

# The Importance of Interaction in Information Retrieval

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SIGIR 2019

# Continuing the Interaction Discussion

- Nick Belkin, Gerald Salton Award 2015, “People, Interacting with Information”
- Kalervo Jarvelin, Gerald Salton Award 2018, “Information Interaction in Context”
- Also an important part of the work of Norbert Fuhr (2012) and Sue Dumais (2009)

# Two IR Research Communities?

## SYSTEM-ORIENTED

- Researchers focused on “algorithms”, IR models and system implementation
- Ranking models, text representation, efficiency
- Computer Science viewpoint

## USER-ORIENTED

- Researchers focused on the users and interfaces of IR systems
- How they use it, why they use it
- Information Science viewpoint

# Retrieval models!



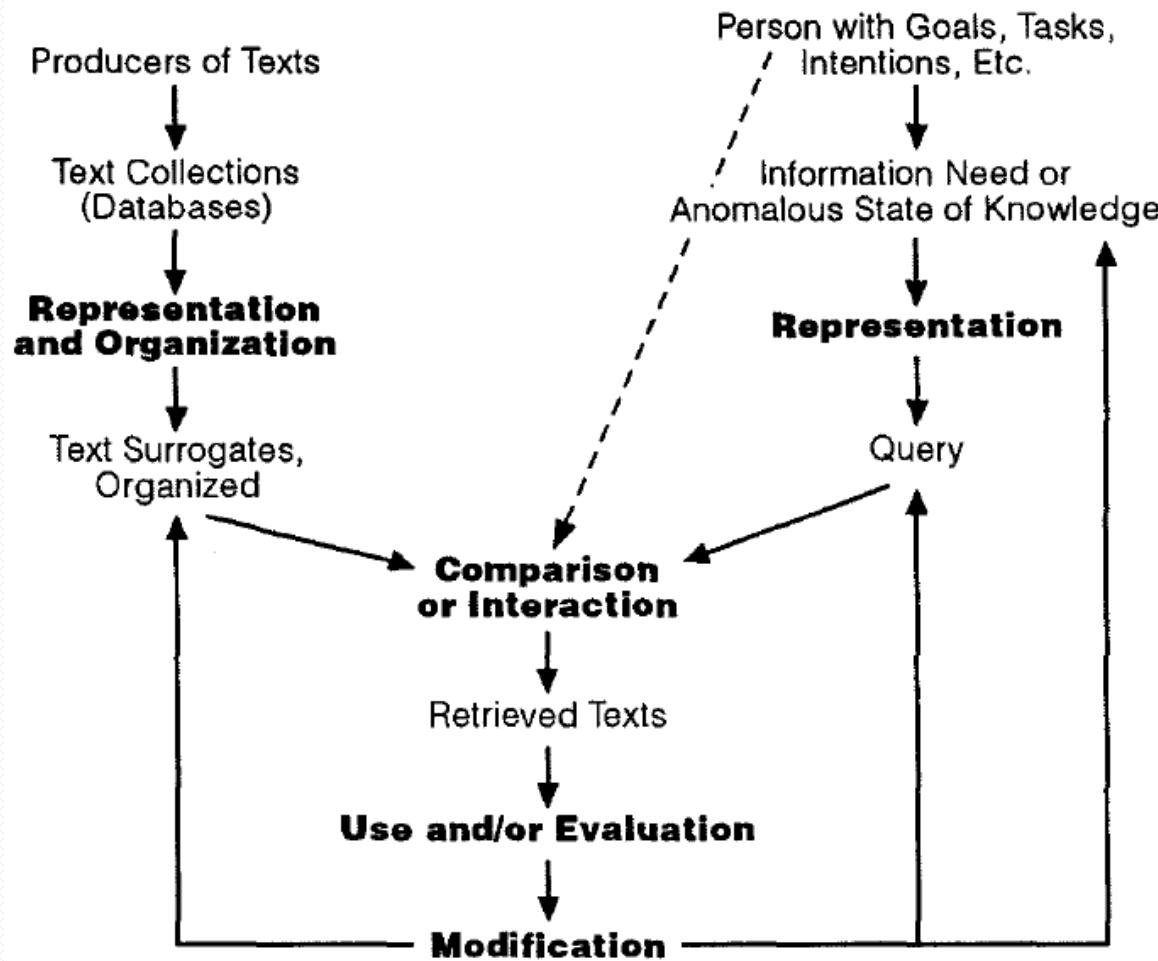


Users!

# Common Ground

- Users have always been a central focus of IR
- Distinguished IR from database research and even AI
- Core concepts of IR are based on people
  - Information needs, relevance, feedback, browsing, evaluation
- Different views on the relative importance of the system

# The IR Community Collaborating



Belkin and Croft,  
1992

# Interaction is Key

- Effective access to information often requires interaction between the user and the system
  - More than a “one-shot” query
  - Both the user and the system should play a role
- Even more effective information access requires a system that **actively** supports effective interaction
  - Modeling the interaction
  - Becomes more crucial in “limited bandwidth” scenarios such as mobile phones or voice-based systems



All Images Maps Videos News More Settings Tools

About 4,640,000 results (0.57 seconds)

### Catacombs In Paris | TripAdvisor Official Site | TripAdvisor.com

[Ad](#) www.tripadvisor.com/Tours/Book-Now ▾

TripAdvisor Official Site

#### Top Tickets & Tours

Choose from the top tickets and tours for your holiday.

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Find top-rated tours and activities in your destination. See the world with GetYourGuide. We make changing your travel plans easy with our free and flexible cancellation policy. Best selection. Easy mobile booking. Sightseeing tours. Best price guarantee. Skip the line tickets. Top attraction tickets.

[Tickets](#) · [Tours](#) · [About Us](#) · [Activities](#) · [Day Trips](#) · [Top Boat Tours & Cruises](#)

### The Paris Catacombs | Catacombes de Paris

catacombes.paris.fr/en ▾

Ticket window closes at 7:30 p.m.. Adress: 1 av. du Colonel Henri Rol-Tanguy 75014 Paris. Access.

Prices: €13 / €11 (reduced rates). Quick-access ticket online ...

[Site history](#) · [Useful Information](#) · [Visit](#) · To read before your visit

### Catacombs of Paris - Wikipedia

[https://en.wikipedia.org/wiki/Catacombs\\_of\\_Paris](https://en.wikipedia.org/wiki/Catacombs_of_Paris) ▾

The Catacombs of Paris (French: Catacombes de Paris, (help, info)) are underground ossuaries in Paris, France, which hold the remains of more than six million people in a small part of a tunnel network built to consolidate Paris' ancient stone mines.

[Mines of Paris](#) · [Ossuary](#) · [Holy Innocents' Cemetery](#) · [Barrière d'Enfer](#)

#### People also ask

Why does Paris have catacombs?



## Catacombs of Paris

[Website](#)

[Directions](#)

[Save](#)

4.0 ★★★★☆ 4,379 Google reviews

Cemetery

[BUY TICKETS](#)

The Catacombs of Paris are underground ossuaries in Paris, France, which hold the remains of more than six million people in a small part of a tunnel network built to consolidate Paris' ancient stone mines.

[Wikipedia](#)

**Address:** 1 Avenue du Colonel Henri Rol-Tanguy, 75014 Paris, France

**Hours:** Open · Closes 8:30PM ▾

**Did you know:** There was an incident which took place in the year 2004 when the police officials who were undertaking a training exercise in the catacombs came across something really unexpected.

[weirdnewsledger.com](#)

[Suggest an edit](#)

#### Events

Wed, Apr 24 ECHOFIRE

2:00 AM

Tue, Jun 25 Jour 8: Les Catacombes

8:30 AM

Sat, Jun 29 Catacumbas de Paris: Sin colas + Audioguía

9:45 AM

#### Questions & answers

Q: How long catacombs is?

[Ask a question](#)

A: Around 1.5km, we were there for 30 minutes. I suggest buying the tickets online in advance.

(5 more answers)

Example:  
Web search

# Web Search

- Generally viewed as placing most of the burden for successful search on the user
  - e.g., query reformulation, browsing SERPs
- But, web search engines perform many functions to make browsing more effective
  - Query completion
  - Aggregated ranking
  - Query suggestion
- System has a more passive role in the interaction

*Relief Whichever Act is Act 1989, 1993, 1993*

## House Passes Bill Boosting Benefits Under Medicare

By Joe Davidson

Staff Reporter of The Wall Street Journal

The House, despite a veto threat from President Reagan, approved health-care legislation for catastrophic illness that would provide broad expansion of Medicare programs and impose a surtax on the more affluent elderly.

The Medicare Catastrophic Protection Act of 1987, passed on a 302-127 vote, also would create a prescription-drug benefit to cover 80% of a recipient's medicine bill after he or she paid the first \$500 in a given year.

Out-of-pocket expenses for such things as outpatient services would be limited to \$1,789 in 1989, the first year all provisions of the bill would be in effect. Currently there is no such limit. The measure also would, in effect, cover all hospital costs except for one deductible payment each year. The deductible currently is set at \$520 for each hospital stay.

And for the first time, Medicare would pay for 80 hours a year for home-health services to provide relief for unpaid care givers, generally relatives of the Medicare recipient. Although this provision is limited, senior citizens advocates viewed it as significant because it would address a social purpose rather than a direct medical need.

President Reagan, who while an actor campaigned against the original Medicare legislation, has threatened to veto the catastrophic-care legislation. In a letter sent to House Speaker Jim Wright (D., Texas) before the vote, four cabinet officers called the bill "totally unacceptable." Its benefits would cost \$2 billion more than the revenue it would generate in 1995, they estimated, and would widen the federal deficit \$20 billion by the year 2005.

The Congressional Budget Office estimated the House bill's catastrophic-care program would cost \$1.2 billion for the fiscal year starting Oct. 1, and would rise to more than \$10 billion by 1992. The premium that recipients pay for outpatient services would increase to \$25.50 in 1989 from \$22.90 projected under current law, the budget office estimated.

The catastrophic-illness program would be funded with a mandatory premium collected through the Internal Revenue System. The non-deductible premium would be related to income, with those elderly having \$6,000 in adjusted gross income in 1988 paying an additional \$10 annually, and those with more than \$15,000 in annual income paying \$580. The surtax would apply to the 40% of the elderly who earn enough to pay income taxes.

Rep. Fortney Stark (D., Calif.) said the overwhelming support for the legislation "shows we could override a veto in the House."

Mr. Reagan initiated the move toward catastrophic-care legislation during his 1986 State of the Union message, and sent his proposal to Congress a year later. The administration proposal, recommended by Health and Human Services Secretary Otis Bowen, was faulted by many conservatives as being potentially too expensive, and by many liberals because it wouldn't have covered nursing home expenses.



1 2 3 4 5 6 7 8 9 10  
min max

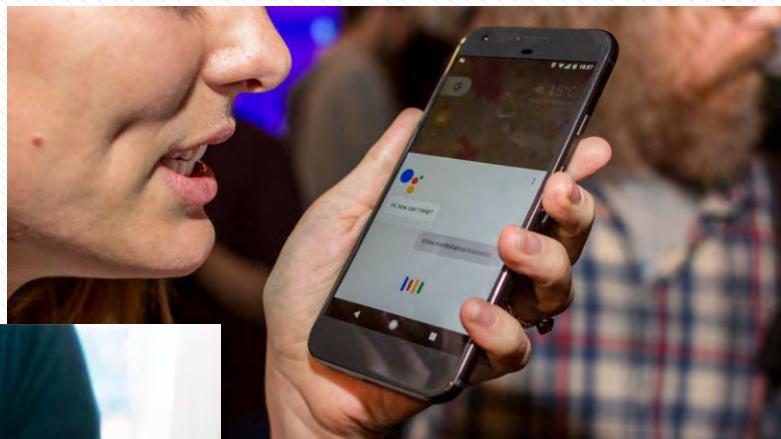
Example: Golovchinsky et al, 1999  
From reading to retrieval: Freeform ink annotations as queries.

# Interacting with text

- User selects and annotates text in documents
  - Annotations then used as the basis for new queries
- Effective retrieval requires the system to use this feedback effectively in query generation and ranking
  - Lee and Croft, Generating queries from user-selected text. IUIX '12.
  - Sorig, Collignon, Fiebrink, and Kando, Evaluation of rich and explicit feedback for exploratory search. CHIIR '19.
- System still a passive partner in the interaction



Example:  
Conversational search



# Conversational Search

- Always one of the ultimate goals of IR
- System clearly has an active role in the interaction
- Limited bandwidth of speech and screen means that the system's role is crucial for success

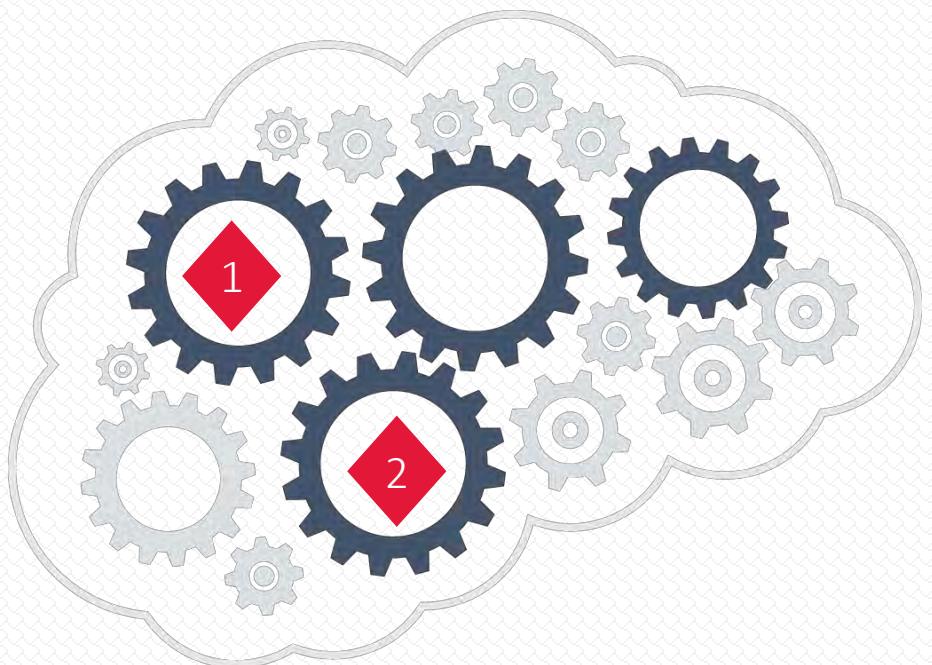
# What am I going to talk about?

