



From Data Mining to Data Strategy -- towards the New Sciences Underlying the Internet

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What is Data Mining?

Finding *interesting structure* in data

- *Structure*: refers to statistical patterns, predictive models, hidden relationships
- *Interesting*: ?

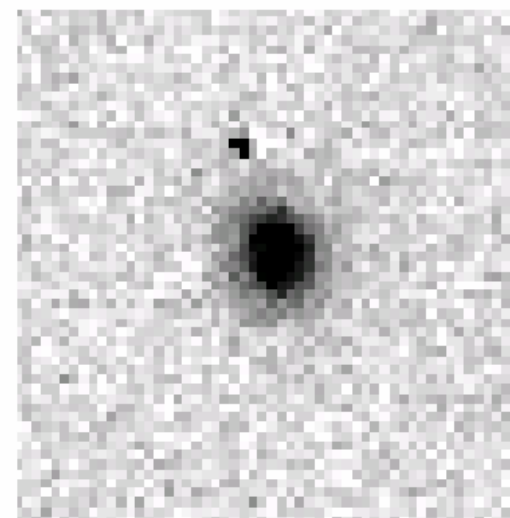
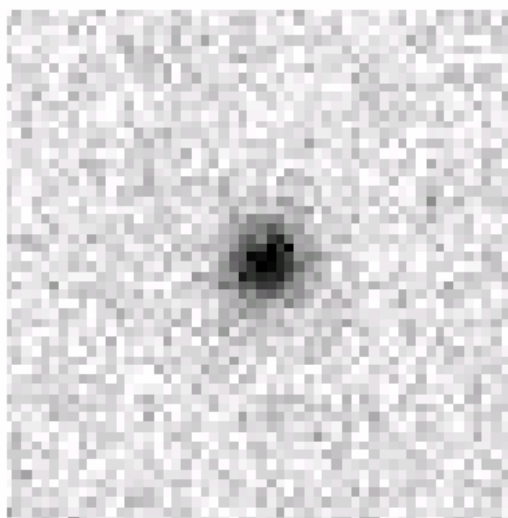
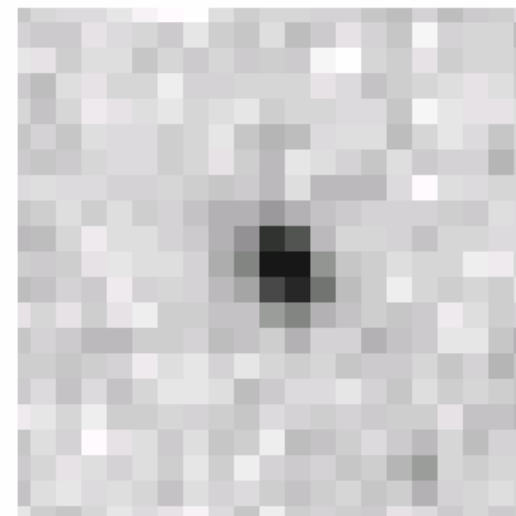
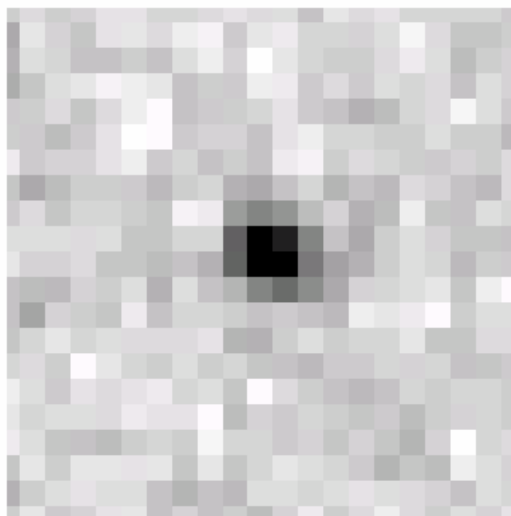
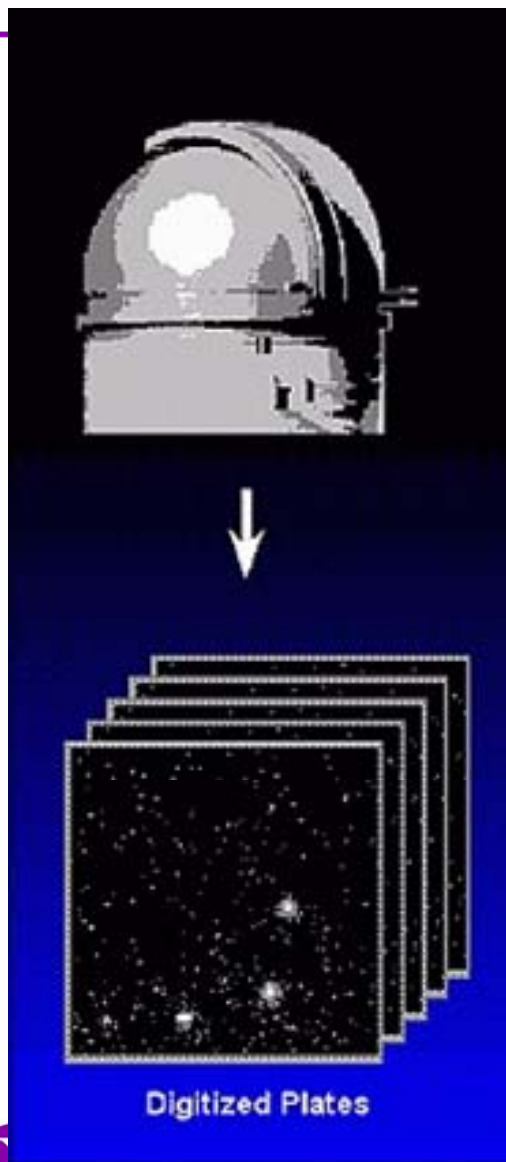
- Examples of tasks addressed by Data Mining
 - Predictive Modeling (classification, regression)
 - Segmentation (Data Clustering)
 - Affinity (Summarization)
 - relations between fields, associations, visualization



Beyond Data Analysis

- **Scaling analysis to large databases**
 - How to deal with data without having to move it out?
 - Are there abstract primitive accesses to the data, in database systems, that can provide mining algorithms with the information to drive the search for patterns?
 - How do we minimize--or sometimes even avoid--having to scan the large database in its entirety?
- **Automated search**
 - Enumerate and create numerous hypotheses
 - Fast search
 - Useful data reductions
- **More emphasis on understandable models**
 - Finding patterns and models that are “interesting” or “novel” to users.
- **Scaling to high-dimensional data and models.**

