Delusion in Attribution:
Caveats in Using Attribution for Multimedia
Budget Allocation

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Google Analytics Solutions | Attribution

OPTIMAHUB
Customer Journey Analytics + Marketing Attribution

Marketing attribution: Giving credit where credit is due

Attribution Evolved
Cloud Analytics + Machine Learning for Enterprise Marketers
RESEARCH PRIORITIES 2016–2018

RESEARCH PRIORITY 1

Quantitative models to understand causality, levers, and influence in a complex world

“#1 priority is attribution!”
Questions

- What is attribution?
- How can we calculate it?
- What can we use it for?
- What is the “delusion in attribution”?
Attribution

• Attribution: allocate appropriate credit for a desired customer action to each marketing touchpoint across all online and offline channels (Moffett et al. 2014)
Example of attribution outcome

Attribution

Caveat 1: Attribution only works for digital touchpoints, not for traditional advertising.

Email, 25%
How can we calculate attribution?

Last touchpoint attribution: 100% credit to this medium

Assign credit% to each touch point

Source: Shao and Li (2011)
Attribution needs to account for carryover

Assign credit% to each touch point
Attribution needs to account for synergy

Synergy Effect: Joint effect larger than separate effects

Assign credit% to each touch point
Caveat 2: Attribution is a rather fuzzy concept, without an explicit analytical expression, so far...

- Scientific Literature: increasingly sophisticated statistical methods for attribution:
  e.g., Li and Kannan (2014); Xu, Duan, and Whinston (2014); De Haan, Wiesel, and Pauwels (2015); Zamora (2015); Li, Kannan, Viswanathan, and Pani (2016).
New, Straightforward Attribution Measure

1. Estimate Probit Model to link the probability of purchase to current and past exposures to different media.
   [Proc Nlmixed in SAS with random effects]
2. Model allows for carryover and interaction effects
3. Use model to calculate the relative contribution that each medium makes in influencing a purchase:

   \[
   \frac{\text{Lift in purchase likelihood due to medium } m}{\text{Lift in purchase likelihood due to all media}}
   \]
4. Take average across purchases \(\Rightarrow\) Attribution to medium m
Should attribution be used for budget allocation?

Attribution result

- Banner ads, 25%
- Email, 25%
- Sponsored search, 50%

Budget allocation?

- Banner ads, 25%
- Email, 25%
- Sponsored search, 50%
Caveat 3: Attribution ➔ Budget allocation?

- Top benefit mentioned (by 72% of the respondents) in a survey of marketers is to use attribution to be better able to allocate budget across channels (Google analytics 2012, p.5).

- Marketing attribution helps you analyze the impact and business value of company-generated marketing interactions to help make the best marketing investment decisions (SAS White Paper p. 1).

- Li and Kannan (2014, p. 41) develop their attribution method "to assist decisions on optimizing marketing investments."

- Xu, Duang, and Whinston (2014, p. 1409): "This study provides valuable managerial implications for marketing managers seeking optimal online advertising strategies."

- Kannan, Reinartz, and Verhoef (2016, p. 1): "Attribution models can provide insights for allocating marketing investments across channels."
Attribution vs Optimal allocation

- What is attribution? A backward-looking summary of how much of a contribution each medium has made to a set of purchase outcomes.
- What is optimal allocation? A forward-looking prescription on how to allocate a budget across media in order to maximize a profit outcome.
- Comparison between:
  - Attribution given budget $B$ spent on media
  - Optimal allocation of budget $B$ across media to optimize profit
## Attribution vs Optimal allocation

<table>
<thead>
<tr>
<th></th>
<th>Attribution</th>
<th>Optimal Allocation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depends on media effectiveness</td>
<td>✔</td>
<td>✔</td>
<td>The more effective the medium, the higher the attribution weight and optimal allocation weight</td>
</tr>
<tr>
<td>Depends on media exposure levels</td>
<td>✔</td>
<td>✗</td>
<td>The more a medium is used, the higher the attribution weight, but no effect on optimal weight</td>
</tr>
<tr>
<td>Depends on media cost</td>
<td>✗</td>
<td>✔</td>
<td>The more expensive a medium is to use, the lower the optimal weight but no effect on attribution.</td>
</tr>
</tbody>
</table>
Simulation with two media:

- Display Ads: high exposure frequency, low cost, low effectiveness
- Social Media Ads: low frequency, high cost, high effectiveness
Impact on Purchase Probability

Purchase Probability for Different Allocations

Current allocation: 4.63%
Last Touchpoint Attribution: 4.79%
Probit Attribution: 4.93%
Optimal allocation: 5.42%

17% increase in purchase rate with the same budget
Empirical Application:
Wharton Customer Analytics Initiative (WCAI)

- Three apparel retailers: B1, B2, B3

<table>
<thead>
<tr>
<th></th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of customers in sample data</td>
<td>7,703</td>
<td>5,176</td>
<td>2,699</td>
</tr>
<tr>
<td>Number of observations in sample data</td>
<td>200,612</td>
<td>177,608</td>
<td>74,935</td>
</tr>
<tr>
<td>Total purchases</td>
<td>8,484</td>
<td>7,114</td>
<td>2,733</td>
</tr>
<tr>
<td>Purchase conversion, %</td>
<td>4.2</td>
<td>4.0</td>
<td>3.6</td>
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<table>
<thead>
<tr>
<th>Medium</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
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</thead>
<tbody>
<tr>
<td>Email</td>
<td>185,611</td>
<td>176,120</td>
<td>56,606</td>
</tr>
<tr>
<td>Organic Search</td>
<td>18,600</td>
<td>21,538</td>
<td>7,015</td>
</tr>
<tr>
<td>Catalog</td>
<td>5,373</td>
<td>4,229</td>
<td>2,125</td>
</tr>
<tr>
<td>Paid Search</td>
<td>4,789</td>
<td>8,966</td>
<td>3,688</td>
</tr>
<tr>
<td>Referral</td>
<td>2,806</td>
<td>4,924</td>
<td>1,256</td>
</tr>
<tr>
<td>Social</td>
<td>1,120</td>
<td>981</td>
<td>4,076</td>
</tr>
</tbody>
</table>
Across the three retailers: 15-26% increase in purchase rate with the same budget
Discussion: Delusion in Attribution

- Attribution increasingly “hot” in marketing analytics, but...
  1. Attribution has myopic focus on digital media
  2. Attribution is rather fuzzy, so far.
  3. Attribution cannot be used for budget allocation
- New comparison with optimal allocation:
  → Attribution grows in advertising intensity
  → Allocation does not grow in advertising intensity
- Temptation to use attribution percentages as guideline for allocation → Don’t or you will overallocate to high-frequency media
# Masters in Analytics [Business]

<table>
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<tr>
<th>180 credit masters</th>
<th>Auckland and Wellington</th>
<th>Block mode</th>
<th>12 or 24 months</th>
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- **Data analysis (60 credits)**
- **Business analytics (60 credits)**
- **Applied business analytics project (60 credits)**
- **Introduction to analysis**
- **Practical data mining**
- **Multivariate statistics**
- **Applied Econometric models**
- **Marketing or Finance or Health or Public Policy**
- **Practical project in collaboration with business/organization**

For more information click [here](#).
Massey University forges 'Big Data' partnership with SAS

Programme aims to help address the skills shortage and provide SAS skilled business graduates “who will hit the ground running”.

“Our students will not only get a Master of Analytics but also SAS certification for many of its licensed courses,” says Paas. “These are the most widely-used analytics software packages for big data applications and therefore highly sought after by employers.”
Thanks for your attention

- Email: heerde@massey.ac.nz