- The importance of interaction for information retrieval: past, present and future
  - Historical overview
  - Interaction in question answering
  - Interaction in conversational search
  - Examples from CIIR
  - What needs to be done

# A Short History of Interaction in IR

Time	Boolean search systems Indexing tools and thesauri Cranfield evaluation studies Natural language queries and ranking Relevance feedback Result presentation Term weighting and highlighting Summaries and snippets Exploratory search Recommendation systems Conversational search	Search strategies Studies of information dialogues Browsing Expert intermediaries Hypertext and links Web search Clustering and visualization Information interaction in context Question answering Query transformation Forums and CQA Evaluation of interactive systems Voice-based search	Mobile search
			

# Early Days



- ◆ Boolean search engines
- ◆ Indexing tools and thesauri
- ◆ Cranfield evaluation studies
- ◆ Search strategies
- ◆ Studies of information dialogues

H. M. Brooks and N. J. Belkin. Using discourse analysis for the  
Bates, M.J. Information Search Tactics. JASIS, 1979  
design of information retrieval interaction mechanisms. SIGIR 83  
Bates, M.J. The Design of Browsing and Berrypicking Techniques  
H. M. Brooks, P.J. Daniels and N. J. Belkin. Research on  
for the Online Search Interface. Online Review, 1989  
information interaction and intelligent information provision  
mechanisms. Journal Inf. Sci. 1986

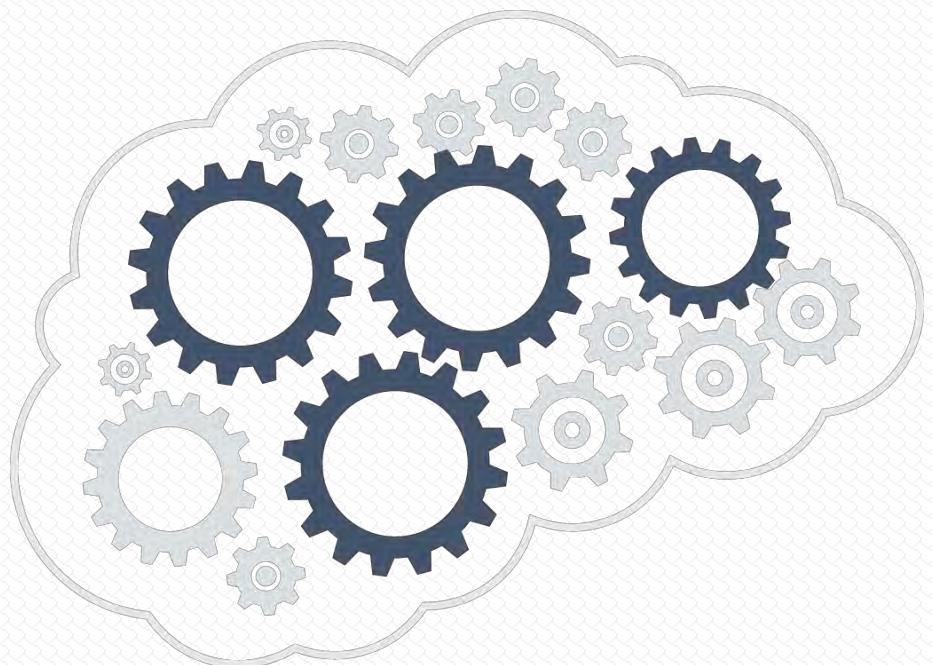
# Understanding Intermediary Interactions

I UNo (,) what I'm interested in (,)/18a er I'm doing this	
I ah um/19	
U(,) in Nova Scotia (,) when I finish/18b and er (,) I	
I I spent four years with the governm	
I mr U(inaud) outdoor recreation so I/2	
I I handle on what kinds of recreation	
I yes/25	
U(.) but what I'm looking at now is	
I	
Uconflict and cost benefit (,) aspect	
I yes mm/28	
Uthey/27 I (,) I will have to look a	
I yeah/ Uaspects of um (,) recreation/29 b	
I but you (,) you've (,) got an idea	
U	
I things go on (laughter) in the for	
U yeh	
I yeah?/34 um: (.) now (.) are you going to (.) look	
U yeh/33	
I at this on a world (,) world wide level [35]	
U	

Utterance number	Subgoal acronym	Utterance analysis
18a	RES	User begins to talk about his
18b	UGOAL	User has the goal of returning to his own country after completing his thesis
19	ph	Phatic communication
20	BACK	User describes his employer background
21	ph	Phatic communication
22 & 24a	KNOW	User refers to his state of knowledge on part of the se
23, 25, 26	ph	Phatic communication
24b, 27,	RES	User continues to describe his research topic
29 & 31		Phatic communication
28 & 30	ph	User continues to describe his research topic
32, 34	MATCH: KNOW	Intermediary attempts to mat model of the user's state of
33	MATCH: KNOW: CONFIRM	User confirms that the two m of the user's state of knowle appear to match
35	FRAME WORD–FOCUS SHIFT	

Name of function	Description
1. Problem State (PS)	Determine position of user in problem treatment process, e.g. formulating problem, problem well-specified, etc.
2. Problem Mode (PM)	Determine appropriate mechanism capability, e.g. document retrieval
3. User Model (UM)	Generate description of user type, goals, beliefs, knowledge, etc., e.g., graduate student, thesis etc.
4. Problem Description (PD)	Generate description of problem type, topic, structure, environment, etc.
5. Dialogue Mode (DM)	Determine appropriate dialogue type and level for situation, e.g. menu, natural language.
6. Retrieval Strategy (RS)	Choose and apply appropriate strategies to knowledge resource.
7. Response Generator (RG)	Determine propositional structure of response to the user, appropriate to the situation.
8. Explanation (EX)	Describe mechanism operation, restrictions etc. to user as appropriate.
9. Input Analyst (IA)	Convert input from user into structures usable by functional experts.
10. Output Generator (OG)	Convert propositional response to the form appropriate to user, situation, dialogue mode.

# Ranking and Result Presentation



Simplifying user interaction and providing information

- ◆ Natural language queries and ranking
- ◆ Relevance feedback
- ◆ Term weighting and highlighting
- ◆ Summaries and snippets
- ◆ Clustering and visualization

# Ranking and Interaction

Query Alteration Process	Explanation
<p><i>Pre-Search</i></p> <ol style="list-style-type: none"> <li>1. Repeated Concepts</li> <li>2. Thesaurus Display</li> <li>3. Word Frequency</li> <li>4. Source Document</li> </ol>	User chooses query terms to be repeated for emphasis User chooses terms obtained from thesaurus display to update query (with or without time restrictions) User looks at display of word frequency information before updating query User looks at display of source document before updating
<p><i>Post-Search</i></p> <ol style="list-style-type: none"> <li>5. Title Display</li> <li>6. Abstract Display</li> <li>7. Relevance Feedback</li> </ol>	User looks at titles of first five retrieved documents before updating User looks at abstracts of first five retrieved documents Query is updated automatically using relevance judgments supplied by user following an initial search
<p><i>Combined Methods</i></p> <ol style="list-style-type: none"> <li>8. Abstract plus Thesaurus</li> </ol>	User looks at pre- and post-search information
	A. <i>Fully Automatic</i> word stem match automatic thesaurus  B. <i>Pre-Search Interaction</i> thesaurus display source document display  C. <i>Post-Search Interaction</i> title display abstract display relevance feedback

Lesk and Salton, 1969. Interactive search and retrieval methods using automatic information displays

Demands on Computer	Demands on User	Precision Improvement Over Word Stem Match	
		Low Recall	High Recall
normal	none	—	—
normal	none	+4%	+6%
normal +	medium-high	+6%	+4%
normal +	medium	+8%	+5%
high	medium	+13%	+2%
high	very high	+17%	+7%
high	low	+10%	+7%

# Relevance Feedback Interactions

- Positive document examples
- Negative document examples
- Positive passage examples
- Positive and negative terms in documents
- Batch and incremental document feedback

*Relief Whole  
Hlth & Health Inv Act 1988  
& Medicare Act 1993, 1994*

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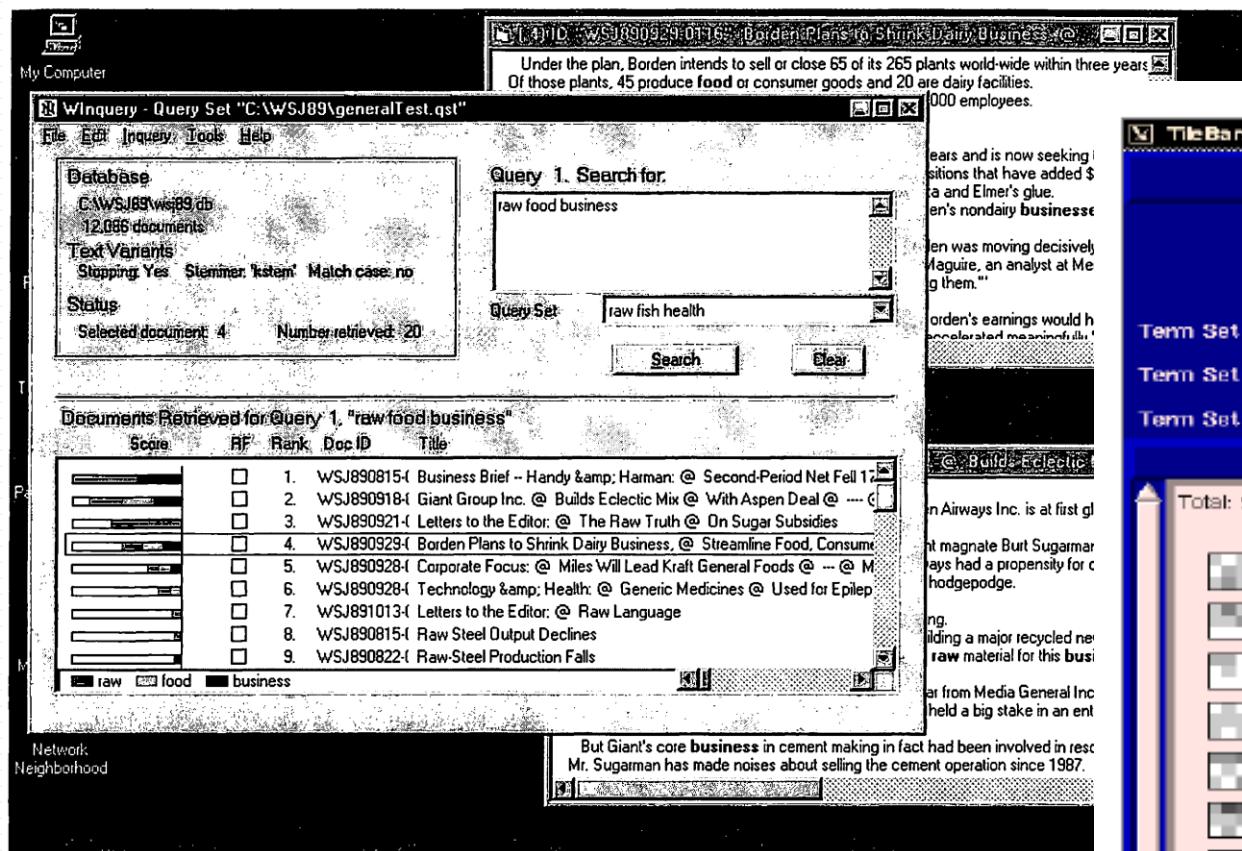
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1 2 3 4 5 6 7 8 9 10  
min max

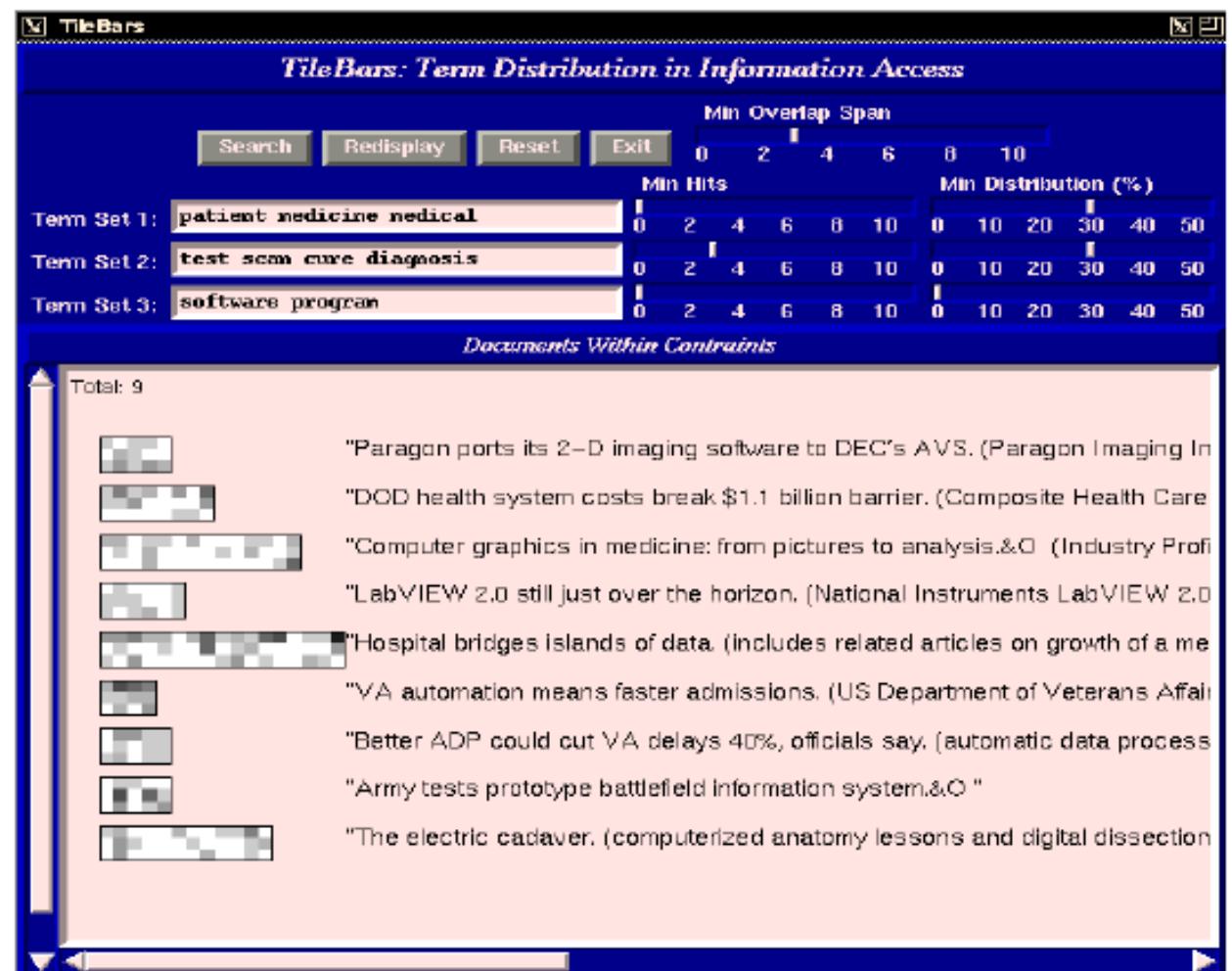
Example: Golovchinsky et al, 1999  
From reading to retrieval: Freeform ink annotations as queries.

# Text Highlighting



Shneiderman, Byrd, Croft. 1997. Clarifying search:  
A user interface framework for text searches.

Hearst, 1995. TileBars: Visualization of term distribution information in full text information access.



