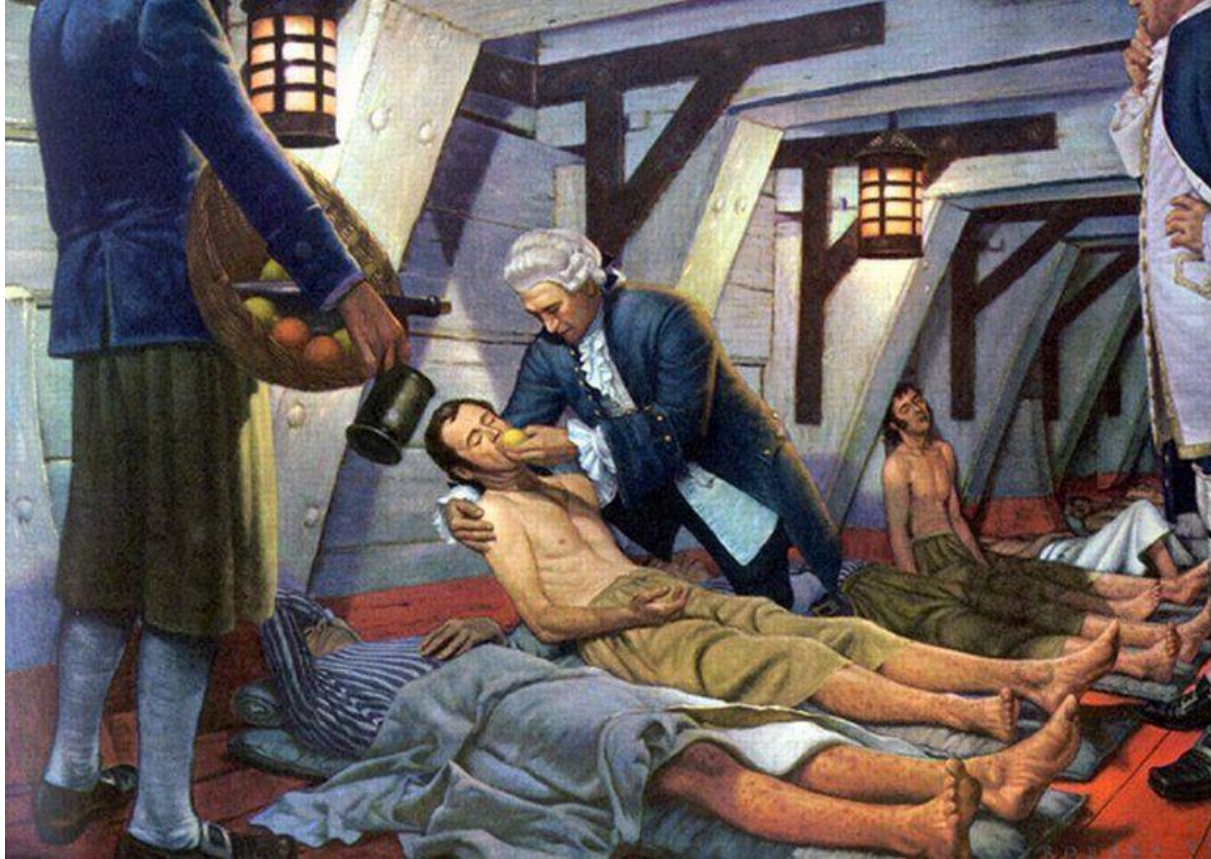


Controlled experiments on the web: survey and practical guide

Ron Kohavi * Roger Longbotham * Dan Sommerfield * Randal M. Henne

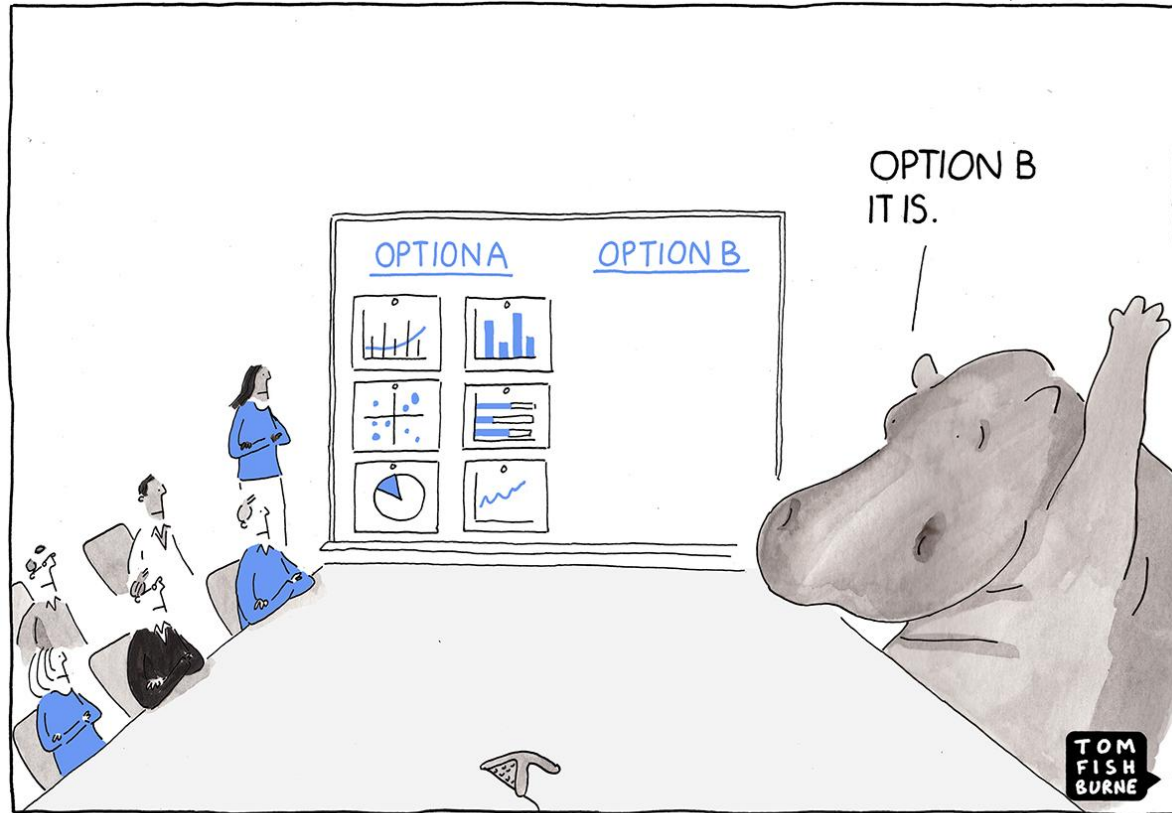
What are controlled experiments?

What are controlled experiments?



Why controlled experiments?

HiPPO decision making



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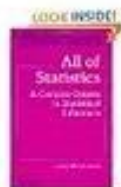


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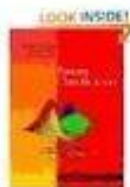
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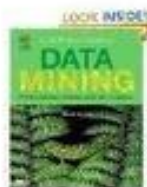
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Item Name	Item Number	Quantity	Remove	Unit Price	Subtotal
Trial Kit	FFCS	1		\$0.00	\$0.00
					Discount: \$0.00
					Total: \$0.00

