
Customer Analytics Intro

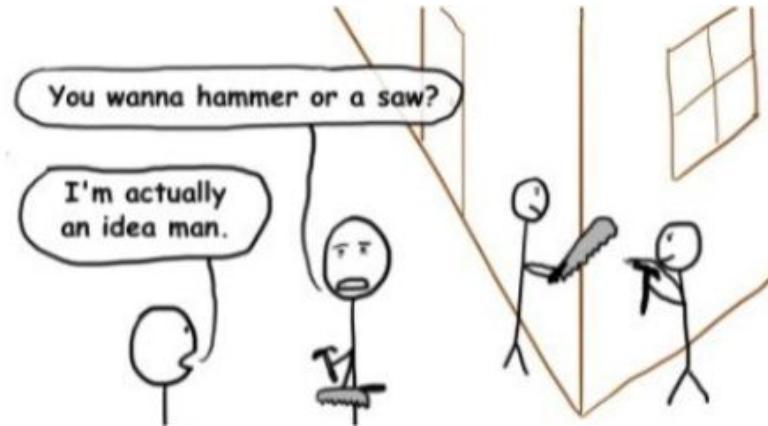
Marketing Analytics
Product Analytics
A/B Testing
MVT Testing
Personalization

Reid Bryant
Director, Analytics at Red Hat
Email: reidbryant@gmail.com



My background

- UNC undergrad, class of '05
- 8 year of real estate + finance stuff
- IAA grad, class of '14
- 4 years @ Brooks Bell
 - experimentation analytics
- 1.5 years @ Blue Acorn iCi
 - marketing analytics
- Almost 4 years @ Red Hat
 - marketing + product analytics
- Still learning daily :)



WHY SHOULD YOU CARE ABOUT CUSTOMER ANALYTICS?

“Marketing is too important to be left to the marketing department.”

- David Packard, HP co-founder

“[x] is too important to be left to the [x] department.”

- Every analyst in the world (its equally true across Product, Sales, Customer Success, etc)

What's your goal for today's lecture?

My napkin math says you will spend ~500 hours listening to lectures here at the IAA

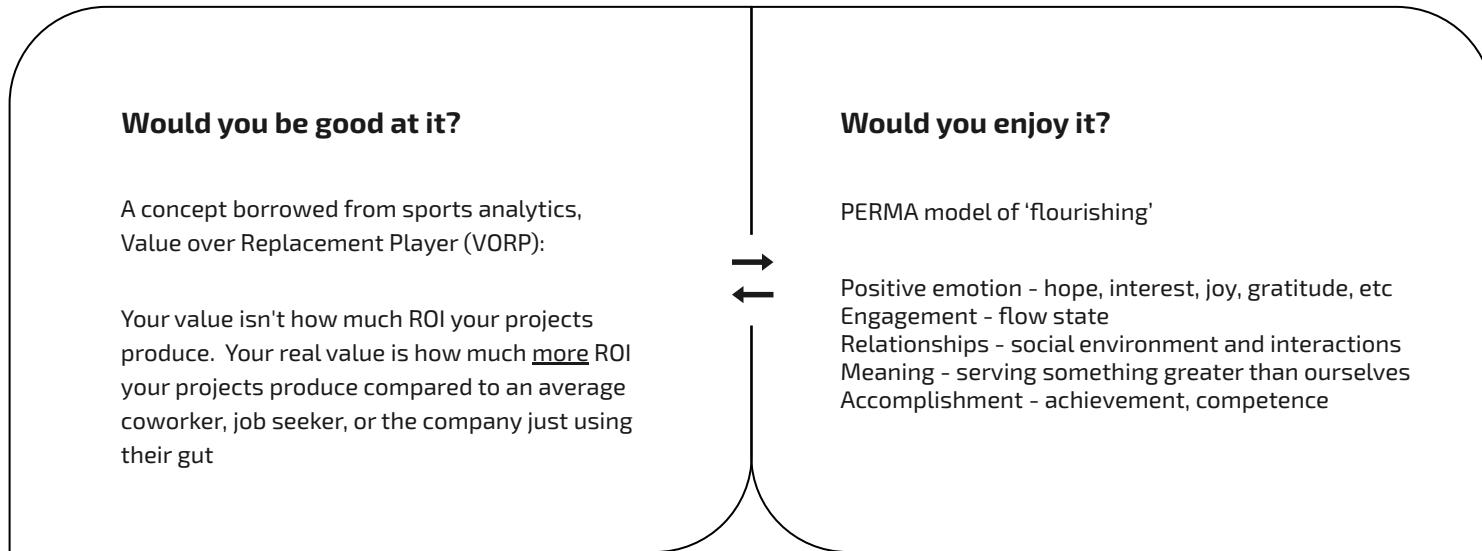
Two truths:

- 1) That's not enough to be 'great' at anything
- 2) What you pay attention to grows; you can be 'great' if you want to be

The question to ask yourself today:

- 1) Is customer/marketing/product analytics something that you want to be great at?

How to think about 'Is this for me?'



Would you enjoy it compared to other options?

From my experience on the marketing side...

Shorter, Iterative ----- Longer, Singular

Creative ----- Defined

Collab w/ the biz ----- Collab w/ data peeps

Industry tool heavy ----- Data tool heavy

Generate insights ----- Build production models

CUSTOMER ANALYTICS

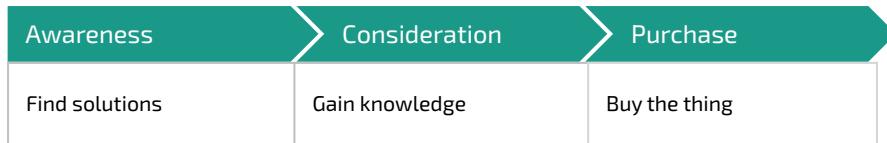
**MARKETING ANALYTICS, AND ITS
CONVERGENCE WITH PRODUCT ANALYTICS**

A Quick Intro

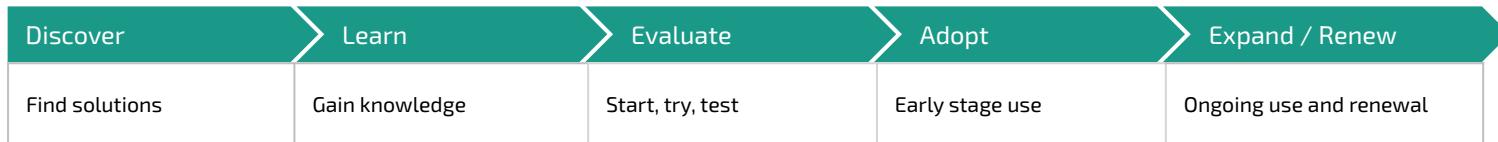
- First, some industry basics
- Will provide context to apply experimentation principles later in lecture

The Buying Journey

Can be as simple as a few mins in B2C / eCommerce



Or as long as a year in complex B2B software scenarios



Huge differences in terms of the type/amount of data and effectiveness of attribution

Channels / Touchpoints

How the user/account is reached:

- Organic - do we have the right content to drive users/accounts to our website?
- Paid - are we targeting net new via paid social, search engine, display, etc?
- Email - are we growing our contact database and nurturing effectively?
- Events - are our in person events and webinars converting?
- Trials - are our freemium offerings leading to paid subscriptions?