# Summaries and Snippets

You have just typed in the following query:

"Alternatives to Postscript"

A brief explanation about the query:

To be relevant, a document must identify a need for, or the existence of, an alternative to Postscript, a page description language.

The following articles have been retrieved in relation to that query:

Documents 1-10 (of 50) matching the query.

[1]

Publishing: Papers Take Alternative Path to Success ---- By Andrew Palmer Staff Reporter of The Wall Street Journal

As publisher of the Chicago Reader, an alternative weekly newspaper, Robert A. Roth refuses to read daily papers. He's afraid their stodgy ways might be infectious. The 68 papers that belong to the Association of Alternative Newsweeklies now reap \$100 million-plus in combined revenue, and their 3.5 million total circulation includes an enviable share of the coveted 18- to 35-year-old market, the very group that daily newspapers are having the most trouble attracting. The alternative weeklies group admitted seven new papers this year and had applications from seven more. Cartoonists Lynda J. Barry, whose work appears in Esquire, Mother Jones and other magazines, and Matt Groening, of "The Simpsons," started with alternative papers and still do weekly strips for them.

[\[Click here to get the whole article.\]](#)

[2]

School Days: Break the Teaching Monopoly ---- By C. Emily Feisistrater

There are vast numbers of adults with at least a bachelor's degree who want to teach. Many have advanced degrees and years of successful experience in other careers. That means one has to go to college and complete a series of education courses approved by the state department of education. Alternative teacher certification programs are not wanting for detractors. Since last week, after an article about our study of alternative teacher certification appeared in the New York Times, we've gotten scores of phone calls from people who want to know where the alternative certification programs are — they included a dentist who wants to teach biology, an international business man with a master's degree in physics who wants to teach high school physics and math, and a corporate executive who wants to teach elementary school.

[\[Click here to get the whole article.\]](#)

Tombros and Sanderson. 1998. Advantages of query biased summaries in information retrieval.

Google patent, 2005.



theory of relativity space travel

Search

"of" is a very common word and was not included in your search. [\[details\]](#)

Scholar

Results 1 - 10 of about 9,480 for [theory of relativity space travel](#).

Chronology protection conjecture

SW Hawking - Physical Review D, 1992 - link.aps.org

... Of course, in the theory of relativity, time travel and faster-than-light space travel are closely connected. If you can do one, you can do the other. ...

Cited by 280 - Web Search - [adsabs.harvard.edu](#) - [adsabs.harvard.edu](#) - [ncbi.nlm.nih.gov](#)

(book) The large scale structure of space-time

SW Hawking, GFR Ellis - 1976 - print.google.com

... Page 13. In this book we shall study the large scale structure of space-time on the basis of Einstein's General Theory of Relativity. ...

Cited by 2771 - Web Search - [ali 2 versions](#) » - Library Search

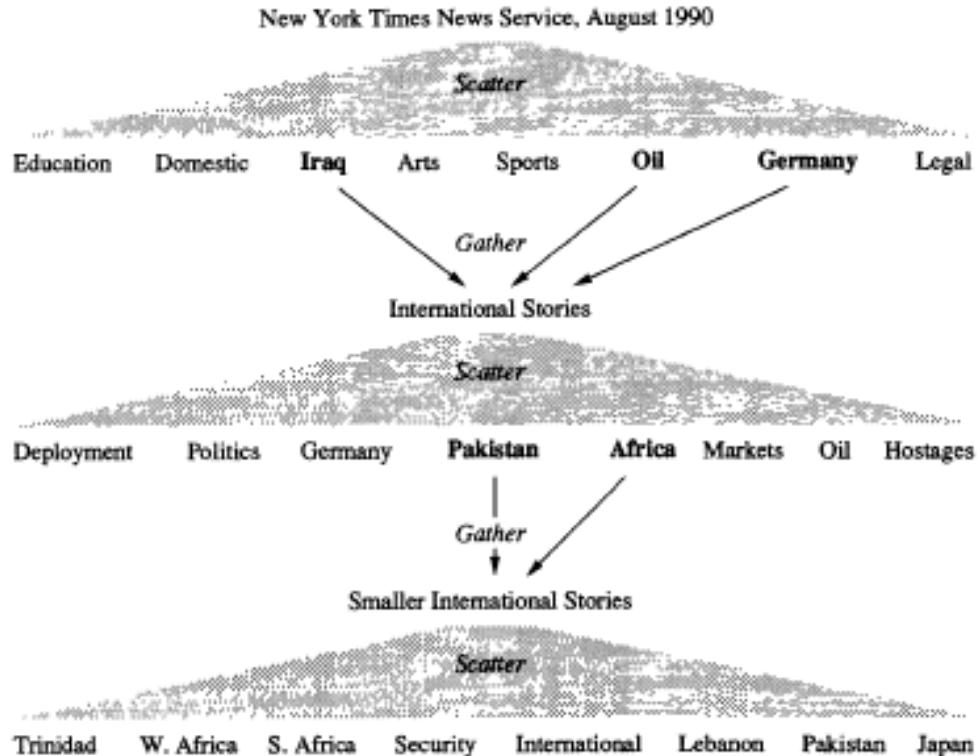
... (Clock paradox problem resolution in relativity theory, considering space travel effects on time ...)

M SACHS - PHYSICS TODAY, 1971 - csa.com

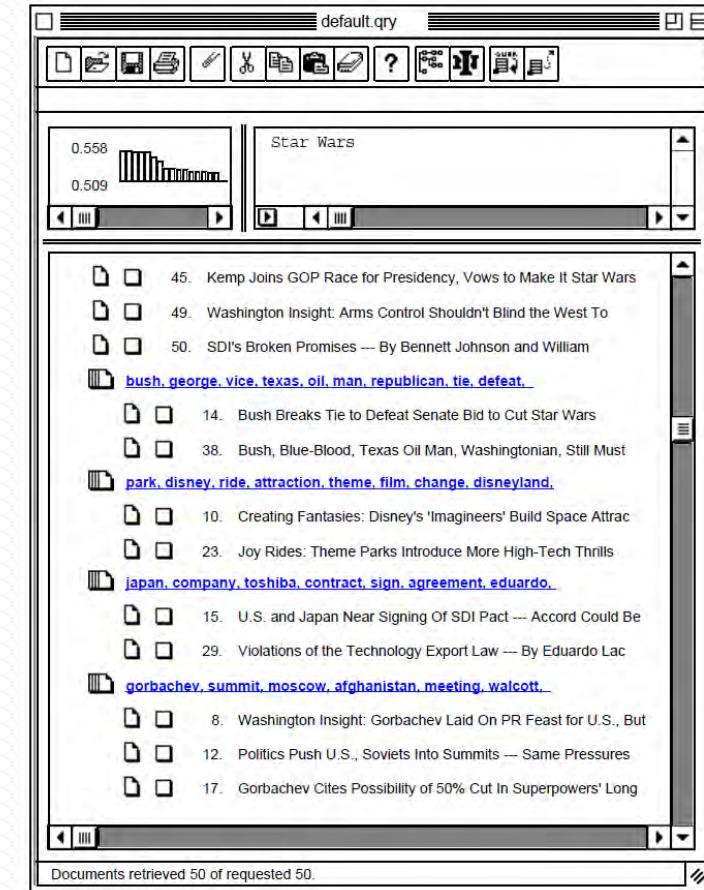
A resolution of the clock paradox(Clock paradox problem resolution in relativity theory, considering space travel effects on time measurement and aging process ...) 302

Cited by 5 - Web Search - 305

# Clustering in Research



Cutting, Karger, Pedersen, and Tukey. 1992. Scatter/Gather: a cluster-based approach to browsing large document collections.



Leuski, Croft. 1996. An evaluation of techniques for clustering search results.

# Clustering in Commercial Systems

Clusty // Clustering MP3 player - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://dusty.com/search?query=MP3+player

Best of the Web Channel Guide Customize Links Free Hotmail Internet Start Baruch College - Th... Microsoft Windows Media Windows Update Win

Clusty Beta

Web+ News Images Shopping Encyclopedia Gossip Customize!

MP3 player

Advanced Help Tell a Friend Tell us what you think! NEW! Download Clusty's Firefox Toolbar

Cluster by: Topics

Top 273 results of at least 20,523,691 retrieved for the query MP3 player

- MP3 player (273)
  - Review (41)
  - Portable Mp3 Player (35)
  - Software (31)
  - Car (23)
  - Apple, iPod (21)
  - Cd Mp3 Player (23)
  - Jukebox (19)
  - Creative, Labs (16)
  - Multimedia (14)
  - Recorder (14)
  - More...
- MP3 Player at CircuitCity.com
- HP Music - Official Site
- WinAmp - Nullsoft
- MP3.com
- MP3 player

Clusty // Clustering MP3 player - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://dusty.com/search?v%3afile=viv\_53%4018%3ayn0xv58%3afame=list&v%3astate=root%28shopping%29%7c

Best of the Web Channel Guide Customize Links Free Hotmail Internet Start Baruch College - Th... Microsoft Windows Media Windows Update Win

Clusty Beta

Web+ News Images Shopping Encyclopedia Gossip Customize!

MP3 player

Advanced Help Tell a Friend Tell us what you think! NEW! Download Clusty's Firefox Toolbar

Cluster by: Topics

Cluster Review contains 41 documents.

Sponsored Results for review

- Reviews on eBay
- Get Movie Reviews at Moviefone
- Review: PlayStation Portable a Likely Hit
  - Dec 24, 2004 AP - Technology - game machine, delivering sharp graphics on a 4.3-inch display and weighing just 10 ounces, it is also a multimedia player designed for music and movies. And within the sleek, black plastic shell of this 7-inch by 3-inch wonder, ... story.news.yahoo.com/...4%2fap\_on\_hi\_te%2ftech\_test\_sony\_psp - Clusty's Yahoo News
- MP3-Player-Guide.com
- RioVolt SP50 Portable CD and MP3 Player - Amazon.com
- Rio Mp3 Player 600 - Review

Search Results

Clusty, 2004.

MP3 & Media Players

Car CD/MP3 Players

MP3 Player Accessories

Hardware & Software

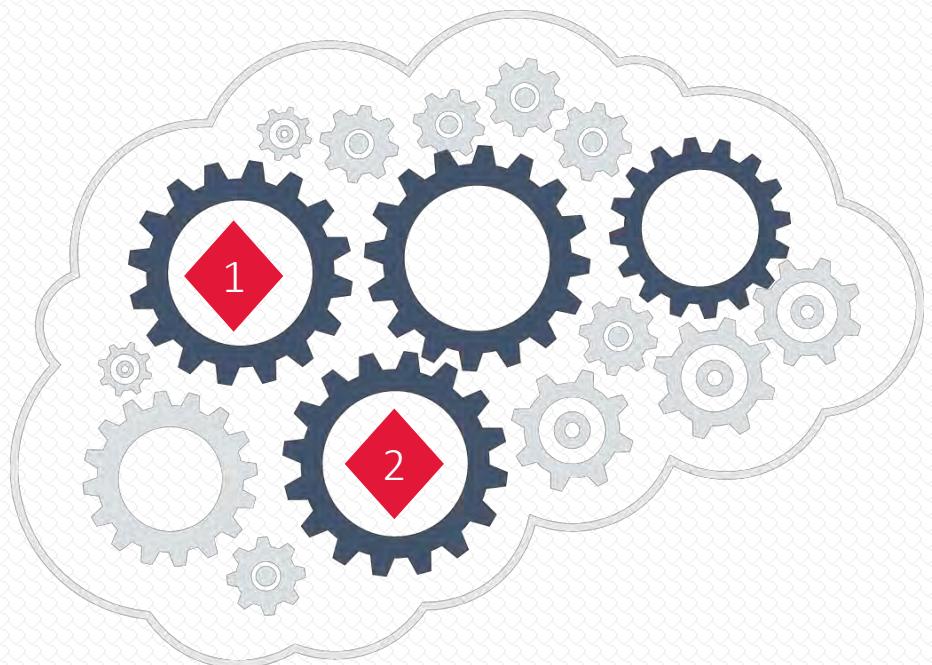
MP3 & Media Players

Car CD/MP3 Players

MP3 Player Accessories

Hardware & Software

# Browsing and Guided Assistance



Active, dynamic system support for interaction

Identifying need to support more complex activities

- 1 Iterative search and dialogues
- 1 Expert intermediaries
- 2 Hypertext and links
- 2 Information interaction in context
- 2 Exploratory search

# THOMAS

There can be three parts to your statement (all optional):

1. Your reaction to the reference just shown (if any).

This must come first:

"Yes" or "No"

2. A selection from the names (authors) or terms shown, by number. The statement signifies rejection of all numbers that follow it.
3. New names or terms (terms preferably in quotes). The element should be separated by commas.

Examples: 'posture', 'circulatory system'

Yes, not 11,12

No, 7,13,4

'heart rate'

Yes

Press enter key when you are ready to proceed ►

Oddy, 1977. Information Retrieval  
through Man-Machine Dialog

A Positive End-Expiratory Pressure—Nasal-Assist Device (PEEP-NAD) for treatment of respiratory distress syndrome.; Tummons, *Anesthesiology*, 38, 592-5, June 73

1. J L Tummons, 2. blood, 3. carbon dioxide, 4. human, 5. hydrogen-ion concentration, 6. infant, newborn, 7. masks, 8. methods, 9. nose, 10. oxygen, 11. oxygen inhalation therapy, 12. positive-pressure respiration, 13. respiration, 14. respiratory distress syndrome

► Yes, 13, not 6

We are not making progress.

Please reconsider this document:

The arterial-alveolar nitrous oxide difference: a measure of ventilation-perfusion mismatch during anesthesia.; Markello *et al*, *Anesth Analg (Cleve)*, 52, 347-50, May-Jun 73

1. R Markello, 2. R Schuder, . . .

.

.

