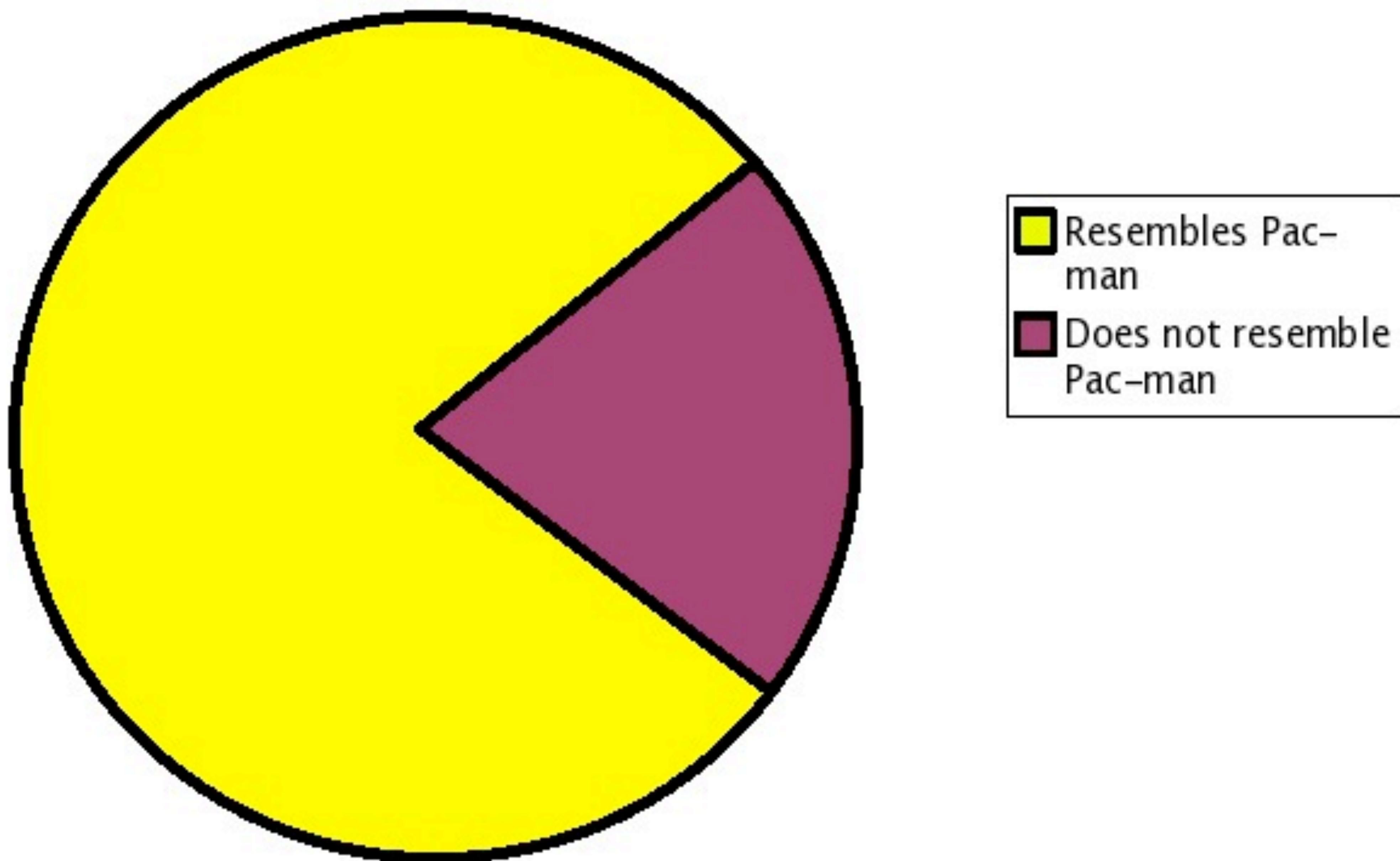


Percentage of Chart Which Resembles Pac-man



Otagami? → see Stanford P.D. professor
or others geometric designs

crown/claw pulling up



Alan's idea:
attach the wires to
the middle fulcrum

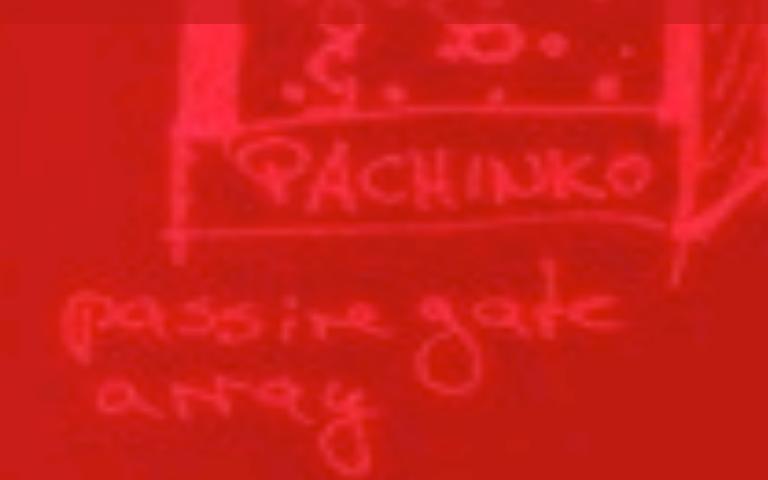


Analyzing Experiments

SCOTT KLEMMER

FALL 2011

cs147.stanford.edu



passive gate array



Scott: a gate that shows who walked through it less

B.U.: a gate that measures ceremonial gates



turnstile

NY Times, July 1, 2009

Facebook to Offer New Features to Allow Users to Control Privacy of Information

By JENNA WORTHAM
Published: July 1, 2009

[Facebook](#)'s biggest asset — its population of more than 200 million users — is also part of its Achilles' heel. As more people join and connect with more people they know, the chances grow that one's embarrassing photographs from a night of carousing might be seen by the wrong person.

