Factors Affecting Aggregated Search Coherence and Search Behavior

Jaime Arguello, Robert Capra, & Wan-Ching Wu

School of Information and Library Science
University of North Carolina at Chapel Hill

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mont blanc [search box]

Montblanc Shop - Luxury Watches, Writing Instruments, Jewelry ...
www.**montblanc**.com/shop ▼
Visit the **Montblanc** shop and discover our luxury watches, writing instruments, jewelry, leather, fragrance & eyewear now available for purchase online.

Mont Blanc - Wikipedia, the free encyclopedia
en.wikipedia.org/wiki/Mt_**Blanc** ▼
History · Elevation · Climbing routes · Exploits · Cultural works · Protection
Mont Blanc or **Monte** Bianco (Italian), meaning "White Mountain", is the highest mountain in the Alps, Western Europe, and the European Union. It rises 4,810.45 m ...

MONTBLANC - Homepage
world.**montblanc**.com ▼
Visit the official **Montblanc** Website and experience the beauty and variety of the **Montblanc** collections of fine writing instruments, watches, large and small leather ...

Images of **mont blanc**

Montblanc - Luxury Watches, Writing Instruments, Jewelry & Leather
www.**montblanc**.com/flash
Visit the Official **Montblanc** site to experience the timeless beauty of **Montblanc** watches, writing instruments, jewelry, leather goods fragrance & eyewear

⋮

Shop for **mont blanc**

Mont blanc Meisterstuc... $320.00 | Mont blanc Generation ... $265.98 | Mont Blanc Presence fo... $9.49 | Mont Blanc 's Eyeglas... $268.99 | Mont Blanc MB 247 001... $330.00

web 1-3

images

web 4-10

shopping

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Thursday, October 31, 13

ambiguous query

mont blanc 🔍

Montblanc Shop - Luxury Watches, Writing Instruments, Jewelry ...
www.montblanc.com/shop ▾
Visit the **Montblanc** shop and discover our luxury watches, writing instruments, jewelry, leather, fragrance & eyewear now available for purchase online.

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images

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web 4-10

⋮

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shopping

Mont blanc Meisterstuc...	Mont blanc Generation ...	Mont Blanc Presence fo...	Mont Blanc 's Eyeglas...	Mont Blanc MB 247 001...
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Aggregated Search Coherence

[Arguello & Capra CIKM 2012]

- **Aggregated search coherence:** the extent to which results from different sources have a similar query-sense distribution

- **Research question:** Do the query-senses in the image results affect interaction with the web results?

- **Result:** Users are more likely to interact with the web results when the images are more consistent with the intended query-sense (aka the "spill-over effect")
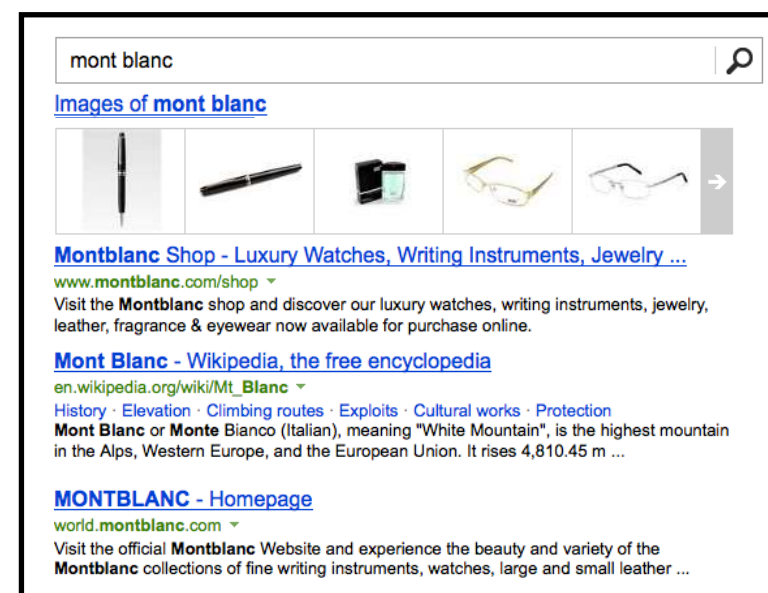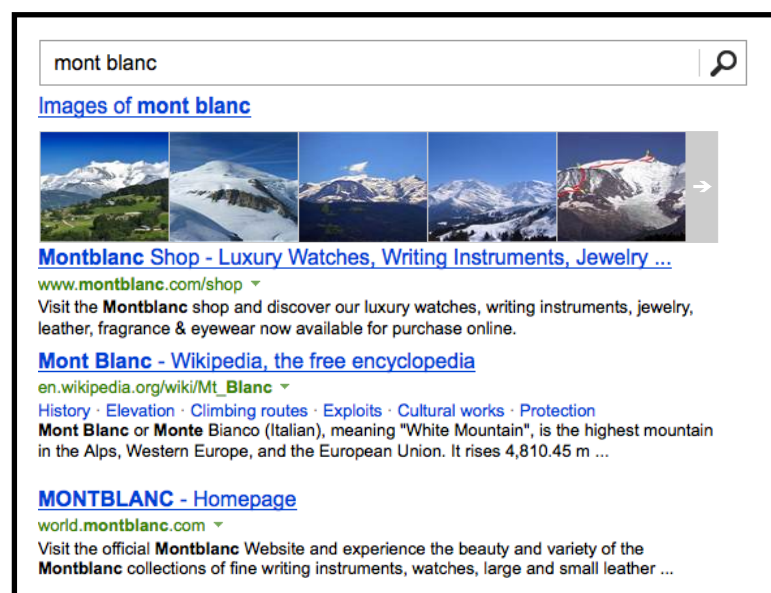
Research Questions

RQ1	Does the spill-over effect generalize to other verticals besides images?
RQ2	Is the spill-over effect stronger for verticals that include thumbnail images?
RQ3	What factors affect if and when a spill-over happens from a user's perspective?

