



Technical challenges in web advertising

Andrei Broder

Yahoo! Research



Disclaimer

- This talk presents the opinions of the author. It does not necessarily reflect the views of Yahoo! Inc.



Advertising

What is it?





The two basic forms of advertising

1. Brand advertising

- creates a distinct favorable image

2. Direct-marketing

- Advertising that involves a "direct response": **buy, subscribe, vote, donate, etc, now or soon**





Sometimes both ...



PALO ALTO/EAST PALO ALTO
263 University Avenue
(Downtown/Delivery to Stanford)
650-322-2893



Round Table PIZZA

We Deliver

| | |
|--|---|
| <p>E-D 20% OFF Any Order Offer excludes beverages, Manager's Specials, Kids Meal or any promotional items. <small>Offer valid on Drive-In, Carry-out, or Delivery. Limited delivery area & hours. Minimum delivery fee may apply. Not valid with any other offer or discounts. Expires 7/15/06.</small></p> | <p>E-D \$15⁹⁹ Any Large Specialty Pizza Original or Skinny Crust only. <small>Offer valid on Drive-In, Carry-out, or Delivery. Limited delivery area & hours. Minimum delivery fee may apply. Not valid with any other offer or discounts. Expires 7/15/06.</small></p> |
| <p>E-D \$11⁹⁹ Any Large 1-Topping Pizza Original or Skinny Crust only. <small>Offer valid on Drive-In, Carry-out, or Delivery. Limited delivery area & hours. Minimum delivery fee may apply. Not valid with any other offer or discounts. Expires 7/15/06.</small></p> | <p>E-D \$12⁹⁹ Any Large 2-Topping Pizza Original or Skinny Crust only. <small>Offer valid on Drive-In, Carry-out, or Delivery. Limited delivery area & hours. Minimum delivery fee may apply. Not valid with any other offer or discounts. Expires 7/15/06.</small></p> |
| <p>E-D \$5.00 OFF ANY X-LARGE PIZZA \$4.00 OFF ANY LARGE PIZZA \$2.00 OFF ANY MEDIUM PIZZA <small>Offer valid on Drive-In, Carry-out, or Delivery. Limited delivery area & hours. Minimum delivery fee may apply. Not valid with any other offer or discounts. Expires 7/15/06.</small></p> | <p>E-D FREE Medium 1 Topping Pizza with the purchase of any Large or X-Large Specialty at regular menu price. <small>Offer valid on Drive-In, Carry-out, or Delivery. Limited delivery area & hours. Minimum delivery fee may apply. Not valid with any other offer or discounts. Expires 7/15/06.</small></p> |

ADVERTISEMENT WITH MONEY MAILER OF PALO ALTO/LOS ALTOS WITH VIEW (551) 960-1230

226-07-0082 226-07-0082



H.O.T! Coupons Web Ad • 226-07-0082F

©2006 Money Mailer LLC
<http://www.hotcoupons.com>



Web Advertising

There are lots of ads on the web ...



Graphical ad

HOME PAGE | MY TIMES | TODAY'S PAPER | VIDEO | MOST POPULAR | TIMES TOPICS | TimesSelect Free 14-Day Trial | Welcome, broder | Member Center | Log Out

The New York Times **Health** Health All NYT

WORLD | U.S. | N.Y. / REGION | BUSINESS | TECHNOLOGY | SCIENCE | HEALTH | SPORTS | OPINION | ARTS | STYLE | TRAVEL | JOBS | REAL ESTATE | AUTOS

FITNESS & NUTRITION | HEALTH CARE POLICY | MENTAL HEALTH & BEHAVIOR



**You've heard of Netflix...
Now try us for FREE** 

PERSONAL HEALTH

Growing Older, and Adjusting to the Dark

By JANE E. BRODY
Published: March 13, 2007

How well do you see at night? If you're over 50, probably not as well as you think, no matter how many carrots you eat. The typical 50-year-old driver needs twice as much light to see as well after dark as a 30-year-old. Yet few of us compensate adequately for the reduction in nighttime acuity that occurs in the aging eye.

- E-MAIL
- PRINT
- SINGLE PAGE
- REPRINTS
- SAVE
- SHARE

Next Article in Health (6 of 13) »



NETFLIX 

No Late Fees
FREE Shipping
75,000+ Titles
FREE Trial



Textual: Sponsored Link:

Text-based ads usually driven by a keyword search

[Sign in](#)



[Web](#) [Images](#) [Groups](#) [News](#) [Froogle](#) [Maps](#) [more »](#)

sigir

Search

[Advanced Search](#)
[Preferences](#)

Web

Results 1 - 10 of about 1,540,000 for sigir (0.07 seconds)

[SIGIR: Information Retrieval](#)

"Addresses issues ranging from theory to user demands in the application of computers to the acquisition,...

[www.acm.org/sigir/](#) - 7k - [Cached](#) - [Similar pages](#)

[SIGIR • 2005](#)

SIGIR is the major international forum for the presentation of new research ... The 28th Annual International ACM **SIGIR** Conference will be held at the ...

[www.dcc.ufmg.br/eventos/sigir2005/](#) - 14k - [Cached](#) - [Similar pages](#)

[Special Inspector General for Iraq Reconstruction : SIGIR Homepage](#)

SIGIR, the successor to the Coalition Provisional Authority Inspector General (CPA-IG), ... **SIGIR** oversight is accomplished via independent audits, ...

[www.sigir.mil/](#) - 16k - [Cached](#) - [Similar pages](#)

Sponsored Links

[Sigir](#)

Whatever you're looking for you can get it on eBay.
[www.eBay.com](#)

[Sigir 2006 Tutorial](#)