B2C v B2B - Traditional Models

Business to Consumer (B2C)

- Selling to a user / customer
- Short(er) sales cycles
- Goals are to build brand awareness and convert as quickly as possible, ideally within a single browsing session
- Conversion occurring through the site system, a third party retailer, or Amazon.

Business to Business (B2B)

- Selling to an account which consists of many buying personas
- Long(er) sales cycles
- Early funnel goals are to build awareness, grow contact database, land inquiries
- Later funnel goals are to build 'opportunity value' in the customer relationship management and convert that to 'closed won' revenue
- Conversion usually occurring via a sales team to close the deal

Traditional Marketing Desired Outcomes

Optimize the 4 V's, often against finance targets or period over period targets:

- Volume - Target the right audience to generate qualified, early stage traffic
- Velocity - Move these users/accounts through the funnel at speed
- ConVersion - Maximize conversion through each step of the funnel
- Value - Increase revenue to return business value

Convergence with Product Analytics

Distinction between B2B and B2C is narrowing with more focus on 'Product Outcomes', which esp important in Product Led Growth (PLG) models

- Can apply to both B2C as well as B2B where the funnel is shorter with similarities to B2C (aka SaaS models)
- PLG uses product as acquisition vehicle rather than a traditional sales funnel, typically using a trial or freemium to get users in the product ASAP
- Therefore there is the need to improve the whole user experience
- Experiences start unauthenticated on websites, but often end authenticated in-product / in-app
- Marketing teams want to understand how their efforts against product outcomes (usually activation, onboarding, usage, shorter term retention)
- Product teams want to understand the correlation between features added and product outcomes (usually usage, longer term retention)

EXPERIMENTATION

A UNIFYING PRACTICE

Quick note

- The remainder will focus on digital experimentation on the marketing side because those use cases are simple and common in practice
- Experimentation is also very popular in product applications, medical trials, etc so these concepts will be equally valuable elsewhere

How did they go from one iteration to the next?

The image shows two versions of the Barnes & Noble website side-by-side, illustrating the changes in design and layout over time.

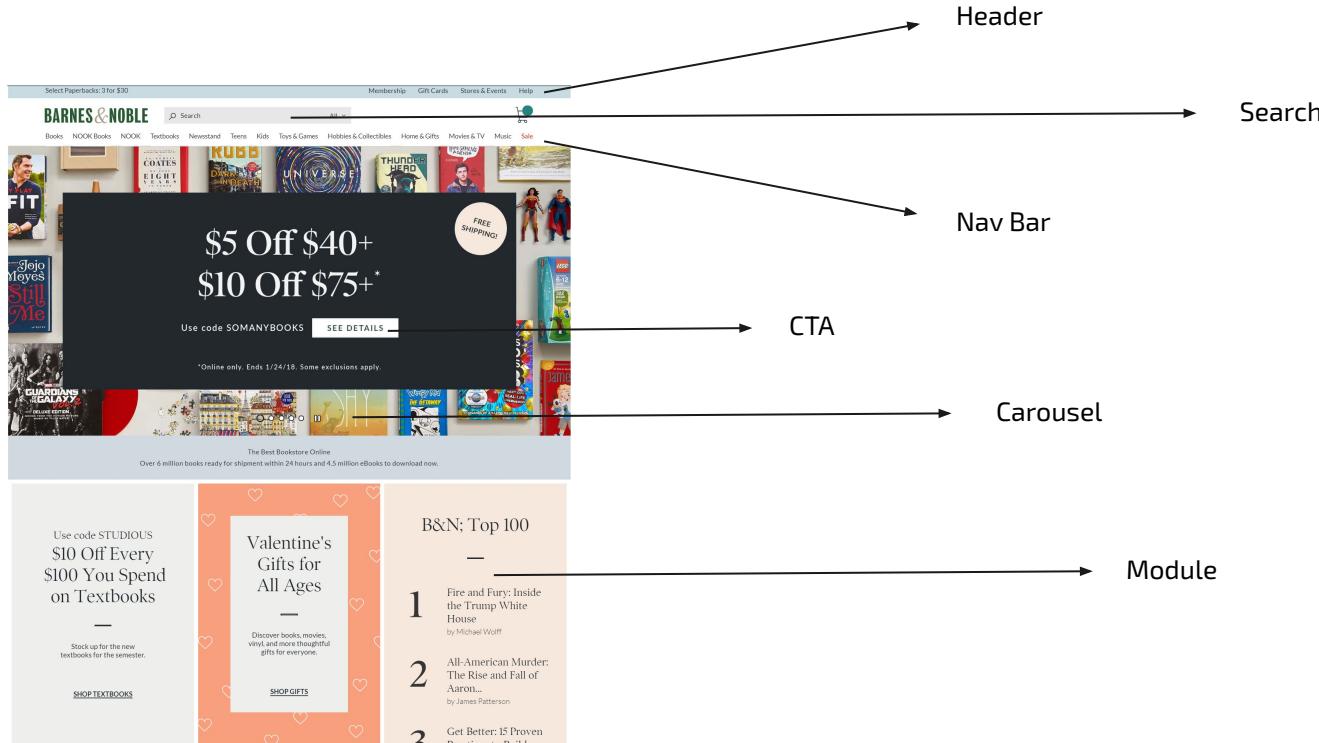
Left Side (2007 Version):

- Header:** Features a "FAST & FREE DELIVERY" banner with a "SEE DETAILS" link, a "CART" button with "0 Items", and a "CHECK OUT" button.
- Navigation:** Includes links for "HOME", "AFTER HOLIDAY SALE", "BOOKS", "USED & OUT OF PRINT", "NEW & USED TEXTBOOKS", "DVD", "MUSIC", "PC & VIDEO GAMES", "CHILDREN'S", "TODDLERS & GAMES", "GIFTS & CALENDARS", "GIFT CARDS", and "B&N MEMBER PROGRAM".
- Content:** Promotions for "Members Save 10% Every Day!" and "After Holiday Sale Save Up to 80%". A sidebar highlights "FIND YOUR LOCAL B&N STORE" and "BROWSE B&N'S UNIQUE OFFERINGS".
- Bottom:** A "TOP BOOK SUBJECTS" section and a "TOP 10 BESTSELLERS" list.