Y! Example: Cataloging Sky Objects

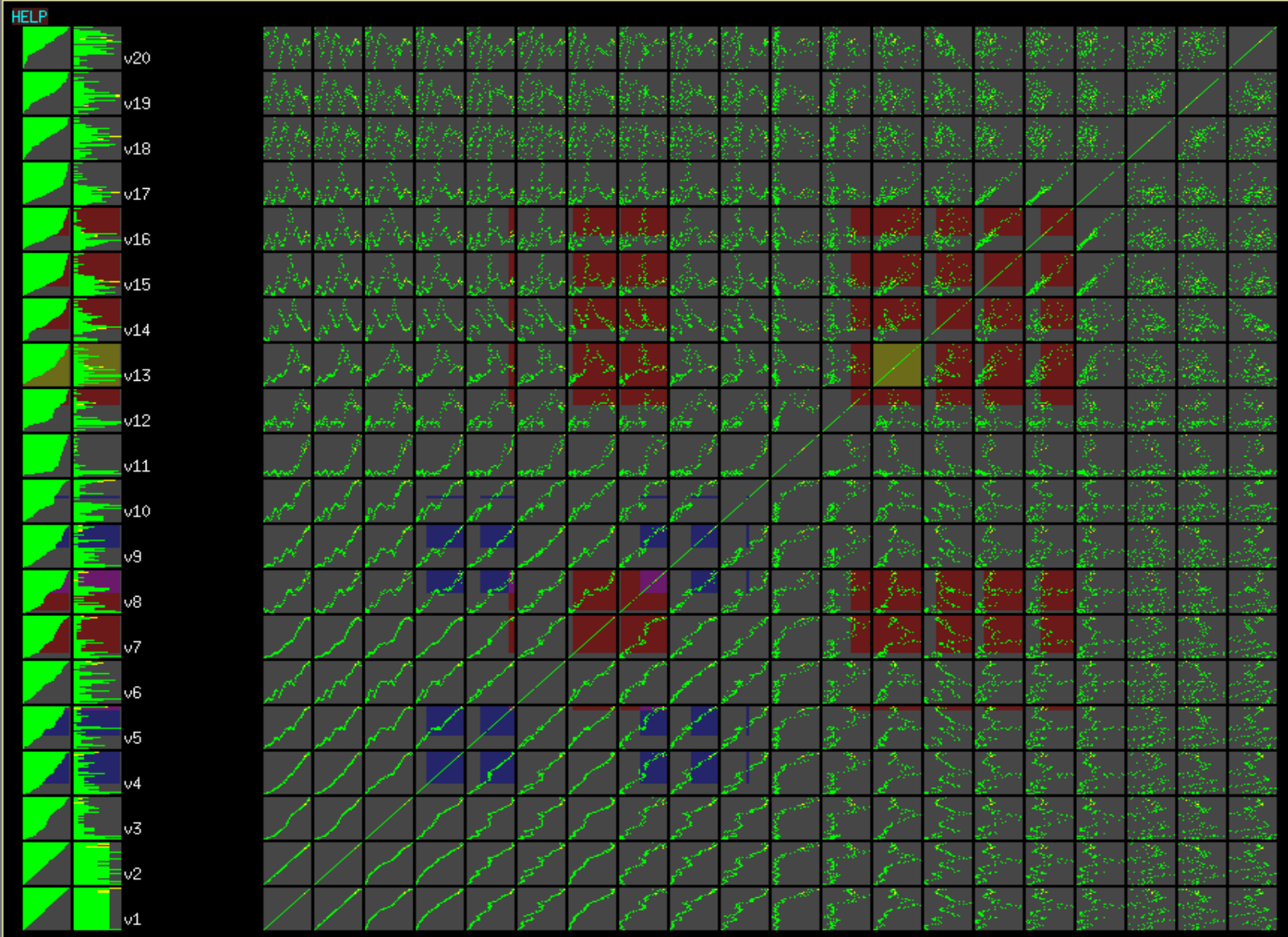




Data Mining Based Solution

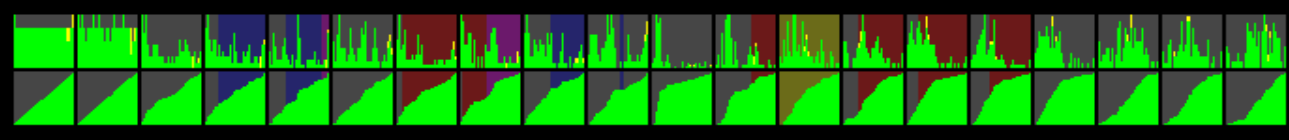
- Automated recognition of over 2 billion sky objects
- 94% accuracy in recognizing sky objects
- Classify objects that are at least one magnitude fainter than “state-of-art”.
- Tripled the “data yield”
- Generate sky catalogs with much richer content:
 - on order of billions of objects:
 - > 2×10^7 galaxies > 2×10^8 stars, 10^5 quasars
- Discovered new quasars 40 times more efficiently

So why did it work???



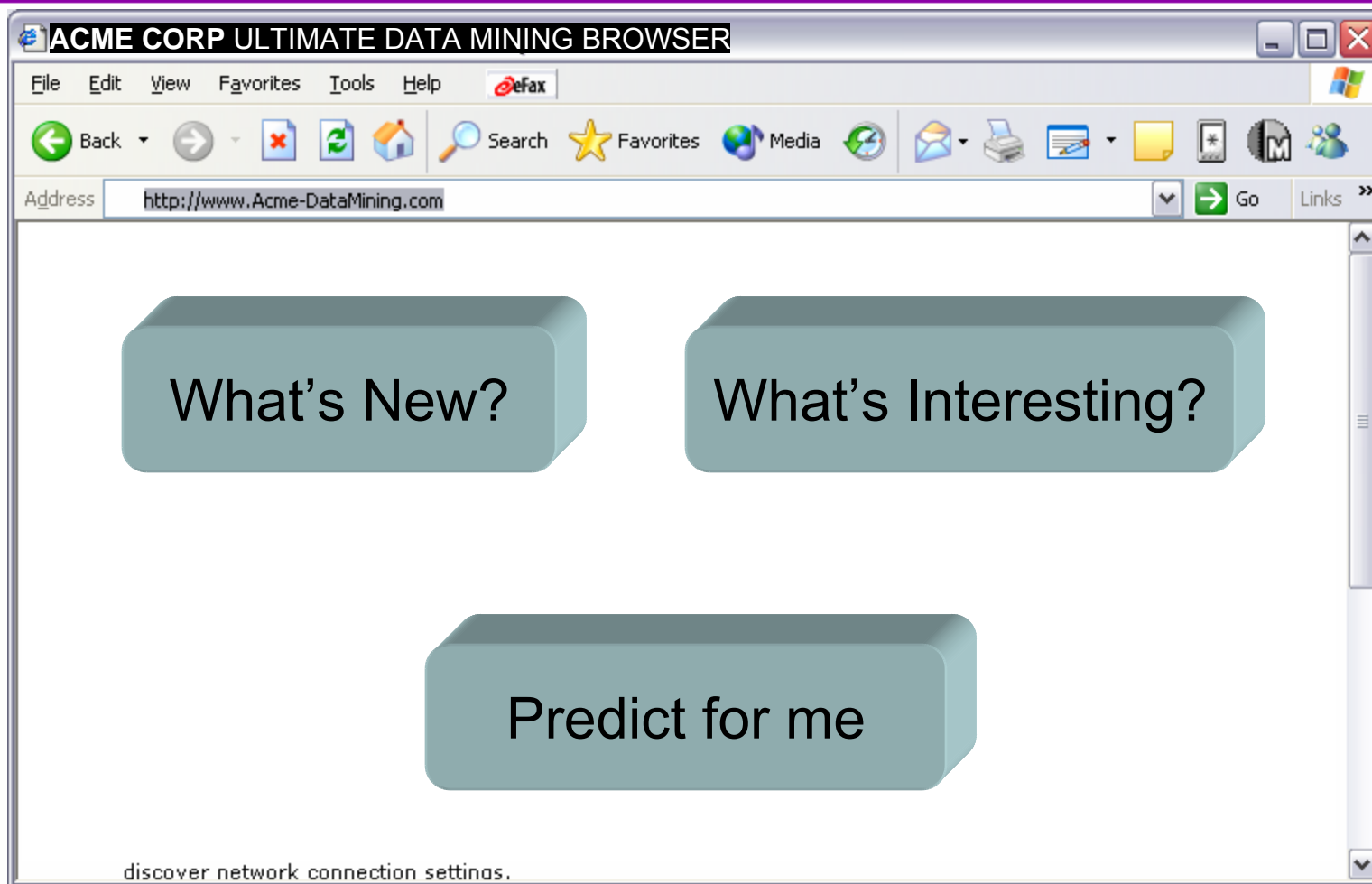
20 variables
98 cases

AND v1 v2 v3 v4 v5 v6 v7 v8 v9 v10 v11 v12 v13 v14 v15 v16 v17 v18 v19 v20





Data Mining Grand Vision



The myths...

- Companies have built up some large and impressive data warehouses
- Data mining is pervasive nowadays
- Large corporations know how to do it
- There are tools and applications that discover valuable information in enterprise databases

The truths...

- Data is a shambles,
 - most data mining efforts end up not benefiting from existing data infra-structure
- Corporations care a lot about data, and are obsessed with customer behavior and understanding it
- They talk a lot about it...
- An extremely small number of businesses are successfully mining data
- The successful efforts are “one-of”, “lucky strikes”



Grand Challenges

- Pragmatic:
 - Achieving integration and invisibility
- Research:
 - Solving some serious unaddressed problems



Summary of Grand Challenges



Challenges

0. *Public and challenging benchmark data sets*

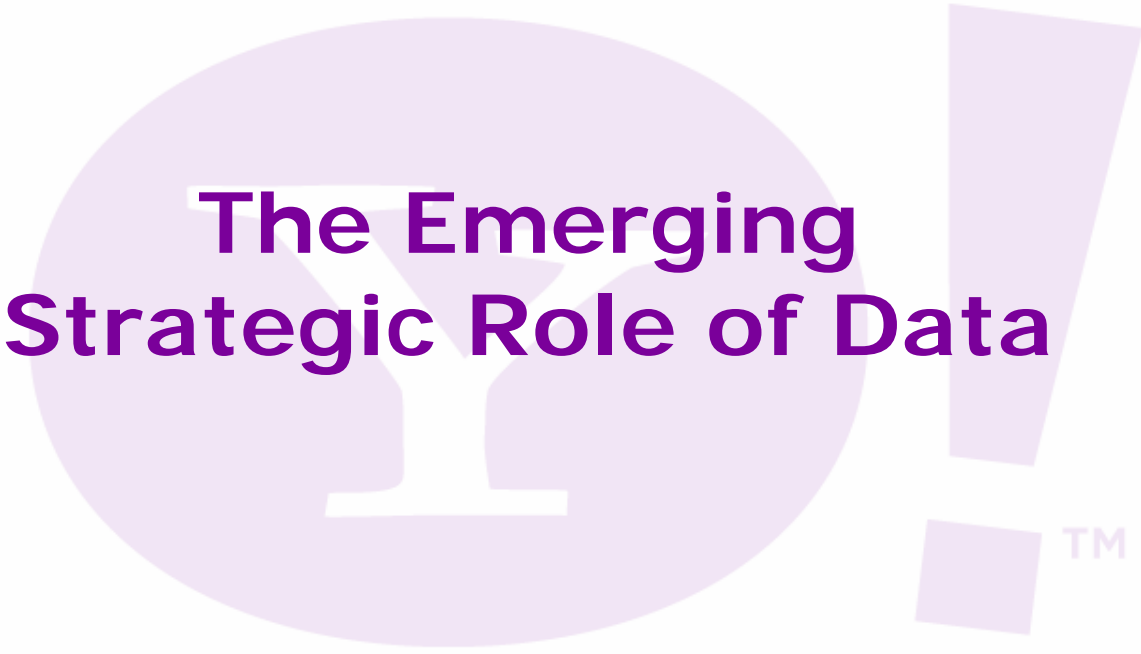
Pragmatic

1. Where's the Data?
2. *In Situ* mining
3. Domain knowledge
4. Life-cycle maintenance
5. Metrics

Technical

1. Understanding "large"
2. Simplicity knob
3. Interestingness
4. Scalability
5. Theory of what we do

A Scorecard for the field: *At least 2 advances in the next 10 years!!!*



The Emerging Strategic Role of Data



Data Strategy: beyond data mining

Shifting gears into what the problem really is:

- “Data” as a “mundane” notion
 - Many essential business functions generate “data”
 - To most businesses, this data is just a historic record
 - Book keeping
 - Documenting events
 - Little to no value in determining business strategy
 - Little to no value in driving revenue
 - Strategy is the realm of “business thinking”
- Academic and technical communities have not helped
 - viewed the problem as technical
 - Never bothered to address the gap in understanding
 - When they explained stuff, they explained techniques and capabilities, not major principles



What is new?