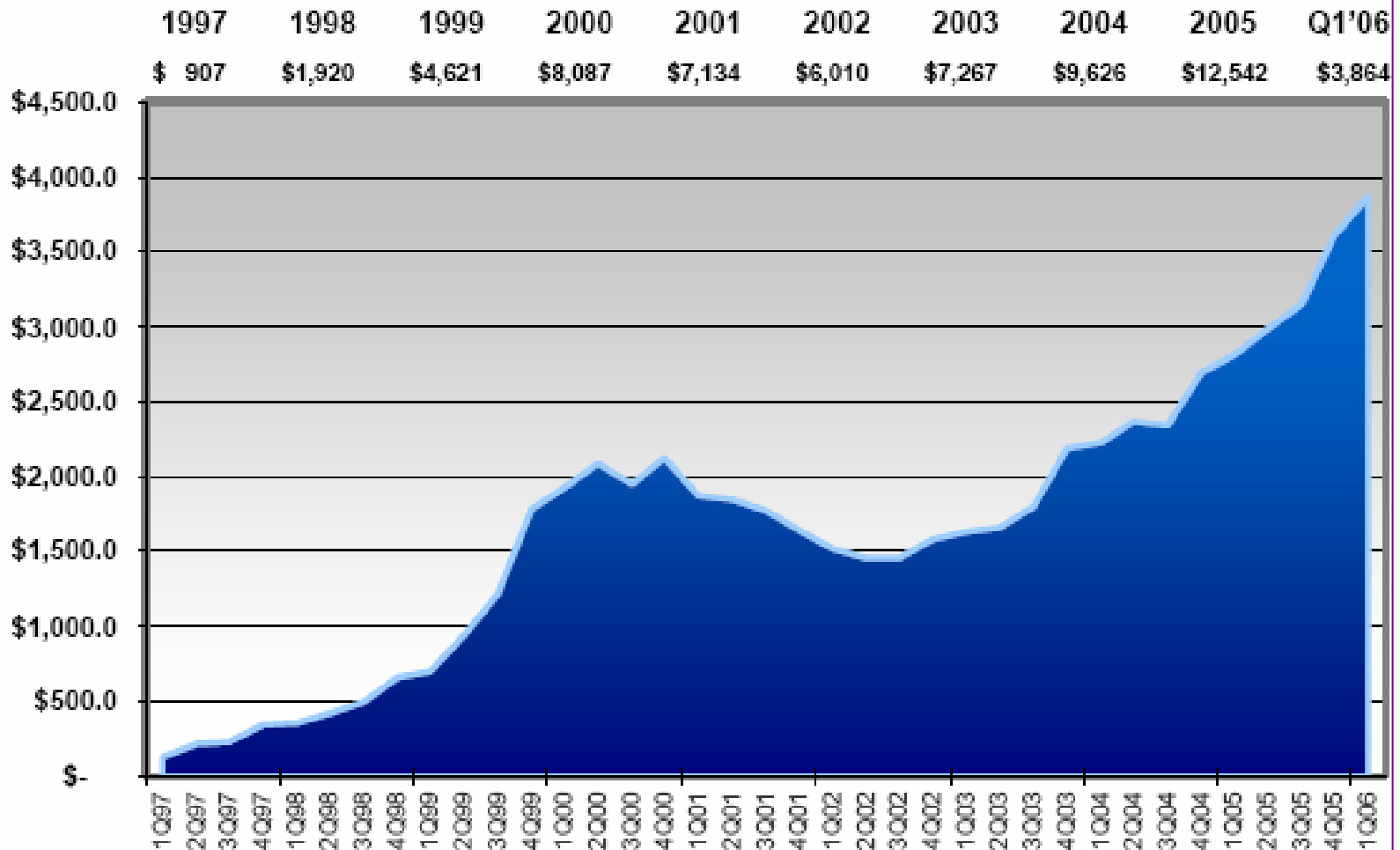
Introduction to Web Advertising
Seattle, August 6, 2006
[www.sigir2006.org/tutorials.asp](#)



Ad revenue stats from Internet Advertising Board

Quarterly Internet Ad Revenues Close to \$ 4 Billion

\$ Millions





We concentrate on

1. Ads driven by search keywords – “sponsored search” (a.k.a. “keyword driven ads”, “paid search”, etc)
2. Ads directly driven by the content of a web page – “context match” (a.k.a. “context driven ads”, “contextual ads”, etc)

Both types are heavily related to web search



A sponsored search ad

[Sign in](#)

Google™

[Web](#) [Images](#) [Groups](#) [News](#) [Froogle](#) [Maps](#) [more »](#)

sigir

Search

[Advanced Search](#)
[Preferences](#)

Web

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[SIGIR: Information Retrieval](#)

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[SIGIR • 2005](#)

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[www.dcc.ufmg.br/eventos/sigir2005/](#) - 14k - [Cached](#) - [Similar pages](#)

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[www.sigir.mil/](#) - 16k - [Cached](#) - [Similar pages](#)

Sponsored Links

[Sigir](#)

Whatever you're looking for you can get it on eBay.
[www.eBay.com](#)

[Sigir 2006 Tutorial](#)

Introduction to Web Advertising
Seattle, August 6, 2006
[www.sigir2006.org/tutorials.asp](#)



A content match ad

Content match ad

Photographer's Stop    

Portal | Forum | Album | Search | Memberlist | Profile | Private Messages | FAQ | Register | Log in

SPONSORED LINKS

Ads by Yahoo!

Olympus Digital Cameras - Official...
Visit the official Olympus Web site for comprehensive information about our digital cameras and...
www.olympusamerica.com

Latin American Art Galleries Online
Visit Latin American online art galleries. Features images and detailed information. Read...
www.artnexus.com

Discount Prices on Sony Digital...
5-star CNET service rating - find low prices today at BeachCamera.com.
www.beachcamera.com

General

| Forum | Topics | Posts |
|---|--------|-------|
| Welcome - come on in! Hi - are you new? Come in and let everyone here know about you. Moderator shanky_pec | 29 | 123 |
| Announcements, Feedback & Suggestions Check this section for board updates, announcements of new features. Leave your kind feedback, suggestions here.. Moderator shanky_pec | 18 | 67 |
| Site Support Report site related problems, broken links, not-working-features here. We will surely resolve problems Moderator shanky_pec | 5 | 18 |

Photography

| Forum | Topics | Posts |
|--|--------|-------|
| General Discussion General photography discussions Moderator shanky_pec | 64 | 284 |
| Photo Album Discussion, tips-tricks, suggestions regarding photo gallery Moderator shanky_pec | 26 | 129 |



Web & Search Advertising business

- All large players (Google, Yahoo, MSN) now own:
 1. Web search engine
 2. Advertising platform + network
 - They are both a search engine and an ad agency
- Google
 - Own engine for keyword ads (Adwords)
 - Bought Applied Semantics (context ads, Adsense)
- Yahoo
 - Bought Inktomi, AltaVista, AlltheWeb, Overture
 - Search ← Inktomi derived
 - Ads ← Overture (keyword, context)
- MSN
 - Used search from Inktomi + own corpus. Has now its own
 - Used ads from Overture, has now own platform (“AdCenter” for keywords from May 2006, announced “ContentAds” beta in summer)



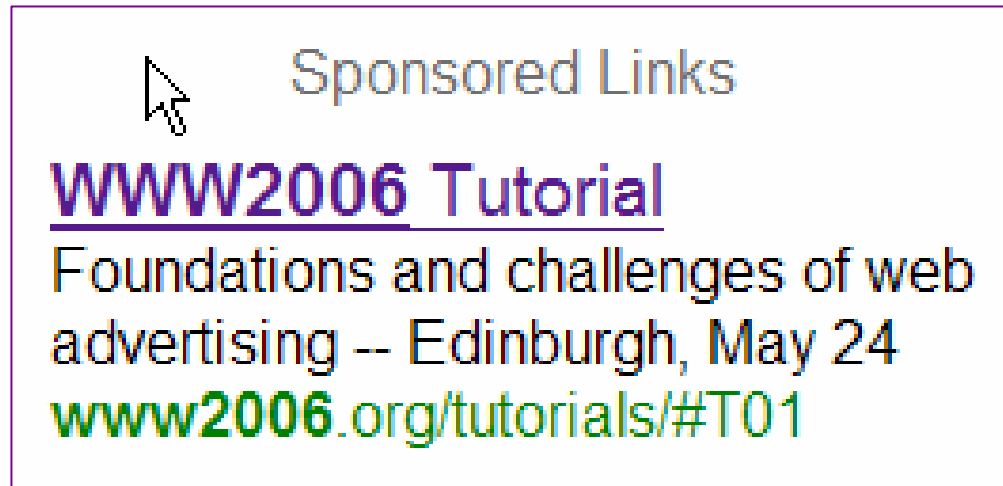
Key pricing concepts

- Concepts
 - CPM = cost per thousand impressions
 - Typically used for graphical/banner ads
 - CPC = cost per click
 - CPT/CPA = cost per transaction/action
a.k.a. referral fees or affiliate fees
 - Typically used for shopping (“buy from our sponsors”), travel, etc



CPC Example

- We advertised a tutorial:

A screenshot of a sponsored link advertisement. It features a mouse cursor icon pointing at the text. The text includes the heading "Sponsored Links", a link title "WWW2006 Tutorial" with a purple underline, a description "Foundations and challenges of web advertising -- Edinburgh, May 24", and a URL "www2006.org/tutorials/#T01" in green.