Right Side (2013 Version):

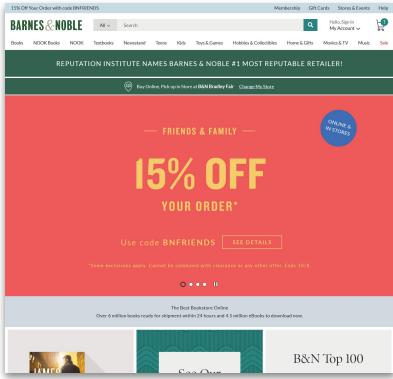
- Header:** Shows a "Sign In" link, "My Account", "Order Status", "My NOOK", "Stores & Events", and "Help". A banner for "After Holiday Clearance Sale: Save 50% or More".
- Navigation:** Includes "All Products" and "Search" buttons, along with links for "Books", "NOOK Books", "NOOK", "Textbooks", "Newsstand", "Trends", "Kids", "Toys & Games", "Home & Gifts", "Movies & TV", "Music", "Gift Cards", and "Bargain Books".
- Content:** Promotions for "Up to 90% Off Textbooks", "50% Off Bestselling NOOK Books", and "Buy 2, Get a 3rd Free". A large "Book of the Year" banner for "The Heaven & Earth Grocery Store" by James McBride.
- Bottom:** A "Only at Barnes & Noble" section featuring a "Command Authority" book and a "Author of the Year" banner for "The Wager" by David Grann.

They experimented with each site component...



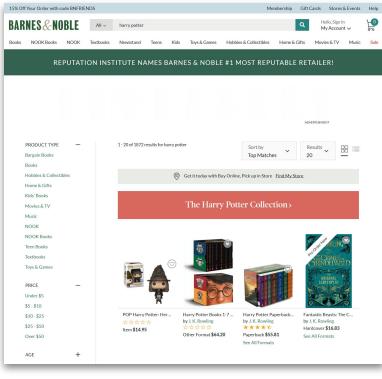
... and each page type

Home



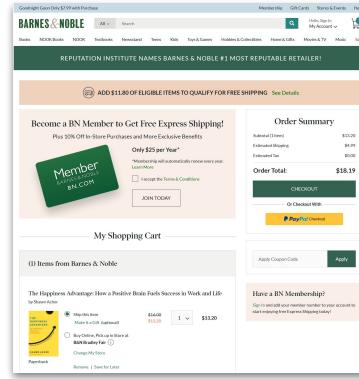
The Barnes & Noble Home page features a prominent red banner at the top offering a 15% discount for Friends & Family. Below the banner, there's a search bar and a navigation menu. A central promotional area highlights the store's reputation as the most reputable retailer. At the bottom, there are sections for B&N Top 100 books and a 'Buy Online, Pick up in Store' button.

Search Results



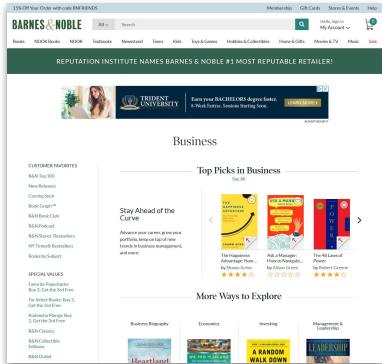
The Search Results page for 'Harry Potter' shows a grid of book covers. A sidebar on the left provides filtering options for Product Type, Membership level, Price, and Age. A callout box highlights the 'The Harry Potter Collection?' which includes the first seven books in the series.

Cart



The Cart page displays a summary of items in the shopping cart, including a Harry Potter book and a membership offer. It shows the subtotal, shipping, tax, and a final order total of \$18.19. A 'CHECKOUT' button is prominently displayed.

Category Page



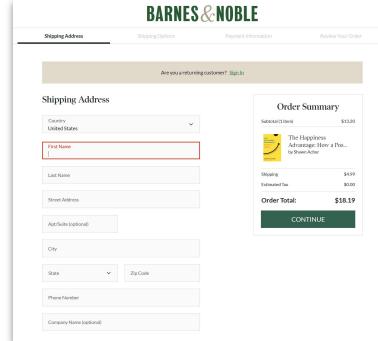
The Category Page for 'Business' shows a grid of book covers. A sidebar on the left lists 'Customer Favorites' and 'Top Picks in Business'. A 'Stay Ahead of the Curve' section features a 'Top 10' list of books. The page also includes a 'More Ways to Explore' section with links to Business Biography, Economics, Investing, Management & Leadership, and Marketing & Sales.

Product Page



The Product Page for 'The Fifth Risk' by Michael Lewis shows the book cover, author information, and purchase options. It includes a 'Buy Online, Pick up in Store' button and a 'Buy Now' button. A 'CONTINUE' button is located at the bottom right.

Checkout



The Checkout page is a multi-step form. The first step, 'Shipping Address', asks for the customer's name, address, city, state, zip code, and phone number. The second step, 'Order Summary', shows the items in the cart and the total price of \$18.19. A 'CONTINUE' button is at the bottom.

What benefit does experimentation provide?

Experimentation allows us to continually **optimize the customer's experience** resulting in positive impact to the business.

Most importantly, experimentation helps build a better understanding of customers than typical descriptive analysis alone, **by isolating variables and identifying causation**.

In this way, experimentation brings **an iterative and data-driven** approach to business decisions - that ideally replaces slow waterfall projects and/or gut-feel decisions.

Experimentation is practiced across almost all domains, and is particularly powerful in:

- 1) high volume, low conversion B2C marketing applications such as websites and paid
- 2) lower volume, high conversion marketing applications like email, product trials, etc

Note: will struggle to reach statistical significance in low volume, low conversion scenarios

Why does the business care?

Experimentation is often the mechanism to **drive incremental revenue** and ensures new experiences benefit the customer.

In this example a 10% lift to conversion rate generates \$300k of annual incremental revenue for the business.

	Version A	Version B
Sessions	10M	10M
Conversion Rate	1.0%	1.1%
Orders	100k	110k
Average Order Value	\$30	\$30
Revenue	\$3.0M	\$3.3M

How sure are we about that additional \$300k?