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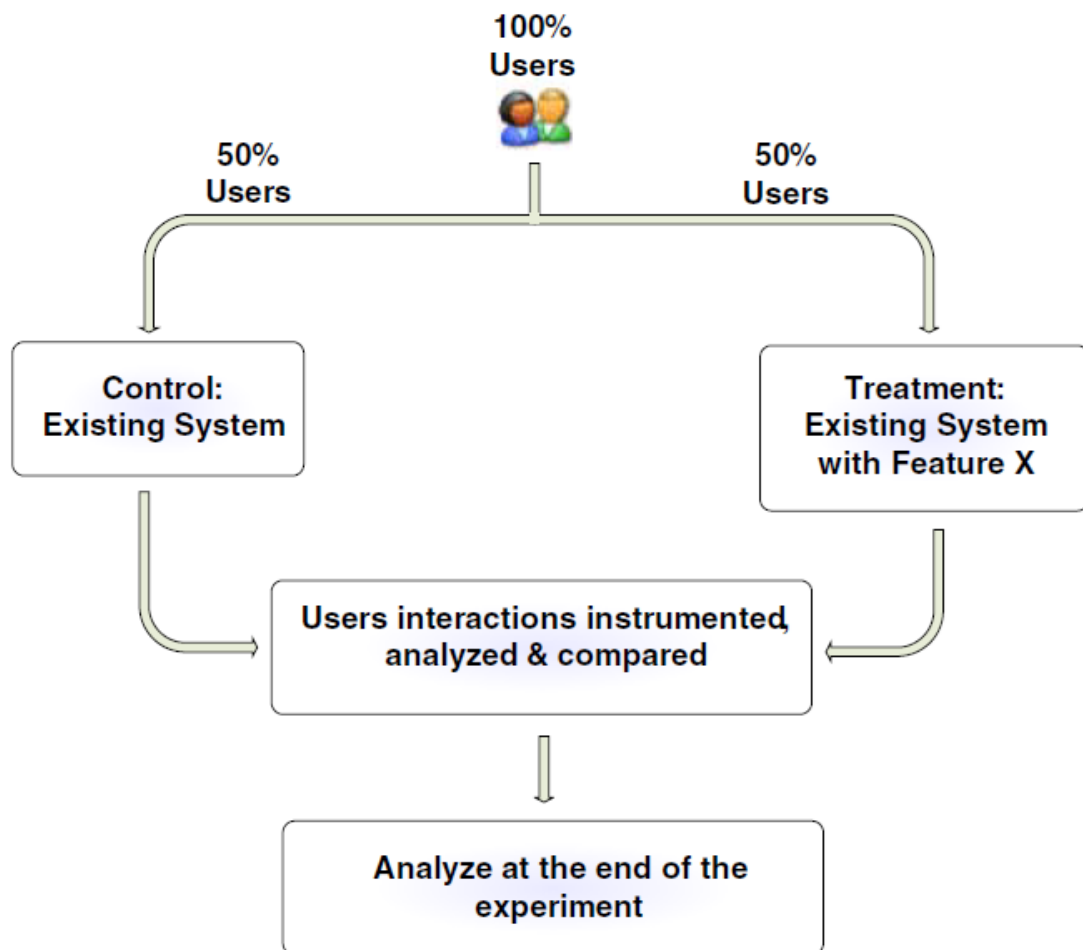
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Različiti algoritmi pretrage

A/B testing



A/B terminology

- Overall Evaluation Criterion (OEC)
- Factors
- Experimental units
- Null hypothesis
- Confidence level
- Power
- A/A test
- Standard error

T-test

$$t = \frac{\overline{O_B} - \overline{O_A}}{\hat{\sigma}_d}$$

Calculation of minimum sample size

$$n = \frac{16\sigma^2}{\Delta^2}$$

Example: e-commerce

- Suppose you want to detect 5% change on e-commerce site on which 5% of the user make purchases of 75\$ on average. Suppose that standard deviation is 30\$. Number of users needed is 409 000.
- First solution: Look at conversion rates.
- Second solution: Look at the bigger sensitivity in the beginning
- Third solution: If only changes to the checkout page have been made, filter those who didn't click on it. Filter those unaffected by the change

Effect of robots on experimental results

- Robots cause harm and mislead
- On some sites they provide 50% of pageviews
- It is critical to remove those that don't accept cookies and have large number of actions

Limitations

- Quantitative metrics, but no explanations
- Short term versus long term effects
- Primacy and newness effects.
- Features must be implemented

MultiVariable Testing

MultiVariable Testing

The image shows a screenshot of the MSNBC website with several annotations labeled F1 through F5, indicating areas of interest for multi-variable testing.

- F1:** Points to the "Shopping" section, which includes links to "Lands' End: Free deluxe compact w/ purchase", "Special promotions at your favorite stores", "Warm fall fashion styles are here", "Save on top brand digital cameras", and "Free shipping on furniture for every room".
- F2:** Points to the "Advertisements" section, which includes a link to "A smart way to buy a diamond".
- F3:** Points to the "Money" section, which includes links to "Is your waiter a thief?", "Wal-Mart, credit worries slam stocks", "Is the U.S. ready for cheap Chinese cars?", "Tipping guide: Who & how much", and "10 hot stocks for right now".
- F4:** Points to the "CALCULATE YOUR NEW PAYMENT" section, which includes a table of loan options and a "Learn More" button.
- F5:** Points to the "Video Highlights" section, which includes links to "Workers uncover prehistoric trees", "Image of Jesus seen in kitchen cabinet", "Robbery suspect uses duct tape as mask", "Squawk! Runaway parrot stuck in tree", and "First images from inside Utah mine".