⏱ Sponsored Links

[WWW2006 Tutorial](#)
Foundations and challenges of web
advertising -- Edinburgh, May 24
www2006.org/tutorials/#T01

- Started late ...
- Spent < \$10.00 total



Our new ad in Google

[Sign in](#)



[Web](#) [Images](#) [Groups](#) [News](#) [Froogle](#) [Maps](#) [more »](#)

andrei broder

Search

[Advanced Search](#)
[Preferences](#)

Web

Results 1 - 10 of about 197,000 for **andrei broder**. (0.05 seconds)

House ad

Sponsored Links

[Work at Google](#)

Google is hiring expert computer scientists and software developers!
www.google.com/jobs

[Sigir 2006 Tutorial](#)

Introduction to Web Advertising
Seattle, August 6, 2006
www.sigir2006.org/tutorials.asp

[DBLP: Andrei Z. Broder](#)

62, **Andrei Z. Broder**: Introduction: The Fourth International Workshop on ... 3,
Andrei Z. Broder: A Provably Secure Polynomial Approximation Scheme for
the ...
www.informatik.uni-trier.de/~ley/db/indices/a-tree/b/Broder:Andrei_Z=.html - 59k -
[Cached](#) - [Similar pages](#)

[Andrei Broder Joins Yahoo](#)

Andrei Broder, former vice president of research at AltaVista and until recently
Distinguished Engineer & CTO, IBM Research, is joining Yahoo as research ...
blog.searchenginewatch.com/blog/051118-122544 - 65k - [Cached](#) - [Similar pages](#)

[Andrei Broder - Wikipedia, the free encyclopedia](#)

Andrei Broder is a Research Fellow and Vice President of Emerging Search Technology for
Yahoo! ... Appoints Dr. **Andrei Broder** as Research Fellow. Yahoo! ...
en.wikipedia.org/wiki/Andrei_Broder - 14k - [Cached](#) - [Similar pages](#)



CPC Report

WWW2006 Tutorial
 Foundations and challenges of web advertising -- Edinburgh, May 24
www2006.org/tutorials/#T01

+ Create New Ad: [Text Ad](#) | [Image Ad](#) | [Local Business Ad](#)
 44 Clicks | 1.70% CTR | \$0.07 CPC
 Served - 100.0% [\[more info\]](#)
[Edit](#) - [Delete](#)

today May 7 2006 - May 19 2006

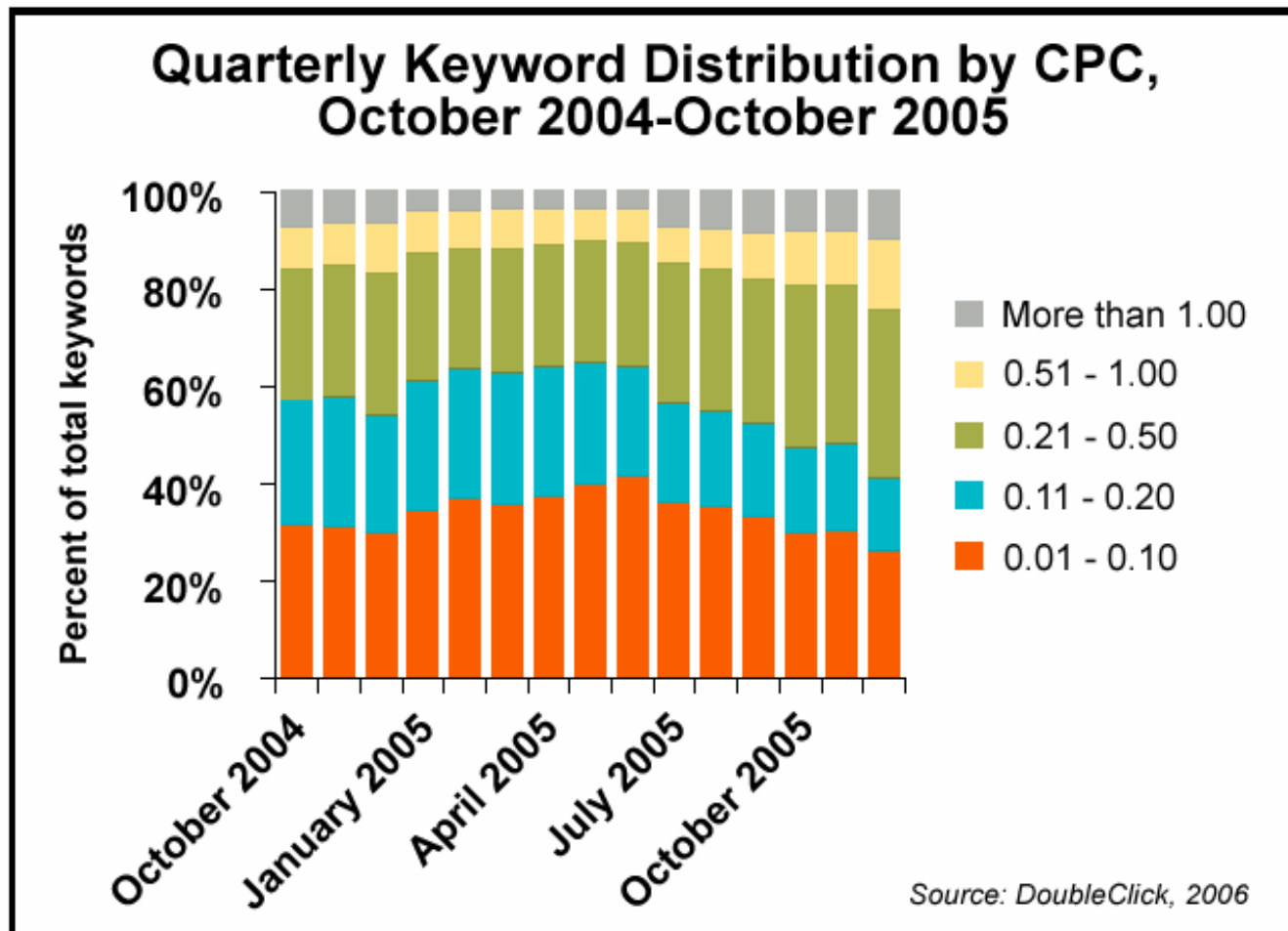
Include deleted items that were active in this date range

[Edit Keyword Settings](#) [Delete](#)

| <input type="checkbox"/> Keyword | Status [?] | Current Bid Max CPC | Hide Settings Sort by: Bid URL | Clicks | Impr. ▼ | CTR | Avg. CPC | Cost |
|--|----------------------------|--|---|------------------------|-------------------------|---------------------|--------------------------|----------------------|
| Search Total | Enabled | Default \$0.07 [edit] | | 44 | 2,447 | 1.79% | \$0.07 | \$2.74 |
| Content Total [?] | Enabled | | | 0 | 136 | 0.00% | - | - |
| <input type="checkbox"/> "www 2006" | Active | \$0.07 | ▼ Settings Default Max CPC [edit] | 26 | 1,095 | 2.37% | \$0.05 | \$1.06 |
| <input type="checkbox"/> www2006 | Active | \$0.20 | ▼ Settings \$0.20 Max CPC [edit] | 6 | 509 | 1.17% | \$0.13 | \$0.78 |
| <input type="checkbox"/> "www conference" | Active | \$0.10 | ▼ Settings \$0.10 Max CPC [edit] | 9 | 357 | 2.52% | \$0.09 | \$0.75 |
| <input type="checkbox"/> Prabhakar Raghavan | Active | \$0.10 | ▼ Settings \$0.10 Max CPC [edit] | 3 | 164 | 1.82% | \$0.05 | \$0.15 |
| <input type="checkbox"/> Andrei Broder | Active | \$0.07 | ▼ Settings Default Max CPC [edit] | 0 | 145 | 0.00% | - | - |



CPC costs





Technical challenges

- For advertisers
 - What words to buy?
 - How much to pay?
 - Arbitrage among keywords/suppliers, try to cherry pick demographics
 - Classic optimization problem
 - Spamming is an economic activity ...
- For sellers (search engines)
 - How to price the words?
 - Let the market decide: bidding! (more later)
 - When to place ad? (“Broad match” on non-bidder phrases)
 - How to price “extended” or “broad” match?
 - Forecasting (scale)
 - Long term costs (bad user experience, training people not to click)
- For both
 - What are good words?
 - What extra words to buy?