Outline

Motivation and Research Questions

Experimental Protocol

Study 1 & Results

Study 2 & Results

Discussion

Conclusion

Overview

- **Study 1 (RQ1-2):** run on Amazon's Mechanical Turk

- **Study 2 (RQ3):** laboratory study

- **Experimental protocol:** participants were given a search task and a search interface and asked to find a webpage containing the requested information

- **Search tasks:** associated with an ambiguous entity and designed to require web results (not vertical results)

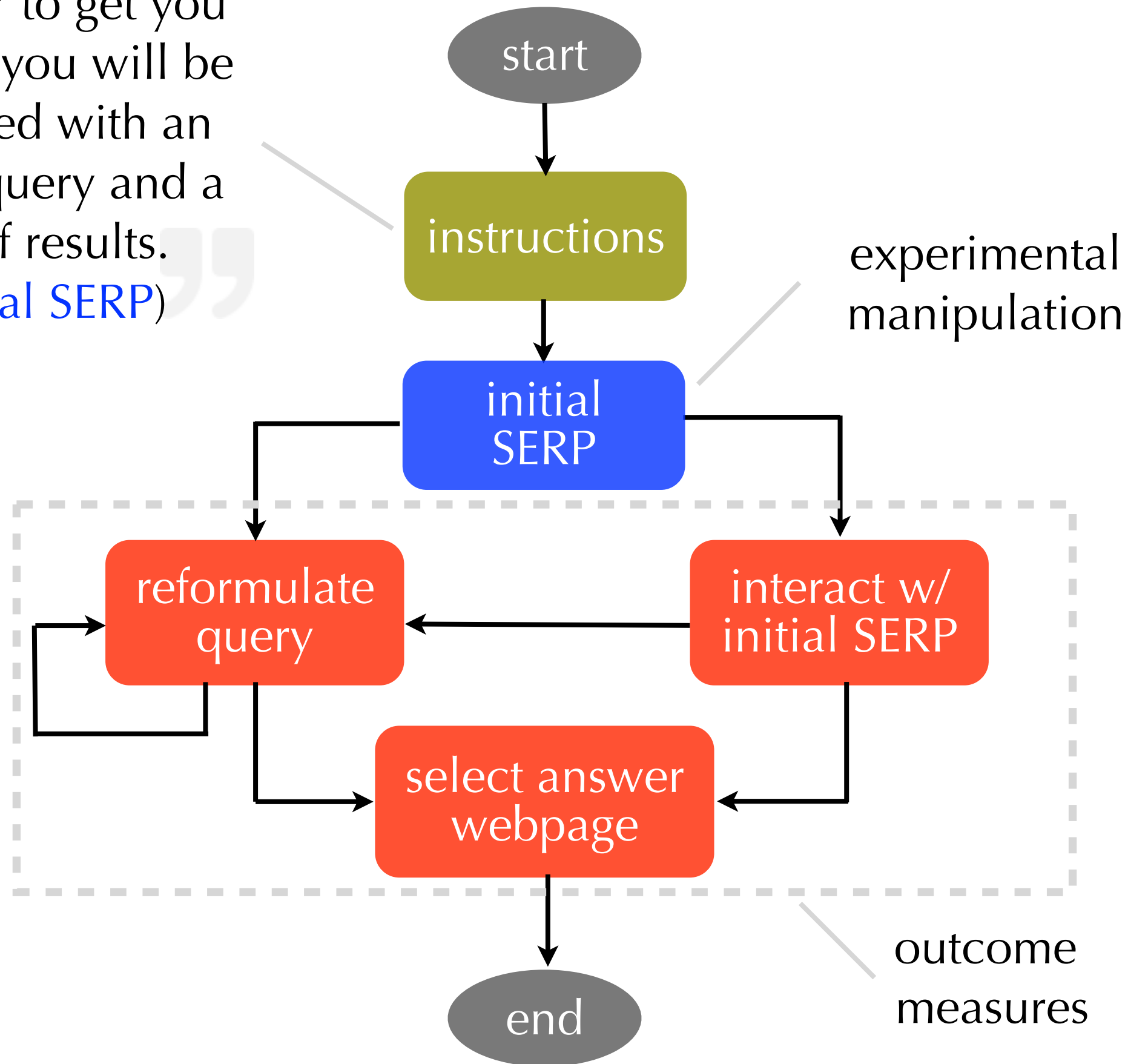- **Example:** "Find a website that contains information about what causes a snow <u>avalanche</u>"

snow
avalanche

chevy
avalanche

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Experimental Protocol

"In order to get you started, you will be provided with an initial query and a set of results. (initial SERP)

start → instructions → initial SERP

experimental manipulation

reformulate query ⇄ interact w/ initial SERP

select answer webpage

end

outcome measures

Initial SERP

Task: Find a website that contains information about what causes a snow avalanche. ⟵ search task

avalanche [Search] ⟵ initial query (ambiguous)