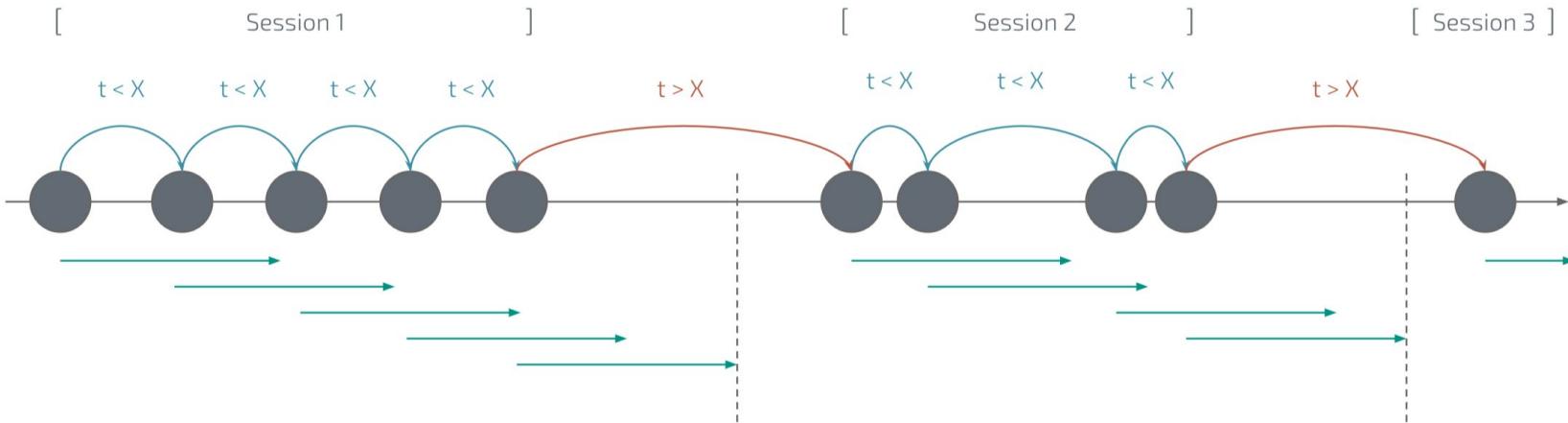
- Experimentation is industry speak for a Randomized Control Trial (RCT)
- Each user is randomly assigned to control or variation
- Random assignment guards against bias and spreads the variance of uncontrollable factors
- Allows us to establish causation when tested against a control during the same time period.
- No experiment will provide a positive return forever, different user expectations and future interactions necessitate continual testing to maximize revenue → yay, job security :)

DIGITAL DEFINITIONS

DATA COLLECTION

Visit Hierarchy + Sessionization

- Hit - single instance of website request
- Session (aka Visit) - collection of Hits in single session
 - Must time window (X) to see if the time between hits (t) should count as a single Session or not
- Visitor - collection of Sessions unique to a single visitor ID
 - Sessions stitched together by ID where $t > X$



Data Generation + Collection

- 1) Page is requested when user attempts to load page of interest
- 2) Browser reads the source code and the imbedded JavaScript tags
- 3) All tags are executed (independently or executed by tag manager)
- 4) Analytics tags send tracking code (things like ID, referrer, location, SKU, page name, URL parameter, etc)
- 5) Data is stored by third parties like Adobe or Google Analytics for later analysis

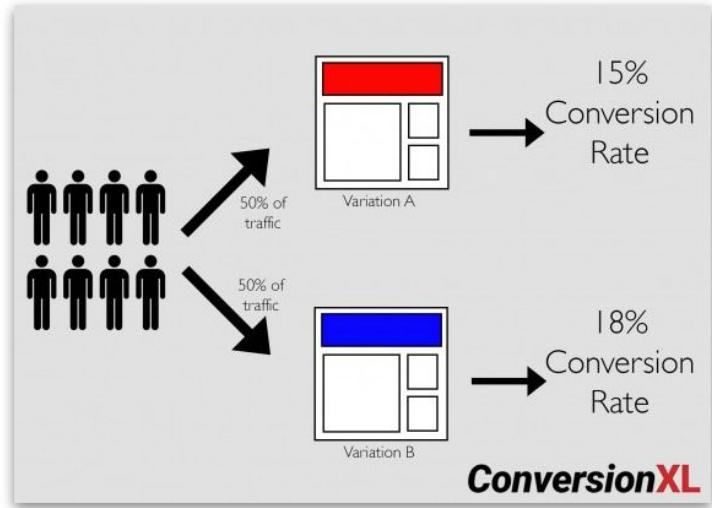
TOOL FUNCTIONALITY

Testing Tool Functionality + Vendors

- 1) Allows select page or site component
- 2) Allows targeting/segmentation to be set
- 3) Allows developers to create a variation(s) that modifies the control using front-end JavaScript or a WYSIWYG
- 4) Randomizes traffic assignment to the control and each variation
- 5) Summarizes the statistical results of each test

Vendors

- Adobe Target
- Optimizely
- Google Optimize
- Maxymizer
- Sitespect
- Many more!



Client Side v Server Side Testing

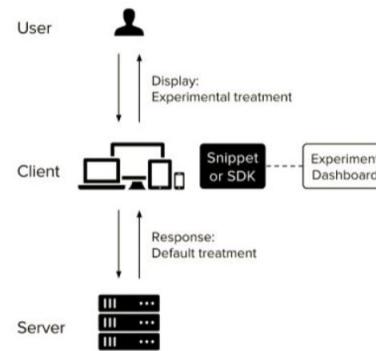
Client side:

Changes the content sent by the companies server to the user in the browser, can manipulate elements that are already present, can result in flicker

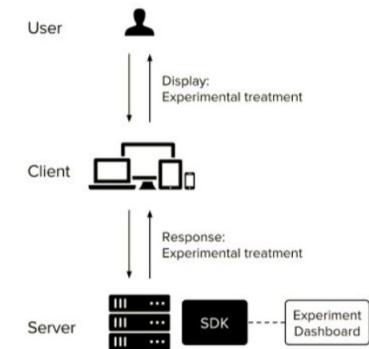
Server side:

The companies server takes on the task of sending variations to each user, limitless in terms of test-able scope, no flicker