Technical issue: Finding the Right Ad

- Relatively simple on “bidded phrases”
- What about queries on which there is no bid?
- Advertiser can bid on “broad queries” and/or “concept queries”
 - Bid on any query that contains “sigir” or the “sigir” concept.
- Pitfalls:
 - A seller of car water pumps might bid on “**pumps**”.
 - How do you avoid “**re-built water pumps**” ads on “**breast pumps**”? On “**black pumps**”?
- Opportunity: Design both algorithms & marketplace!



Finding the right ad (cont)

- Ads Database = Keywords +
Title + Description + URL +
stats (CTR, bid)
- Ad Query = Search Keywords + Context
- Search problem similar to Web Search, but
 - Ad database entries are “small pages” [+ URL]
 - Different metadata
 - Problem still large (0.5-1B ads)
 - Historical data is enormous (billions of searches/ad/clicks records)
 - Ranking depends also on bids (more later)

A large, light purple graphic in the background features a stylized white letter 'Y' inside a circle, followed by a large exclamation point to its right. The exclamation point has a small 'TM' trademark symbol at its base.

Keyword advertisements: auctions and pricing

to try: miele vacuum, miele appliances, miele dishwasher More...

Miele Vacuums and Appliances

www.factorydirectsuperstore.com Full line of vacuum cleaners, bags, filters, HEPA filters, Persil, Somat and built-in appliances.

Miele Vacuums and Accessories

www.thinkvacuums.com Miele vacuum cleaners and accessories. Free shipping and no sales tax.

Free Next Day Express On Miele Vacuums

www.vac-cleaner.com Free gift-wrapping. All Miele vacuums models in stock.

Miele on Yahoo! Shopping

Top Categories: Dishwashers - Cooktops - Washers - Canister Vacuum Cleaners - Dryers
Yahoo! Shortcut - About

My Web Results for miele (7)

1. Miele USA

Subsidiary providing company, product and dealer information.
Category: Miele > Regional
www.mieleusa.com - 35k - Cached - More from this site - Save

2. Miele

Welcome to Miele the home of the very best appliances and kitchens in the world

SPONSOR RESULTS

Buy Miele Appliances - Free Delivery

Call for trade pricing. Buy with confidence from Witbecks, 89 year...
www.witbeckappliance.com

Miele Vacuum Cleaners - Free Shipping

Extensive reviews, specifications and comparisons of Miele vacuums.
www.ristenbatt.com

Shop Miele Appliances

Find Miele home appliances, along with other great brands like...
www.us-appliance.com

Miele at Best-Vacuum.com

...me as cash financing.
...ailable and free...
...uum.com





A marketplace

- For each keyword, a *market* in which advertisers compete for attention
 - Advertisers willing to pay for placement on ads next to search results
- Market varies by keyword
 - Commercial vs non-commercial intent in keywords
 - ***Ford vs Stanford map***



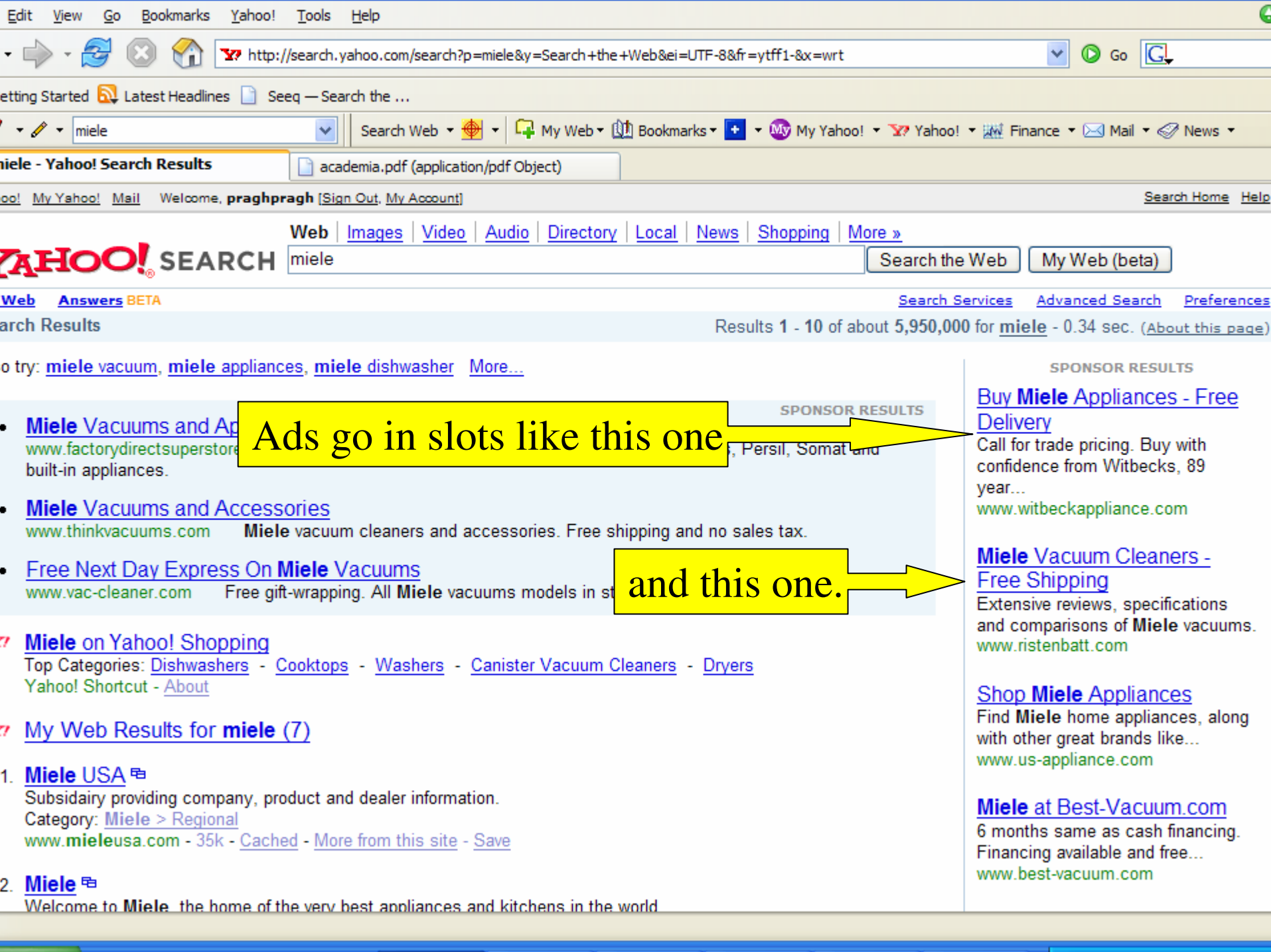
Monetization

- CPC = When a searcher clicks on a displayed ad, advertiser pays the search engine
 - E.g., a Ford dealership may place an ad for the search **Ford**
 - Out of all such ads, engine chooses to display some on each **Ford** search
 - When a searcher clicks an ad, the advertiser who placed it pays



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 from questions in microeconomics



Ads go in slots like this one

and this one.