Related

Times Topics: [Facebook](#)

To help remedy this, the company is testing new controls that will allow members to specify which groups or individuals are able to see each text update, photo or video they post on

the site. For example, the controls would make it easy for a user to remind all the family members on Facebook about a surprise birthday party, while excluding the birthday girl.

"Our overall philosophy is that people should be as open or as closed as they want to be," said Chris Kelly, chief privacy officer for the company, in a conference call with reporters Wednesday to discuss the changes.

For now the new features are available only to a limited number of users, but the company said it planned to provide them eventually to everyone on the site.

The changes are part of Facebook's effort to simplify its privacy settings, which had ballooned to more than six pages and 40 different options. The company said that fewer than a quarter of its users regularly adjusted privacy settings, so it planned to condense them into a single, easy-to-navigate page.

"When tools are simple, people are more likely to use them," Mr. Kelly said. "If there are too many options, users are not fully appreciating what they are sharing with whom."

Recent changes at Facebook — including a redesign that focused attention on so-called



Project goals (from Julie Zhuo)

- message the fact that privacy has been simplified, and there is now an ‘everyone’ option
- encourage people to open up the information they’re comfortable sharing in order to make themselves more discoverable in search
- make sure point 2 is done with full user understanding.

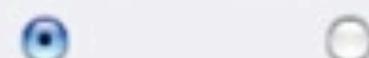


Facebook is making changes to privacy—update your settings now.

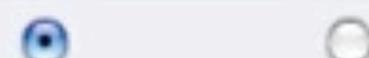
Facebook has simplified Privacy to make it easier to control your information. You can share some of your info with Everyone or choose to apply your old settings to the fields below. Note that Everyone means everyone on the internet.

Everyone Old Setting

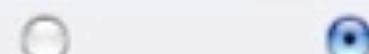
Basic Info [?]



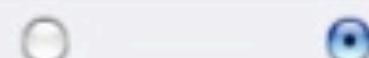
Family and Relationships [?]



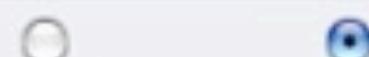
Education and Work



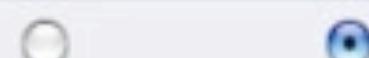
Personal Info [?]



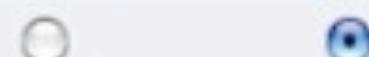
Photos and Videos of Me [?]



Wall tab and Posts I Publish [?]



Photos Tab



Save Settings

Customize Settings

Qr Chris Berry

Displaying 1 - 10 out of over 500 results for: chris berry

	Name: Chris Berry	Network: New York, NY	Friends: 4 mutual friends
	Name: Chris Berry	Friends: 3 mutual friend	
	Name: Chris Berry	Friends: 2 mutual friend	

Friends can connect with you more easily when more information is available.

- News Feed
- campfire
- designers
- girls
- platform
- si ren



What's on your mind?

Attach



Share

Facebook Design [Rob] — Found the logo history between Pepsi and Coke thought-provoking. Coca-Cola's mass-culture brand is a testament to the power of consistency. Stick to your style — it may fall out of fashion from time to time, but if it's really good it will last forever.

Requests

See All

50 friend requests 1 event invitation

1 other request 1 new update

Suggestions

See All



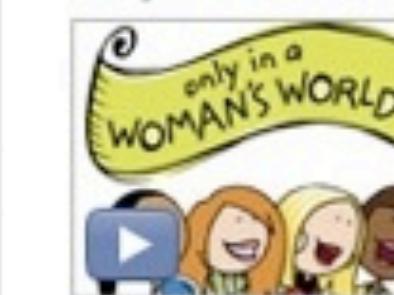
Ben Newman

47 people are mutual friends.
You both went to Stanford.
Add as Friend

Sponsored



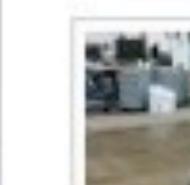
Only in a Woman's World



Join the four, funny ladies of A Woman's World for hilarious webisodes, great conversation and a chance to win a girls getaway to NYC.

Become a Fan of Only in a Woman's World

Highlights



Mobile Uploads
by Alison Rosenthal

1



Wall Photos
by Jared Morgenstern

3 11



Facebook is making changes to privacy—update your settings now.

Facebook has simplified Privacy to make it easier to control your information. Please choose your new privacy level from the options below. Note that Everyone means everyone on the internet:

Open

Everyone can see your profile and posts. [Show details](#)

Recommended

Everyone can see your general info and posts. Friends of Friends can see your sensitive info. [Show details](#)

Limited

Only friends can see your entire profile and content that you publish. [Show details](#)

Apply Old Settings

Only people who could see your info before will continue to have access. No information or content will be exposed.

[Save Settings](#)[Customize Settings](#)

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- [News Feed](#)
- [campfire](#)
- [designers](#)
- [girls](#)
- [platform](#)



What's on your mind?

Attach



Share



Eston Bond Late. Very.

6 minutes ago · Comment · Like

Requests

[See All](#)

50 friend requests 1 event invitation

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Suggestions

[See All](#)

Ben Newman
47 people are mutual friends.
You both went to Stanford.
[Add as Friend](#)

Sponsored

[See All](#)

How strong is your score?

693 See your 2009 credit score online in just two easy steps from Experian.

Highlights

- Audio slide show: GIVE HIM HIS PROPS – Los An...
posted by Alexandre Roche
 2
- Shooting Jan's Skate Session
Alexandre Roche likes this.
- Oooold School Pics
Sasha Rush is tagged.