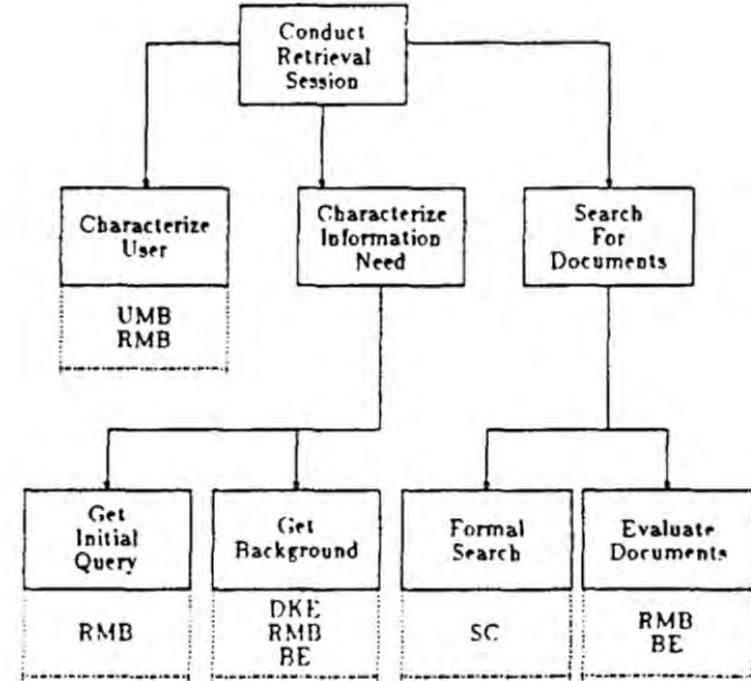
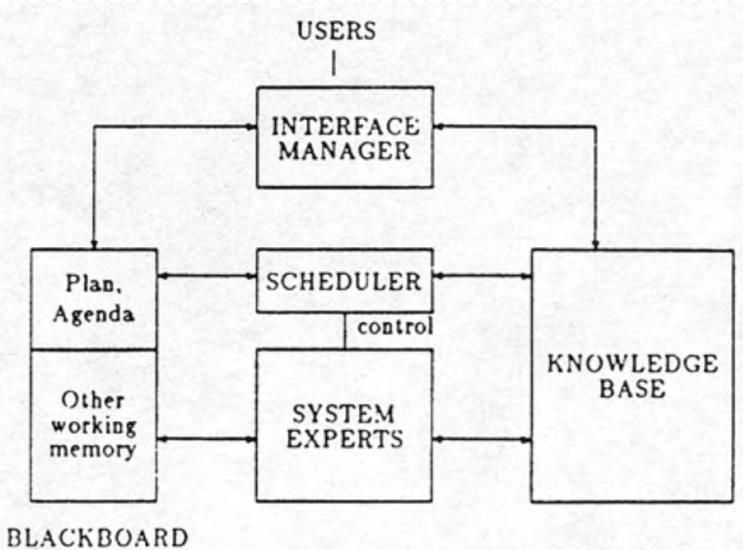
.

18. respiration, 19. surgery, operative, 20. time factors, 21. ventilation-perfusion ratio

► Yes, 1, not 19, 20

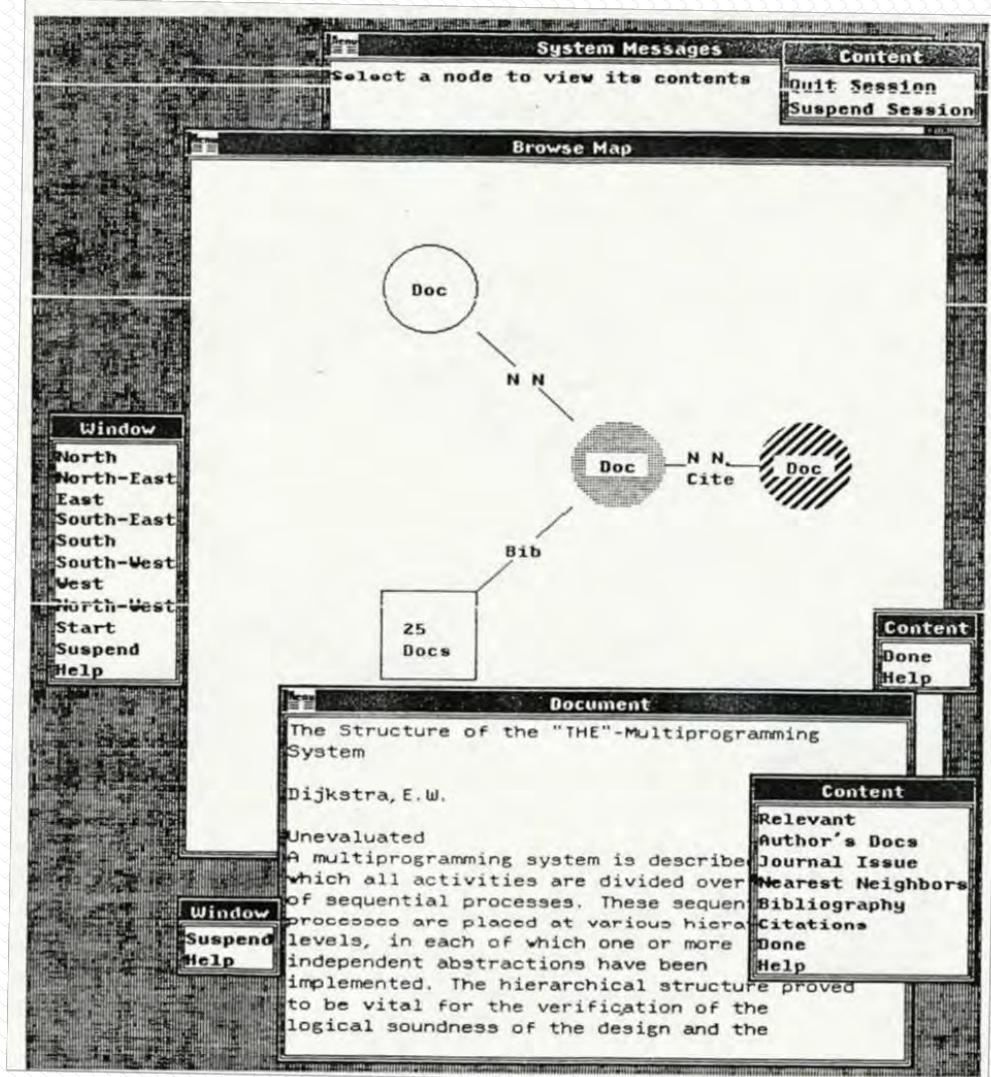
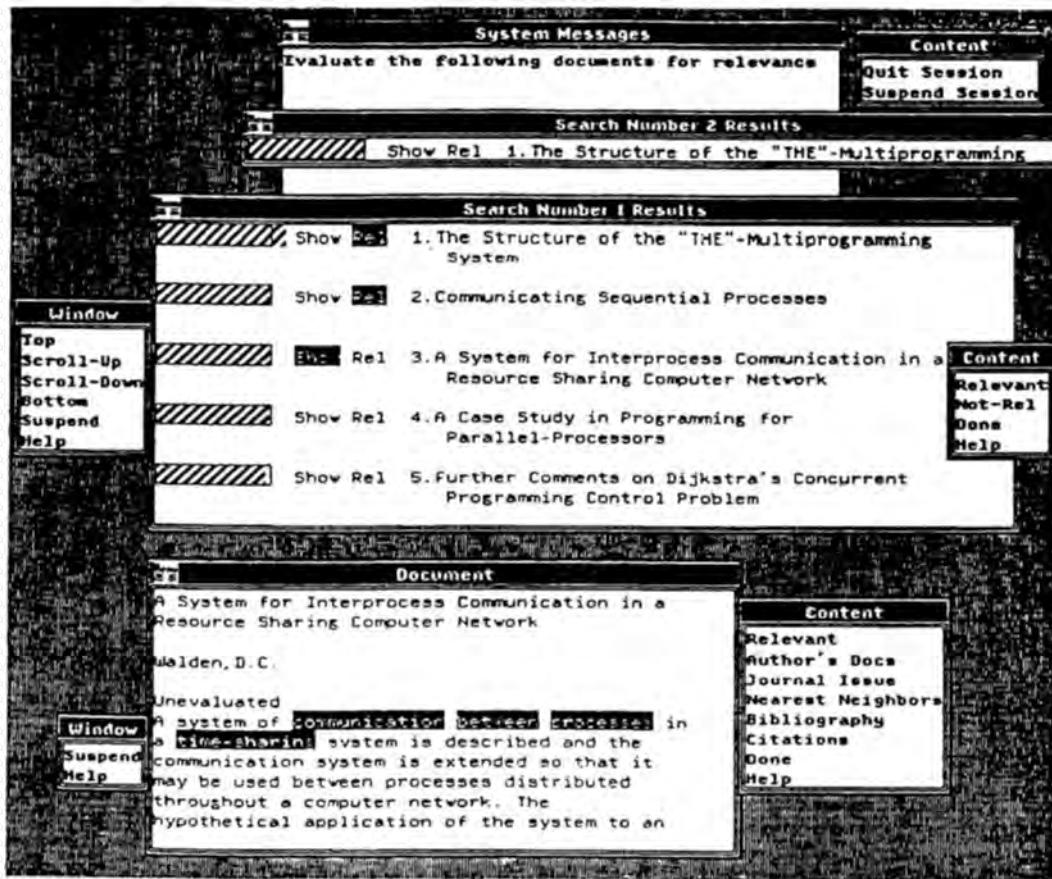
# I<sup>3</sup>R

- Designed to structure a search session based on interactions with a “expert intermediary”
- Inspired by Belkin’s work and research on multiple search strategies and representations

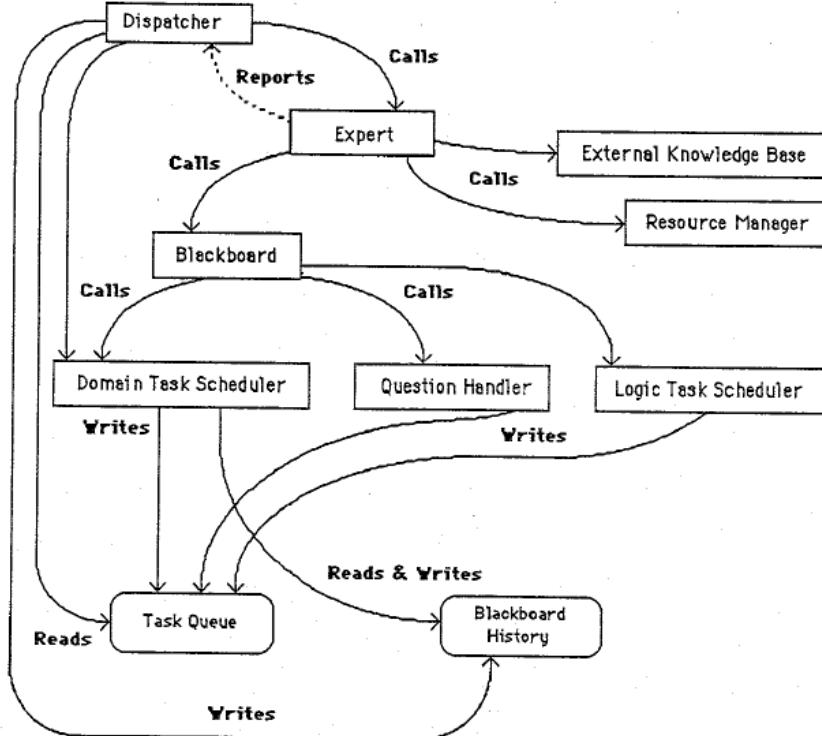


Croft and Thompson, 1987  
I3R: A new approach to the design of document retrieval systems