SPONSOR RESULTS
[Buy Miele Appliances - Free Delivery](#)

Call for trade pricing. Buy with confidence from Witbecks, 89 year...
www.witbeckappliance.com

SPONSOR RESULTS
[Miele Vacuum Cleaners - Free Shipping](#)

Extensive reviews, specifications and comparisons of Miele vacuums.
www.ristenbatt.com

[Shop Miele Appliances](#)
Find Miele home appliances, along with other great brands like...
www.us-appliance.com

[Miele at Best-Vacuum.com](#)
6 months same as cash financing. Financing available and free...
www.best-vacuum.com

[Miele Vacuums and Appliances](#)
www.factorydirectsuperstore.com
built-in appliances.

[Miele Vacuums and Accessories](#)
www.thinkvacuums.com Miele vacuum cleaners and accessories. Free shipping and no sales tax.

[Free Next Day Express On Miele Vacuums](#)
www.vac-cleaner.com Free gift-wrapping. All Miele vacuums models in stock.

[Miele on Yahoo! Shopping](#)
Top Categories: [Dishwashers](#) - [Cooktops](#) - [Washers](#) - [Canister Vacuum Cleaners](#) - [Dryers](#)
[Yahoo! Shortcut](#) - [About](#)

[My Web Results for miele \(7\)](#)

1. [Miele USA](#)
Subsidiary providing company, product and dealer information.
Category: [Miele > Regional](#)
www.mieleusa.com - 35k - [Cached](#) - [More from this site](#) - [Save](#)

2. [Miele](#)
Welcome to Miele the home of the very best appliances and kitchens in the world

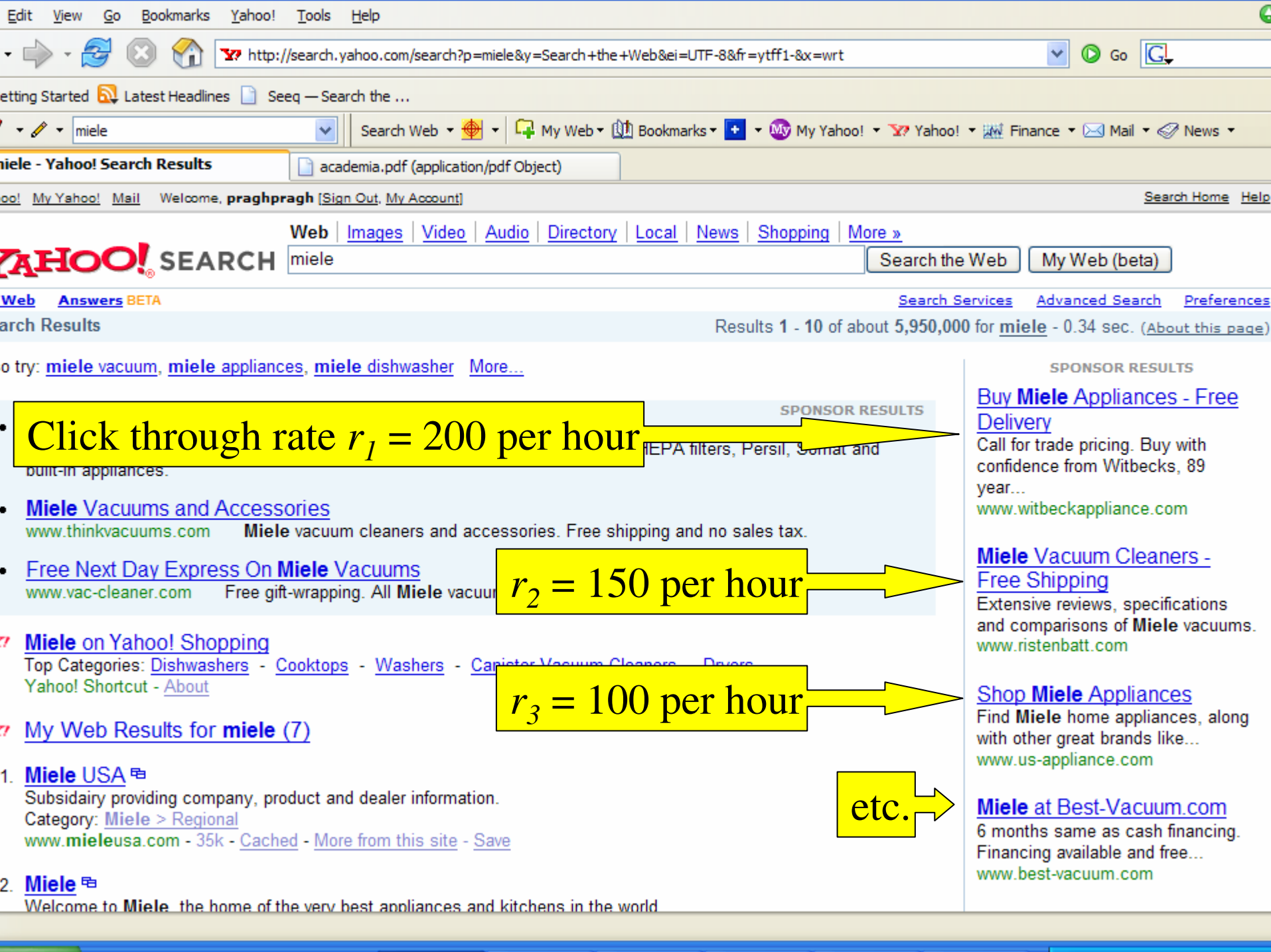


Advertisers generally prefer this slot

to this one.

- SPONSOR RESULTS
- [Buy Miele Appliances - Free Delivery](#)
Call for trade pricing. Buy with confidence from Witbecks, 89 year...
www.witbeckappliance.com
 - [Miele Vacuum Cleaners - Free Shipping](#)
Extensive reviews, specifications and comparisons of Miele vacuums.
www.ristenbatt.com
 - [Shop Miele Appliances](#)
Find Miele home appliances, along with other great brands like...
www.us-appliance.com
 - [Miele at Best-Vacuum.com](#)
6 months same as cash financing. Financing available and free...
www.best-vacuum.com

- [Miele Vacuums and Accessories](#)
www.thinkvacuums.com Miele vacuum cleaners and accessories. Free shipping and no sales tax.
- [Free Next Day Express On Miele Vacuums](#)
www.vac-cleaner.com Free gift-wrapping. All Miele vacuums models in stock.
- [Miele on Yahoo! Shopping](#)
Top Categories: [Dishwashers](#) - [Cooktops](#) - [Washers](#) - [Canister Vacuum Cleaners](#) - [Dryers](#)
[Yahoo! Shortcut](#) - [About](#)
- [My Web Results for miele \(7\)](#)
- 1. [Miele USA](#)
Subsidiary providing company, product and dealer information.
Category: [Miele > Regional](#)
www.mieleusa.com - 35k - [Cached](#) - [More from this site](#) - [Save](#)
- 2. [Miele](#)
Welcome to Miele the home of the very best appliances and kitchens in the world



Click through rate $r_1 = 200$ per hour

$r_2 = 150$ per hour

$r_3 = 100$ per hour

etc.