News Feed

campfire

designers

girls

platform

si ren

Pages

Links

Video

Notes

Photos

Typing Maniac

Status Updates

FriendFeed

More

Important Privacy Announcement

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Family and Relationships [?]



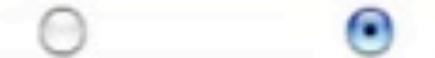
Education and Work



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Photos and Videos of Me [?]



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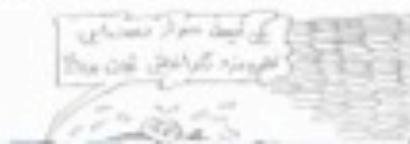
Save Settings

Skip For Now

Customize Settings



Babak Irani Old one from NikAhang Kosar:
Ayatollah 'Temsah' (Crocodile) (pun on Ayatollah Mesbah): Will anyone rescue me from this sell out journalists?

www.muslim-refusenik.comSource: www.muslim-refusenik.com

by Jared Morgenstern

3 11



Disappearing Car Door posted by Nirav Sanghani

3 2



What's on your mind?

Requests

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50 friend requests 1 event invitation

1 new update

See All

Sorority Life! It's game with the hottest glam around!

News Feed

campfire

designers

girls

platform

si ren

Pages

Links

Video

Notes

Photos

Typing Maniac

Status Updates

Microsoft

More

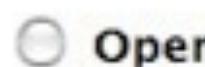


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**Open**

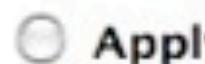
Everyone can see your profile and posts. [Show details ▾](#)

**Recommended**

Everyone can see your general info and posts. Friends of Friends can see your sensitive info. [Show details ▾](#)

**Limited**

Only friends can see your entire profile and content that you publish. [Show details ▾](#)

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Save Settings

Skip For Now

Customize Settings



Eston Bond Late. Very.

7 minutes ago · Comment · Like



Mega Rally SF, July 25th

(Part 2)

posted by Babak Irani



- [News Feed](#)
- [campfire](#)
- [designers](#)
- [girls](#)
- [platform](#)
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- [Pages](#)
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- [Notes](#)
- [Photos](#)
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- [Microsoft](#)
- [More](#)

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[See All](#) 50 friend requests

[1 event invitation](#)

[1 new update](#)

[See All](#)

Chris Berry
New York, NY
4 mutual friends

Chris Berry
1 mutual friend

Chris Berry
1 mutual friend

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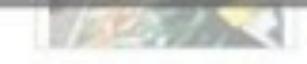
[Save Settings](#)

[Skip For Now](#)

[Customize Settings](#)

July 25th

posted by Babak Iran



BEAR ATTACK
by Evan Priestley
+50

Help your friends find you on Facebook.

We've simplified the privacy settings. Now you can make it easier for friends to connect with you by making a few fields visible to everyone on the internet. Please take a moment to review our recommended settings:

Profile Info, Wall and Status Updates

 Everyone ▾

Photos and Videos

 My Friends and Their Friends ▾

Private Info and Contact Info

 Only My Friends ▾

Your custom settings will be preserved for:

- Videos tagged of you, Interests, and Email addresses

Save Settings

or for more information, view your Privacy Settings

[11 Comments](#)[Print](#)[Retweet](#)[Email this article](#)[Like](#)

416

By Nick Heath, 1 November 2010 16:15

NEWS Online travel firm Expedia has found that data analytics can deliver a multi-million dollar kick to a company's bottom line.

The company used SAS analytics to identify a single change to a web page that generated an overnight surge in sales, Expedia's VP of global analytics and optimisation Joe Megibow told the SAS Premier Business Leadership Series conference in Las Vegas last week.

Expedia analysts realised the site needed to be changed after investigating why many customers who clicked the 'Buy Now' button on the company's site did not complete the transaction.

"This is someone who was on our site, found the right location and hotel, put in all their billing and travel information and clicked the 'Buy Now' button," Megibow said.

"As far as leading indicators of purchase intent go, this is as good as it gets and yet we weren't taking the money."

Analysts began examining and correlating information about these failed transactions to identify what traits they had in common.

The answer, it turns out, was quite simple: "We had an optional field on the site under 'Name', which was 'Company'," Megibow said.

"It confused some customers who filled out the 'Company' field with their bank name."

FACEBOOK

silicon.com is on
Facebook

A blue rectangular button with the word "facebook" in white lowercase letters.

For all the latest stories and
updates from Silicon
Towers...
['Like' us on Facebook](#)

Typography Experiment Color Contrast on MSN Live Search

This screenshot shows the Windows Internet Explorer browser displaying search results for "typography trends" on MSN Live Search. The interface has a light blue and white color scheme. The results page includes a header with "Live Search" and a search bar containing "typography trends". Below the header are links to various websites such as EnterpriseNetworkingPlanet, networking.webopedia.com, Adobe, Encyclopaedia Britannica, Google Groups, and Capella University. A sponsored site for "Trendy New Fleur De Lis" is also visible.

A: Softer colors

This screenshot shows the same search results for "typography trends" but with a high-contrast color scheme. The background is dark, and the text is in bright colors like yellow, orange, and red. The layout is identical to the first screenshot, showing the same search bar, header, and list of results. The sponsored site for "Trendy New Fleur De Lis" is also present.

