40 ml</td>
<td>Eau de Parfum (1071)</td>
</tr>
<tr>
<td>Estee Lauder (33)</td>
<td>30-50 USD (843)</td>
<td>40-80 ml (733)</td>
<td>Eau de Toilette (1188)</td>
</tr>
<tr>
<td>Calvin Klein (15)</td>
<td>50-80 USD (527)</td>
<td>80-120 ml (752)</td>
<td></td>
</tr>
<tr>
<td>Gucci (6)</td>
<td>80-110 USD (185)</td>
<td>120-160 ml (48)</td>
<td></td>
</tr>
<tr>
<td>Givenchy (11)</td>
<td>More than 110 USD (243)</td>
<td>More than 160 ml (22)</td>
<td></td>
</tr>
</tbody>
</table>

Total results: 2363

List of items:

- **Givenchy Very Irresistible Eau de Parfum, 2.5 oz.**
  - GIVENCHY
  - Around 77 USD
  - 73ml
  - A red carpet of roses illuminated by star anise and the ...

- **Kai Perfume Kai Perfume Oil**
  - KooKai
  - Around 45 USD
  - An intoxicating blend of tropical gardenia and white exotic ...

- **Kai Perfume Kai Eau de Parfum Spray**
  - KooKai
  - Around 65 USD
  - Shipping March 5th...... What you’ve asked for ...

- **Angel by Thierry Mugler for Women 0.8 oz Eau de Parfum Spray Refillable (Decoded Box)**
  - THIERRY MUGLER
  - Around 47.98 USD
  - 23ml
  - Angel by Thierry Mugler fragrance for women is a unique ...
Product detail

Givenchy Very Irresistible Eau de Parfum, 2.5 oz.

Price: Around $77

Features:
- Quantity: 73 ml
- Category: Eau de Parfum
- Gender: Women
- Bestselling rate: 9.5
- Average user rate: 0
- Source: Amazon

Add to shopping list

A red carpet of roses illuminated by star anise and the sparkle of verbena and red berries. Elegant, spontaneous and irresistible.

User Rating: ★★★★★ / 0

Uninteresting ○ ○ ○ ○ I love it

Recommender (RS)

You may also like...

Same brand and cheaper (1/3)
- Organza for Her Eau de Parfum Spray, 1.7 oz.
  - $65
  - From Parfums Givenchy comes Organza, a scent that blends rich Oriental notes and deep woodsly spices with...

Just as popular, but cheaper (1/6)
- Crazylibellule & The Poppies ShanghaiJava Collection - Musc & Patchouli Crazystick
  - $18
  - With top notes of bergamot; heart notes of lily of the valley; and base notes of musk and patchouli you...
Just as popular and cheaper (1/6)

Crazylibellule & The Poppies
ShanghaiJava Collection - Musc & Patchouli Crazystick
$ 18
With top notes of bergamot; heart notes of lily of the valley; and base notes of musk and patchouli you...

• EPC algorithm
• Five features
• Editorial opinions
• Popularity information

more popular and cheaper
more popular but more expensive
same brand and cheaper
same brand but more expensive
just as popular and cheaper
same price range and just as popular
people who like this also like

The Experiment

- eye tracker
- 18 participants
- detailed 1 hour within-subject
- two sessions, two tasks

Task S: 3 perfumes for mySelf
Task G: 1 perfume to offer as Gift
The influence of the recommender system continuously increases across time at the product brokering stage.

Recommendations help users to increase their confidence when comes the time to make a decision.

Important recommendation categories are diverse.
Main AOIs’ Usage Across Time (all users)

Task Completion Time (percentage)

(circle width = duration)
Cumulative usage of AOIs over time (All users, Session 1)

Cumulative usage of AOIs over time (All users, Session 2)

+35%  
$p = 0.005$

+88%  
$p = 0.076$
The influence of the recommender system continuously increases across time at the product brokering stage.

Recommendations help users to increase their confidence when comes the time to make a decision.