Client-Side Experimentation



Server-Side Experimentation



A/B TESTING

MULTIVARIATE TESTING

Types of Experiments, aka RCTs

A/B Testing



A single 'factor' is changed in each variation

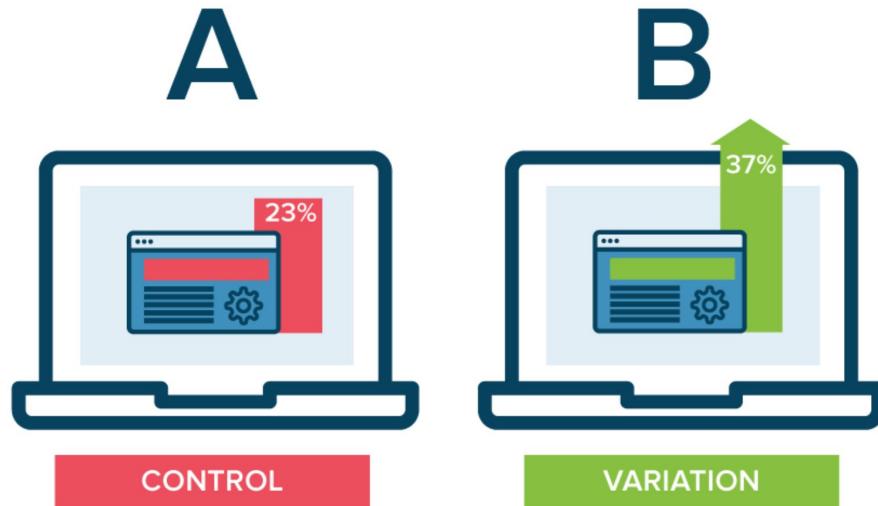
Multivariate Testing (MVT)



Multiple 'factors' are identified, each factor with ≥ 2 levels; each variation changes different permutations of factors and factor levels.

A/B/n Testing

- Also known as “split testing”
- A/B testing refers to the method of randomly dividing site traffic between a control and one or more variations
- Compares the performance of the each variation against the control to inform decisions on which variation is best



A/B example...

The single factor may be the CTA

- The Control may be 'See Details'
- Variation A may be 'Learn More'

The image shows two versions of the Barnes & Noble homepage side-by-side, illustrating an A/B test. Both pages feature a large promotional banner at the top offering discounts for purchases over \$40 and \$75. Below the banner, a call-to-action button is present in both versions.

Control (Left): The button text is "SEE DETAILS". An arrow points from this text to the right, labeled "CTA".

Variation A (Right): The button text is "LEARN MORE".

Common Elements:

- Banner:** "\$5 Off \$40+
\$10 Off \$75+*".
- Call-to-action button:** "Use code SOMANYBOOKS" followed by either "SEE DETAILS" or "LEARN MORE".
- Text below banner:** "*Online only. Ends 1/24/18. Some exclusions apply."
- Bottom section:** Promotions for textbooks ("\$10 Off Every \$100 You Spend on Textbooks") and Valentine's Day gifts ("Valentine's Gifts for All Ages").
- Top navigation:** Barnes & Noble logo, search bar, and various categories like Books, NOOK Books, Nook Textbooks, etc.
- Bottom footer:** "The Best Bookstore Online" and "Over 6 million books ready for shipment within 24 hours and 4.5 million eBooks to download now."

A/B/n - Pro/Con

PROS

Investigating & understanding strategic levers, page redesigns, low traffic

- ✓ Fewer assumptions
- ✓ Shorter test duration
- ✓ Requires lower traffic volumes
- ✓ Relatively inexpensive

CONS

Decision to lump multiple changes to a variation vs one small singular change

X Lumping changes causes you to lose isolation of each component

X One component at a time requires multiple tests to optimize a page

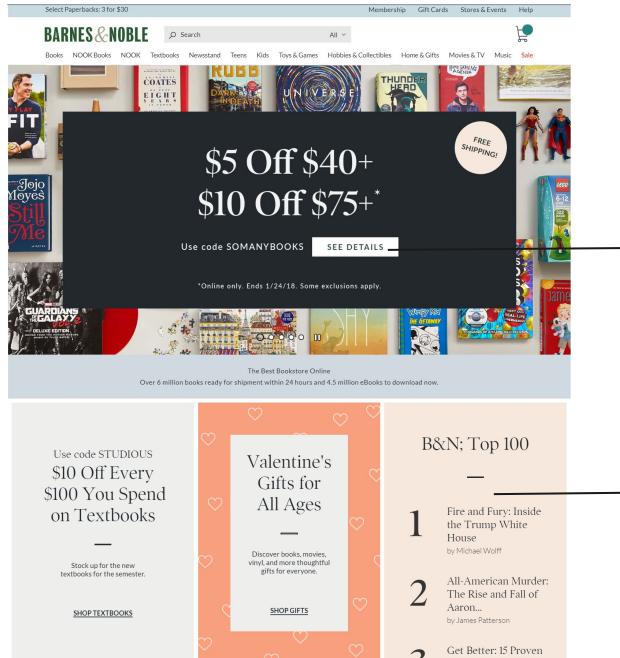
Multivariate Testing

- A method of testing your online campaign using many variations of a design, usually organized by "factor" with each "factor" having two or more "levels"
- You could live test changes to a headline, an image, and new copy ... all at once, in various permutations
- Also known as MVT



	Image	Headline
VERSION 1		+ "ACME WIDGETS"
VERSION 2		+ "ACME WIDGETS"
VERSION 3		+ "THE ONE AND ONLY ACME WIDGETS"
VERSION 4		+ "THE ONE AND ONLY ACME WIDGETS"

MVT example...



CTA

Module

The two factors may be the CTA and Module

For the CTA:

- The Control may be 'See Details'
- Variation A may be 'Learn More'

For the Module:

- The Control may be 'Top 100'
- Variation A may be 'On Sale Now'

Multivariate - Pro/Con

PROS

Optimizing a page in small, iterative way and finding the best combination of factor

✓ Allows greater optimization within a single test

✓ Insight into impact of specific attribute change

CONS

Strategic tests where learning key insights is priority over finding the optimal configuration

X Higher LOE due to tech resources and analytics

X Longer test duration, more traffic

X In partial designs, winner might be "predicted" not empirically verified

Multivariate Testing - Full v Partial Factorial

Full

- All permutations of factor levels are formed into variations and all are selected for the test
- So many permutations lead to long durations

Treatments:	
1. A1, B1, C1	✓
2. A1, B1, C2	✓
3. A1, B2, C1	✓
4. A1, B2, C2	✓
5. A2, B1, C1	✓
6. A2, B1, C2	✓
7. A2, B2, C1	✓
8. A2, B2, C2	✓

2^3 variations tested = 8

Partial

- Only a certain number (percentage) of permutations are selected for the test
- Testing tools leverage an algorithm to choose the best variations of the different elements based on which combinations provide sufficient information to determine element effects.