WEB RESULTS: 1-10 of 50

The Official Web Site - Colorado **Avalanche**
The Official Site of the Colorado **Avalanche** ... Twitter Fan Video Promotion A Lucky Fan Will Receive A Team-Signed Camouflage Jersey.
avalanche.nhl.com/

Avalanche - The Game Homepage
Games played today! play: discuss. game finder; search
www.thegamehomepage.com/play/avalanche/

Avalanche - Free Online Action Games from AddictingGames
Avalanche : Are you a towelette, or maybe a marshmallow? Whatever the case, there are huge, square bolts to dodge. Can you avoid this **avalanche?** Free Online ...
www.addictinggames.com/action-games/avalanche.jsp

Image Results

⟵ vertical results (on-target, off-target)

Name of man killed in **avalanche** released | ksl.com
The death of one person in an **avalanche** has been confirmed by local officials.
www.ksl.com/?nid=148&sid=19040802

Avalanche
An **avalanche** is a sudden, drastic flow of snow down a slope, occurring when either natural triggers, such as loading from new snow or rain, or artifical triggers ... ...
en.wikipedia.org/wiki/Avalanche

2012 Chevy **Avalanche** | SUV Truck | Chevrolet
Explore the fuel efficient 2012 Chevy **Avalanche,** a new Chevy SUV truck with unrivaled versatility. Discover the Chevy **Avalanche** here.
www.chevrolet.com/avalanche-suv-truck/

Avalanche: Definition from Answers.com
Headlines Sea to Sky Highway Closed by Landslide Landslide Affords Tycoon an Even Better View Illegal Digging Causes Landslide, Five Dead An **avalanche** is a massive ...
www.answers.com/topic/avalanche

Study 1 (RQ1-2)

- Run on Amazon's Mechanical Turk

- Vertical: images, news, shopping, video

- Vertical image: news, shopping (with and without thumbnails)

- Vertical query-sense: on-target, off-target, mixed

- 75 search tasks per vertical

- 10 redundant search sessions per experimental condition

- 16,500 Mechanical Turk HITs total

- Each HIT was priced at $0.10 USD

- Outcome measure (binary): Did the participant click on at least one web results on the initial SERP?

Task: Find biographical information about the Greek bishop, Saint Basil the Great.

saint basil   Search

WEB RESULTS: 1-10 of 50

Basil of Caesarea
Basil of Caesarea, also called **Saint Basil** the Great, (329 or 330 January 1, 379) was the Greek
bishop of Caesarea Mazaca in Cappadocia, Asia Minor (modern-day ...
en.wikipedia.org/wiki/Basil_of_Caesarea

CATHOLIC ENCYCLOPEDIA: St. **Basil** the Great - NEW ADVENT: Home
St. **Basil** the Great. Bishop of Caesarea, and one of the most distinguished Doctors of the Church.
Born probably 329; died 1 January, 379. He ranks after Athanasius as ...
www.newadvent.org/cathen/02330b.htm

Saint Basil's Cathedral
The Cathedral of the Protection of Most Holy Theotokos on the Moat or Pokrovsky Cathedral - both are
official names used by the Russian Orthodox Church - also known ...
en.wikipedia.org/wiki/Saint_Basil%27s_Cathedral

Image results for saint basil

St. **Basil** the Great - Saints & Angels - Catholic Online
Feastday: January 2 Patron of hospital administrators Died: 379. St. **Basil** the Great was born at
Caesarea of Cappadocia in 330. He was one of ten children of St ...
www.catholic.org/saints/saint.php?saint_id=261

Basil the Great - OrthodoxWiki
Life. **Basil** was born about 330 at Caesarea in Cappadocia. He came from a wealthy and pious family
which gave a number of saints, including his mother **Saint** Emily ...
orthodoxwiki.org/Basil_the_Great

on-target images

on-target

off-target

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Task: Find biographical information about Michael Moore, the Scottish Secretary of State.

michael moore   Search

WEB RESULTS: 1-10 of 50

Michael Moore - Welcome to MichaelMoore.com
Official site of the gadfly of corporations, creator of the film Roger and Me and the television show The Awful Truth. Includes mailing list, message board, and news.
www.michaelmoore.com/

Michael Moore
Michael Francis Moore (born April 23, 1954) is an American liberal filmmaker, author, social critic, and activist. He is the director and producer of Fahrenheit 9/11 ...
en.wikipedia.org/?title=Michael_Moore

Michael Moore
Director: Sicko (2007) Roger & Me (1989) Fahrenheit 9/11 (2004) Bowling for Columbine (2002).
Michael Moore was born in Flint, Michigan April 23, 1954, but ...
www.imdb.com/name/nm0601619/

News results for michael moore
Michael Moore Twitter Hashtag Backfires
ABC News - 9 hours ago
After Mitt Romney asserted in a closed-door fundraiser that hed have a better chance at winning the election if he were Latino, liberal filmmaker Michael Moore tried to poke a little fun at the statement by creating a Twitter hashtag #IfIWereMexican.
Michael Moore and other high-profile backers lose Julian Assange bail money
Entertainment Weekly Online - 15 days ago
Michael Moore Predicts Romney Will Win in November
Big Hollywood - 19 days ago

Michael Moore, Piers Morgan Clash Over Moore's Wealth (VIDEO)
Piers Morgan and Michael Moore clashed about Moore's own wealth during a special edition of Morgan's show on Tuesday. Moore refused to play along when ...
www.huffingtonpost.com/2011/10/26/michael-moore-piers-morgan...