Other visible content on the page includes:

- Super-Rich Renters:** Some pay over \$20,000 a month for apartments & vacation properties. Video: \$44M for this house?
- MSNBC News:** Debate on drinking age brews, Mattel recalls millions of toys, Hawaii faces hurricane 'emergency', 5 killed in Iraq chopper crash, Costly side effects of drug ad blitz?
- FOX Sports:** Yankees legend Rizzuto dies at 89, Report: Vick given plea deal deadline, Kriegel: Yanks finding a new way back, Tiger's new course won't allow carts, Busch gives Gibbs powerful 3-car punch.
- Today's Picks:** Scientists: Interstellar gas mimics key properties of life, Imus may make comeback, Is tech bad for students?
- Countrywide Home Loans:** Need Cash? Low Refinance Rates, America's #1 Home Loan Lender, No Closing Costs. Call 1-800-508-9037.
- Opinion: Candidates' Money:** Edwards: Man of the profits, Giuliani's portfolio of dogs, Obama's conservative side, McCain's wife in control, Search: 2008 election guide.
- Also on MSN:** Why I became a collector, Shop women's T-shirts for all body types, Dads: Make your kids' youth memorable, Play a fun dice game online with friends, Be Jane: How to install a ceiling fan.
- Video Highlights:** Workers uncover prehistoric trees, Image of Jesus seen in kitchen cabinet, Robbery suspect uses duct tape as mask, Squawk! Runaway parrot stuck in tree, First images from inside Utah mine.
- Entertainment:** Gossip: Jolie-Pitts' day at the museum, On Debate: McCain better shirtless?, Pavarotti to be released from hospital, Mel Gibson meets Guatemala's president, James Gandolfini returning to HBO.
- Popular Searches:** Dream analysis, Dreams, nightmares: They come bearing gifts, experts say. Discover what your imagination is telling you while you sleep.
- People:** Jennifer Aniston, Phil Spector, Nancy Grace, Kate Ziegler, Donald Fisher.
- Hot Topics:** Infidelity, Overcoming shyness, Blogger union, Brain exercise, Extreme weather.
- Add Content from MSN:** Add additional content from MSN to this page.

MultiVariable Testing

Benefits:

- Testing multiple factors at the same time
- Analysing interaction between different factors

Limitations:

- Large antagonisms
- More complex to analyse results
- More expensive

Implementation architecture

Implementation architecture

1. Randomization assignment
2. Assignment method
3. Data Path

Random assignment

It has several requirements:

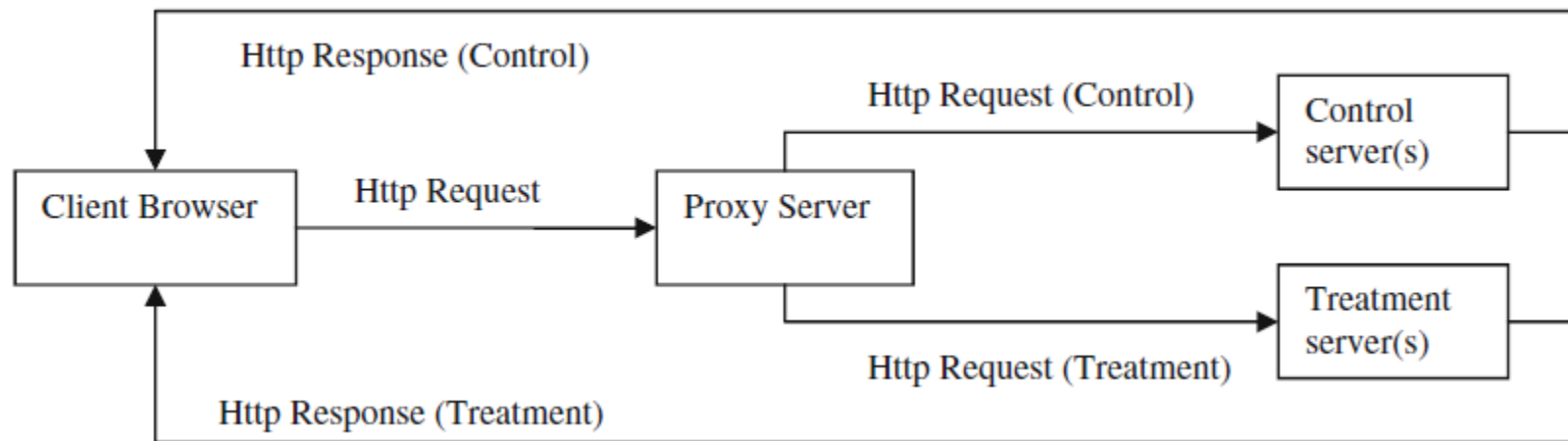
- No bias to any variant
- Repeated assignments for the same user
- No correlation between factors