Treatments:	
1. A1, B1, C1	
2. A1, B1, C2	
3. A1, B2, C1	
4. A1, B2, C2	
5. A2, B1, C1	
6. A2, B1, C2	
7. A2, B2, C1	
8. A2, B2, C2	

Total variations tested = 4

Multivariate Testing - Partial Design Resolution

Design Resolution is the measure of a tradeoff between speed and certainty
Higher resolution provides more certainty at the cost of speed

For Partial 2-level experiments

RESOLUTION V

- un-confounded main effects
- un-confounded two-level interactions

RESOLUTION IV

- un-confounded main effects
- two-level interactions confounded

RESOLUTION III

- main effects confounded with two-level interactions
- two-level interactions confounded

Aim for (at least) resolution IV designs

Factors	Min # Res. IV Variations	Min # Res. V Variations
1	2	2
2	4	4
3	8	8
4	8	16
5	16	16
6	16	32
7	16	64
8	16	64

PERSONALIZATION

Personalization

Personalization is defined as creating a site that bends to the unique needs of each user, rather than remaining static across the population, based on event or profile data

Performance is governed by effectiveness of the algorithms

Site Areas

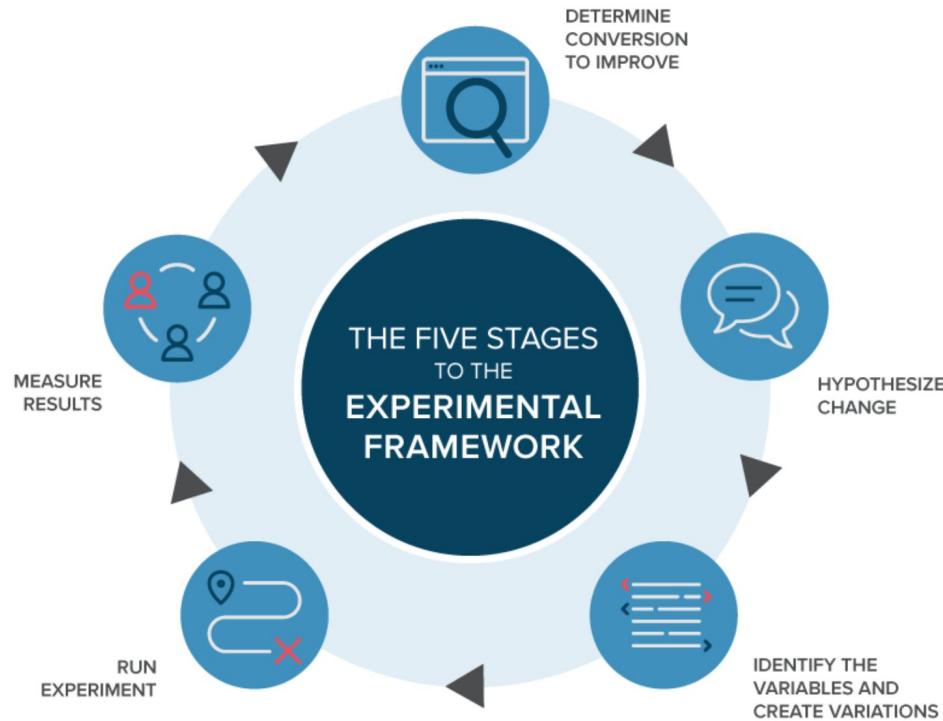
- Landing Pages
- Hero Images
- Banners
- Content
- Navigation
- Product Recommendations
- Interstitials
- Search

Common Algorithms

- Trending
- Recently (Soon to) Expired
- Co-browse, Co-buy
- Similar Items
- Collaborative Filterings
- Clustering
- Decision Trees
- Multi-armed Bandits

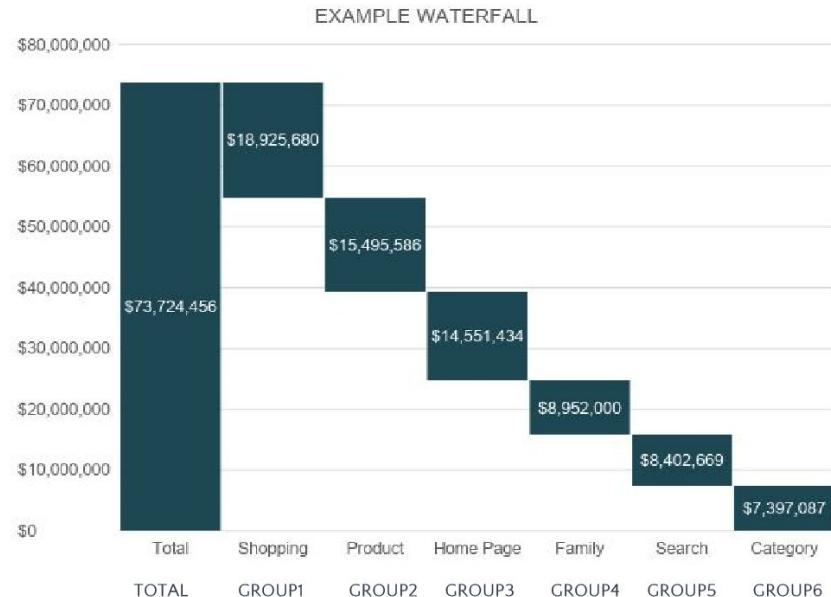
A/B TESTING PROCESS: TO DEFINE THE EXPERIMENT

Cross Functional Involvement and Steps



Prioritization: Size Expected Impact

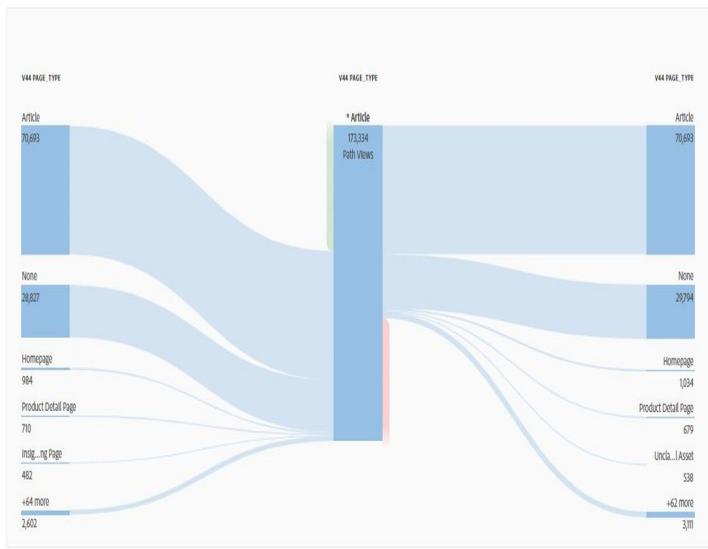
- Forecasting impact should drive decisions about where to test on the site
- A waterfall analysis helps forecast potential impact by looking at:
 - revenue participation (what parts of the site are hit on buying journeys)
 - usability issues across page types (giving more weight to pages with a higher ceiling for improvement)