- Technology has enabled scalability of interactions
 - Computers have made it easy to deal with an order of magnitude larger customer base
- The Web has introduced massive scalability in business
 - Your customer base is no longer geographically limited
 - The interactions can happen 24 hours a day (no catch-up time)
 - Interactions are highly automated
 - The result, is another order of magnitude increase in number of interactions
- Bottom-line: businesses have crossed into an entirely new terrain without realizing it:
 - The scale of interactions is no longer easy to understand
 - The variety of interactions represent an unprecedented complexity
 - Data analysis is suddenly a critical tool

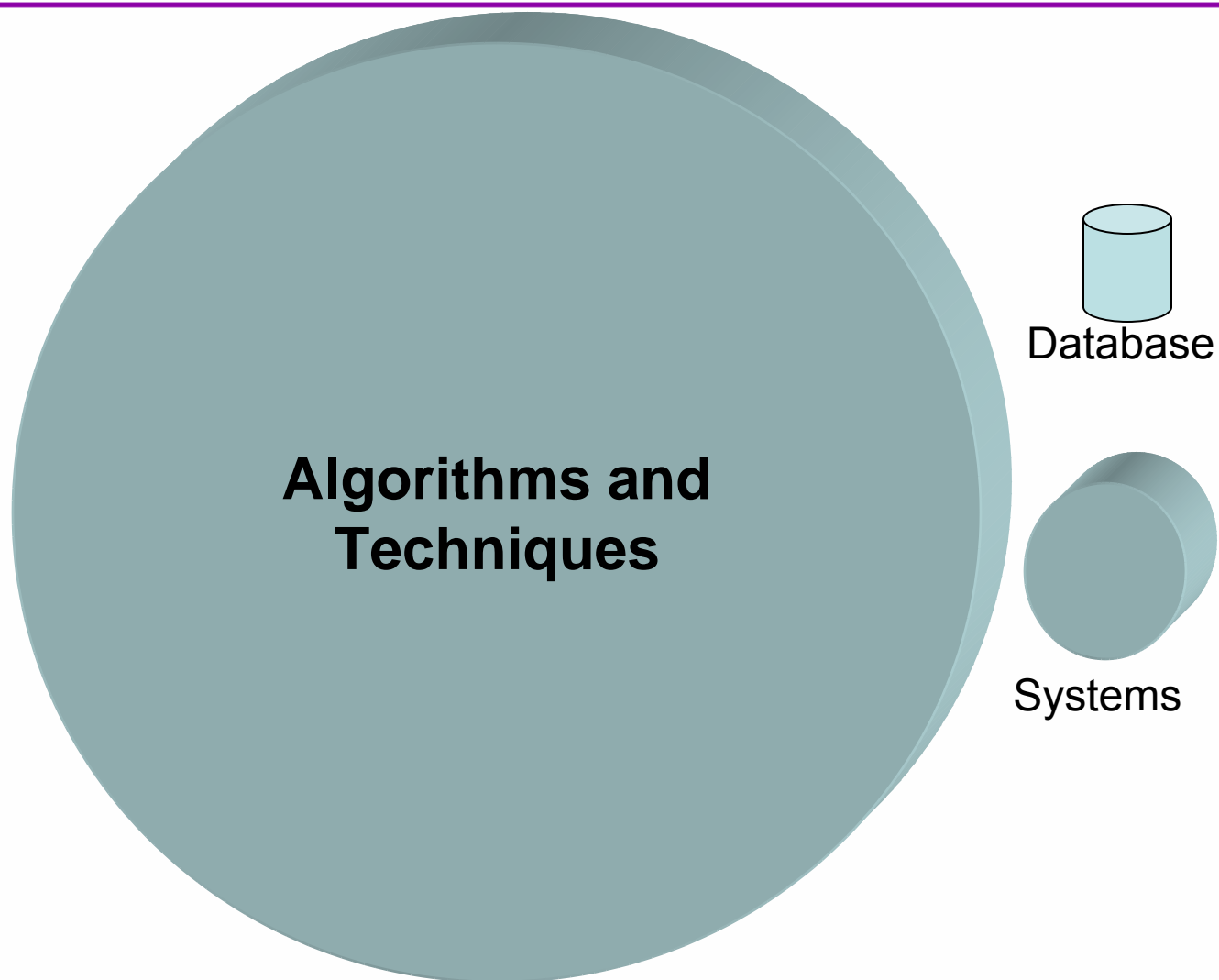


In the meantime, there is an understanding gap

- The technical community speaks of tech problems
- The business strategic thinking hit an “understandability wall”
- Traditionally, the thinking of business strategy never included data
- A new generation of business challenges are born