A: Softer colors

B: High contrast

B: Queries/User up 0.9%
Ad clicks/user up 3.1%

Run Experiments at 50/50%

- Novice experimenters run 1% experiments
- To detect an effect, you need to expose a certain number of users to the treatment (based on power calculations)
- Fastest way to achieve that exposure is to run equal-probability variants (e.g., 50/50% for A/B)
- But don't start an experiment at 50/50% from the beginning: that's too much risk.
Ramp-up over a short period

Ramp-up and Auto-Abort

- **Ramp-up**
 - Start an experiment at 0.1%
 - Do some simple analyses to make sure no egregious problems can be detected
 - Ramp-up to a larger percentage, and repeat until 50%
- **Big differences are easy to detect because the min sample size is quadratic in the effect we want to detect**
 - Detecting 10% difference requires a small sample and serious problems can be detected during ramp-up
 - Detecting 0.1% requires a population $100^2 = 10,000$ times bigger
- **Automatically abort the experiment if treatment is significantly worse on OEC or other key metrics (e.g., time to generate page)**



MSN US Home Page

Proposal: New Offers module below Shopping

Shopping

- Lancôme: Free deluxe compact w/ purchase
- Special promotions at your favorite stores
- Warm fall fashion styles are here
- Save on top brand digital cameras
- Free shipping on furniture for every room

Advertisements



A smart way to buy a diamond

- Wal-Mart: Back-to-school
- Our editor picks budget electronics
- Get fit & save money: Sports sale

Control

Shopping

- Lancôme: Free deluxe compact w/ purchase
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Advertisements



A smart way to buy a diamond

- Wal-Mart: Back-to-school
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Offers



Search GM Certified
With our 117-Point Inspection
GM Certified means no worries



Online University
Earn degree from a top school
100% Online. Get Free Info!



\$200k Loan, Get Low Rates
Secure Financing and Increase
Cash Flow. Click Here Now!

Treatment

EXP

MSN US Home Page Experiment

- **Offers module eval**
 - Pro: significant ad revenue
 - Con: do more ads degrade the user experience?
 - How do we trade the two off?
- **In August, we ran an A/B test for 12 days on 5% of the MSN US home page visitors**

Experiment Results

- Clickthrough rate (CTR) decreased 0.49% (p-value <0.0001)
Small change, but highly significant
- Page views per user-day decreased 0.35% (p-value<0.0001)
- Value of click from home page: X cents
Net = Expected Revenue –
 direct lost clicks –
 lost clicks due to decreased page views

Net was negative (in the millions of dollars), so the offers module did not launch

The OEC

- **OEC = Overall Evaluation Criterion**

- Agree early on what you are optimizing
- Experiments with clear objectives are the most useful
- Suggestion: optimize for customer lifetime value, not immediate short-term revenue
- Criterion could be weighted sum of factors, such as
 - Time on site (per time period, say week or month)
 - Visit frequency
- Report many other metrics for diagnostics, i.e., to understand the why the OEC changed and raise new hypotheses

The Cultural Challenge

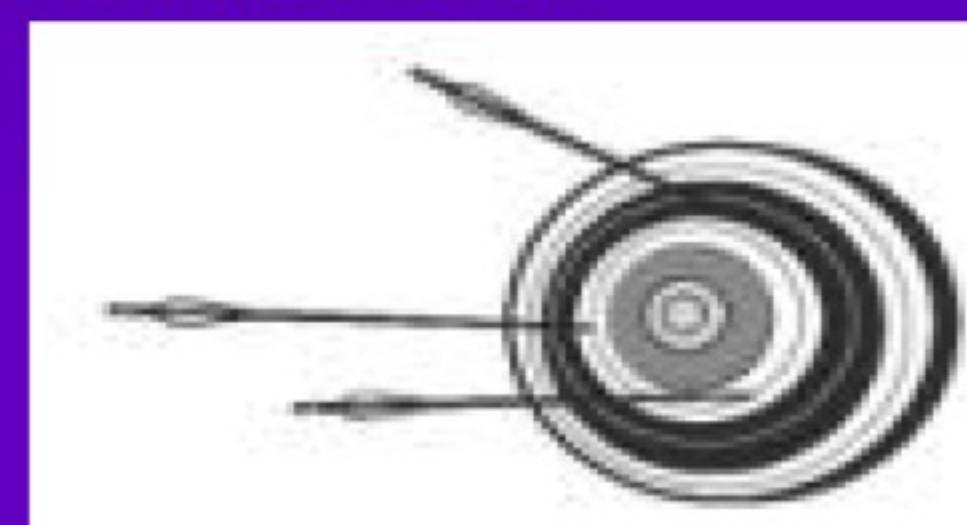
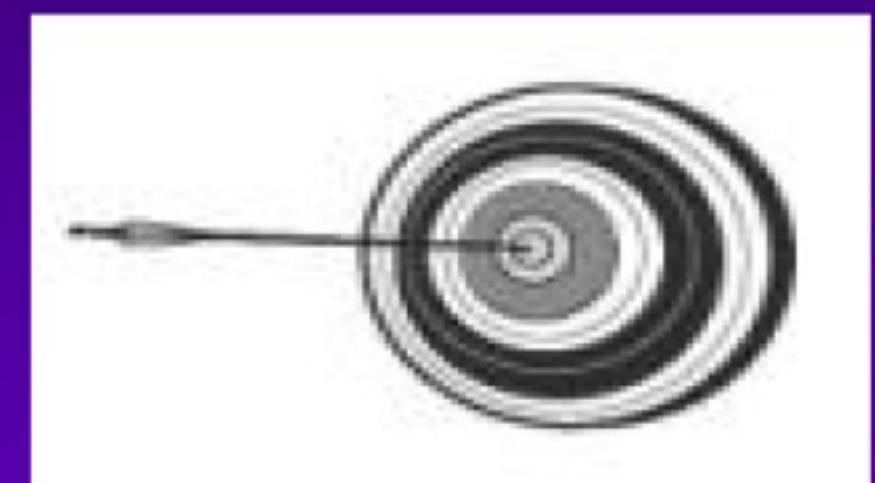
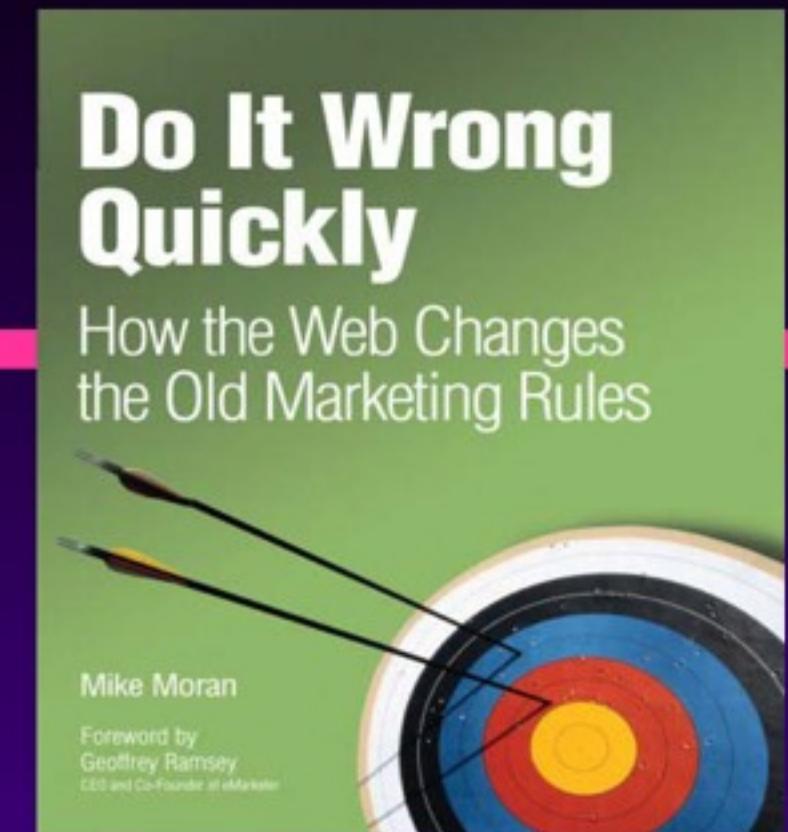
*It is difficult to get a man to understand something
when his salary depends upon his not understanding it.*
-- Upton Sinclair