Defining Goals and Outcome Metrics

PAGE TYPE	GOAL	METRICS
HOME	Promote brand messaging, inspire customers, move down funnel in broadest terms	Bounce Rate, Flow Through Rate
SEARCH	Find a specific item of interest	Percent to PDP, Null Search Results
CATEGORY	Display catalog and assist browsing	Flow Through Rate
SUB-CATEGORY	Display catalog and assist browsing with further refinement	Percent to PDP, PDP Page Views
PRODUCT	Provide details about specific item	Carting Rate
CART	Inform and provide selection related to purchase	Checkout Rate, Order Rate, Cart Adds, Cart Removals
CHECKOUT	Execute the purchase	Order Rate, Checkout Flow Rate

Perform Unstructured Analysis to Find Insights



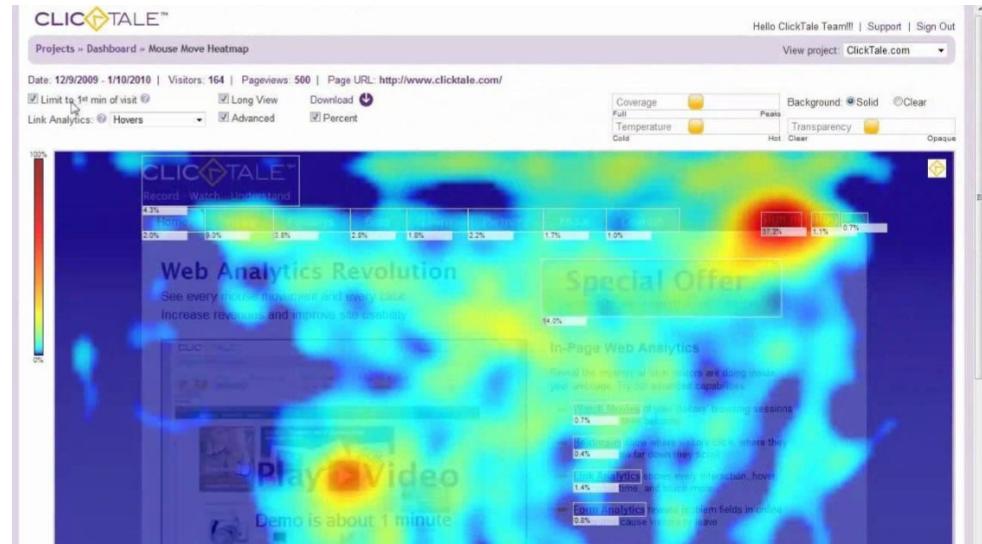
Sample Items of Interest

- Volume of traffic and attributed revenue
- Conversion rate and average order value
- Time spent, Content engagement
- Search Terms
- Entries from / Exits to
- Segments
 - Device Type
 - New vs Returning
 - Converters vs Not

Augment with Qualitative Methods

Usability: Use heatmaping, watch session replays or conduct live research to baseline how users are interacting with the current UI

Competitive Analysis: Analyze competitor websites for distinguishing features then conduct research asking users how they feel on a relative basis



Apply Behavioral Economics Principles

1. Risk / Uncertainty - is there any anxiety around the purchase decision?
2. Usability and Site Design - how much effort does it take to interact with the site interface to achieve your objective?
3. Financial Sensitivity to the Product - is user demand elastic to price and how would discount messaging be perceived?
4. Time Scarcity - how long will it take to complete the action and how is the time commitment explained to the user?
5. Company and Product Differentiation - is it clear to the user why they should purchase from that particular company

A/B TESTING PROCESS: DESIGN OF EXPERIMENT

Create Hypothesis

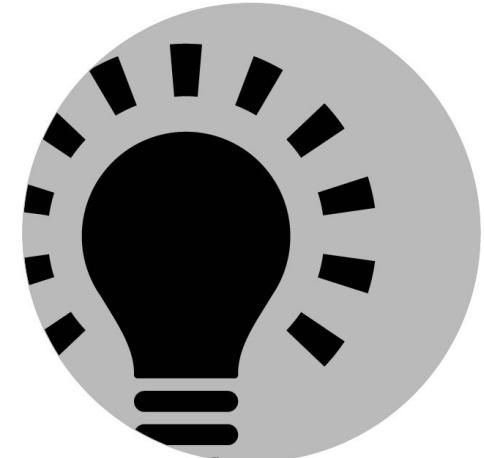
Hypothesis Statement:

Based on [analytics + research] we believe that [user problem] exists.
We believe [solution] will result in [this KPI outcome].

Variation Creation:

- Each variation could potentially have its own hypothesis
- Increasing variations increases test duration

Caution: when testing multiple variations ensure that post test statistical significance analysis corrects for the multiple correction problem to avoid inflating Type 1 error rate



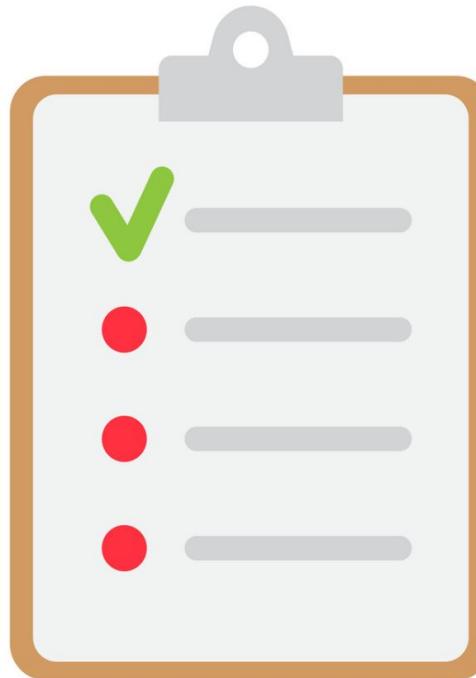
Select Single KPI

Primary Metrics:

- What the test is “decisioned” on
- “Intended” consequences

Secondary Metrics:

- “Unintended” consequences
- Should drive future testing
- Corroborate the story of the primary metric



Primary KPI Details

Choosing a Single Primary KPI

- A single KPI consists of one meaningful, predefined, standalone metric
- Balance choosing a KPI close to the change and one impactful to the business
- Signal will be stronger closer to the change, but that metric may not be meaningful
- Ex: Measuring Engagement clicks on a Hero test vs Revenue per Visitor: it's easy to move clicks around on a page, but it's tough to increase revenue
- "Next step" metrics can be utilized when each step of the journey will be optimized, eventually impacting meaningful metrics (Ex. Using Add to Cart as the KPI when testing on a Product Page when later tests are planned in the Cart and Checkout flow)

Caution: substituting secondary metrics to decision winners can inflate Type 1 errors

Choose between KPI Types

Most KPI can be categorized in two groups:

BINARY – Metrics that translate to 0 or 1 and can be described as rates (ensure they are defined as count once rather than count all metrics)

- Examples include: Order Rate, Click-through Rate, Bounce Rate, etc.