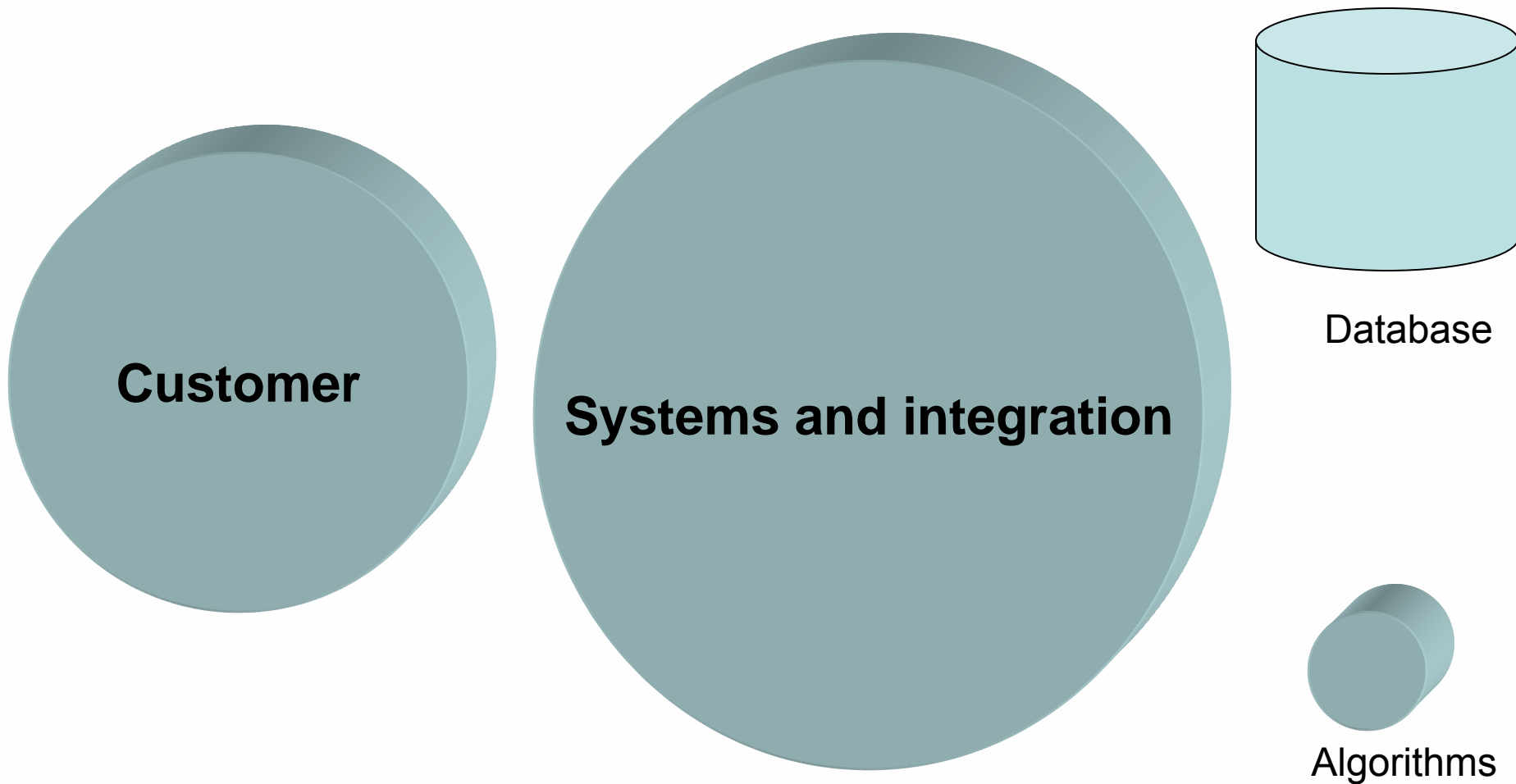


Researcher view



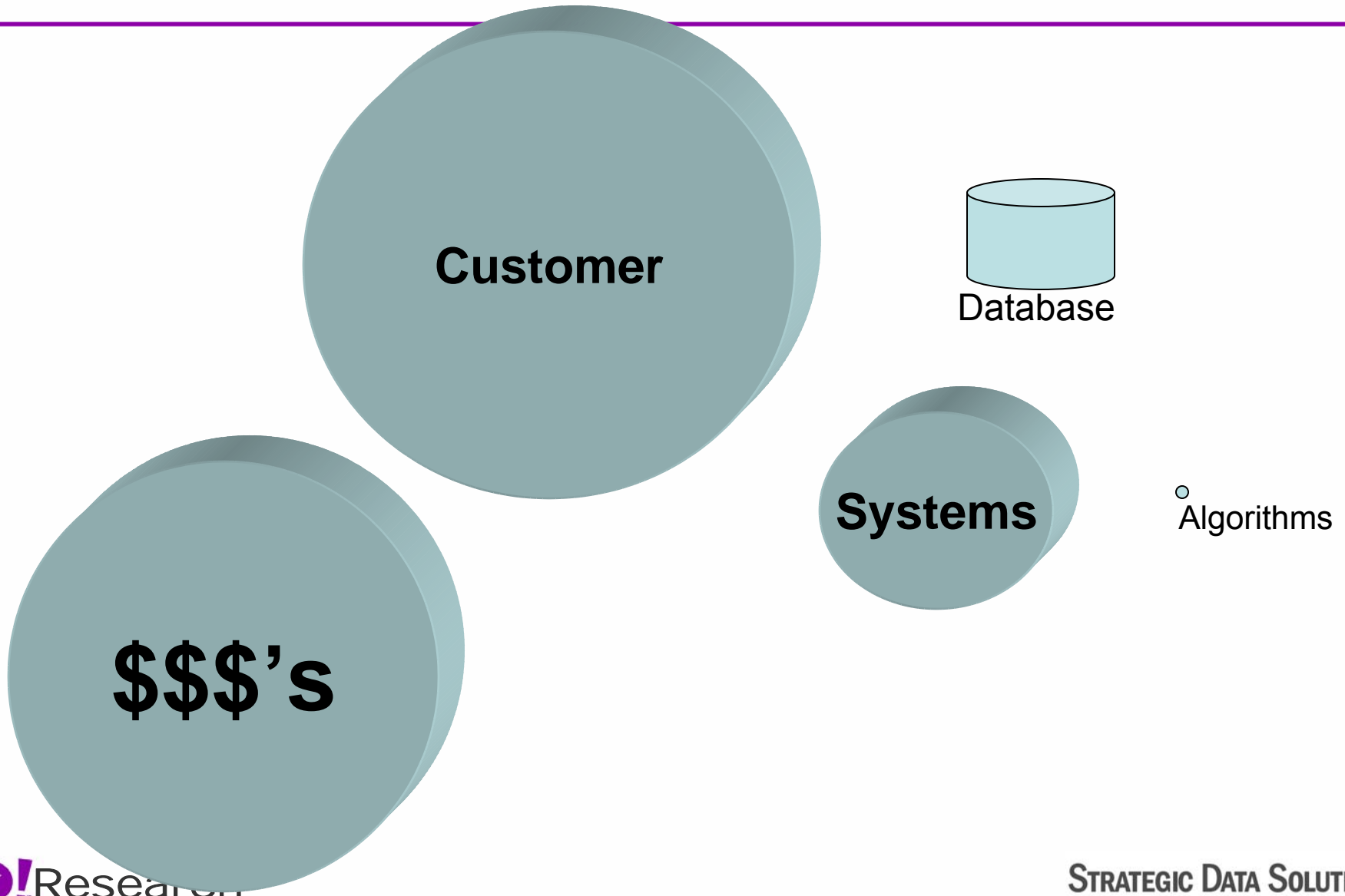


Practitioner view





Business view





What we mean by data strategy?

- Realizing that data is a critical component of understanding business
 - Much like it is critical to understand revenue sources and markets...
 - Much like it is critical to understand profit margin...
 - Data is one of the keys to unlocking the bottleneck generated by the inability of human intuition to scale to the interactions conducted by a modern business
- Defining the methodology and practice of
 - Understanding what data means to the business
 - How data can be exploited for the business?
 - How data can drive strategic decisions?
 - How data can drive revenues?



The Catch-22

- Because the business leaders do not understand what data means to the business
 - They are unlikely to invest in an “expensive” enterprise to try to exploit data
 - Which results in a lack of proper feedback to technical community and practitioners
 - Which perpetuates the continued lack of appreciation for data
- Resulting in a continued lack of development of methods for addressing the needs



Data Strategy

- Is the mapping of the capabilities enabled by data in driving the business
- The Integration of data-driven capabilities in revenue-driving activities
- The Integration of data-derived metrics to feedback into the measurement of the success of the business
- Evolving to an operational state where planning includes data, measurability, and data-driven feedback loops

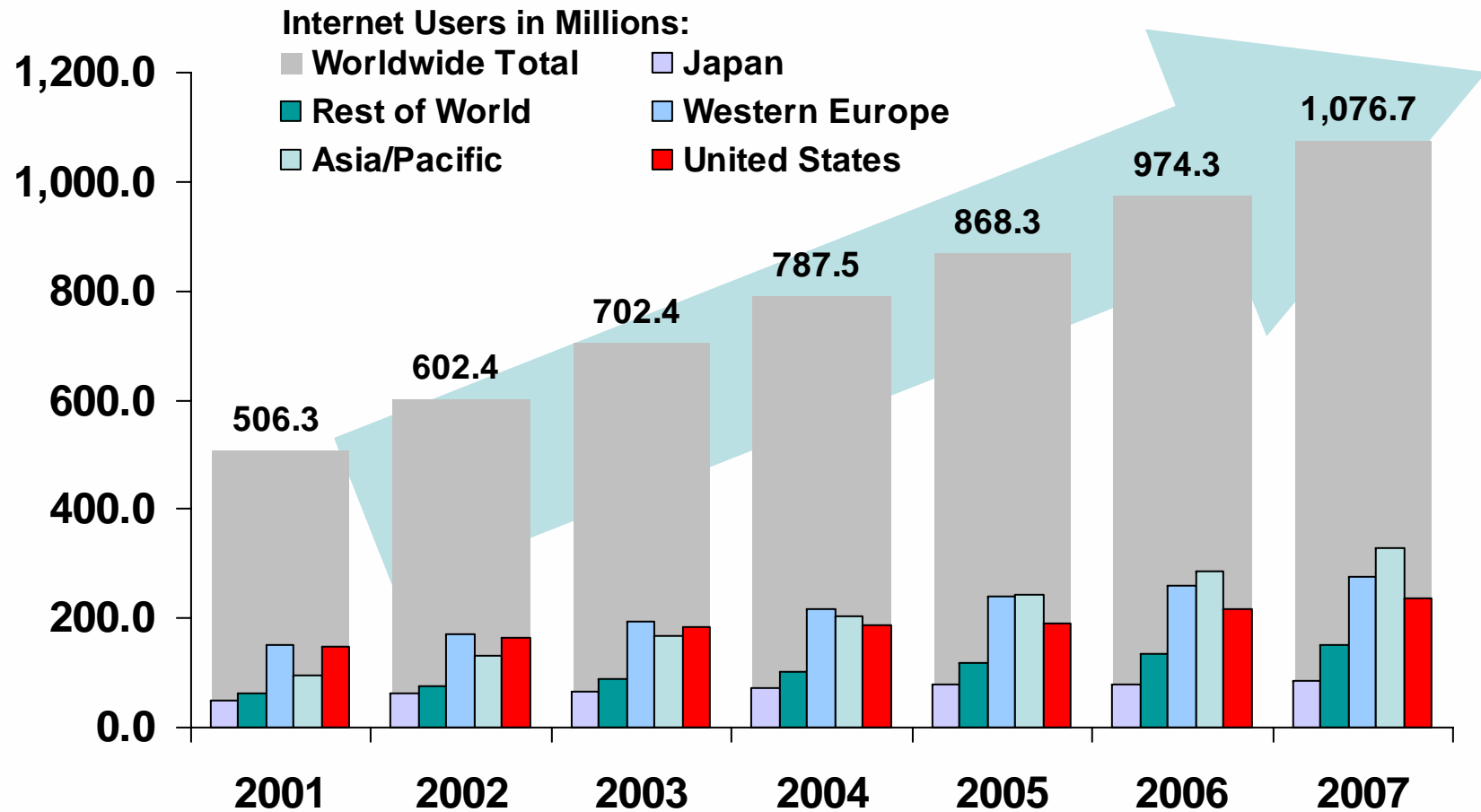
A large, faded watermark of the Yahoo! logo is centered on the slide. It consists of a purple oval containing a white 'Y' and a purple exclamation point to its right, with a 'TM' trademark symbol below the exclamation point.