- **Why people/orgs avoid controlled experiments**

- Some believe it threatens their job as decision makers
- At Microsoft, program managers select the next set of features to develop. Proposing several alternatives and admitting you don't know which is best is hard
- Editors and designers get paid to select a great design
- Failures of ideas may hurt image and professional standing.
It's easier to declare success when the feature launches
- We've heard: "we know what to do. It's in our DNA," and
"why don't we just do the right thing?"

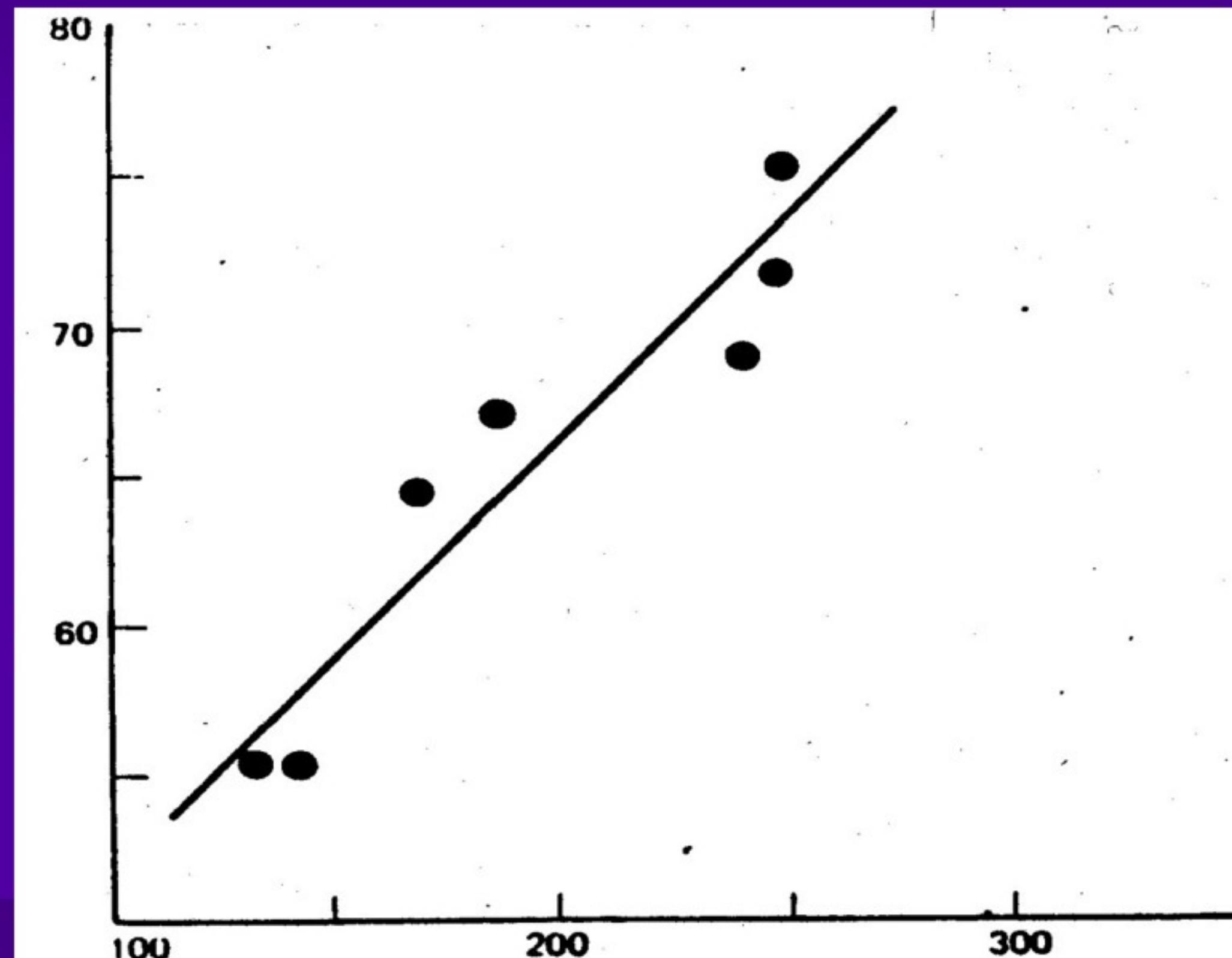
Do It Wrong Quickly

- We work on “the plan,” which is reviewed and approved by execs, then we execute flawlessly (or do we?)
- We’re looking to hit the arrow in the center—the bulls-eye