Assignment method

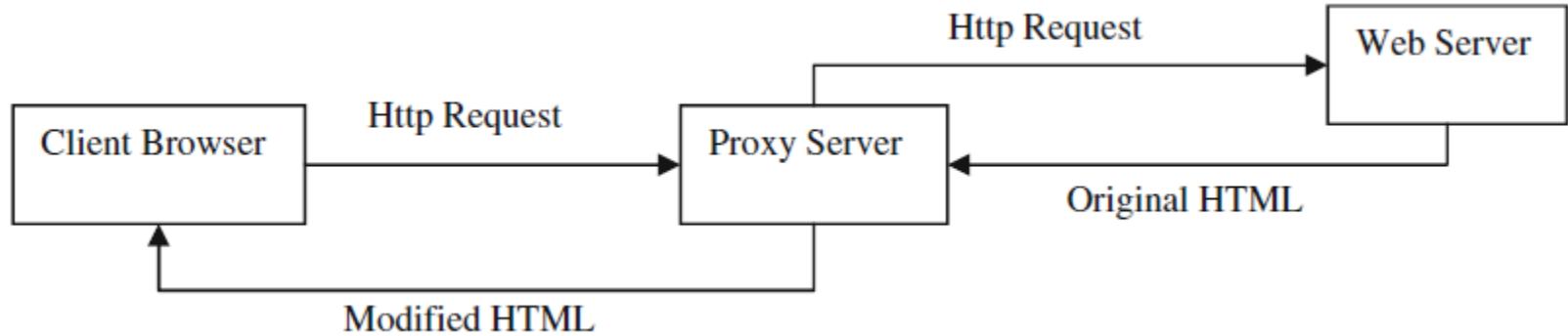
Assignment method

1. Traffic splitting
2. Page rewriting
3. Server-side assignment

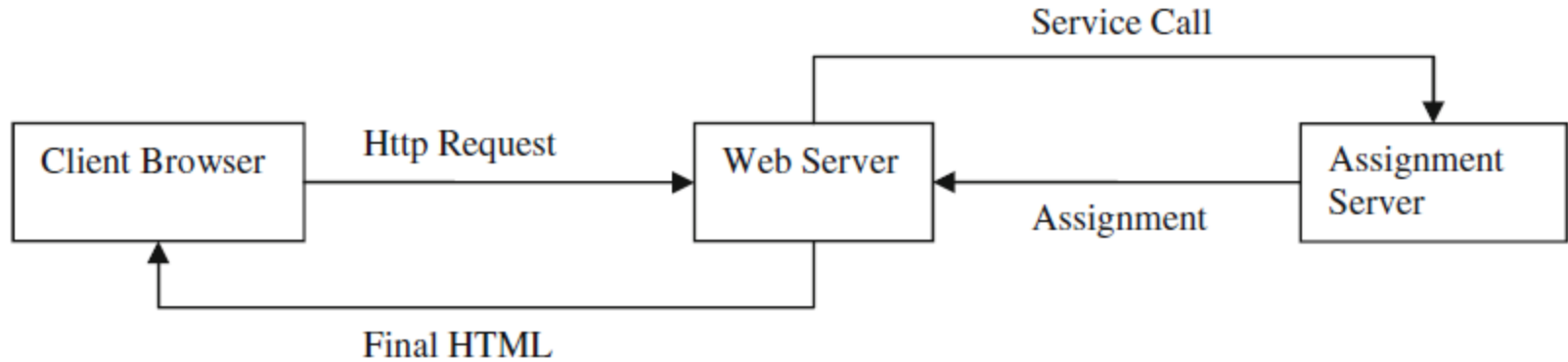
Traffic splitting



Page rewriting



Server side assignment



Data path

Lessons learned

Analysis:

- Mine the data you obtain
- Speed can have big impact
- Interactions are rarer than expected
- Be bold. Try different designs

Lessons learned

Trust and execution:

- Run A/A tests
- Automatic ramp-up and abort
- Beware of the day of week effect
- Beware of different cultures and geography

Lessons learned

Culture and business:

- Agree on the OEC upfront
- Beware of launching features that “do not hurt” users
- Weigh the feature maintenance costs
- Change to a data-driven culture

Conclusion

Questions?