Important recommendation categories are diverse.
### % of usage of a category

$$\% \text{ of usage of a category} > \frac{100\%}{\# \text{ of categories}}$$

### When a basket product comes directly from a recommendation of the considered category.

### Table:

<table>
<thead>
<tr>
<th># of cat. looked at</th>
<th># of dominating categories</th>
<th># of cat. clicked</th>
<th># of influential categories</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task S</strong> (self)</td>
<td>5.89</td>
<td>2.74</td>
<td>2.74</td>
</tr>
<tr>
<td><strong>Task G</strong> (gift)</td>
<td>4.42</td>
<td>1.95</td>
<td>0.84</td>
</tr>
<tr>
<td><strong>Both</strong></td>
<td><strong>5.16</strong></td>
<td><strong>2.34</strong></td>
<td><strong>1.79</strong></td>
</tr>
</tbody>
</table>
## Perfumes added to basket

<table>
<thead>
<tr>
<th></th>
<th>Session 1</th>
<th>Session 2</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Added after MCF selection without RS</td>
<td>11</td>
<td>17</td>
<td>28</td>
</tr>
<tr>
<td>Total number coming from RS (influence + interaction)</td>
<td>23</td>
<td>19</td>
<td>42</td>
</tr>
</tbody>
</table>

40% MCF

60% RS
The influence of the recommender system continuously increases across time at the product brokering stage.

Recommendations help users to increase their confidence when comes the time to make a decision.

Important recommendation categories are diverse.
\begin{align*}
Sim(p_1, p_2) &= \frac{\sum_{i=1..5} w_i \times sim_{attribute=i}(p_1, p_2)}{\sum_{i=1..5} w_i} \\
ILS(C) &= \frac{\sum_{p_i \in C, i=1..n-1} \sum_{p_j \in C, j=i+1..n} Sim(p_i, p_j)}{n \times \frac{(n-1)}{2}} \\
RD(p_i, P) &= \frac{\sum_{j=1..n} (1 - Sim(p_i, P_j))}{n}
\end{align*}

<table>
<thead>
<tr>
<th></th>
<th>Sim</th>
<th>ILS</th>
<th>RD</th>
</tr>
</thead>
<tbody>
<tr>
<td>People who like this also like</td>
<td>0.4</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>More popular and cheaper</td>
<td>0.4</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>More popular but more expensive</td>
<td>0.4</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Same brand and cheaper</td>
<td>0.6</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Same brand but more expensive</td>
<td>0.6</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Just as popular and cheaper</td>
<td>0.6</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Same price range, just as popular</td>
<td>0.8</td>
<td>0.8</td>
<td>0.2</td>
</tr>
</tbody>
</table>
Time spent looking $t_n$

- More popular and cheaper: $19.1\%$
- More popular, but more expensive: $17.1\%$
- Same brand, but more expensive: $17.0\%$
- People who like this also like: $14.5\%$
- Same brand and cheaper: $13.5\%$
- Just as popular and cheaper: $10.2\%$
- Same price range and just as popular: $8.6\%$
<table>
<thead>
<tr>
<th>Sim</th>
<th>ILS</th>
<th>RD</th>
<th>$t_n$</th>
<th>clicks</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4</td>
<td>0.6</td>
<td>0.6</td>
<td>19.1%</td>
<td>0.7</td>
<td>More popular and cheaper</td>
</tr>
<tr>
<td>0.4</td>
<td>0.4</td>
<td>0.6</td>
<td>14.5%</td>
<td>0.6</td>
<td>People who like this also like</td>
</tr>
<tr>
<td>0.4</td>
<td>0.6</td>
<td>0.6</td>
<td>17.1%</td>
<td>0.1</td>
<td>More popular but more expensive</td>
</tr>
<tr>
<td>0.6</td>
<td>0.6</td>
<td>0.4</td>
<td>17.0%</td>
<td>0.3</td>
<td>Same brand but more expensive</td>
</tr>
<tr>
<td>0.6</td>
<td>0.6</td>
<td>0.4</td>
<td>13.5%</td>
<td>0.4</td>
<td>Same brand and cheaper</td>
</tr>
<tr>
<td>0.6</td>
<td>0.6</td>
<td>0.4</td>
<td>10.2%</td>
<td>0.2</td>
<td>Just as popular and cheaper</td>
</tr>
<tr>
<td>0.8</td>
<td>0.8</td>
<td>0.2</td>
<td>8.6%</td>
<td>0.3</td>
<td>Same price range and just as popular</td>
</tr>
</tbody>
</table>
The influence of the recommender system continuously increases across time at the product brokering stage.

Recommendations help users to increase their confidence when comes the time to make a decision.

Important recommendation categories are diverse.
What to take home?
Time dependent diversity model

Maximisation of user satisfaction

Compromise

100%

0%

Decision Process (time)

phase 1

phase 2

phase 3

similarity

diversity
Conclusions

• The recommender’s influence increases
• Recommenders help to build confidence
• Recommenders are not just about accuracy
• Diversity, a time dependent dimension
The End