- But what if we the game is to score the most points, i.e., the sum of arrow scores.
- Shooting three arrows may be much more effective



Typical Discovery

- With data mining, we find patterns, but most are correlational
- Here is one a real example of two highly correlated variables



Correlations are not Necessarily Causal

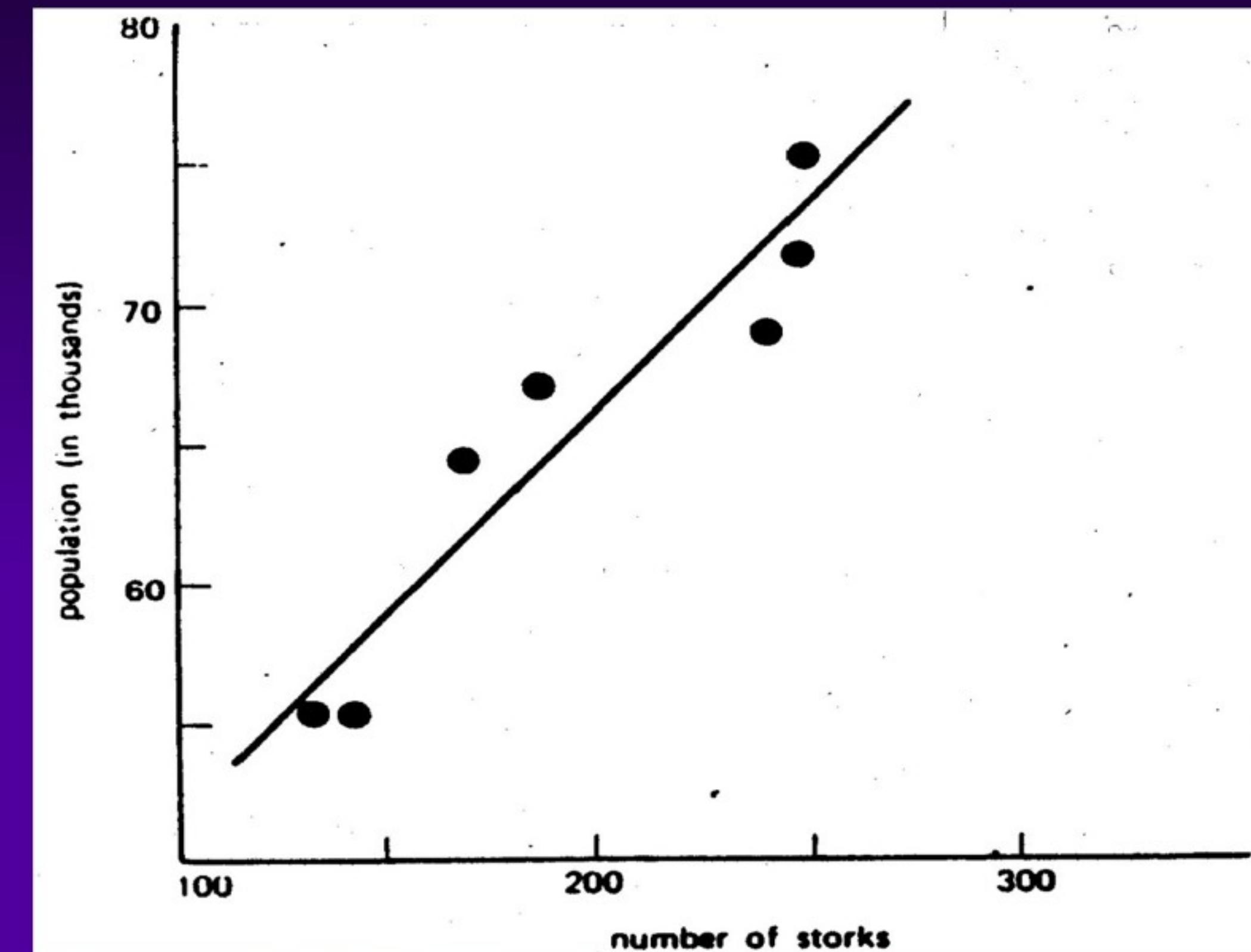
- City of Oldenburg, Germany
- X-axis: stork population
- Y-axis: human population

What your mother told you about babies when you were three is still not right, despite the strong correlational “evidence”

- Example 2:
True statement (but not well known):
Palm size correlates with your life expectancy

The larger your palm, the less you will live, on average.

Try it out - look at your neighbors and you'll see who is expected to live longer.



Why?