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off-target news (text only)

on-target

off-target

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Task: Find information about the history of the Big Bang Theory of the universe.

big bang theory | Search

WEB RESULTS: 1-10 of 50

The **Big Bang Theory**: Watch Episodes and Video and Join the ...
Watch video, browse photos and join the ultimate fan community for The **Big Bang Theory**
www.cbs.com/primetime/big_bang_theory/

The **Big Bang Theory**
The **Big Bang Theory** is an American sitcom created by Chuck Lorre and Bill Prady, both of whom
serve as executive producers on the show, along with Steven Molaro. All ...
en.wikipedia.org/wiki/The_Big_Bang_Theory

The **Big Bang Theory** (TV Series 2007)
Created by Chuck Lorre, Bill Prady. Actors: Johnny Galecki: Leonard Hofstadter Jim Parsons: Sheldon
Cooper Kaley Cuoco: Penny Simon Helberg: Howard Wolowitz ...
www.imdb.com/title/tt0898266/

News results for big bang theory

Big Bang Theory: Johnny Galeckis a fan of Penny, Amy and Bernadette
Toronto Star - 13 hours ago
There are now just so many creative directions, which is very exciting, and I dont know how
many shows could say that going into Season 6. The **Big Bang Theory** is Canadas No. 1 rated
TV show. The new season premieres next Thursday, Sept.
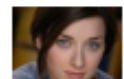
Big Bang Theory Boss Confirms: Bent Bad Girl Is Leonard's New Romantic Interest
YAHOO! - 4 days ago

This week's cover: Inside the phenomenon that's 'The **Big Bang** Theory'
Entertainment Weekly Online - 23 hours ago

Big Bang
The **Big Bang theory** is the prevailing cosmological model that describes the early development of the
Universe. According to the **Big Bang theory,** the Universe was once ...
en.wikipedia.org/wiki/Big_Bang_theory

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on-target

off-target

off-target news with thumbnails

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Task: Find information about which book inspired the 1982 movie Bladerunner.

bladerunner   [Search]

WEB RESULTS: 1-10 of 50

Blade Runner
Blade Runner is a 1982 American dystopian science fiction action film directed by Ridley Scott and
starring Harrison Ford, Rutger Hauer, and Sean Young. The ...
en.wikipedia.org/wiki/Blade_Runner

Blade Runner (1982)
Director: Ridley Scott. Actors: Harrison Ford: Rick Deckard Rutger Hauer: Roy Batty Sean Young:
Rachael Edward James Olmos: Gaff M. Emmet Walsh: Bryant ...
www.imdb.com/title/tt0083658/

Blade Runner - Rotten Tomatoes - Movies | Movie Trailers | Reviews ...
Misunderstood when it first hit theaters, the influence of Ridley Scott's mysterious, neo-noir Blade
Runner has deepened with time. A visually remarkable, achingly ...
www.rottentomatoes.com/m/blade_runner/

Shopping results for bladerunner
Bluray Lot 5 Movies: **Bladerunner,** Minority Report, Total Recall, plus others $39.99 Used
Blade Runner Advantage Womens Sz 9 Black Pink Silver Inline Skates Roller Blades $49.99 Pre-owned
Blade Runner: The Final Cut Blu-ray $19.47 Brand New
BLADE RUNNER PRO 4700 ROLLERBLADES-INLINE SKATES, WOMENS 8 $25.0 Pre-owned
INLINE skates men 10 BLADE RUNNER Horizon roller blades skates INLINE SKATES $12.99 Pre-owned

Best Deal on **Bladerunner** Formula 82 Womens Inline Skates 2012 ...
Bladerunner Formula 82 Womens Inline Skates 2012 Are you looking to fine the **Bladerunner**
Formula 82 Womens Inline Skates 2012 ? Yes! You can order ...
tricyclesscooterswagonshappy.wordpress.com/2012/10/14/best-d...

Amazon.com: Blade Runner (Five-Disc Complete Collector's Edition ...
In celebration of Blade Runner 's 25th anniversary, director Ridley Scott has gone back into post
production to create the long-awaited definitive new version. Blade ...
www.amazon.com/Five-Disc-Complete-Collectors-Edition-Blu-ray...

⋮

mixed shopping (text only)

on-target

off-target

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mixed shopping (with thumbnails)

on-target

off-target

on-target

off-target

on-target video

Study 1 Results

RQ1	Does the spill-over effect generalize to other verticals besides images?
RQ2	Is the spill-over effect stronger for verticals that include thumbnail images?
RQ3	What factors affect if and when a spill-over happens from a user's perspective?