- SPONSOR RESULTS
- [Buy Miele Appliances - Free Delivery](#)
Call for trade pricing. Buy with confidence from Witbecks, 89 year...
www.witbeckappliance.com
 - [Miele Vacuum Cleaners - Free Shipping](#)
Extensive reviews, specifications and comparisons of Miele vacuums.
www.ristenbatt.com
 - [Shop Miele Appliances](#)
Find Miele home appliances, along with other great brands like...
www.us-appliance.com
 - [Miele at Best-Vacuum.com](#)
6 months same as cash financing. Financing available and free...
www.best-vacuum.com

to try: miele vacuum, miele appliances, miele dishwasher More...

Miele Vacuums and Appliances

www.factor...
built-in app

Why did witbeckappliance win

SPONSOR RESULTS
PA filters, Persil, Somat and

Miele Vacuums and Accessories

www.thinkvacuums.com

Miele vacuum cleaners and accessories. Free shipping and no sales tax.

over ristenbatt?

Free Next Day Express On Miele Vacuums

www.vac-cleaner.com

Free gift-wrapping. All Miele vacuu

Miele on Yahoo! Shopping

Top Categories: Dishwashers - Cooktops - Washers - Canister Vacuum Cleaners - Dryers

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Miele at Best-Vacuum.com

6 months same as cash financing. Financing available and free...

www.best-vacuum.com



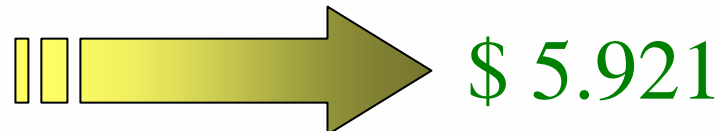
First-cut assumption

- Click-through rate depends only on the slot, not on the advertisement
- In fact not true; more on this later
 - In reality a function of both the slot and the advertisement.



Advertiser's value

- We'll assume that an advertiser j has a value v_j per click through
 - Some measure of downstream profit
- Say, user buys a Miele product, e.g.,
 - 96% of the time, no purchase
 - 0.7% buy Dishwasher, profit \$500
 - 1.2% buy Vacuum Cleaner, profit \$200
 - 2.1% buy Cleaning agents, profit \$1

\$ 5.921



Example

- For the keyword *miele*, an appliance vendor 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.



Competitive market

- We have multiple advertisers, users, and the central service;
- Each has an economic incentive in participation
- How do we set up a system of payments that works for all?
 - *Mechanism design*
 - Sub-field of *game theory*



Game theory

- Study of strategic interactions between two or more rational players
- Classic tool for studying markets
 - Competition as well as collaboration.

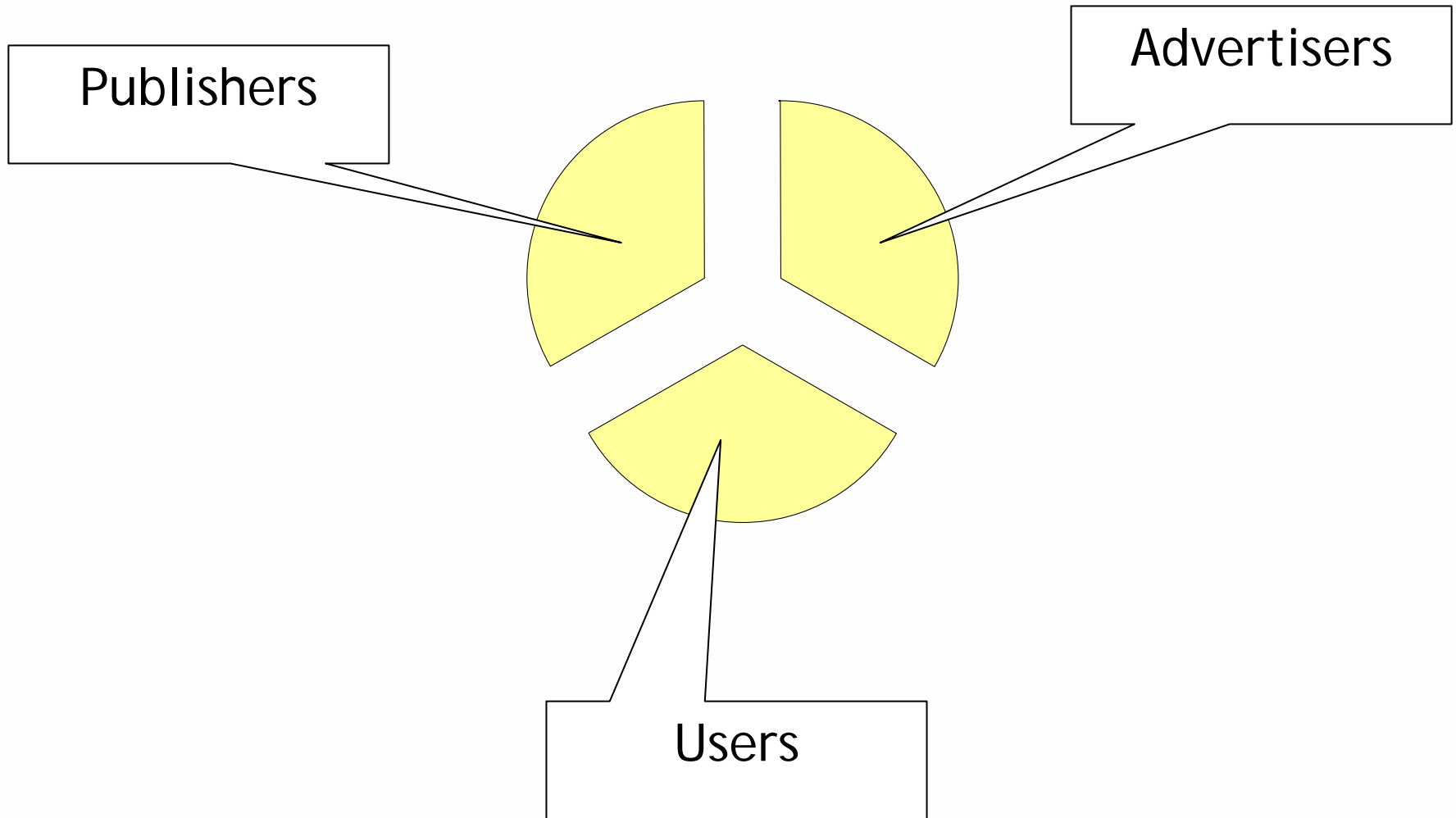


Open Questions

- Most real problems are unsolved:
 - Budgets/Allocations
 - Scarcity does not fully explain desire for position 1 – quality of clicks might be different + brand effect
 - These are repeated auctions & there are alternative goods (= synonyms)
 - There are incentives to exhaust the competitors budget.
 - Etc, etc



Contextual ads = meeting of Publishers, Advertisers, Users





Another problem not quite solved



WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPL

POLITICS WASHINGTON EDUCATION

Testimony by Former Cheney Aide Hurts Libby

By NEIL A.
Published:

WASHI
[Dick Ch](#)
directly

Ads by Google

[what's this?](#)

[Libby Shoes](#)

Great deals on everything Libby Shoes themed.
[eBay.com](#)

[isbn: 0073208140 Only \\$60](#)