Women have smaller palms and live 6 years longer on average

Simpson's Paradox

- Lack of awareness can lead to mistaken conclusions about causality
- Unlike esoteric brain teasers, it happens in real life. My team at Blue Martini spent days debugging our software once, but it was fine
- In the next few slides I'll share examples that seem “impossible”
- We'll then explain why they are possible and do happen
- Discuss implications/warning

Exampes 1: Drug Treatment

- **Real-life example for kidney stone treatments**
- **Overall success rates:**
 - Treatment A succeeded 78%, Treatment B succeeded 83% (better)
- **Further analysis splits the population by stone size**
 - For small stones
 - Treatment A succeeded 93% (better), Treatment B succeeded 87%
 - For large stones
 - Treatment A succeeded 73% (better), Treatment B succeeded 69%
 - Hence treatment A is better in both cases, yet was worse in total
- **People going into treatment have either small stones or large stones**
- **A similar real-life example happened when the two populations segments were cities (A was better in each city, but worse overall)**

Not Really a Paradox, Yet Non-Intuitive

- If $a/b < A/B$ and $c/d < C/D$, it's possible that $(a+c)/(b+d) > (A+C)/(B+D)$
- We are essentially dealing with weighted averages when we combine segments

Issues with Controlled Experiments (1 of 2)

If you don't know where you are going, any road will take you there

—Lewis Carroll

- **Org has to agree on OEC (Overall Evaluation Criterion).**
This is hard, but it provides a clear direction and alignment
- **Quantitative metrics, not always explanations of “why”**
 - A treatment may lose because page-load time is slower.
Example: Google surveys indicated users want more results per page.
They increased it to 30 and traffic dropped by 20%.
Reason: page generation time went up from 0.4 to 0.9 seconds
 - A treatment may have JavaScript that fails on certain browsers, causing users to abandon.

Issues with Controlled Experiments (2 of 2)

- **Primacy effect**

- Changing navigation in a website may degrade the customer experience (temporarily), even if the new navigation is better
- Evaluation may need to focus on new users, or run for a long period

- **Multiple experiments**

- Even though the methodology shields an experiment from other changes, statistical variance increases making it harder to get significant results. There can also be strong interactions (rarer than most people think)

- **Consistency/contamination**

- On the web, assignment is usually cookie-based, but people may use multiple computers, erase cookies, etc. Typically a small issue

- **Launch events / media announcements sometimes preclude controlled experiments**

- The journalists need to be shown the “new” version

Beware of Twyman's Law

*Any statistic that appears interesting
is almost certainly a mistake*

- **Validate “amazing” discoveries in different ways.
They are usually the result of a business process**
 - 5% of customers were born on the exact same day (including year)
 - 11/11/11 is the easiest way to satisfy the mandatory birth date field
- **For US Web sites, there will be a small sales decrease
March 9th, 2008**
 - Due to Daylight Saving Time starting, clocks at 2AM are moved to 3AM, there is one less hour in the day

Three Rules for Random Assignment

- Consistent Assignment
- Durable across ramp-up
- Independent Assignment

Statistical analysis

- Explore your data!
- Compute aggregate statistics for each condition
 - Usually mean and standard deviation
- Compute significance (p value)
 - Likelihood that results are due to chance variation
 - $p = 0.05$ usually considered significant

Statistical tests

- T-tests (compare 2 conditions)
- ANOVA (compare >2 conditions)
- Correlation and regression
- Many others