Study 1 Results (RQ1)

	images	shopping (thumbnail)	video	news (thumbnail)
▢ web only	44.40%	43.39%	35.51%	37.81%
▨ off	37.87%	37.52%	34.13%	37.11%
▨ mix	43.39%	43.60%	35.20%	35.79%
■ on	49.20%	45.07%	36.93%	35.13%

- Significant effect for images ($p < .05$) and shopping ($p < .05$)

- Similar trend for video ($p = .726$)

- Different trend for news ($p = .283$)

Study 1 Results (RQ2)

	shopping (text-only)	shopping (thumbnail)	news (text-only)	news (thumbnail)
web only	43.39%	43.39%	37.81%	37.81%
off	38.27%	37.52%	36.05%	37.11%
mix	43.26%	43.60%	35.79%	35.79%
on	43.73%	45.07%	33.07%	35.13%

- Logistic regression analysis

- For shopping, the only significant predictor was vertical query-sense ($p < .05$)

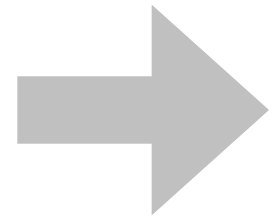- For news, no predictor was significant

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Study 2 (RQ3)

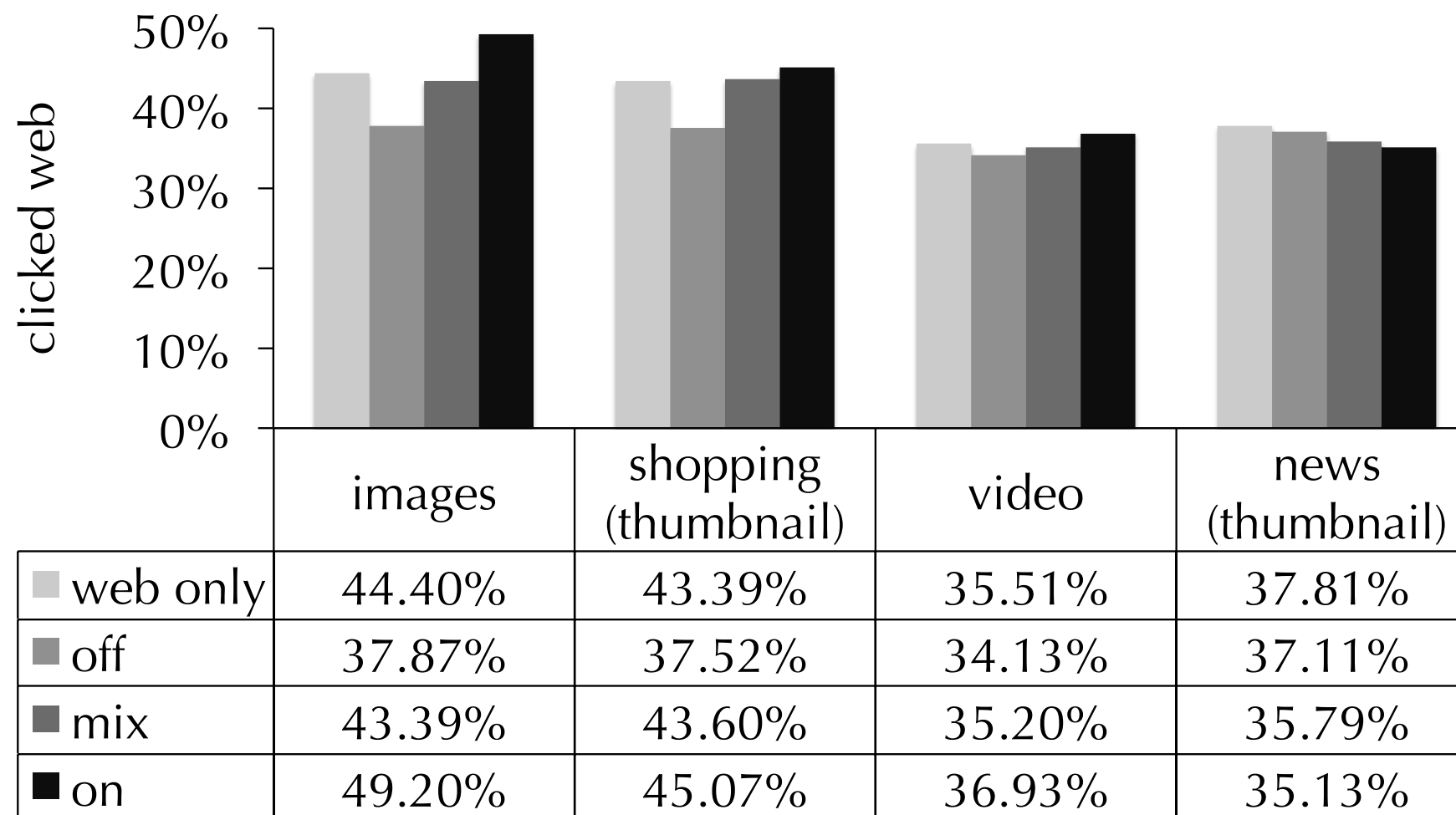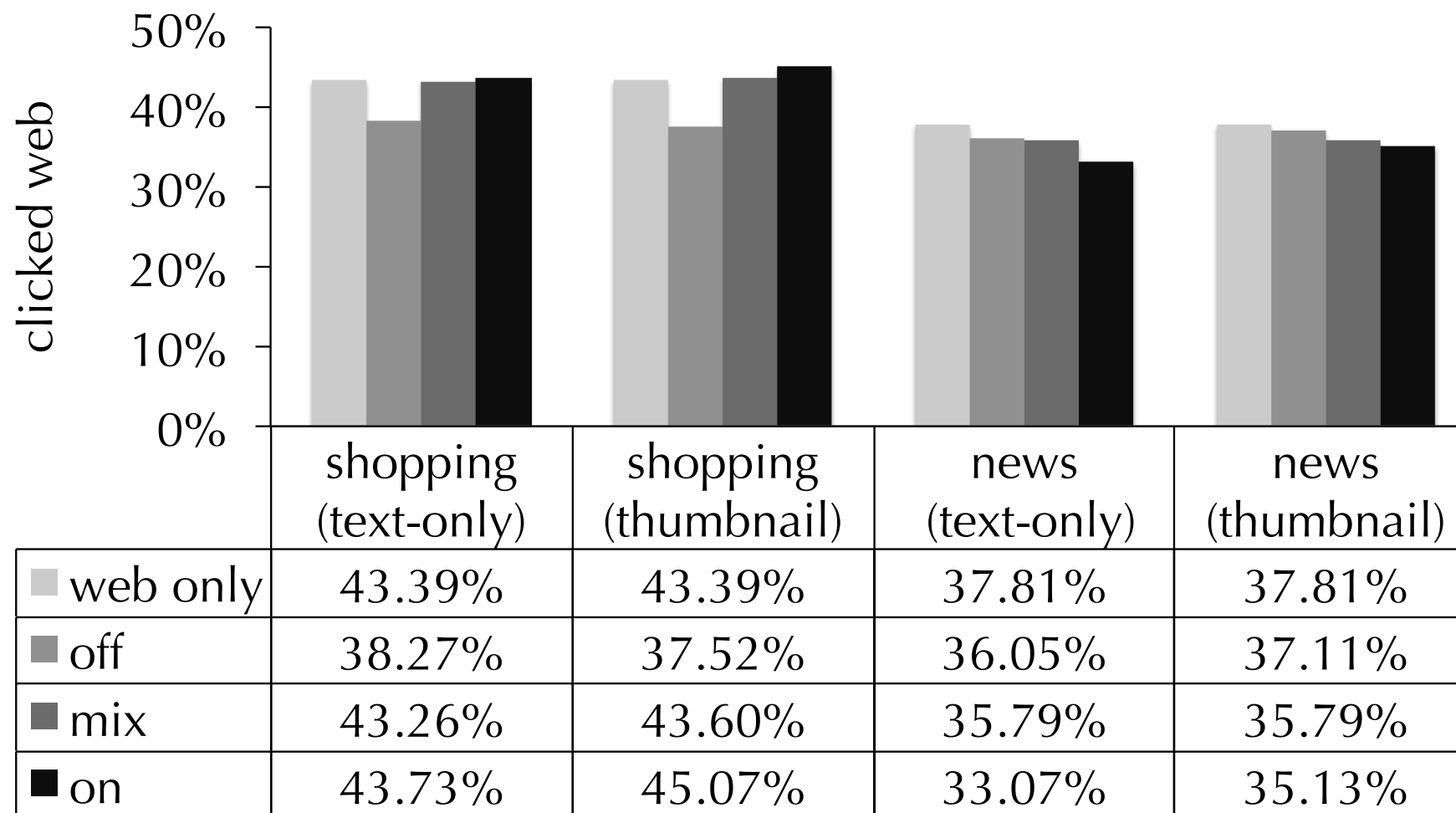|	
RQ1	Does the spill-over effect generalize to other verticals besides images?
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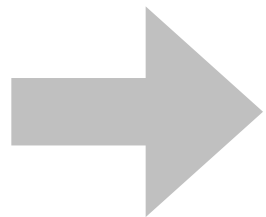
Study 2 (RQ3)

- Laboratory study using a retrospective think-aloud protocol

- Vertical: images, news (with thumbnails)

- Vertical query-sense: on-target, off-target

- 4 search tasks per vertical

- 16 participants (6 male, 10 female)

- Each participant completed 4 tasks

Study 2 (RQ3)

- Searches were recorded and played back to participants

- Participants were instructed to narrate their actions and thought processes on the initial SERP

- At the end of the four tasks, participants were re-played their searches and asked target questions about their actions on the initial SERP

- Think-aloud comments and interview responses were analyzed in order to classify search sessions into one of four categories:

  ‣ (1) positive spill-over, (2) negative spill-over, (3) no spill-over, and (4) unknown spill-over.