Financial Accounting 5th by Libby 70% Off! Lowest Price & Fast Ship
[www.Miraukl.com](#)

[Tumuc libby shoes](#)

Huge Selection of Tumuc Shoes Free Shipping, Free Returns (Aff)
[www.Zappos.com](#)

Ads by Google

[Coffee Exposed](#)

A shocking secret coffee co's don't want you to know
[www.coffeefool.com](#)

[Libby Shoes](#)

Great deals on everything Libby Shoes themed.
[eBay.com](#)

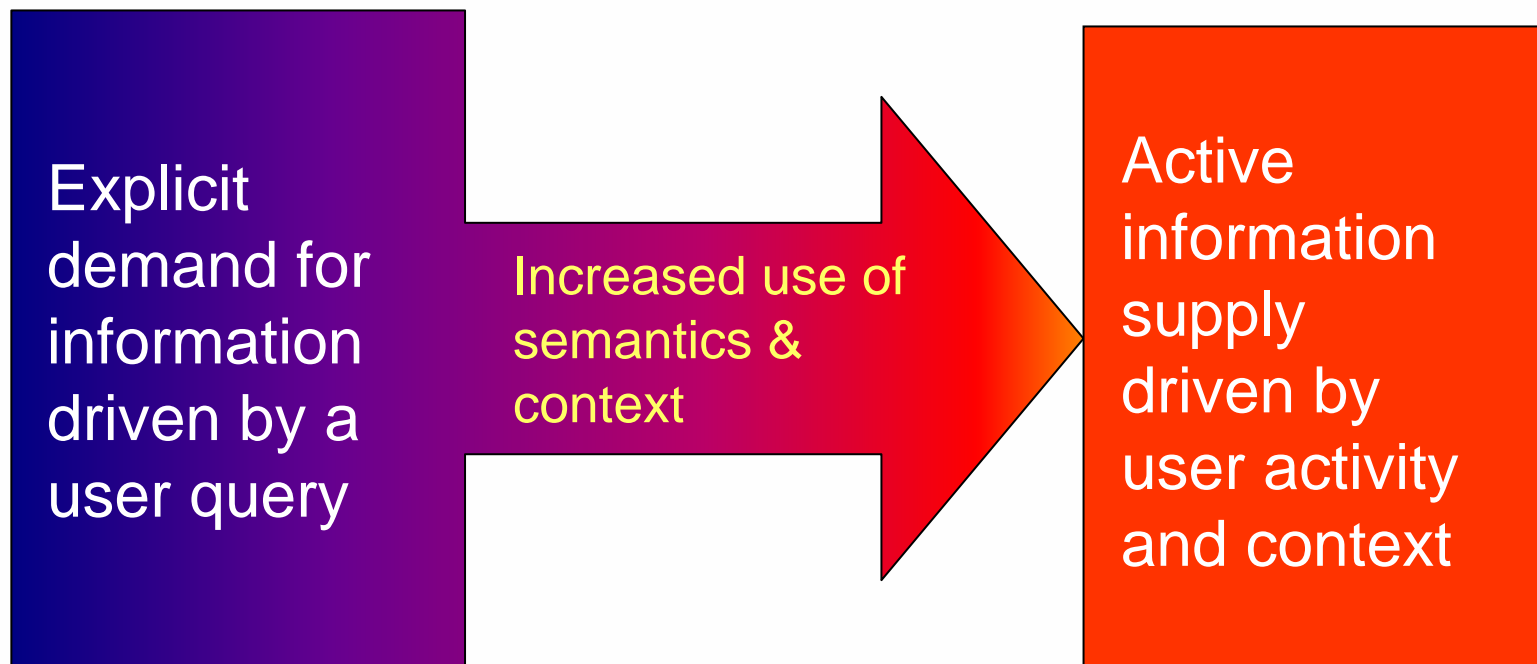
[Say No to Troop Surge](#)

Nationwide petition to stop escalation of Iraq War
[TrueMajority.org](#)



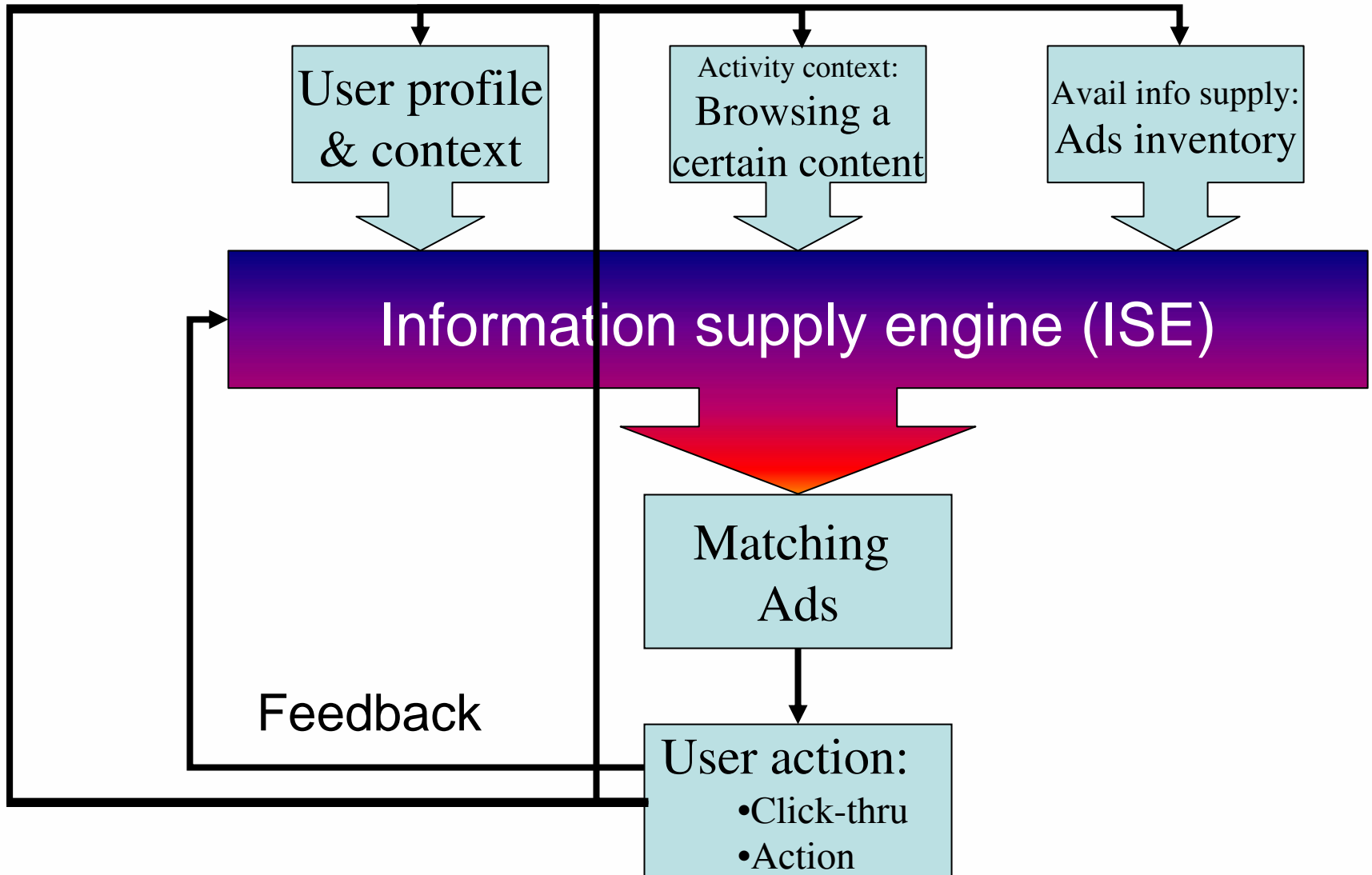


A general trend: From Information Retrieval to Information Supply





Ads as Information supply





Technical challenges to the transition to information supply

- A theory of information supply
- Representation of context
 - Vector model with lots of parameters?
- Representation of information
 - Certainly bag of words is not enough ...
- Representation of user
 - Probabilistic data
- Matching the three above
 - What to use? IR, Huge ML models, HMM, Control Theory, ...???



