

# Good vs. Bad Analytics

Professor Song Yao  
Olin Business School

Customer Analytics

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The trouble with ubiquitous and easy access to data ...



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# Case study: E-mail marketing at a sporting goods retailer

**Kellogg School of Management**  
Northwestern University



## Pentathlon: Promotional E-mail Frequency

Anna Quintero walked out of the monthly Product Department Director meeting feeling pummeled. In her new role as the director of digital marketing for Pentathlon, a leading European sporting goods retailer, Quintero had argued that e-mail access to customers had to be carefully restricted to make sure that customers wanted to continue receiving promotional e-mails from the company. But the department directors just weren't convinced.

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## Anna Quintero's evidence for e-mail limits

### SURVEY EVIDENCE

All consumers	Result
"I receive too many promotional e-mails from Pentathlon"	72%
"I receive just the right amount of promotional e-mails from Pentathlon"	21%
"I receive too few promotional e-mails from Pentathlon"	7%
Consumers in 30-44 age group (30.33% of total consumers)	
"I receive too many promotional e-mails from Pentathlon"	74%
"I receive just the right amount of promotional e-mails from Pentathlon"	23%
"I receive too few promotional e-mails from Pentathlon"	3%
Consumers who are among top 25% total euro sales (last 12 months)	
"I receive too many promotional e-mails from Pentathlon"	87%
"I receive just the right amount of promotional e-mails from Pentathlon"	10%
"I receive too few promotional e-mails from Pentathlon"	3%
Consumers who are among bottom 25% total euro sales (last 12 months)	
"I receive too many promotional e-mails from Pentathlon"	52%
"I receive just the right amount of promotional e-mails from Pentathlon"	31%
"I receive too few promotional e-mails from Pentathlon"	17%

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# Frank Cabret's evidence *against* e-mail limits

## EVIDENCE FROM CUSTOMERS DATA

	<b>Number of orders during last 12 months</b>
Average weekly e-mail frequency: 1 - 2.9	3.5
Average weekly e-mail frequency: 3 - 4.9	9.9
Average weekly e-mail frequency: 5 or more	17.3

	<b>Total euro sales during last 12 months</b>
Average weekly e-mail frequency: 1 - 2.9	€ 41.6
Average weekly e-mail frequency: 3 - 4.9	€ 210.4
Average weekly e-mail frequency: 5 or more	€ 498.1

	<b>Average order size during last 12 months</b>
Average weekly e-mail frequency: 1 - 2.9	€ 10.92
Average weekly e-mail frequency: 3 - 4.9	€ 19.97
Average weekly e-mail frequency: 5 or more	€ 27.50

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## Put yourself in the shoes of the CMO of Pentathlon: *How do you reconcile the evidence?*

### Anna's evidence for less emails

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# Case study: Advertising Effectiveness

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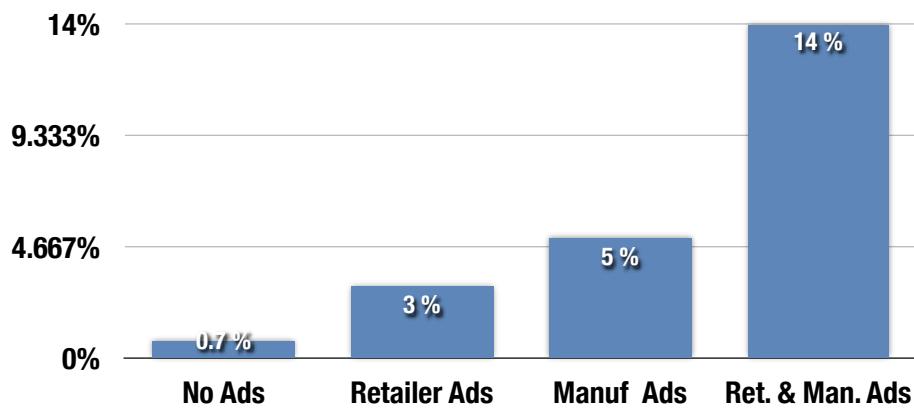
## Harmony: Advertising Effectiveness

Technology provider Harmony had made its name by solving an important branding problem for the automotive industry. When the Internet first became popular, independent automobile dealers started building their own websites. Not surprisingly,

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## Consider my experience at an executive retreat ...