Yahoo! Case Study

Evolving the Data Strategy

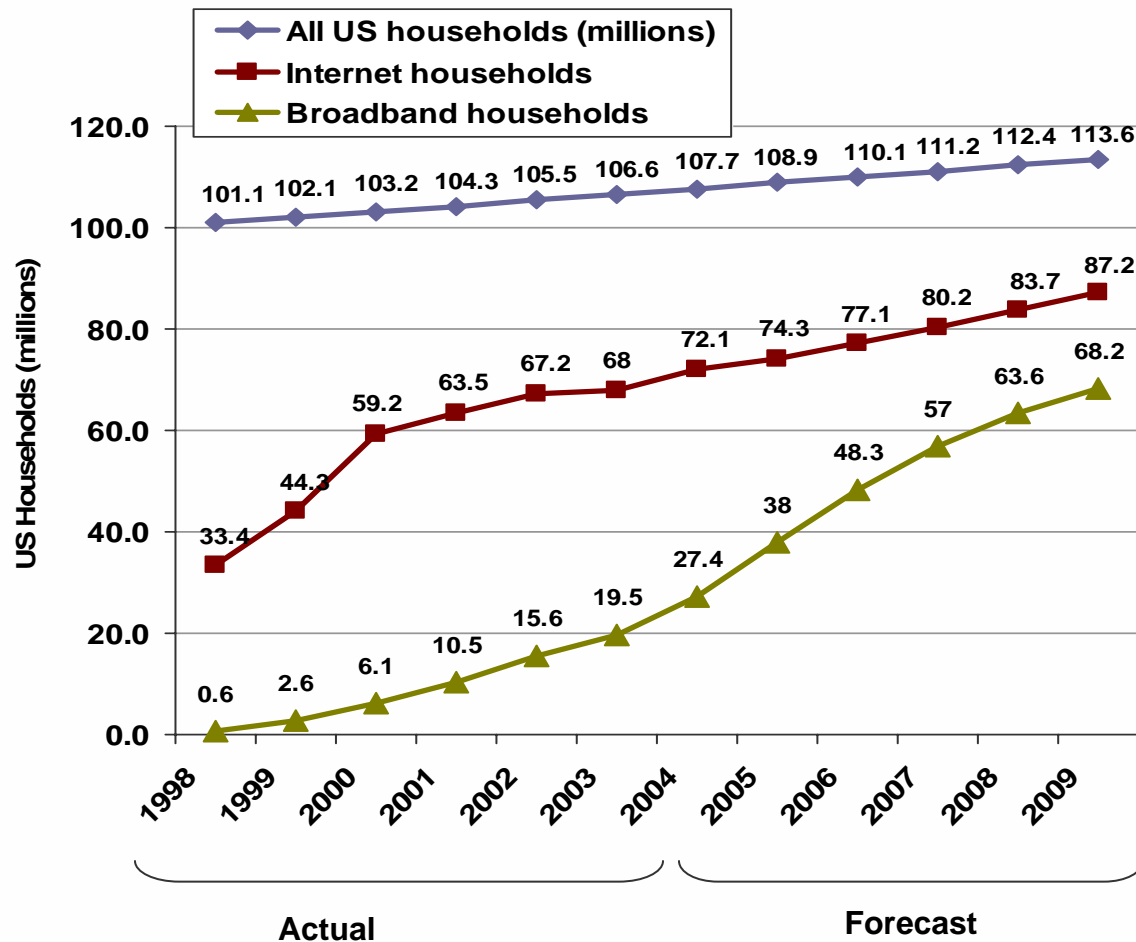


Globally, Internet Users Will Number Over 1 Billion by 2007





In the U.S, Broadband Hits 68% in '04, and Continues to Grow

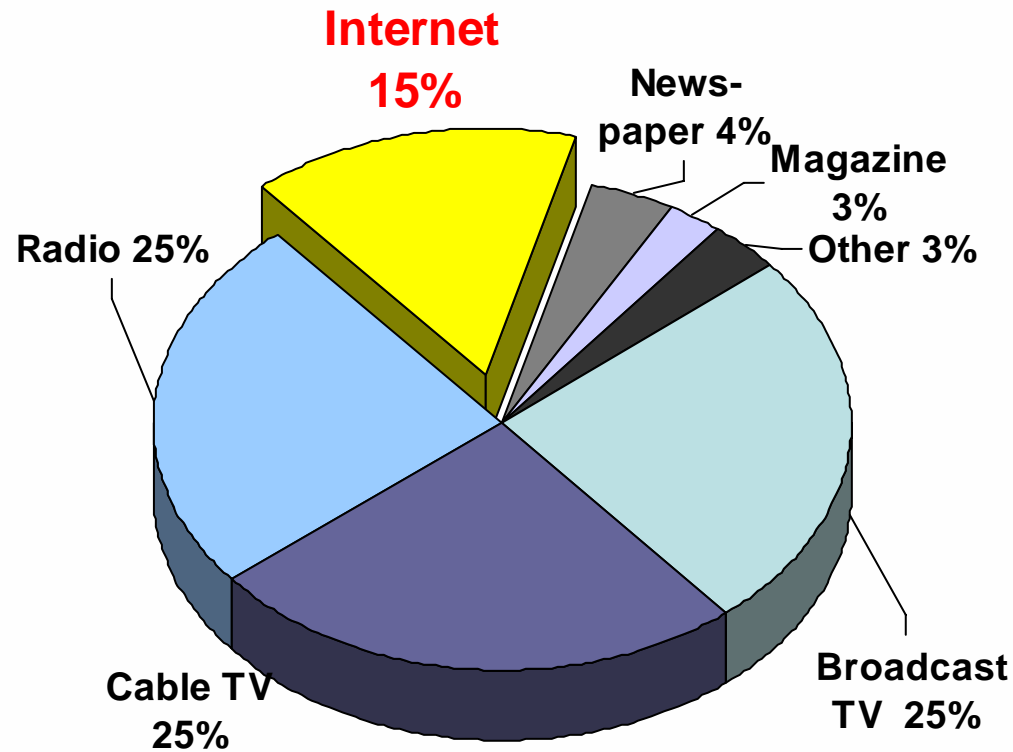


- In 1998, 33% of US households were online.
- At the beginning of 2004, 68% of US Households were online.
- By the end of 2009, 77% of US Households will be online.
- Broadband is expected to grow at a 20% CAGR between over the next 5 years.



Today, Internet Represents **15%** of Weekly Media Time Spent

U.S. adults age 12-64:

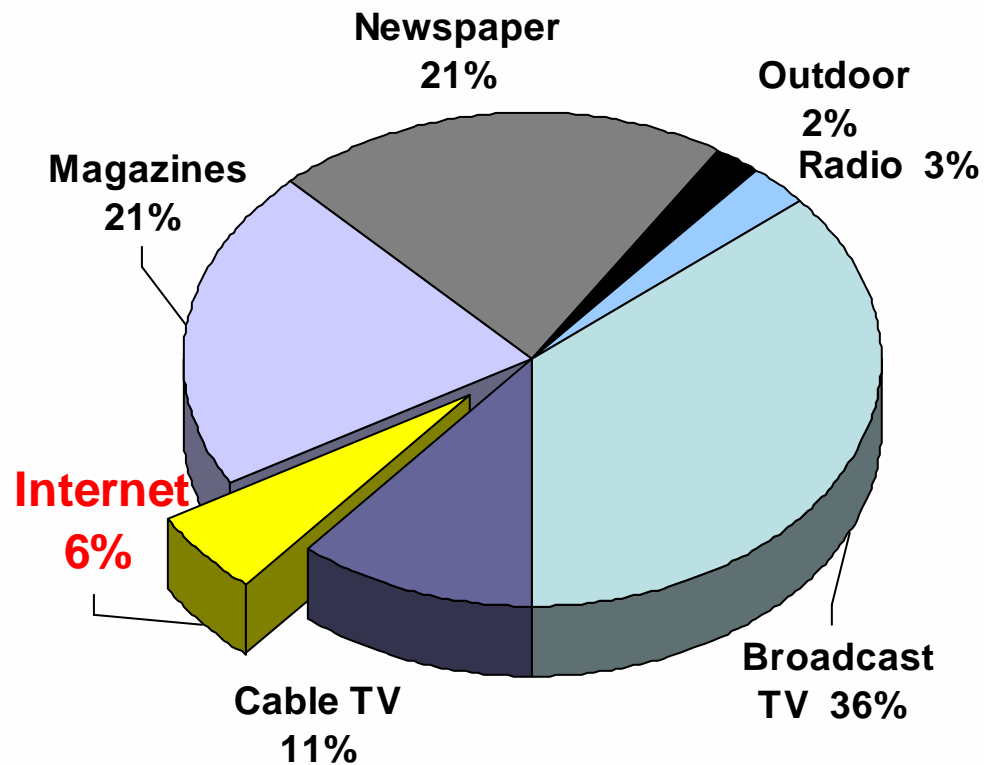


U.S. adults age 12-64 spend an average of 15% of their weekly media consuming hours on the Internet.

That's over 9 hours per week online!



Yet During 2004, The Majority of Ad Budgets Still Went to Print and TV



In the 1st half of 2004, companies spent nearly \$135 billion in brand advertising:

- 36% went to broadcast TV
- 11% went to cable TV
- 21% went to newspaper
- 21% went to magazine
- **6% went to Internet**

Slide 27

eb1

Insert any necessary script notes for this slide

eddieb, 8/04/2004



Yahoo! is the #1 Destination on the Web

YAHOO!

73% of the U.S. Internet population uses Yahoo!

– About 500 million users per month globally!

- Global network of content, commerce, media, search and access products
- 100+ properties including mail, TV, news, shopping, finance, autos, travel, games, movies, health, etc.
- 12 terabytes of data collected each day... and growing
 - Representing over 5,000 cataloged consumer behaviors

More people visited Yahoo! in the past month than:

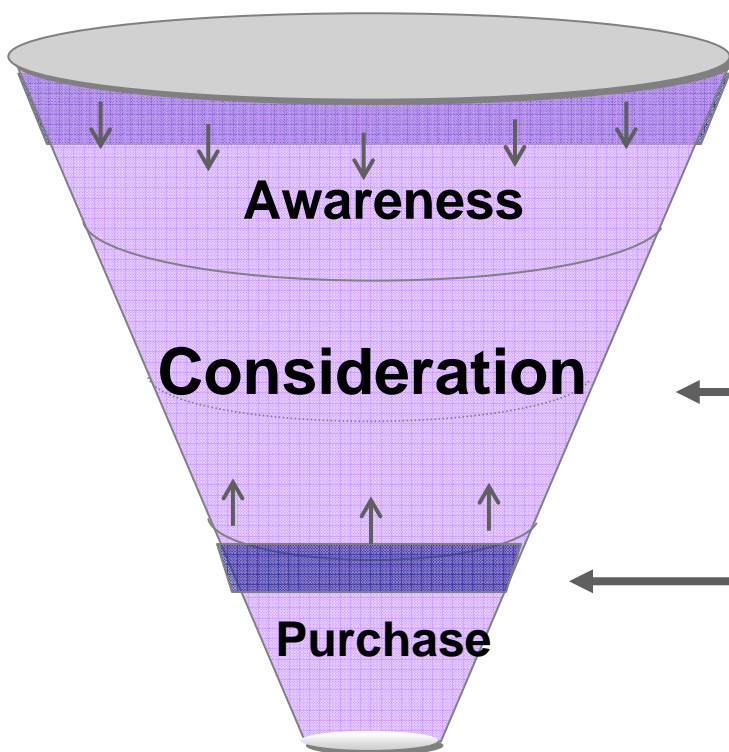
- Use coupons
- Vote
- Recycle
- Exercise regularly
- Have children living at home
- Wear sunscreen regularly