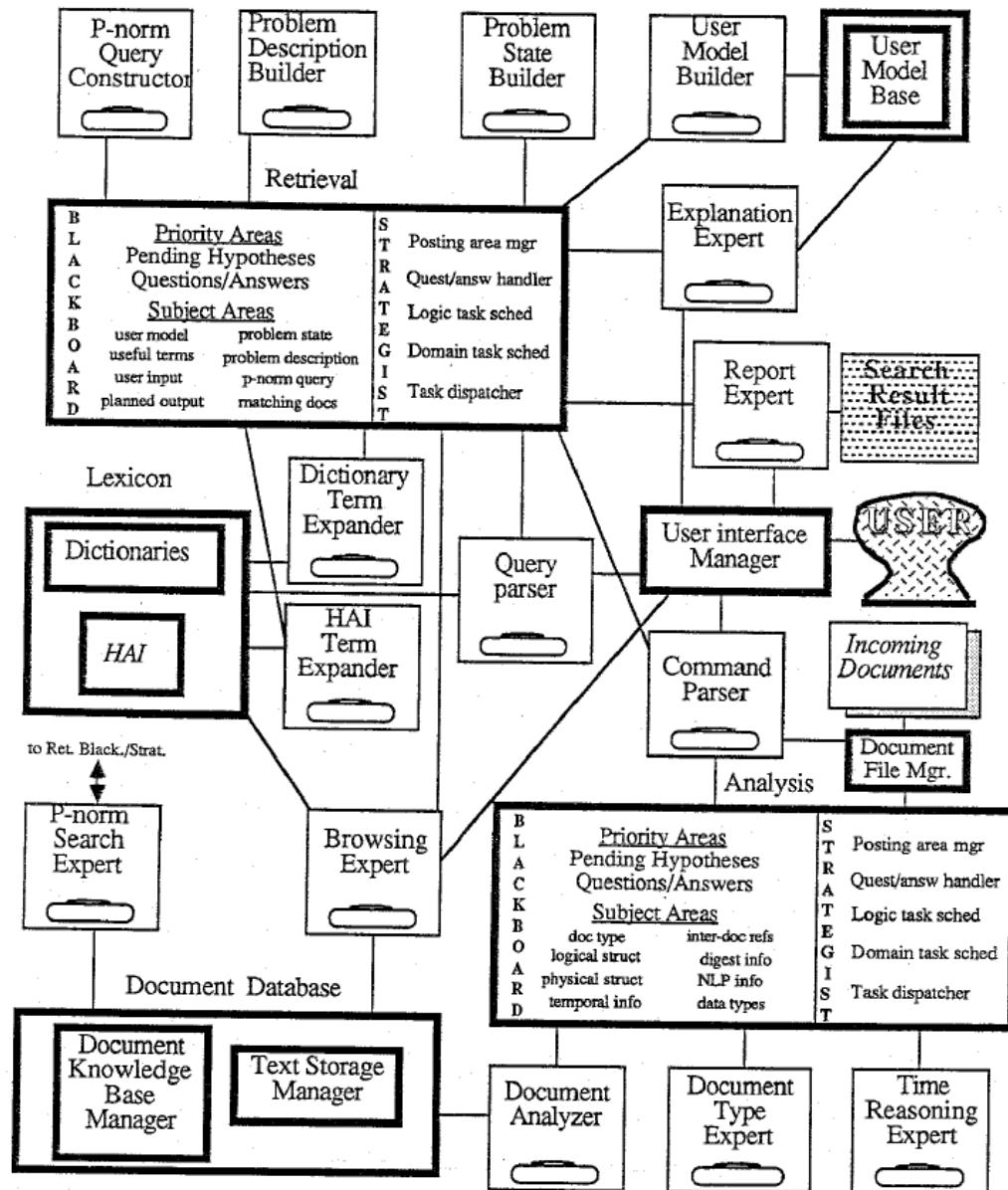
# I<sup>3</sup>R Interface



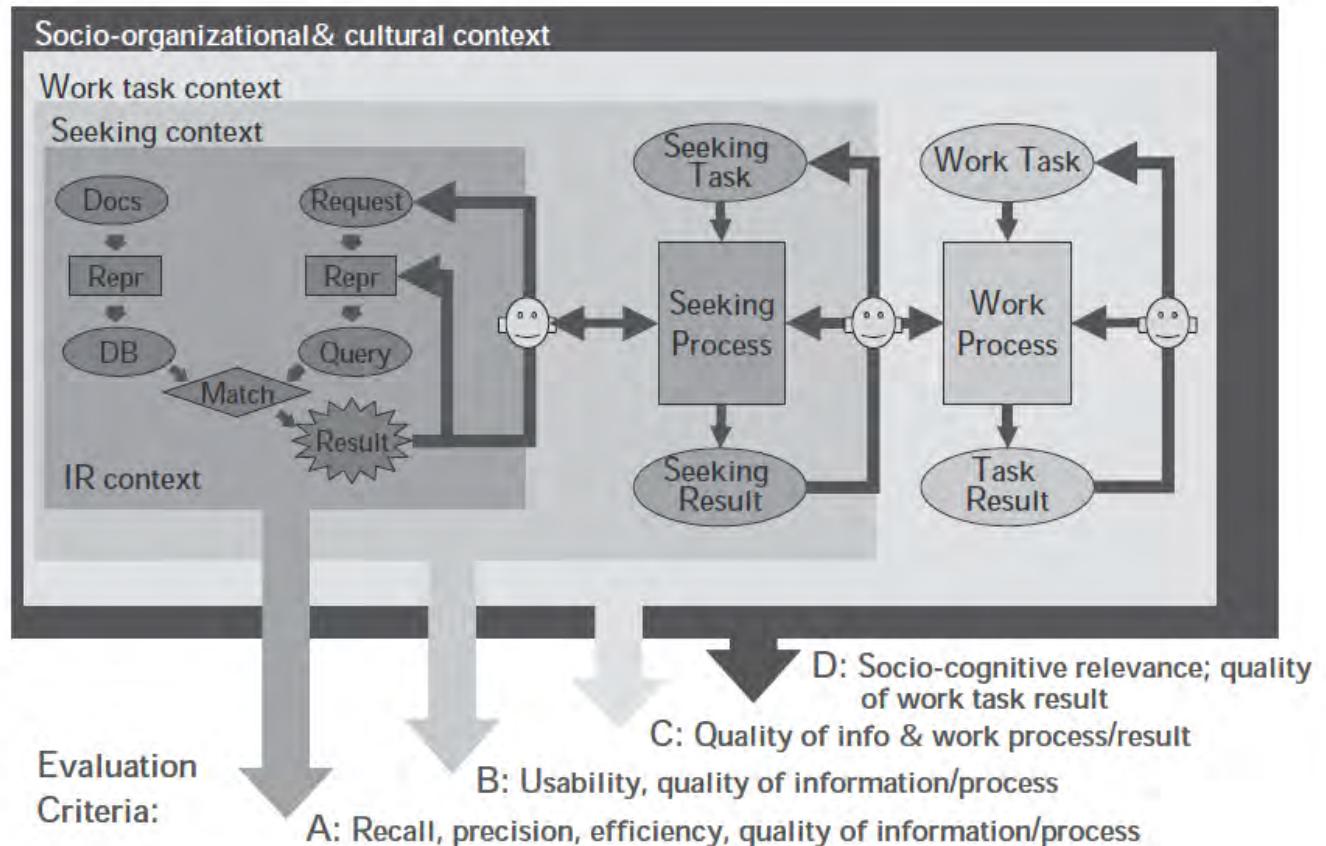
# CODER



Fox, 1987. Development of the CODER system: A testbed for artificial intelligence methods in information retrieval



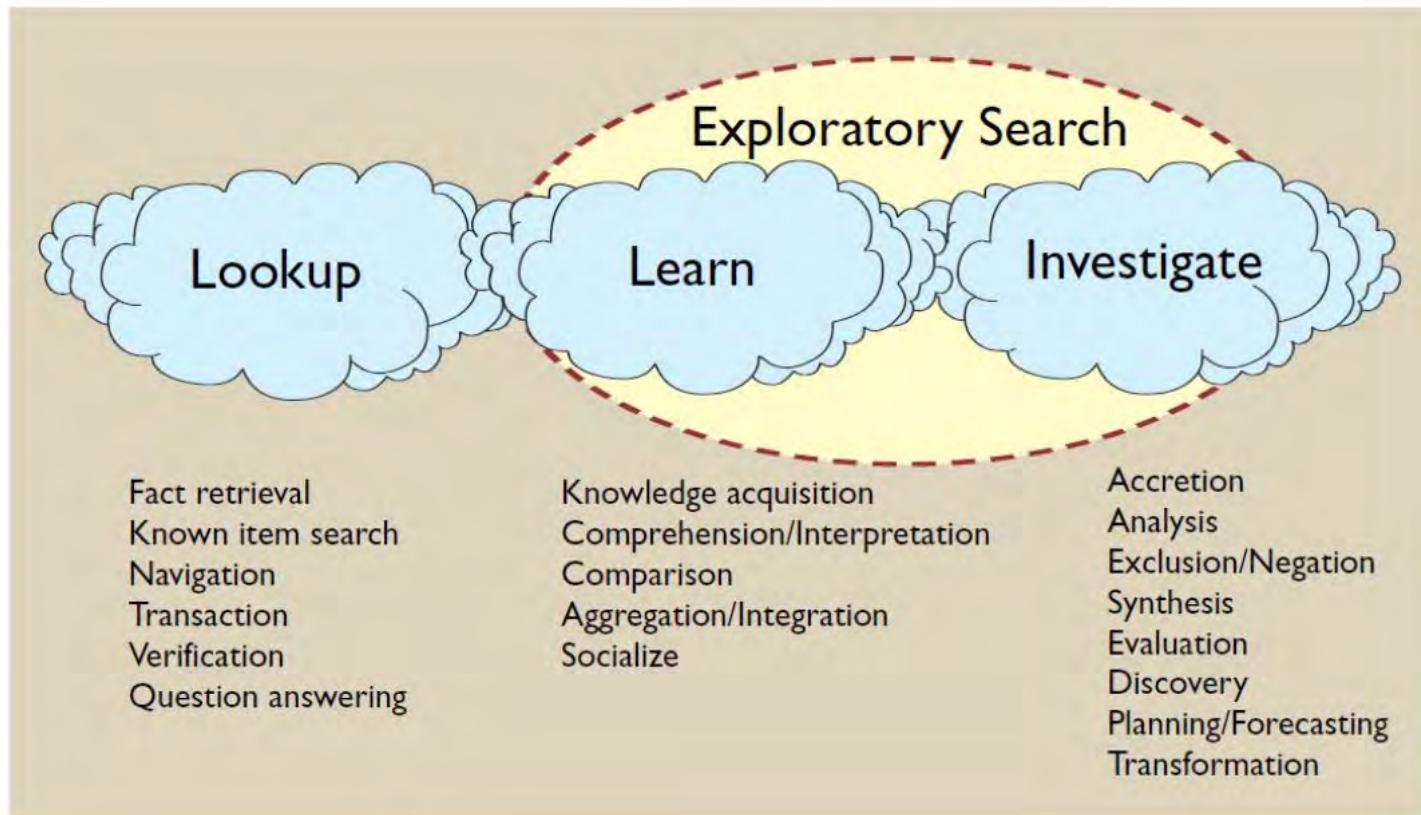
# Information Interaction in Context



Ingwersen and Järvelin, 2005. The Turn: Integration of Information Seeking and Retrieval in Context.

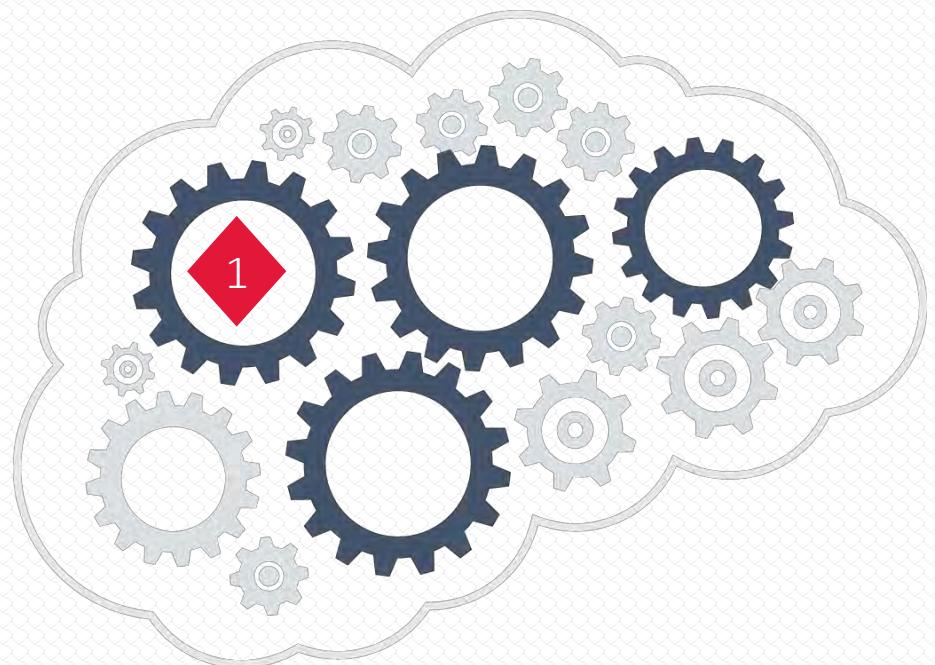
# Exploratory Search

- Supporting complex search processes beyond “one-shot” retrieval



Marchionini, 2006. Exploratory search: From finding to understanding

# Web Search and SERPs



Providing diverse sources of information to the user

Papers by Dumais, Teevan, White on user behavior,  
including “sessions”

- ◆ “Ten blue links”
- ◆ 1 Query log analysis
- ◆ ◆ Query suggestion
- ◆ Query transformation
- ◆ Search aggregation



catacombs in paris



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Ad [www.viator.com/Tours-&Tickets/Paris-Catacombs](http://www.viator.com/Tours-&Tickets/Paris-Catacombs)

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★★★★★ Rating for getyourguide.com: 4.7 - 1,372 reviews

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### The Paris Catacombs | Catacombes de Paris

[catacombes.paris.fr/en](http://catacombes.paris.fr/en)

Ticket window closes at 7:30 p.m.. Adress: 1 av. du Colonel Henri Rol-Tanguy 75014 Paris. Access. Prices. €13 / €11 (reduced rates). Quick-access ticket online ...

Site history · Useful Information · Visit · To read before your visit

### Catacombs of Paris - Wikipedia

[https://en.wikipedia.org/wiki/Catacombs\\_of\\_Paris](https://en.wikipedia.org/wiki/Catacombs_of_Paris)

The Catacombs of Paris (French: Catacombes de Paris, (help, info)) are underground ossuaries in Paris, France, which hold the remains of more than six million people in a small part of a tunnel network built to consolidate Paris' ancient stone mines.

Mines of Paris · Ossuary · Holy Innocents' Cemetery · Barrière d'Enfer

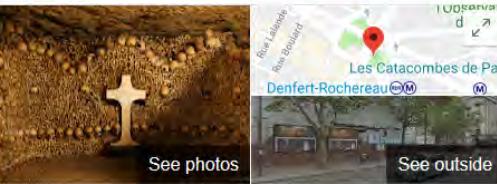
### People also ask

Why does Paris have catacombs?

How long is the tour of the catacombs in Paris?

Why are the Paris catacombs closed?

What were the catacombs used for?



## Catacombs of Paris

[Website](#) [Directions](#) [Save](#)

4.0 ★★★★☆ 4,379 Google reviews

Cemetery

[BUY TICKETS](#)

The Catacombs of Paris are underground ossuaries in Paris, France, which hold the remains of more than six million people in a small part of a tunnel network built to consolidate Paris' ancient stone mines.

[Wikipedia](#)

**Address:** 1 Avenue du Colonel Henri Rol-Tanguy, 75014 Paris, France

**Hours:** Open · Closes 8:30PM

**Did you know:** There was an incident which took place in the year 2004 when the police officials who were undertaking a training exercise in the catacombs came across something really unexpected.

[weirdnewsledger.com](#)

[Suggest an edit](#)

### Events

Wed, Apr 24 2:00 AM ECHOFIRE

Tue, Jun 25 8:30 AM Jour 8: Les Catacombes

Sat, Jun 29 9:45 AM Catacumbas de Paris: Sin colas + Audioguía

### Questions & answers

Q: How long catacombs is?

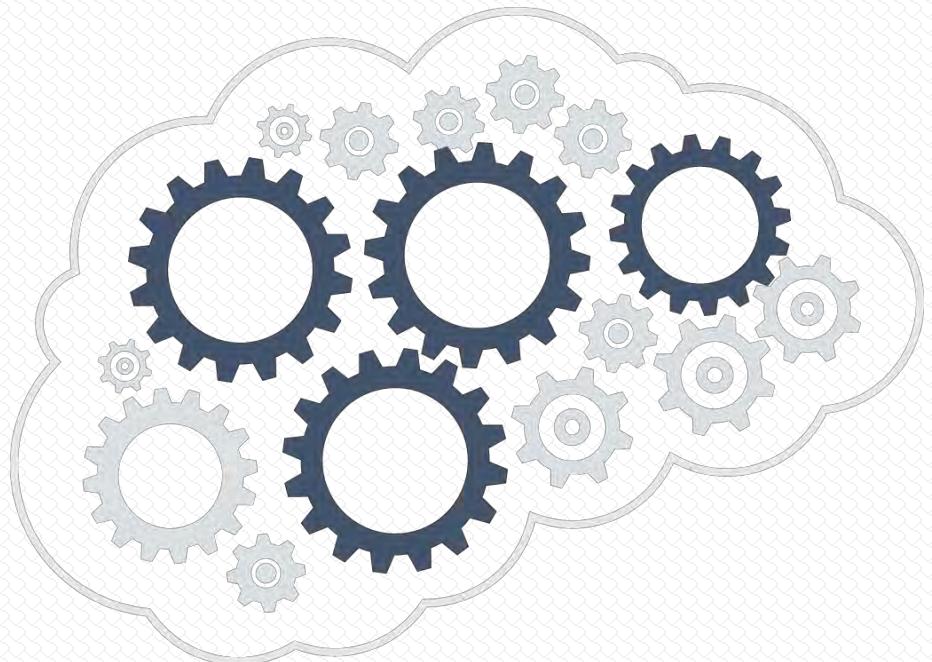
[Ask a question](#)

A: Around 1.5km, we were there for 30 minutes. I suggest buying the tickets online in advance.