**There's nothing
like a
GUINNESS**

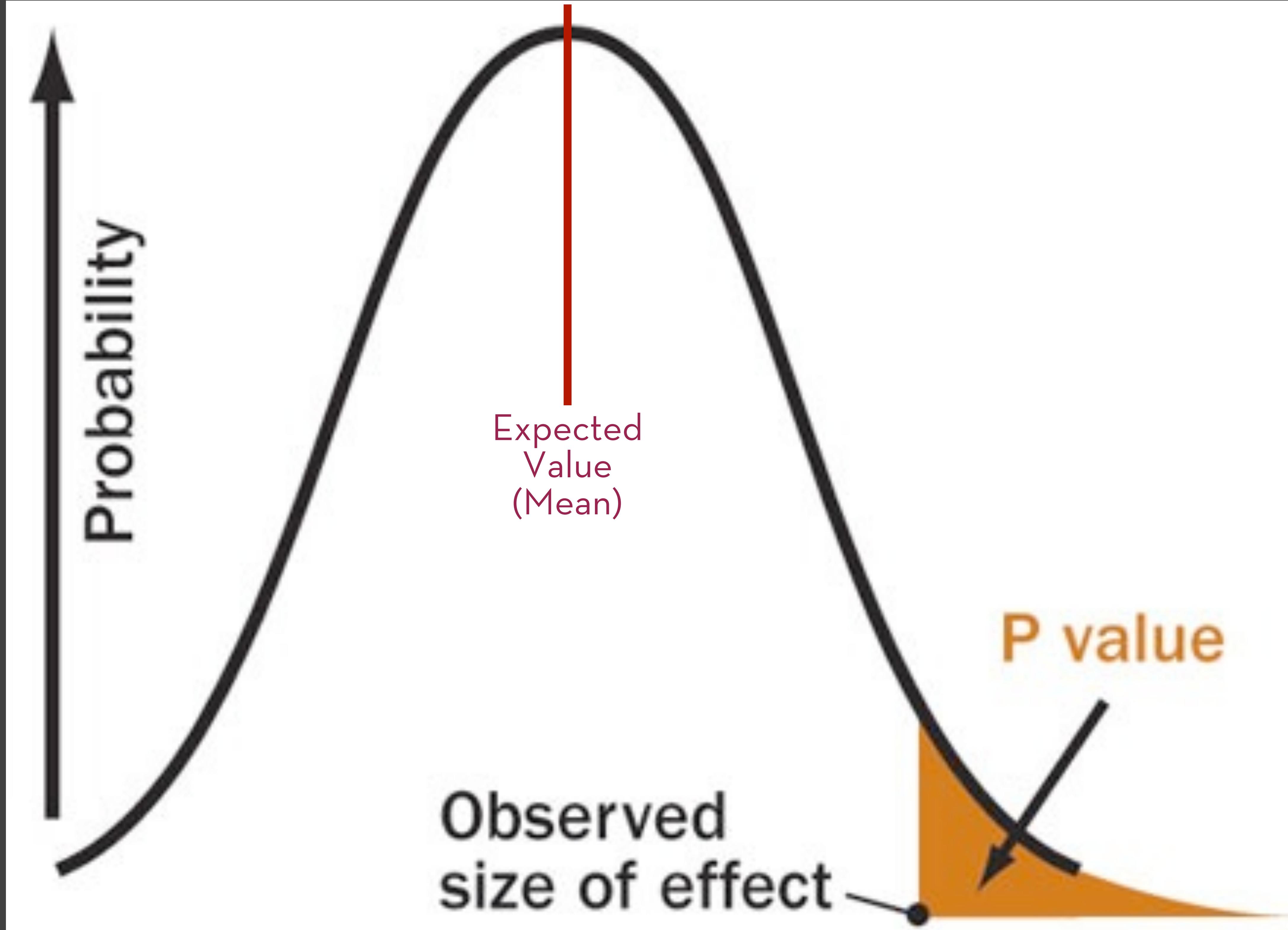
Comparing Rates

Say I have a coin

The Null Hypothesis

What attributes does our statistic need?

Chi-Squared = Sum(observed-expected)² / expected



Critical Values for Chi-Squared

df\area	0.995	0.99	0.975	0.95	0.9	0.75	0.5	0.25	0.1	0.05	0.025	0.01	0.005
1	4E-05	0.0002	0.001	0.004	0.02	0.10	0.45	1.32	2.71	3.84	5.02	6.63	7.88
2	0.01	0.02	0.05	0.10	0.21	0.58	1.39	2.77	4.61	5.99	7.38	9.21	10.60
3	0.07	0.11	0.22	0.35	0.58	1.21	2.37	4.11	6.25	7.81	9.35	11.34	12.84
4	0.21	0.30	0.48	0.71	1.06	1.92	3.36	5.39	7.78	9.49	11.14	13.28	14.86
5	0.41	0.55	0.83	1.15	1.61	2.67	4.35	6.63	9.24	11.07	12.83	15.09	16.75

Example: Is this a balanced coin?

- 20 tosses. 13 heads. At $p < 0.05$, can we reject the null hypothesis that there is no difference between heads & tails?

Example: Is this a balanced coin?

- $(13-10)^2/10 + (7-10)^2/10 = 1.8$
- $df=1$ (the coin has two sides; $df = \# \text{ of choices} - 1$)
- Looking at the table, that puts us at $p \sim .18$
- So no, we can't reject the null hypothesis

df\area	0.995	0.99	0.975	0.95	0.9	0.75	0.5	0.25	0.1	0.05	0.025	0.01	0.005
1	4E-05	0.0002	0.001	0.004	0.02	0.10	0.45	1.32	2.71	3.84	5.02	6.63	7.88
2	0.01	0.02	0.05	0.10	0.21	0.58	1.39	2.77	4.61	5.99	7.38	9.21	10.60
3	0.07	0.11	0.22	0.35	0.58	1.21	2.37	4.11	6.25	7.81	9.35	11.34	12.84
4	0.21	0.30	0.48	0.71	1.06	1.92	3.36	5.39	7.78	9.49	11.14	13.28	14.86
5	0.41	0.55	0.83	1.15	1.61	2.67	4.35	6.63	9.24	11.07	12.83	15.09	16.75

What if the trend continued?

- Say we tossed a coin 60 times, and saw the same pattern: 39 heads out of 60
- $(39-30)^2 / 30 + (21-30)^2 / 30 = 5.4$
- Now the odds that the coin is even are $p \sim .02$
- We can reject the null hypothesis with 98% confidence
- Note (if the trend is robust) increasing sample size by a factor of **3** decreases the probability of a false positive by a factor of **9**

df\area	0.995	0.99	0.975	0.95	0.9	0.75	0.5	0.25	0.1	0.05	0.025	0.01	0.005
1	4E-05	0.0002	0.001	0.004	0.02	0.10	0.45	1.32	2.71	3.84	5.02	6.63	7.88
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Example: Improved click-throughs?

- A web site has a button labeled “sign up”. 10% of visitors click the button.
- To try and improve traffic, they change the button to “learn more”, and start gathering data.
- Over a week, there were 1000 visitors to the site. 118 clicked the “learn more” button.
- Can we say with confidence that the “learn more” button has a higher click-through rate than the “sign up” button?

Example: Improved click-throughs?

- $\sqrt{(118-100)^2 / 100 + (882-900)^2 / 900} = \sqrt{3.64 + 0.40} = 4.04$
- df=1
- The odds that the observed difference happened by chance is (just barely) $p < 0.05$
- It's very likely the change improved click rate

df\area	0.995	0.99	0.975	0.95	0.9	0.75	0.5	0.25	0.1	0.05	0.025	0.01	0.005
1	4E-05	0.0002	0.001	0.004	0.02	0.10	0.45	1.32	2.71	3.84	5.02	6.63	7.88
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5	0.41	0.55	0.83	1.15	1.61	2.67	4.35	6.63	9.24	11.07	12.83	15.09	16.75

Data Often Ain't Gaussian

Handling non-Gaussian Data

- Knowing is half the battle
- Run A/A tests
- Use randomized testing (not covered in cs147, but very cool)

Mapping between Grades and Points

- A+ 1475 pts
- A 1425 pts
- A- 1375 pts
- B+ 1325 pts
- B 1275 pts

A+ 1475 pts

A 1425 pts

A- 1375 pts

B+ 1325 pts

B 1275 pts