Data is used to develop content, consumer, category and campaign insights for our key content partners and large advertisers



Advertising: Brand and DR

Knowledge of users & their behavior throughout the purchase funnel can grow brand & direct response revenue



← \approx \$200B Brand Advertising Market

← Most time & activity is in consideration & engagement, but there are limited metrics & reach strategies

← \approx \$200B Direct Marketing Market

A question for the Audience:

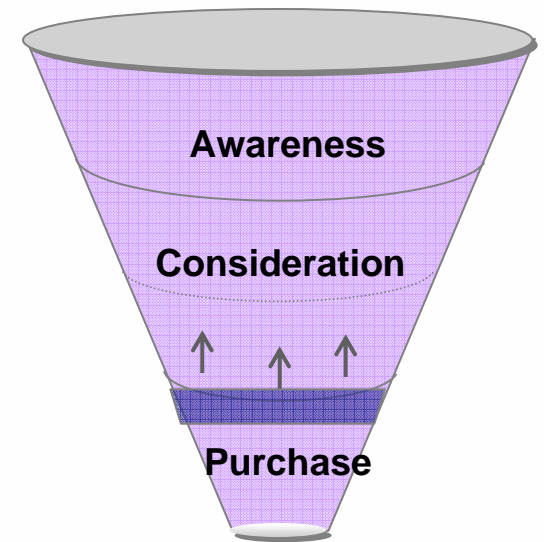
*Why is search-related
advertising so powerful?*



Moving Customers up the Funnel

Impulse Banners

- Target users based on their activity – both search and property -- within the NEXT HOUR
 - Behavioral Categories – Apparel, Computers, Home Appliances – all the same categories that you can use for regular behavioral targeting!





Impulse Banner Example

1

User searches on the word "Credit Card"



2

Sees that "Credit Card" falls under the category: "Finance/Credit and Credit Services"

3

serves "Finance/Credit and Credit Services" banners to User anywhere on the Yahoo! network within 1 HOUR



25% - 261% higher CTR than RON



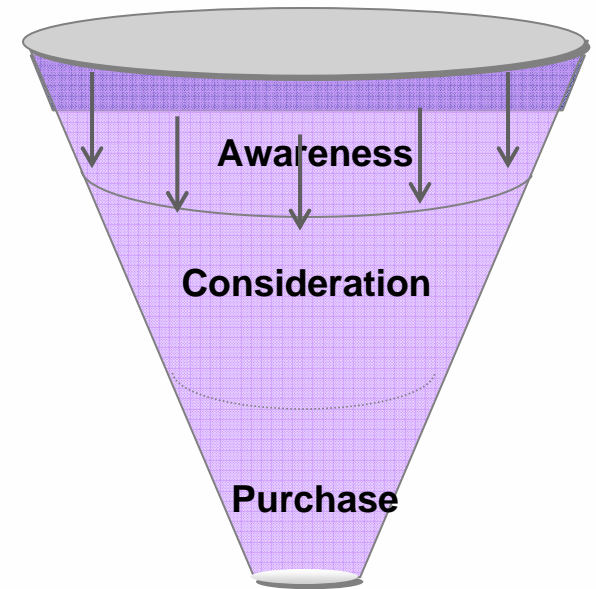
Way Impulse Works

- Searches are not at all associated or tracked through personally identifiable information
- No long-term memory of search terms, all stored on client cookie.
- We generalize the category is targeting is at generic category: e.g. Financial Services, not "credit card"
- All targeting done in anonymous mode



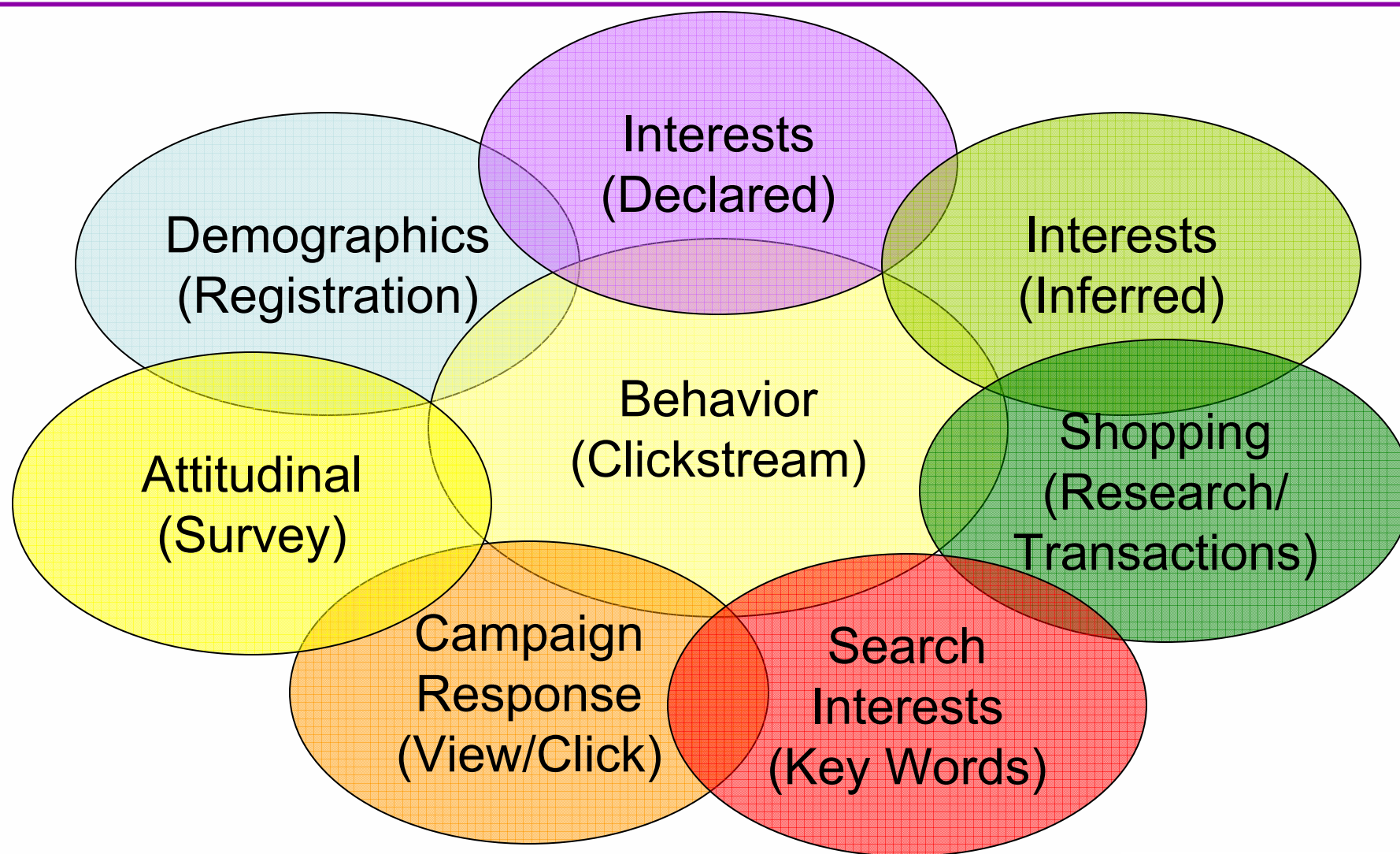
Moving Down the Funnel

- New generation marketing solutions to take brand advertisers down the marketing funnel





Types of Data Captured Across the Yahoo Network





Identifying Car Shoppers

1. Identify relevant actions that indicate buying intent and aggregate them on an user basis
2. Compute a "purchase intent" score for each user
3. Segment results by score to identify top prospects

YAHOO! AUTOS

- Browse specs
- Loan Calculator
- Compare vehicles
- Configure and price

YAHOO! search

- Car manufacturers
- Car dealers
- Car buying guides

YAHOO! LOCAL Yellow Pages

- Local dealer lookups



What Can We Do With This Data?

- Using rich click stream data on Y!, we can identify consumers shopping for a car...
 - Capability unique to online medium; hard to identify “in the market” consumers off-line
- ...with a reasonable degree of accuracy
 - 70% identified “in the market” users looking to buy within 3 months
 - 24% users said they actually made a purchase within a month (results from a self-reported survey)



How Big is the Opportunity?

- Can identify ~250,000 “leads” a month on Yahoo (at 90% confidence level)
 - About 30% of total new cars sold in the U.S. every month to individuals
- More opportunities
 - Car financing, Car insurance, Used car listings
 - *Other categories*: travel intenders, high net worth individuals, small businesses, etc...