Matching Ads and Content via reduction to search

- Ads Database = Keywords +
Title + Description + URL
- Ad Query = Landing Page + Context
- Search problem now changes
 - Large query (a page)
- Main problem: Semantic Gap



Vocabulary Mismatch

- Synonyms
 - A dictionary partially solves the problem
 - Proper names?
- Spelling problems
 - Approximate match?
- Language mismatch



Business challenges in context driven advertising

- Advertising in general and search driven ads in particular are the economic engine behind the web.
 - To date, contextual ads have been less effective than keyword driven ads
- What is the right pricing model?
- Privacy concerns vs. effectiveness
- Great research opportunities: we can build the technology to solve the business problem, and we can change the business problem to make it solvable.



Final Remarks



The net

- Web advertising is scientifically young
- It is intellectually diverse – need to deal with:
 - Economics
 - The human element
 - The social element
 - Solving huge problems ridiculously fast
- The technology mirrors the economic, legal and sociological reality



Change in the game

- Fundamental shift:
 - R&D is no longer an upstream function that creates a product then tosses it over to someone else to market, price and sell.
- The economics and marketplace design have to be built into the product design.
 - Else an engineer makes what they think is a technical decision
 - But it turns out to be a marketplace design decision.



Research consequence

- No single discipline has the answer – need interdisciplinary approach, involving unusual partners.
- Your chance to learn something new and have a big impact!



Thank you!

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TM

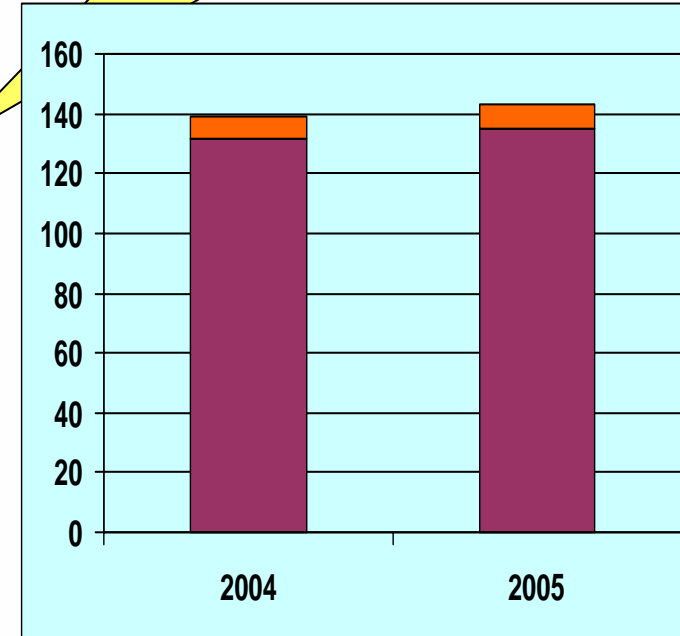


Advertising spend in USA in 2005

Excludes search advertising [TNS Media Intelligence]

| Media | Full Year 2005 (Millions) | Full Year 2004 (Millions) | % Change |
|-------------------------------------|---------------------------|---------------------------|---------------|
| NEWSPAPERS (LOCAL) | \$25,090.50 | \$24,814.40 | 1.10% |
| NETWORK TV | \$22,455.20 | \$22,523.40 | -0.30% |
| CONSUMER MAGAZINES | \$21,688.00 | \$20,167.40 | 7.50% |
| CABLE TV | \$15,874.10 | \$14,248.80 | 11.40% |
| SPOT TV ² | \$15,529.20 | \$17,158.70 | -9.50% |
| INTERNET³ | \$8,322.70 | \$7,343.00 | 13.30% |
| LOCAL RADIO ⁴ | \$7,364.90 | \$7,273.40 | 1.30% |
| B-TO-B MAGAZINES | \$4,471.00 | \$4,364.60 | 2.40% |
| SYNDICATION - NATIONAL | \$4,222.50 | \$3,930.90 | 7.40% |
| SPANISH LANGUAGE MEDIA ⁵ | \$4,219.20 | \$3,976.10 | 6.10% |
| OUTDOOR | \$3,528.80 | \$3,213.00 | 9.80% |
| NATIONAL NEWSPAPERS | \$3,466.70 | \$3,303.50 | 4.90% |
| NATIONAL SPOT RADIO | \$2,604.10 | \$2,616.50 | -0.50% |
| SUNDAY MAGAZINES | \$1,619.50 | \$1,497.40 | 8.20% |
| FSIs ⁶ | \$1,441.50 | \$1,391.90 | 3.60% |
| NETWORK RADIO | \$1,009.90 | \$1,027.80 | -1.70% |
| LOCAL MAGAZINES | \$385.50 | \$317.70 | 21.30% |
| TOTAL⁷ | \$143,293.40 | \$139,168.60 | 3.00% |

Internet 2005: \$ 8.3B
(+13.3% vs 2004)



Total US 2005: \$ 143.3B
(+3% vs 2004)

Source: TNS Media Intelligence

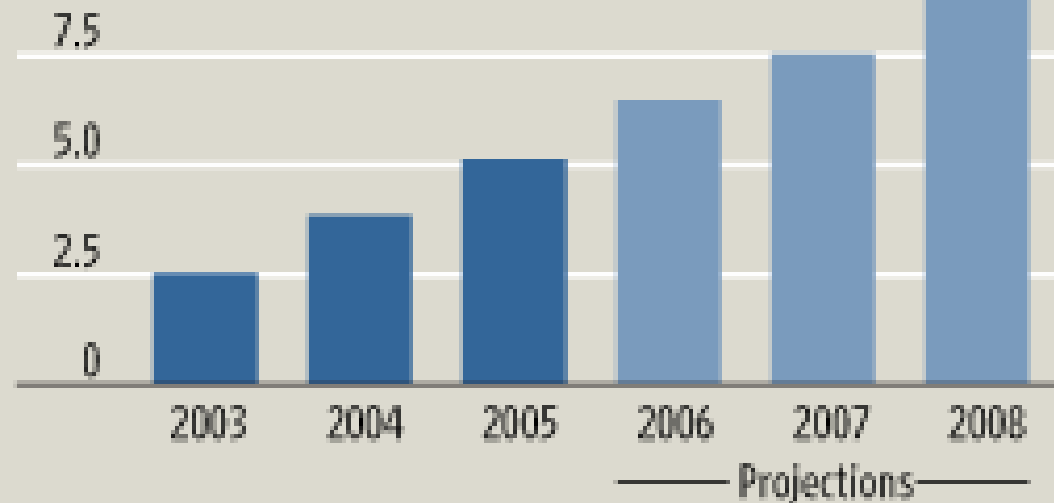


Search advertising spending

Click Costs

Spending on search advertising in the U.S.

\$10.0 billion



Source: eMarketer