(5 more answers)

Example:  
Web search

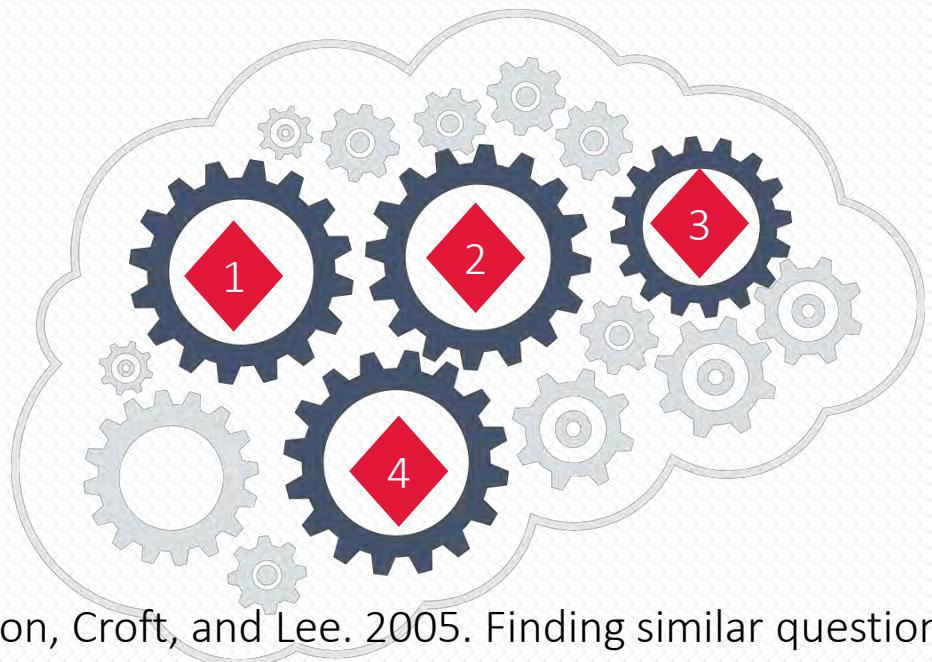
# Evaluation



Difficult to evaluate system actions beyond ranking  
and user actions beyond clicking

- ◆ Expected Search Length and RF measures
- ◆ TREC interactive track
- ◆ TREC session track
- ◆ NDCG and variations
- ◆ User behavior models and simulations
- ◆ User studies and crowdsourcing

# Questions and Answers



Jeon, Croft, and Lee. 2005. Finding similar questions in large question and answer archives.

Xu, Raducanu, and Croft. 2009. 2007 TREC-QA Theoretical Framework and Experimental Results for Conversational Search.

Allan et al., 2012. SWIRE: Conversational Answer Retrieval questionnaire framework for conversational Search.

Surdeanu, Ciaramita, Zaragoza, 2008. Learning to rank answers on large online QA collections.

- 1 Question answering
- 2 Recommendation systems
- 3 Forums and CQA
- 4 Answer retrieval
- 5 Voice-based search
- 6 Mobile search
- 7 Conversational systems

# QA and Interaction

- Longer questions give more context for answers
  - but were thought to require too much user effort
- Answers are more precise than “relevance”
  - different models for evaluation and feedback
  - better basis for modeling interaction?
- SERPs and diversity
  - not appropriate for answers?
  - snippets vs. answers
- CQA data reflects human-to-human, mostly single-turn, interaction with potentially complex information needs
- Forum data reflects multi-turn, multi-party, conversational interaction

# Bandwidth and Interaction

- Mobile devices and voice-based systems limit the bandwidth for interaction
  - mostly on output
- SERPs no longer possible
- Question-answer paradigm more concise and potentially more accurate
- QA interaction requires more active role by system
  - Selecting responses, asking clarifying questions, obtaining feedback about wrong answers
  - Multi-turn “conversational” retrieval

# Conversational Answer Retrieval

(from SWIRL 2012)

- Open-domain, natural language text questions
- Dialogue would be initiated by the searcher and proactively by the system
- *Dialogue is about questions and answers, including history*, with the aim of refining the understanding of questions and improving the quality of answers
- Answers extracted from the corpus (or corpora) being searched, and may be at different levels of granularity, depending on the question
- Evaluated as an open-domain IR task, in contrast to conversational chat or template-based conversation

# Research Challenges for CAR

- Tasks
  - Breaking down the research required into manageable pieces
- Test Collections
  - Creating test collections that capture aspects of conversational retrieval for training and testing
- Evaluation
  - Creating (or agreeing on) measures that can be used for evaluating multi-turn, conversational interactions directed at addressing information needs

# Tasks

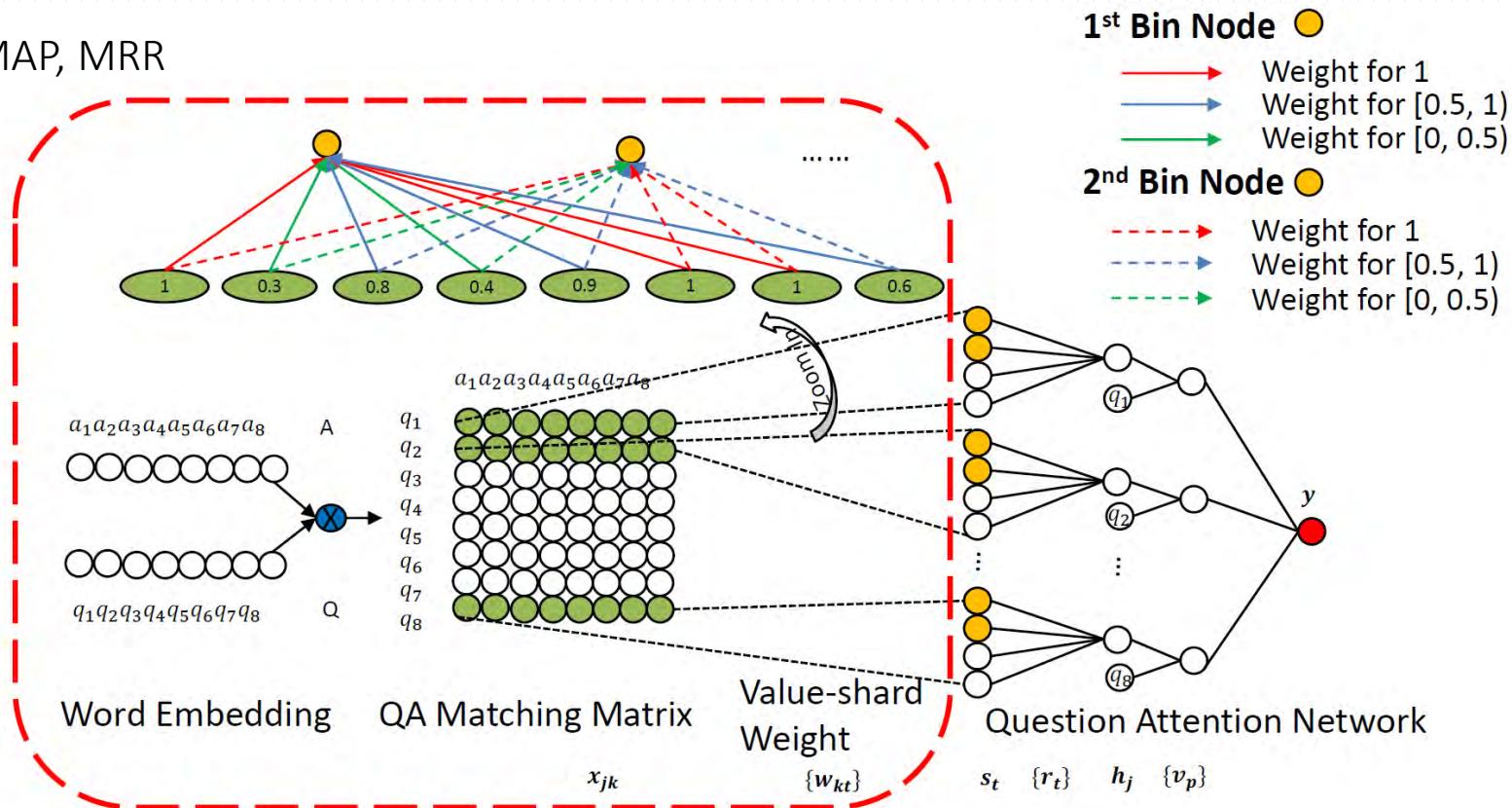
- Retrieving similar questions
- Retrieving good answers
- Predicting next questions
- Response retrieval
- Hybrid generation/retrieval of responses
- Choosing clarifying questions
- Conversational recommendation
- Conversational question answering
- Modeling intent in search conversations
- Intent-based response retrieval
- Intent-based generation/retrieval

*Increasing system modeling of history and context  
of the search dialog  
(cf. Belkin and I<sup>3</sup>R)*



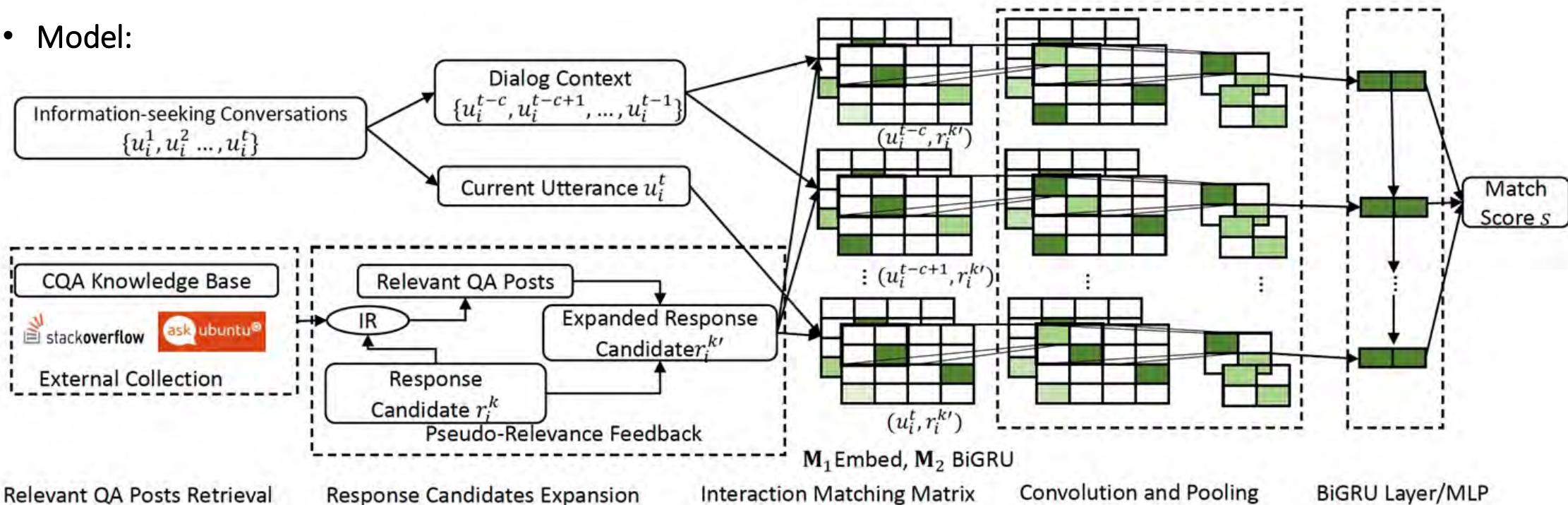
# Answer Retrieval

- Paper: Yang, Ai, Guo, and Croft. 2016. aNMM: Ranking Short Answer Texts with Attention-Based Neural Matching Model.
- Test Collection: TREC QA, Yahoo CQA
- Evaluation: MAP, MRR
- Model:



# Response Retrieval

- Paper: Yang, Qiu, Qu, Guo, Zhang, Croft, Huang, and Chen. 2018. Response Ranking with Deep Matching Networks and External Knowledge in Information-seeking Conversation Systems.
- Test Collection: UDC, MSDialog, AliMe
- Evaluation: MAP, Recall@1, 2, 5
- Model:



# Response Retrieval

QA Dialog Title: : Windows Update Failure

Dialog Tags: Windows, Windows 10, Windows update, recovery, backup, PC

USER: I have Windows10, version 1511, OS Build 10586.1106. For the past year I have tried to upgrade from this without success. Upgrade download OK but on installing only get to 85 - 93% and then on restart install previous version of windows (the 1511 version), I have Windows update assistant installed. Any help or advice on this would be most welcome.

David

Responses

AGENT: James (Microsoft MVP - Windows Client):

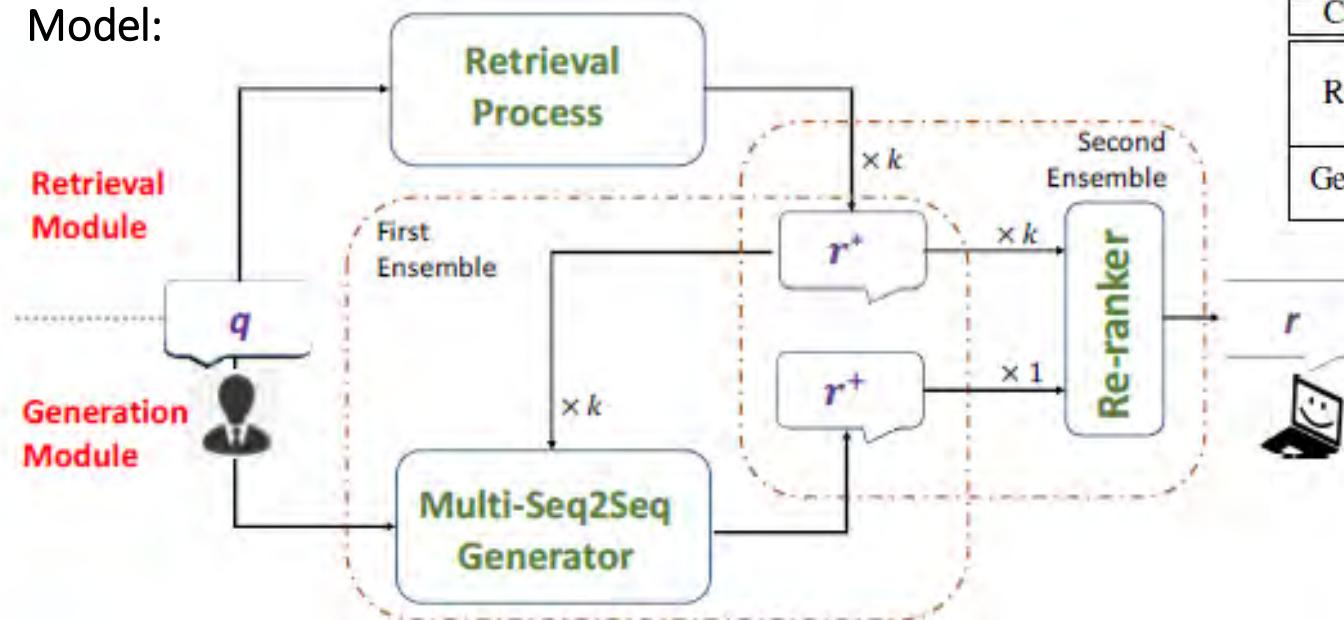
Response:There's not a doubt in my mind that those Norton "leftovers" is your troublemaker here - but now that the Norton Removal Tool has been deprecated and especially since the new-fangled Norton Remove and Reinstall tool doesn't get rid of the leftovers, a manual upgrade or a clean install of Microsoft Win10 appears to be your only possible resolution here. Feel free to give Norton/Symantec a piece of your mind!