Study 2 Results (RQ3)

- Of the 64 search sessions:

  ‣ 25 (39%) had (positive/negative) spill-over

  ‣ 33 (52%) had no spill-over

  ‣ 6 (9%) had unknown spill-over

- Of the 25 search sessions with spill-over:

  ‣ 17 (68%) happened for the image vertical

  ‣ 8 (32%) happened for the news vertical

- Consistent with Study 1 results, the image vertical had more spill-over

Study 2 Results: Positive Spill-over

- The on-target vertical results <u>increased</u> the participant's confidence in the overall results (including the web results)

  " I thought the links on the page [the web results] would be more specific because all the images were about Saint Basil. "

- Given little prior knowledge about the search topic, the on-target vertical results provided visual cues about things to look for on the SERP

  " When I read the task, I knew that I didn't know anything about the topic... First I saw the pictures and I saw that China Lake is a military base in the California. Then I went back up and started going down the page. "

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Study 2 Results: Negative Spill-over

- The off-target vertical results <u>decreased</u> the participant's confidence in the overall results (including the web results)

> I knew that these pictures were about the TV show[off-target news thumbnails]. That was the biggest indicator that the results were about the TV show [and not the Big Bang Theory of the universe]

Study 2 Results: No Spill-over (1)

- The top (on-/off-target) web results caused the participant to not even perceive the vertical results.

    " I don't think I looked at these [news vertical results]. I looked at the top result and noticed it said something about vacations [the off-target query-sense] and decided that the query was too general. "

- The participant perceived the vertical results as being a specific type of result, not relevant to the task, and did not process them enough to recognize their on-/off-target query sense.

  > I did notice the news results again [off-target news]. But, because I was looking for historical information [about the first World Series of baseball] I didn't try to figure out what they were about. Now I see that they're about the World Series of Poker.

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Study 2 Results: No Spill-over (3)

- The participant perceived the vertical results and processed them enough to recognize their query-sense, but did not perceive the off-target query-sense as being off-target.

> I noticed these briefly [off-target images] and figured that this place [Saint Basil's Cathedral] had to be somehow related to the Saint.

Discussion: RQ3

- Insights gained from Study 2 suggest that three things must happen for a spill-over to happen:

  1. <u>perceive</u> the vertical results

  2. process them enough to <u>recognize</u> their on-/off-target query-sense

  3. let their query-sense increase/decrease their <u>confidence</u> in the SERP as a whole

Discussion: RQ3

- Factors that may affect the likelihood of a spill-over effect

	perceive	recognize	confidence
web results	✓		
vertical relevance		✓	
cognitive load		✓	
query-sense relation			✓
user's mental model			✓
layout			✓

Discussion: RQ1

- The spill-over effect did not generalize to the video and news verticals

- Hypothesis: news and video results required more cognitive effort to process

- News results included more text than the other verticals

- Video results were presented using still-frames

- Participants may have perceived the video and news results

- However, given that the tasks did not require vertical results, participants may have not expended the effort to recognize their query-senses

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Discussion: RQ2

- Including thumbnails did not moderate the spill-over for the news and shopping results

- Hypothesis: thumbnails may play a greater role when the vertical is blended lower in the web results

- Vertical results were presented between web ranks 3 and 4 (above the fold)

- Thumbnails may increase the likelihood of perceiving the vertical results when the vertical is ranked lower

Implications for IR

- Aggregated search

    ▸ Approaches to vertical selection and ranking assume that all false positive predictions are equally bad

    ▸ New approaches may need to consider their (positive or negative) effect on other components in the page

    ▸ These approaches may need to consider different factors of the vertical, the user, and the layout

- Web result diversification

    ▸ Approaches to diversity ranking assume homogeneous results (e.g., only web results)

    ▸ New approaches may need to consider the amount of diversification from verticals presented on the SERP

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Conclusions

- Given an ambiguous query, the query-senses in the vertical results can affect user interaction with the web results

- The spill-over effect happens for some verticals (images, shopping), but not others (video, news)

- Including thumbnails in the vertical results has little effect (at least when the vertical is ranked high)