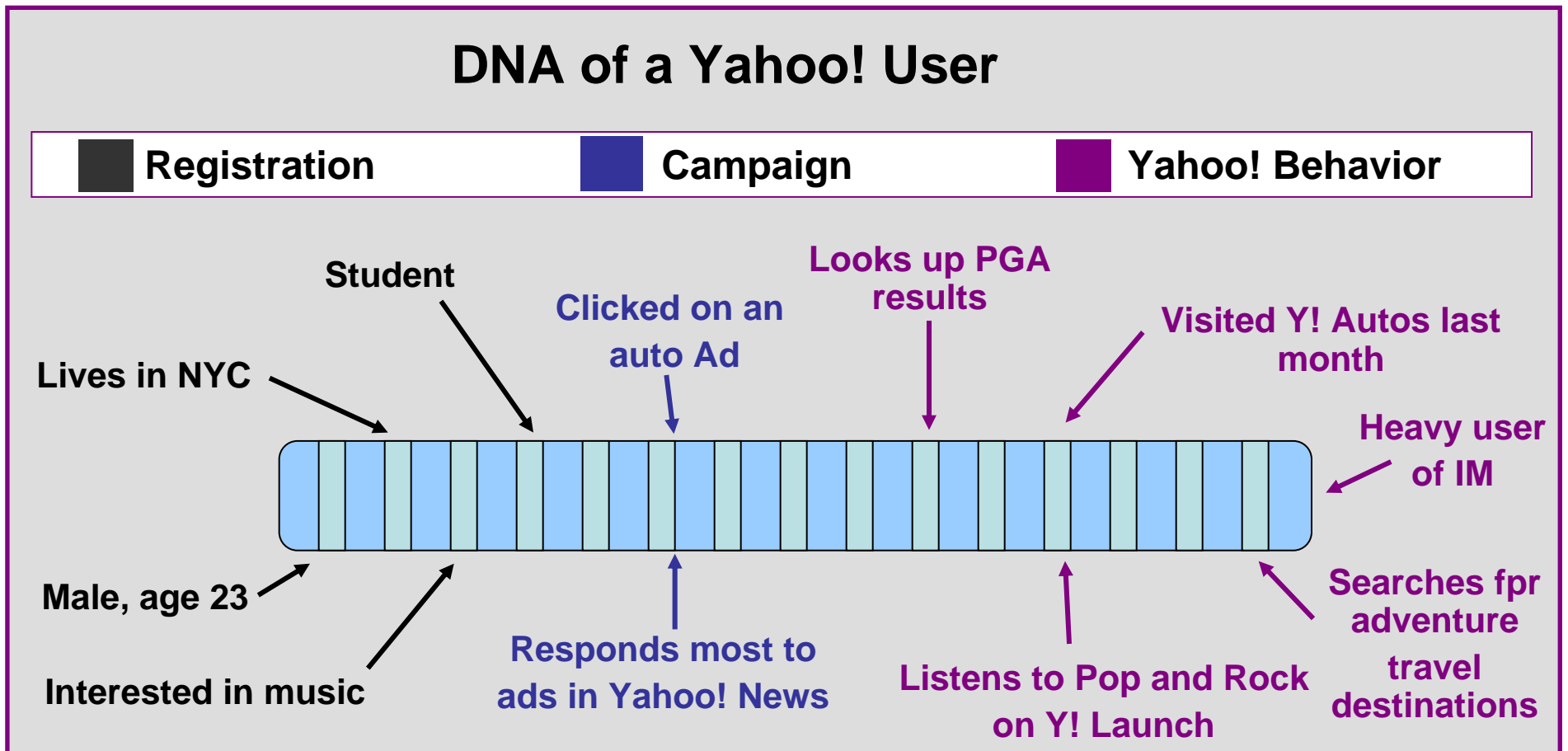
An Example

- A test ad-campaign with a major Euro automobile manufacturer
 - Designed a test that served the same ad creative to test and control groups on Yahoo
 - Success metric: performing specific actions on Jaguar website
- Test results: 900% conversion lift vs. control group
 - Purchase Intenders were 9 times more likely to configure a vehicle, request a price quote or locate a dealer than consumers in the control group
 - ~3x higher click through rates vs. control group



The Y! User DNA

All of this data combines to paint a picture of each Yahoo! User





Addressing the Challenge: Reaching your customers

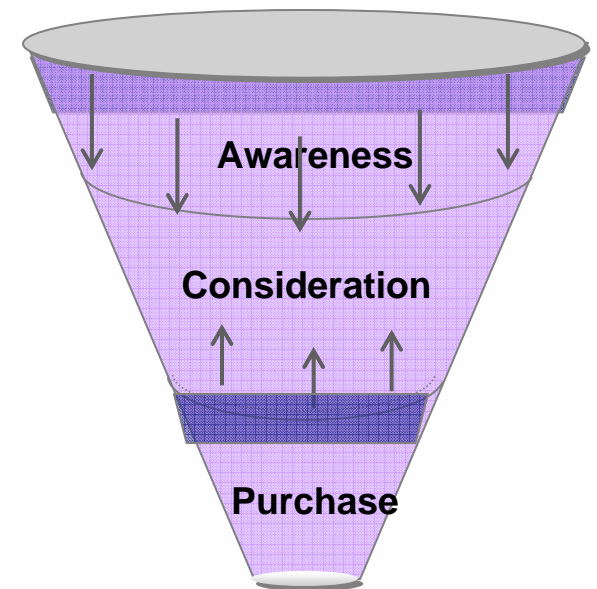
In addition to directly targeting customers, we can also build look-alike models using the data match as its base.





Brand Ads and Search Ads Interact!

- *Is ad search strategy enough for a direct marketer?*
- *Do brand ads play a role in search advertising?*
- *Harris Direct Case Study*





Case Study: Harris Direct

Viewing These Ads:



On: {
YAHOO! FINANCE
YAHOO! MAIL
 MY **YAHOO!**

Had This Effect On:

- Aided Brand Awareness
 - Up 7%



- Brand Favorability
 - Up 32%



- Purchase Intent
 - Up 15%





Case Study: Harris Direct

People who saw display ads were **61% more likely to search** on related topics...

The screenshot shows a Yahoo! search results page for the query 'harris direct'. The search bar at the top contains 'harris direct' and a 'Search' button. Below the search bar, there are navigation links for 'Web', 'Images', 'Video', 'Directory', 'Local', 'News', and 'Products'. The search results are displayed in a list format. The first result is for 'Harrisdirect' and is highlighted with a red box. The second result is also for 'Harrisdirect' and is also highlighted with a red box. To the right of the search results, there is a 'SPONSOR RESULTS' section with a red box around it. The sponsored result is for 'Get a \$100 Credit when You Invest' and is also highlighted with a red box. The search results page also includes a 'Report them' link and a 'Shortcuts' link.

Web | Images | Video | Directory | Local | News | Products

YAHOO! SEARCH harris direct Search

Search Results Results 1 - 10 of about 3,250,000 for harris direct

Shortcuts Advanced Search Preferences

Yahoo! employees: Seeing bad search results for this query? [Report them.](#)

1. [Harrisdirect](#) offers online trading, real-time quotes and news, research and portfolio tracking at low discount commissions. Category: [Brokerages](#) > [Internet Trading](#) [www.harrisdirect.com](#) - 28k - [Cached](#) - [More from this site](#)

2. [Harrisdirect](#) Welcome to Harrisdirect. Market Indices 03/14/2005 16:35 ET. DJIA. 10804.50. +30.2. NASDAQ Comp. 2051.00. +9.4. S&P 500. 1206.83. +6.75. NYSE Composite. 7353.89. +23.46. Access quotes, news, trading, and wireless. [harrisdirect.com](#) - 2k - [Cached](#) - [More from this site](#)

SPONSOR RESULTS

[Get a \\$100 Credit when You Invest](#)

HarrisDirect. HarrisDirect offers you the resources to be a more effective investor.... [www.harrisdirect.com](#)

[Trade Via PocketQuotes Wireless](#)

Trade through your broker via PocketQuotes integrated trading. Get live quotes...

...and drove **139% more clicks** on algorithmic and sponsored links...

...specifically driving **249% more sponsored search clicks** ...



...and driving **91% more activity** on the HarrisDirect.com website.



2 Examples of Data Driven Decisions

- Centering the search box on Yahoo Home page
- Yahoo! Mail Retention Study



Centering the Search Box on Yahoo's Home Page

Data showed that Netscape users had *higher* Search usage

IE Version

Personalize Finance Shop **YAHOO!** Email Messenger HotJobs ? Help

Yahoo! Travel: Flights, Hotels, Cars, More... Holiday Gift Center: Computers, Toys, More...

Search [advanced search](#)
[most popular](#)

Yahoo! Games on Demand
Play PC Games Online: [Hitman 2](#), [Tropico](#), [Civilization III](#), [more...](#)

Personal Assistant [Sign Out](#)
Welcome, [nitin_sh](#) [Acct. Info](#)
[New Mail](#) - [Calendar](#) - [Addresses](#)

In The News 10:39pm PT, Sun Dec 8

- [Iraqi challenges U.S. on evidence claim](#)
- [Al-Qaeda claims Kenya attacks, vows more](#)
- [Source: United Air plans to file Chapter 11](#)
- [Gore, Lieberman fault Bush on economy](#)
- [Protesters, priests demand Law resignation](#)
- [James Bond reclaims top spot at box office](#)
- [NFL · NBA · NCAA Hoops: Men · Women](#)

[News](#) · [Tech](#) · [Sports](#) · [Stocks](#) · [Weather](#)

Marketplace

- [Free Shipping](#) - with \$100 purchase at Macy's
- [Yahoo! Exclusive](#) - Free shipping at Nordstrom
- [Sony PlayStation 2 \\$169.99](#)

Today only! Don't miss this exclusive price. 63% off Sony

Yahoo! Shopping holiday gift ideas [Electronics · Toys · Gifts · More...](#)

- [Nordstrom - Gifts under \\$50](#)
- [Free Phone at AT&T Wireless](#)
- [Ice Cream Mixer - Only \\$69.99!](#)

Search for gifts: go

Depts: [Apparel](#), [Computers](#), [Video Games](#), [Jewelry](#), [More...](#)
Stores: [Circuit City](#), [Barnes & Noble](#), [Sony](#), [More...](#)

[Click here to see all our great holiday offers!](#) **Dell Deals!** Dell has an upgrade you won't want to miss. [Easy as DELL](#)

[Make Yahoo! your home page](#)

Web Site Directory - Sites organized by subject [Suggest your site](#)

Business & Economy [B2B](#), [Finance](#), [Shopping](#), [Jobs...](#) **Regional** [Countries](#), [Regions](#), [US States...](#)

Netscape Version

Personalize Finance Shop **YAHOO!** Email Messenger HotJobs ? Help

Yahoo! Games: Play free online games - [Pool](#), [Literati](#), [Dominoes](#), [Chess](#), [Spades](#), [Furche](#) and [more...](#)

Search [advanced search](#)
[most popular](#)