### Sales Conversion Rate



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# To distinguish good from bad analytics, let's start with causality

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## ESTABLISHING CAUSALITY

- What we really want to measure:  
*"How would a consumer behave in two alternative worlds that are identical except for one difference:*  
*(1) in one world they experience a marketing initiative (e.g., an ad, a coupon)*  
*(2) in the other world they do not*
  - If we observed a difference in outcomes (purchase, retention, etc.), **because the worlds are the same, except for the ad**, we can conclude that the ad caused the difference in the outcomes
- Core problem:  
You can never be in two worlds at once
  - You cannot "see an ad" and "not see an ad" at the same time

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# Experiments solve the problem that you cannot be in two worlds at once

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## FUNDAMENTAL IDEA OF AN EXPERIMENT

- Assign units of observation (e.g. customers) **randomly** to one world or the other world  
(experimental conditions, A/B conditions, treatment and control conditions, random control trial ...)
- Groups of customers in two worlds (conditions) are **not identical**, because they consist of different individuals.
- But they are "**probabilistically equivalent**" meaning that there are not systematic differences between the groups in their characteristics or how they would respond to the ads



**Probabilistic equivalence allows us to compare conditions  
as if consumers were in two worlds at once**

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The #1 reason why analytics goes bad is that data  
that *were not generated as part of an experiment*  
are presented or interpreted *as if they were*

## Consider François Cabret's evidence

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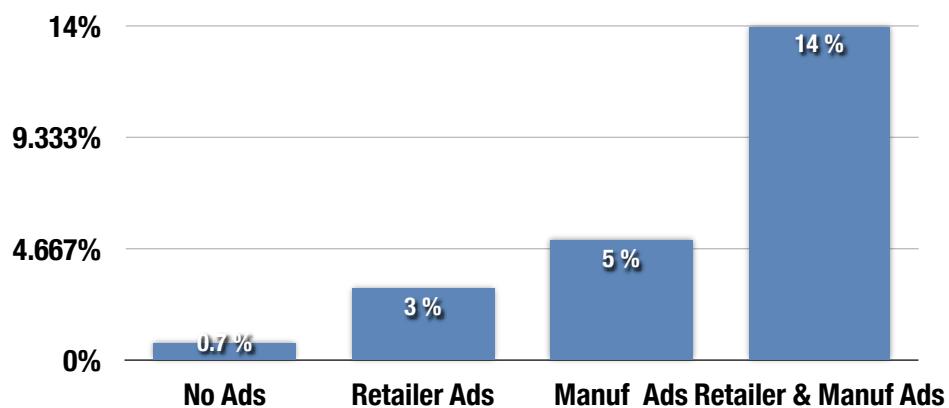
  

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### Sales Conversion Rate



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## A simple checklist can nearly always uncover bad analytics

### What is the data-generating process?

#### Are there pre-existing differences between groups?

i.e. "Could groups be probabilistically *not* equivalent?"

If the answer is "not clear" or "don't know" then ask:

##### 1. Is there a common driver of both group membership and outcome?

- (a) Do firm actions place consumers into groups based on a factor that also drives the outcome?
- (b) Do consumers self-select into groups based on a factor that also drives the outcome?
- (c) Is there any other unrecognized factor that drives both group membership and outcome?

##### 2. Is there reverse causality?

i.e. "Did managerial decisions cause outcomes to change, or was it outcomes that drove managerial decisions?"

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## 1(B) "consumers self-select" and 1(C) "other unrecognized factor"

### Loyalty Program Effectiveness

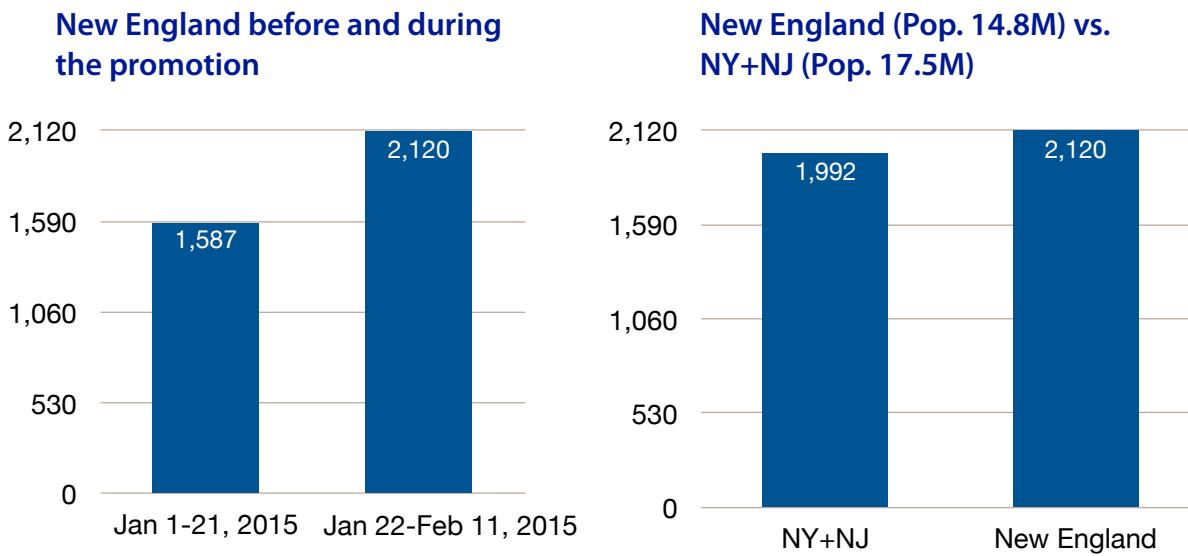
- Hilton wants to evaluate its loyalty program's impact on customer spending.
  - Compare spending by loyalty program participants and non-participants
  - Why are some customers participants and some non-participants?