CONTINUOUS – Metrics that are unbounded below and/or above and can be described as averages

- Examples include: Revenue per visitor, Time on Site, Cart Additions, etc

Define the Audience

Pre-define primary audience

- Select specific group to be included
- Solidify before test launch
- Used for final decision making purposes



Post-test segmentation

- Should help paint the picture of overall results
- Segmentation illustrates the difference in response across important groups
- Segmentation should inform personalization efforts in future testing

Caution: applying post test segmentation to decision winners can inflate Type 1 errors

Set Sample Size as the Stopping Rule

Stopping Rules (Frequentist, Fixed Time Horizon)

- A stopping rule is the criteria at which the test should be stopped and results collected
- Establishing these criteria will ensure your tests are not concluded with bias and that the results will be repeatable
- Test margins will fluctuate greatly over the course of the test duration but predetermined sample sizes are calculated to ensure that the test will approach the true difference in populations instead of "p-hacking" to find a winner

Caution: peeking into the test results with the intention of stopping a test early or extend the duration can inflate Type 1 errors



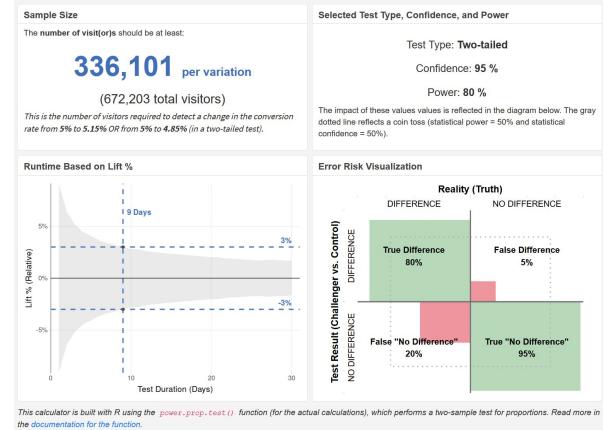
Design the Experiment - Frequentist

Fixed Time Horizon Inputs

- Confidence - controls Type I errors
- Power - controls Type II errors
- Effect Size - the min. detectable lift
- Primary KPI info - response rate for binary,
- Daily Traffic - to convert to duration
- Number of Variations - to calc duration
- Tails - one or two tailed statistical test

Ex:

.05 Alpha
.80 Beta
3% MDE
5% Order Rate
75k Daily Visitors
2 total
2 tails



Notes:

- The Primary KPI info for continuous metrics is the ratio of std. dev. to mean
- Proactively adjust significance if planning a post test multiple comparison adjustment
- Cutting your min. detectable lift in half will increase duration 4x
- Continuous metrics with a standard deviation : mean ratio twice as large as alternative metric will increase duration 4x
- Binary metrics with a response rate of half of an alternative metric will increase duration 2x
- <https://www.searchdiscovery.com/sample-size-calculator/>

Design the Experiment - Algorithmic

Sequential Testing

- Sets accept/reject regions based on effect size and desired significance
- After every visitor, it calculates the chance you EVER meet your significance threshold
- Allows you to declare a win/loss based on relative performance at any point in time
- Risk is that you don't have a duration expectation at onset (i.e., when to call the test flat)
- Requires trusting the tool and how it treats underlying data to make decisions OR create elaborate and near real time systems to utilize analytics tool data

Multi Armed Bandit (MAB)

- Gradually re-allocates traffic to best performing variation
- Auto optimizes exploration vs. exploitation periods

Automated Personalization: Multi-Armed Bandit + Random Forest

- Matches experience received to attributes and analyzes over Primary KPI success
- In exploitation period, some traffic is randomized via MAB to continually evaluate / edit

A/B TESTING PROCESS: ANALYZE THE RESULT

Possible Outcomes and Business Cost

Truth (can never know)	Decision of 'No difference'	Decision of 'Difference'
No difference	True Negative (1-alpha) ★	False Positive (alpha) ✗
Difference	False Negative (beta) ✗	True Positive (1-beta) ★

- False Positive - we recommend change that actually won't make a difference
 - We think +\$ when it's actually \$0 or -\$
 - Generally thought to be the worst, and thus tighter control (5%)
- False Negative - we fail to recommend a change that would make a difference
 - We think it's \$0 or -\$ when it's actually +\$
 - Generally of less concern, as thus less control (20%), but specific to your experiment
- Always consider the costs of each error when assigning alpha and beta

Post Test Analysis and Reporting

- Perform significance testing on the Primary KPI
- Include observed values, statistical significance, and lift percentage w/ confidence intervals
- Use proper methods for underlying data and adjust for multiple comparisons if necessary
- Explore results across segments and secondary metrics to corroborate Primary KPI
- Make implementation recommendations that have practical and statistical relevance
- Propose next steps, supported with data
- Retain summary data on past experiments tagged by win/loss, expected revenue contribution, metric, page, audience, etc to inform future testing and communicate value

QUICK WORKSHOP

Discussion as Time Allows

You are an analyst at Barnes and Noble. The Director of Ecommerce wants your suggestions on what to test on their Homepage, and how. She has given you free reign over 30 days, the only restriction is you can't have more than 1 test live at a time.

Refer to Slide 15 for the Homepage visual and [this](#) sample size calculator

Your Director:

- Will accept an alpha between .01 and .1
- Will accept a beta between .95 and .6
- Expects to receive 1M visitors over the 30 day period
- Wants to optimize Order Rate, which has been 5% historically (Baseline conversion rate, Relative on the Calculator)
- Winning tests have averaged a 3% lift (aka the Minimum Detectable Effect on the Calculator)

Assignment:

- What concepts do you want to test?
- How many tests are you going to run and what will their designs be? Why?
- What other non-causal historical analysis could you perform while the tests are running?



Thank you!

Reid Bryant
Director, Analytics at Red Hat
Email: reidbryant@gmail.com