- Different factors are likely to influence whether a spill-over happens

- As search engines increasingly integrate more content from independent systems, understanding and modeling cross-component effects will greatly affect the user experience
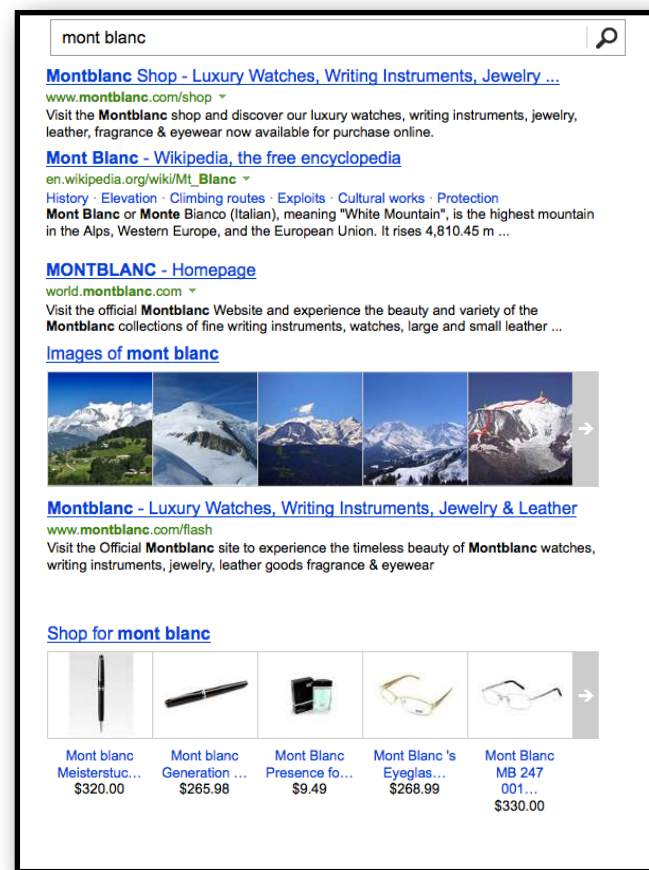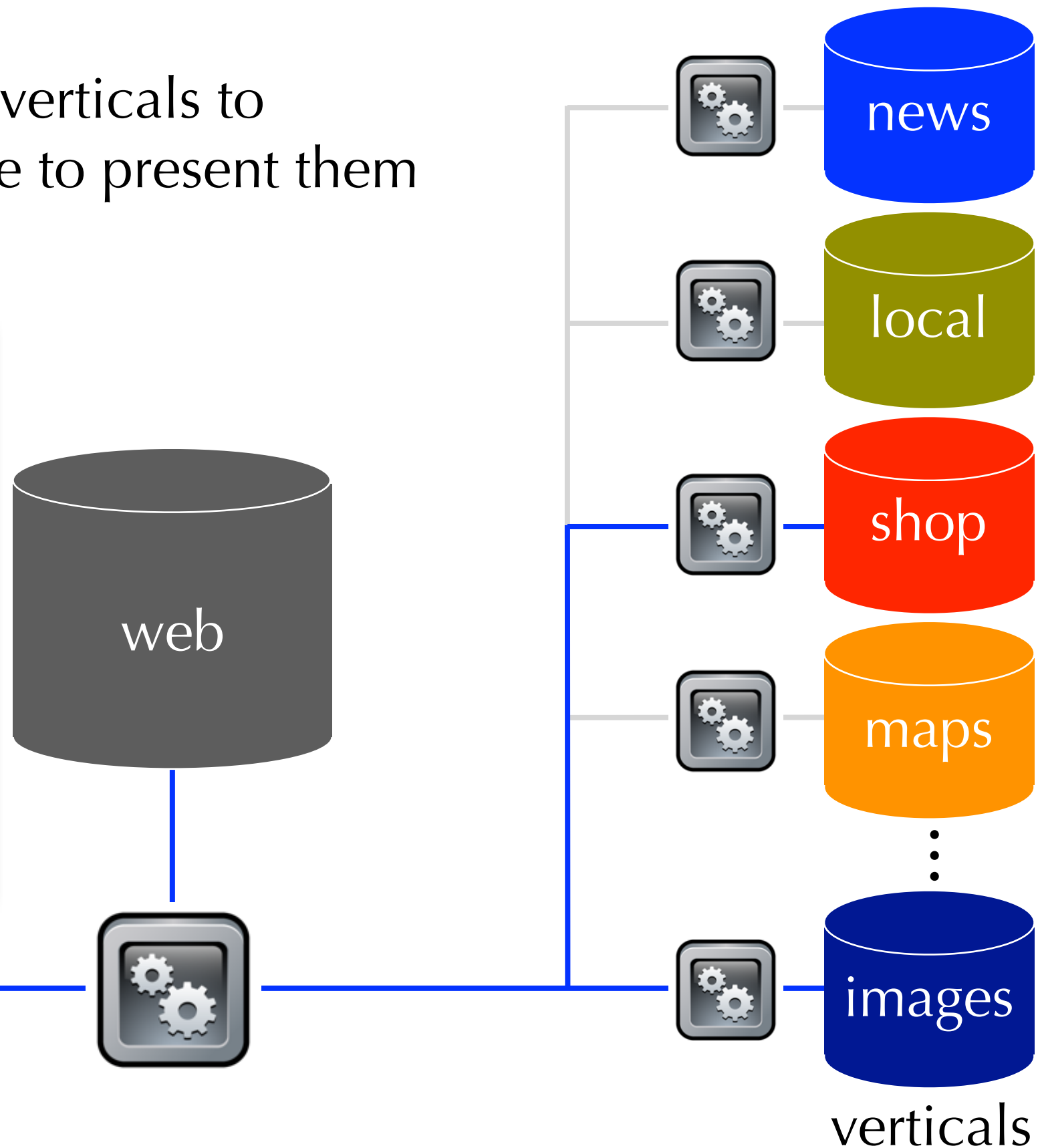
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Thank you!
Questions?

Supplemental Slides

Aggregated Search

- predicting which verticals to present and where to present them

"mont blanc"

verticals

news

local

shop

maps

images

Aggregated Search Coherence

- The extend to which results from different sources focus on similar senses of an ambiguous query

    1. Users issue ambiguous queries

    2. Aggregated search systems follow a "pipeline" architecture: results from different sources are independent of each other

    3. Different collections may have a different query-sense distribution

    4. Different ranking algorithms may favor different query-senses

Study 2 Results: No Spill-over

- The participant noticed the vertical results, processed them enough to recognize their on-target sense, expended effort trying to assess their relevance to the task, and upon judging them non-relevant, decided to try an entirely different query.

  " I looked at the images [on-target news thumbnails], but nothing seem tourism-related. That's when I said: Forget it, I'm just gonna do a totally different query. "