Yahoo! Games on Demand
Play PC Games Online: [Hitman 2](#), [Tropico](#), [Civilization III](#), [more...](#)

Personal Assistant [Sign In](#)
[Sign up](#) to personalize Yahoo! - [learn more](#)

In The News 10:26pm, Sun Dec 8

- [Iraqi challenges U.S. on evidence claim](#)
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- [James Bond reclaims top spot at box office](#)
- [NFL · NBA · NCAA Hoops: Men · Women](#)

[News](#) · [Tech](#) · [Sports](#) · [Stocks](#) · [Weather](#)

Marketplace

- [Yahoo! Web Hosting](#) - Hosting solutions for small businesses
- [Y! Store](#) - build an online store in 10 minutes
- [SBC Yahoo! DSL](#) - only \$39.95/mo for first 12

Web Site Directory - Sites organized by subject [Suggest your site](#)

Business & Economy [B2B](#), [Finance](#), [Shopping](#), [Jobs...](#) **Regional** [Countries](#), [Regions](#), [US States...](#)

Yahoo! Shopping holiday gift ideas [Electronics · Toys · Gifts · More...](#)

- [Free AT&T Wireless](#)
- [Nordstrom - Free Shipping](#)
- [Kmart 70% off Jewelry](#)

Search for gifts: go

Depts: [Apparel](#), [Computers](#), [Video Games](#), [Jewelry](#), [More...](#)
Stores: [Barnes & Noble](#), [Wal-Mart](#), [Crate & Barrel](#), [More...](#)

Dell Deals! Dell has an upgrade you won't want to miss.



Small Change, Big Difference

- Centering search box *did* increase searches as predicted
 - Tested 20 different versions of Home page, live!
 - Already on Yahoo home page
- Better user engagement:
 - No cost of making the change
 - Matches user's "needs" better
 - Incremental 2% in usage, which is HUGE!



Yahoo! Mail – New User Retention

- New users of Yahoo! Mail are most “vulnerable” group
- Having data assets allows us to discover “interesting facts”
 - When reading mail
 - Unusually high proportion of users like to read News!



Integrating Mail and News

- Data showed that users often check their mail and news together in the same session (high affinity)
- Mail users who also visit Y! News are 3X more active on Yahoo: Higher retention, repeat visits and time-spent on Yahoo

“In the news” Module on Mail Welcome Page

- Increased retention on Mail for light users by 40%!

The screenshot displays the Yahoo! Mail interface for user ashleycarlton@yahoo.com. The 'In the News' module is highlighted with a red circle. It features a 'TOP STORIES' section with the following items:

- Najaf sees worst fighting since 2003
- Arrests reportedly damage al-Qaida network
- Reservist: Intelligence officials led Iraq abuse
- Judge lifts Letourneau no-contact order
- Markets: Dow \uparrow 1.5% Nasdaq \downarrow 2.5%

Other visible elements include the 'Folders' list (Inbox (172), Draft, Sent, Bulk (44), Trash), 'My Folders' (Friends, Jobs, Shopping), and an advertisement for Audi dealers.



Inventing The New Sciences of the Internet at Yahoo! Research



New Science?

- The Internet touches all of our lives: personal, commercial, corporate, educational, government, etc...
- Yet many of the basic notions we talk about:
 - Search, Community, Personalization, Engagement, Interactive Content, Information Navigation
 - Are not at all understood, or well-defined
 - These are not disciplines that academia or any industry research labs focus on...



Areas of Research

- **Community:**
 - How do you know what to believe on the Internet?
 - Trust models on-line and trust propagation
 - What makes communities thrive? Whither?
 - Social media, tagging, image and video sharing
- **Microeconomics:** a new generation of economics driven by massive interactions
 - Auction marketplaces
 - The web as a new LEI of activities and economies
- **Information Navigation and Search**
 - We are in the early days of search and retrieval
- **User Experience**



Mission & Vision

Vision: Where the Internet's future is invented

- *with innovative economic models for advertisers, publishers and consumers.*

Mission: *NEXT* -- Invent the

*N*ext generation Internet by defining the future media to

*E*ngage consumers and

*eX*tend the economics for advertisers and publishers through new sciences that establish the

*T*echnical leadership of Yahoo!



How we get there

- Scientific excellence
 - World-recognized leadership through Business impact
 - Build the Largest, Deepest and Smartest Research Organization focused on a few chosen areas
 - Explore areas that nobody else is exploring
 - Open model with strong emphasis on publication, peer review, and real problems



A sampling of the Top Researchers now at Yahoo!



- **Prabhakar Raghavan:** CTO Verity, Web Research architect at IBM, Head of Y!R



- **Andrei Broder:** inventor of key search, web spam, technologies



- **Andrew Tomkins:** chief Scientist of WebFountain, inventor of key algorithms, structure of Web graph



- **Raghu Ramakrishnan :** world authority on data mining, database systems, and social search



- **Ricardo Baeza-Yates:** renowned expert in text and query mining, authored seminal texts in IR



- **Michael Schwarz:** renowned economist, auctions, web, Harvard and U.C. Berkeley

research

New Economics



Auction Markets and Sponsored Search



Burgeoning research area

- Understanding auctions, incentive mechanisms, pricing, optimization – a huge deal
 - Already multi-billion dollar business, growing fast
 - Interface of microeconomics and CS
 - Early work – Edelman, Ostrovsky, Schwarz
- Advertiser's perspective – spending budget optimally
 - Many open problems, a few papers, some of them quite realistic
 - Marketplace design



Generic questions

- Of the various advertisers for a keyword, which one(s) get shown?
- What do they pay on a click through?
- The answers turn out to draw on insights from microeconomics

Edit View Go Bookmarks Yahoo! Tools Help

http://search.yahoo.com/search?p=miele&y=Search+the+Web&ei=UTF-8&fr=ytf1-&x=wrt

Getting Started Latest Headlines Seeq — Search the ...

miele Search Web My Web Bookmarks My Yahoo! Yahoo! Finance Mail News

miele - Yahoo! Search Results academia.pdf (application/pdf Object)

Yahoo! My Yahoo! Mail Welcome, praghpragh [Sign Out, My Account] Search Home Help

Web Images Video Audio Directory Local News Shopping More »

YAHOO! SEARCH miele Search the Web My Web (beta)

Web Answers BETA Search Services Advanced Search Preferences

Search Results Results 1 - 10 of about 5,950,000 for miele - 0.34 sec. (About this page)

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Advertisers generally prefer this slot

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$r_2 = 150$ per hour →

$r_3 = 100$ per hour →

etc. →



Example

- For the keyword *miele*, say an advertiser has a value of \$10 per click.
- How much should he bid?
- How much should he be charged?

The value of a slot for an advertiser, what he bids and what he is charged, may all be different.



Two auction pricing mechanisms

Not truthful.

- First price: The winner of the auction is the highest bidder, and pays his bid.
- Second price: The winner is the highest bidder, but pays the *second-highest* bid.
- Engine decides and announces pricing.
- What should an advertiser bid?



Second-price = Vickrey auction

- Consider first a single advt slot
- Winner pays the second-highest bid
- Vickrey: *Truth-telling is a dominant strategy for each player (advertiser)*
 - No incentive to “game” or fake bids



Auctions and pricing: multiple slots

- Overture's (→Yahoo!'s) model:
 - Ads displayed in order of decreasing bid
 - E.g., if advertiser A bids 10, B bids 2, C bids 4 – order ACB
- How do you price slots? Generalized Vickrey?
 - Generalized second-price (*GSP*)
 - Vickrey-Clark-Groves (VCG): each advertiser pays the *externality* he imposes on others

Generalized Second Price auction pricing

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VCG and GSP

Edelman, Ostrovsky, Schwarz

- Truth-telling is a dominant strategy under VCG ...
- Truth-telling *not* dominant under GSP!

Put Nobel Prize-winning theories to work.

Google's unique auction model uses Nobel Prize-winning economic theory to eliminate the winner's curse – that feeling that you've paid too much. While the auction model lets advertisers bid on keywords, the AdWords™ Discounter makes sure that they only pay what they need in order to stay ahead of their nearest competitor.

<https://google.com/adsense/afs.pdf>



VCG and GSP

Edelman, Ostrovsky, Schwarz

- Truth-telling is a dominant strategy under VCG ...
- Truth-telling *not* dominant under GSP!

Aggarwal, Goel, Motwani (ACM EC 2006): give a truthful mechanism in a model that precludes VCG.



VCG and GSP

Edelman, Ostrovsky, Schwarz

- Static equilibrium of GSP is *locally envy-free*: no advertiser can improve his payoff by exchanging bids with advertiser in slot above.
- Depending on the mechanism, revenue varies: $GSP \geq VCG$.



Locally envy-free mechanisms correspond to *Stable Marriage* solutions.

“Social” Search



Is the Turing test always the right question?

Tags / jaguar / clusters

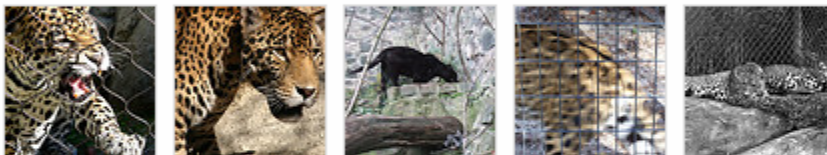
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The power of social media

- Flickr – community phenomenon
- Millions of users share and tag each others' photographs (why???)
- The wisdom of the crowd can be used to search
- The principle is not new – anchor text used in “standard” search
- Don't try to pass the Turing test?



Challenges in social media

- How do we use these tags for better search?
- What's the ratings and reputation system?
- How do you cope with spam?

- The bigger challenge: where else can you exploit the power of the people?
- What are the incentive mechanisms?



Questions?