### Promotion Program Effectiveness

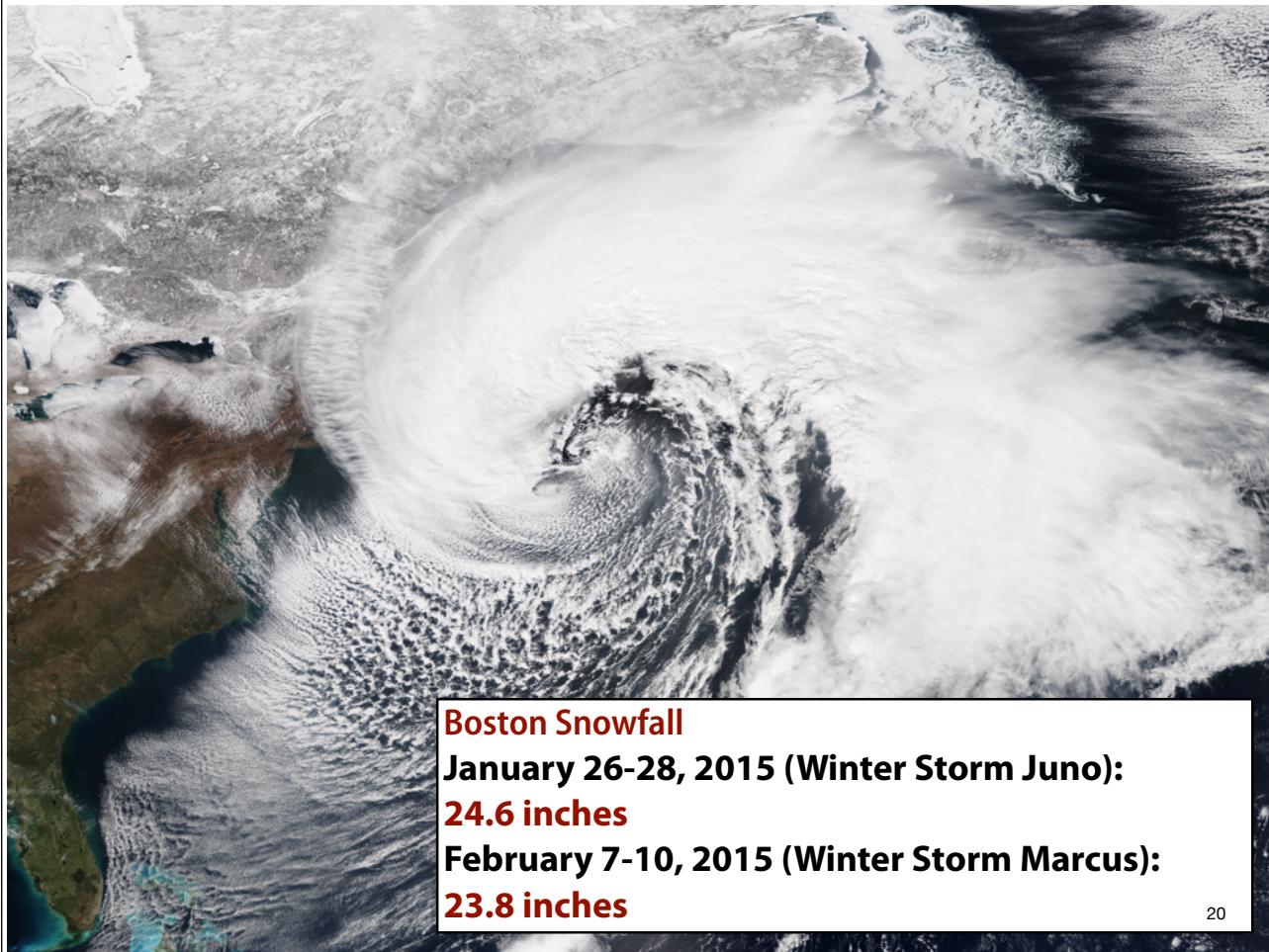
- Subaru ran a promotion in the New England market during Jan-Feb, 2015 and wanted to evaluate the promotion's impact on car sales.
  - Compare car sales before and during the promotion
  - Compare car sales with NY+NJ where no promotion during the period

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**New England sales increased by 33% after promotion, and sold more cars than NY+NJ (with no promo. and more pop.)**



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## Reverse Causality Example

### Does offering discounts boost customer spending?

- Hilton offers various discounts and benefits to their loyalty program participants
  - Finding: More discounts/benefits offered, more spending
  - A feedback loop exists: Customers who spend more are rewarded more benefits.

### Does ads boost sales?

- Many firms set their ads spending budget to be proportional to sales.
  - Finding: More ads, more sales
  - A feedback loop exists: More sales, more ads spending

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