Term Match: Magenta   Semantic Match: Blue   Correspondence Match: Red

Context	[User] I open Excel and it automatically formats my dates into American formatting. I have changed and saved the formatting to NZ style. However everytime I pull the document out of office 365 it reverts back to the American format. How do I stop this? [Agent] Is it one file or all files in Excel? [User] It does seem to be all Excel files. How do I change the global date format setting?	
Method	$y_i^k$	Top-1 Ranked Response
SMN	0	Go to Settings ->System ->Tablet Mode....Change setting as indicated in the snapshot below.
DMN-KD	1	That is a Windows setting. Go to Control Panel >Regional settings. This will change date settings for all applications.
DMN-PRF	1	That is a Windows setting. Go to Control Panel >Regional settings. This will change date settings for all applications.

# Hybrid Response Generation/Retrieval

- Paper: Song, Li, Nie, Zhang, Zhao, and Yan. 2018. An Ensemble of Retrieval-Based and Generation-Based Human-Computer Conversation Systems.
- Test Collection: Wiebo, Tieba, Twitter/Foursquare (Ghazvininejad et al, A Knowledge-Grounded Neural Conversation Model. In AAAI '18)
- Evaluation: Bleu, Rouge-L, human
- Model:



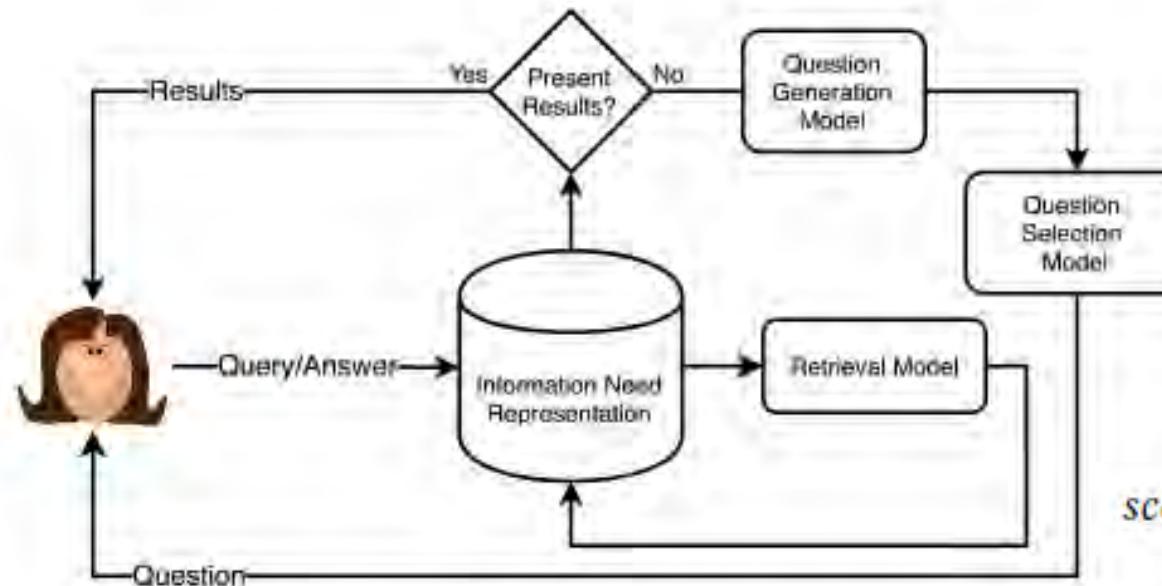
Category	Pros	Cons
Retrieval	literal human utterances; various expressions with great diversity;	not tailored to queries; bottleneck is the size of repository
Generation	tailored for queries; highly coherent	insufficient information; universal sentences

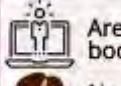
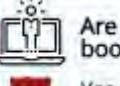
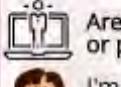
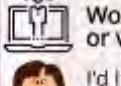
# Hybrid Response Generation/Retrieval

	Utterance (Translated)	Selected by re-ranker	
Query	This mobile phone's photo effect is pretty good.		
Retrieved-1	I really have a crush on it.	Context	Donated to the [ENTITY] last night and now I have to listen to automated phone calls. It's enough to make me want to cancel.
Retrieved-2	Go for it.	Method	r/g System Output Response
multi-seq2seq	Rushing for it rather than having a crush on it.	Ground Truth	- Ask them to put you on their internal dnc list. They will likely respect this, because future calls can get them charged.
seq2seq	Ha-ha.	Seq2Seq	g I didn't get it. I didn't.
Query	Can I see the house tomorrow afternoon?	Seq2Seq-Facts	g I'm sorry to hear that. Please dm us your email address so we can look into this. Thanks!
Retrieved-1	You can call me!	Retrieval	r It's a known issue in LA county. I just got an email from my dm and tech and it should be good in 30 minutes or so.
Retrieved-2	You can see the house on weekends.	HNCM-RS	r We're listening and would like to know more and help with your experience. Please follow us so i can dm you our contact info. [ENTITY]
multi-seq2seq	You can see the house on weekends, please call me in advance	HNCM-RSF	g We're sorry to hear this. Please dm us if you need assistance. Please dm us your contact info so we can look into this.
seq2seq	OK.		

# Choosing Clarifying Questions

- Paper: Aliannejadi, Zamani, Crestani, and Croft, 2019. Asking Clarifying Questions in Open-Domain Information-Seeking Conversations.
- Test Collection: Qulac (TREC Web track, crowdsourcing)
- Evaluation: MRR, P@1, nDCG@1, 5, 20
- Model:

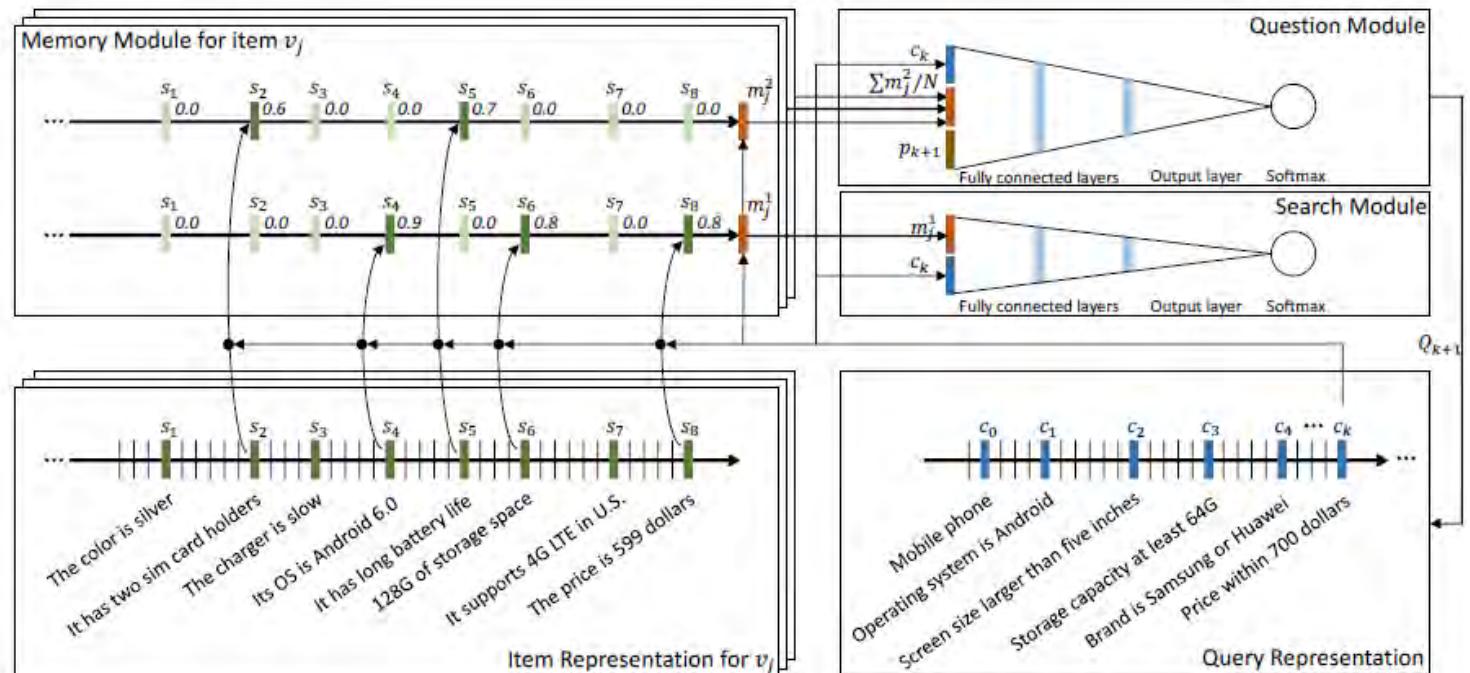
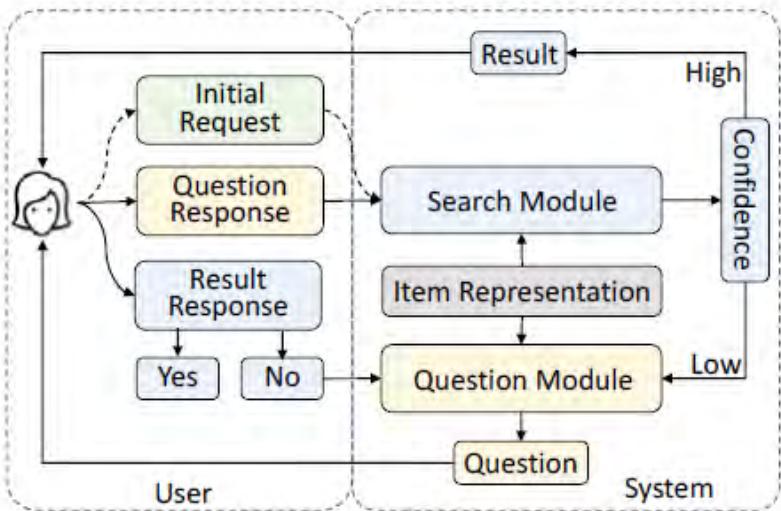


 <b>dinosaur</b> 	<b>Information Need (Facet)</b> I'm looking for the Discovery Channel's dinosaur site, which has pictures of dinosaurs and games.	 <b>dinosaur</b> 	<b>Information Need (Facet)</b> I'm looking for a list of all (or many of) the different kinds of dinosaurs, with pictures.
 Are you looking for dinosaur books?	No, just the discovery channel website.	 Are you looking for dinosaur books?	Yes, if they contain pictures of all the different kinds of dinosaurs.
 Are you looking for meat-eating or plant-eating dinosaurs?	I'm not sure. 	 Which dinosaurs are you interested in?	I'm interested in any and all dinosaurs.
 Would you like to see pictures or videos of dinosaurs?	I'd like to see pictures of dinosaurs on the discovery channels website.	 Do you want a list of dinosaurs names?	Yes, I would also like the list to include pictures of the dinosaurs.

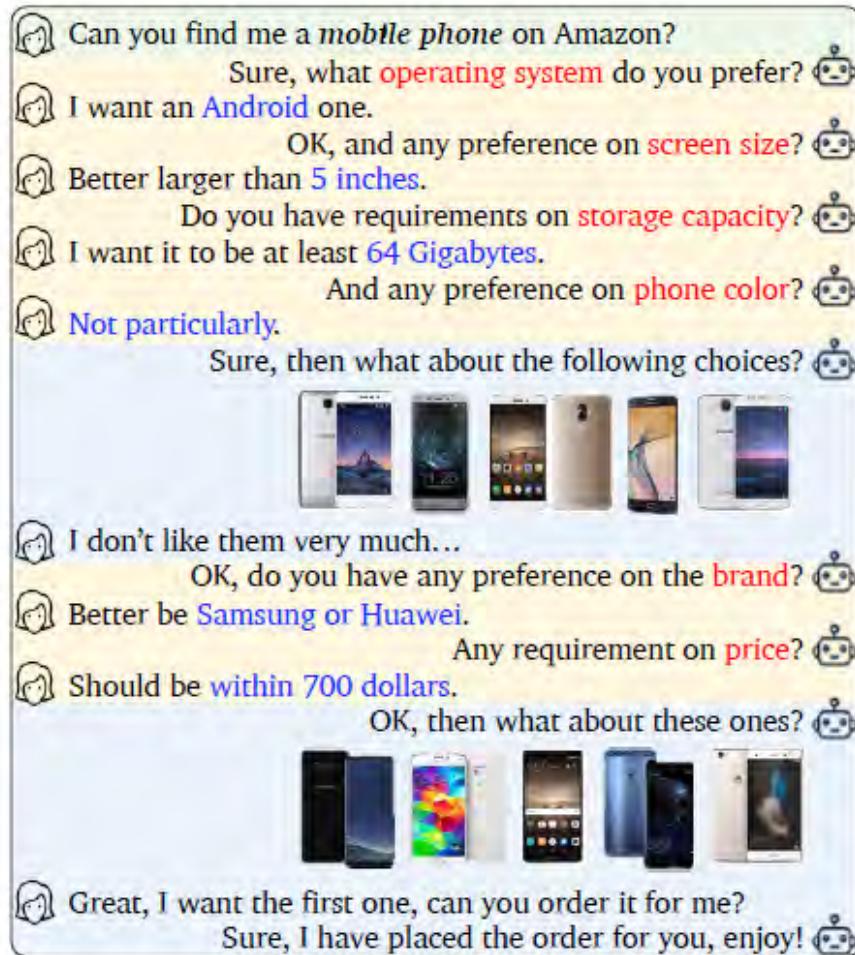
$$score = \gamma(\phi_T(t), \phi_H(h), \phi_Q(q), \eta(t, h, q), \sigma(t, h, q))$$

# Conversational Recommendation

- Paper: Zhang, Xu, Yang, Ai, and Croft, 2018. Towards Conversational Search and Recommendation: System Ask, User Respond
- Test Collection: Amazon product dataset
- Evaluation: MAP, MRR, nDCG
- Model:

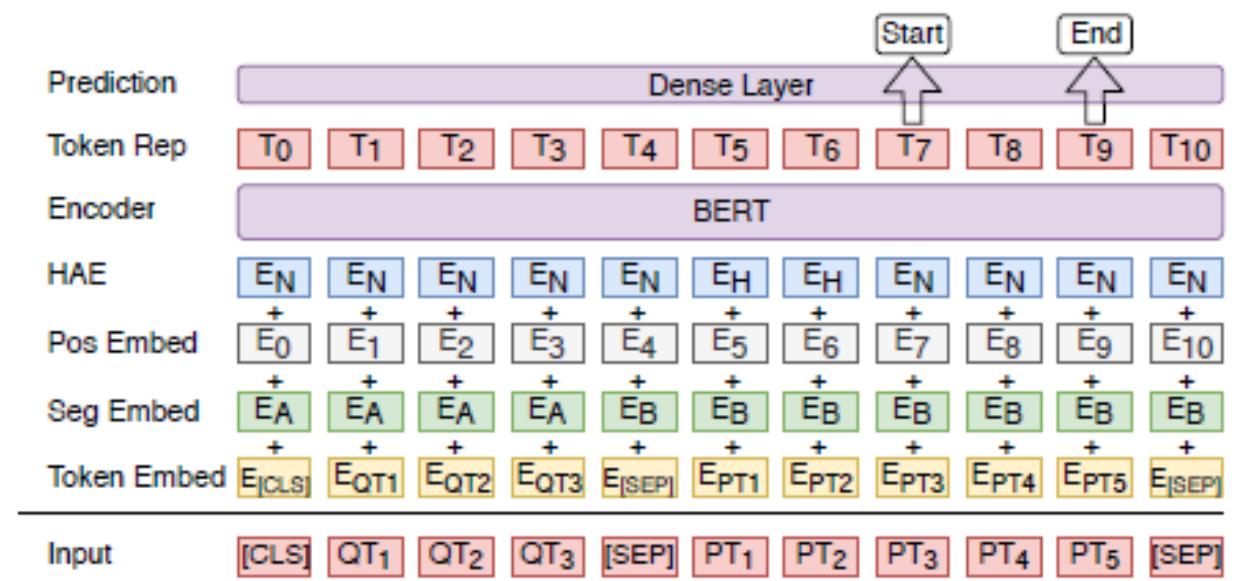
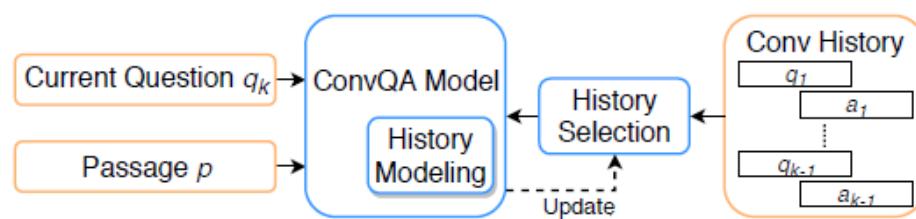


# Conversational Recommendation



# Conversational Question Answering

- Paper: Qu, Yang, Qiu, Croft, Zhang, and Iyer, 2019. BERT with History Answer Embedding for Conversational Question Answering.
- Test Collection: QuAC dataset
- Evaluation: F1, HEQ-Q, HEQ-D
- Model:



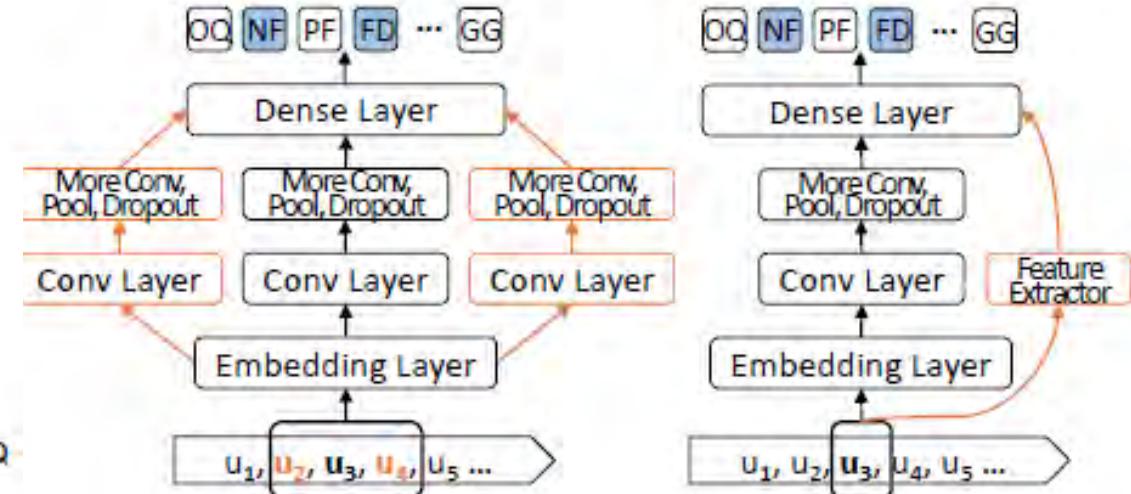
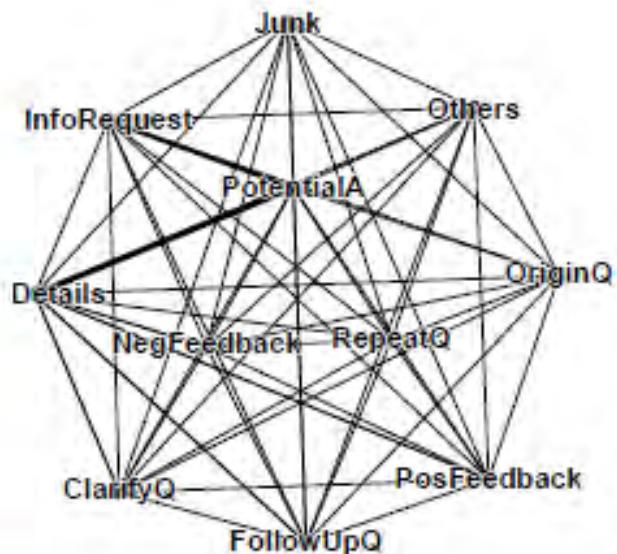
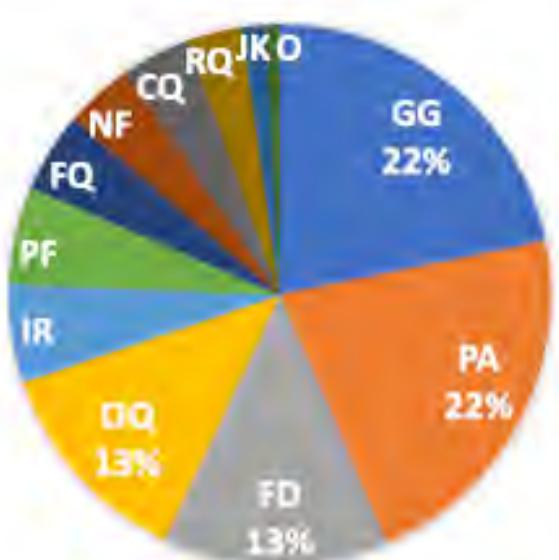
# Conversational Question Answering

Topic: Lorrie Morgan's music career

#	ID	R	Utterance
1	Q <sub>1</sub>	U	What is relevant about Lorrie's musical career?
	A <sub>1</sub>	A	... her first album on that label, Leave the Light On, was released in 1989.
2	Q <sub>2</sub>	U	What songs are included in the album?
	A <sub>2</sub>	A	CANNOTANSWER
3	Q <sub>3</sub>	U	Are there any other interesting aspects about this article?
	A <sub>3</sub>	A	made her first appearance on the Grand Ole Opry at age 13,
4	Q <sub>4</sub>	U	What did she do after her first appearance?
	A <sub>4</sub>	A	... she took over his band at age 16 and began leading the group ...
5	Q <sub>5</sub>	U	What important work did she do with the band?
	A <sub>5</sub>	A	leading the group through various club gigs.
6	Q <sub>6</sub>	U	What songs did she played with the group?
	A <sub>6</sub>	A	CANNOTANSWER
7	Q <sub>7</sub>	U	What are other interesting aspects of her musical career?
	A <sub>6</sub>	A	To be predicted ...

# Modeling Intent in Search Interactions

- Paper: Qu, Yang, Croft, Trippas, Zhang, and Qiu. 2018. Analyzing and Characterizing User Intent in Information-seeking Conversations. 2019. User Intent Prediction in Information-seeking Conversations.
- Test Collection: MSDialog, UDC
- Evaluation: Accuracy, precision, recall, F1
- Model:

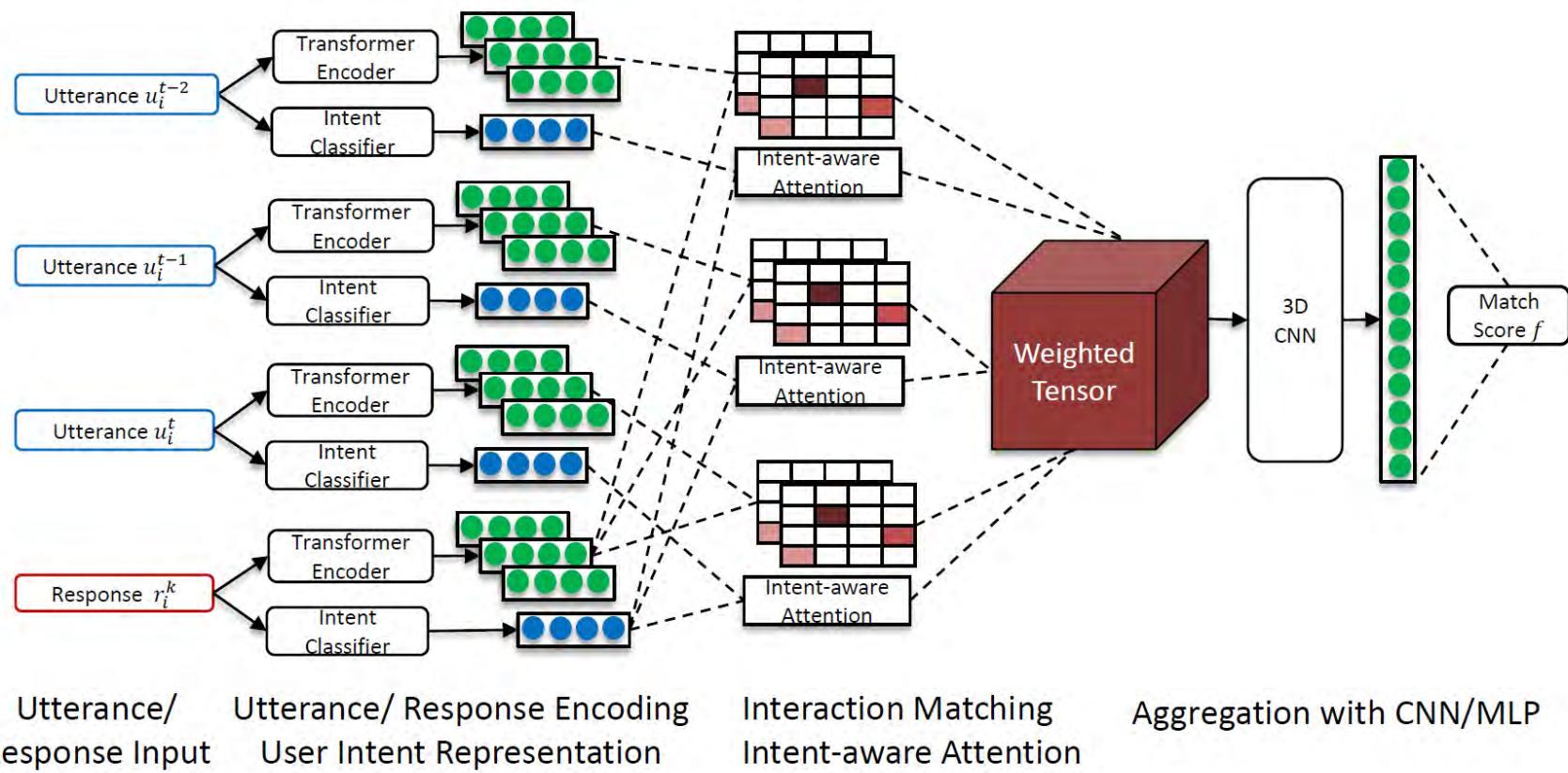


# User Intent Taxonomy

Code	Label	Description	Example	%
OQ	Original Question	The first question by a user that initiates the QA dialog.	If a computer is purchased with win 10 can it be downgraded to win 7?	13
RQ	Repeat Question	Posters other than the user repeat a previous question.	I am experiencing the same problem ...	3
CQ	Clarifying Question	Users or agents ask for clarification to get more details.	Your advice is not detailed enough. I'm not sure what you mean by ...	4
FD	Further Details	Users or agents provide more details.	Hi. Sorry for taking so long to reply. The information you need is ...	14
FQ	Follow Up Question	Users ask follow up questions about relevant issues.	Thanks. I really have one simple question -- if I ...	5
IR	Information Request	Agents ask for information of users.	What is the make and model of the computer? Have you tried installing ...	6
PA	Potential Answer	A potential answer or solution provided by agents.	Hi. To change your PIN in Windows 10, you may follow the steps below: ...	22
PF	Positive Feedback	Users provide positive feedback for working solutions.	Hi. That was exactly the right fix. All set now. Tx!	6
NF	Negative Feedback	Users provide negative feedback for useless solutions.	Thank you for your help, but the steps below did not resolve the problem ...	4
GG	Greetings/Gratitude	Users or agents greet each others or express gratitude.	Thank you all for your responses to my question ...	22
JK	Junk	There is no useful information in the post.	Emojis. Sigh .... Thread closed by moderator ...	1
O	Others	Posts that cannot be categorized using other classes.	N/A	1

# Intent-Aware Response Retrieval

- Paper: ...
- Test Collection: UDC, MSDialog
- Evaluation: MAP, R<sub>n</sub>@k
- Model:



# Intent-Aware Response Retrieval

ID	Role	Utterances	Intent
Utterance-1	User	Windows downloaded this <u>update</u> "2018-02 Cumulative <u>Update</u> for Windows 10 ...." But during the <u>restart</u> it says "we couldn't complete the <u>update</u> , undoing changes". So what can I do to stop this? Thanks	OQ
Utterance-2	Agent	Is there any other pending <u>updates</u> ? Try Download <u>troubleshooter</u> for Win 10.	IR/ PA
Utterance-3	User	Yes, pending <u>updates</u> the same one. I already used the built in <u>troubleshooter</u> , it did fix some 3 issues, but doing a <u>restart</u> the problem persists. Can I stop <u>updates</u> from installing this particular one? Thanks.	PA/ FQ
Utterance-4	User	Not sure if related but I just saw that Malicious Software Removal of March did not install .....	FD
Response-1 <i>(Correct)</i>	Agent	Try run <u>troubleshooter</u> and then <u>restart</u> your PC. If problem persist, open start and search for Feedback and open Feedback Hub app and report this issue.	PA
Response-2 <i>(Wrong)</i>	Agent	Glad to know that you fixed the issue, and as I said downloading the "Show or hide <u>updates</u> " <u>troubleshooter</u> and <u>restarting</u> the PC will help you. Thank you for asking questions and providing feedback here!	GG

# What Next?

- Intent-aware hybrid generation and retrieval of responses
- Incorporating NLP comprehension and inference models
- Studying explicit vs. implicit dialog models for search
- User studies of answer interaction and visualization [...](#)
- Developing better evaluation methodologies for interactive conversational retrieval
- Developing large test collections [...](#)
- Developing other modes of interaction

# Summary

- Both user- and system-oriented IR researchers have recognized the importance of interaction
- Search systems are increasingly modeling and participating actively in the search process
- Conversational answer retrieval is driving progress in this direction, and much remains to be done
- As we move to multi-modal (and multi-party) interactive search, modeling the search context (history, goals, etc.) and the dialog will be the basis for effective user-system collaborations



# SIGIR 2022?



SIGIR 2019

A complex network graph composed of numerous black lines and small red dots, set against a white background. A large, solid red rectangular overlay covers the center of the image, containing the text "THANK YOU".

SIGIR 2019

THANK YOU

# Answer Interaction

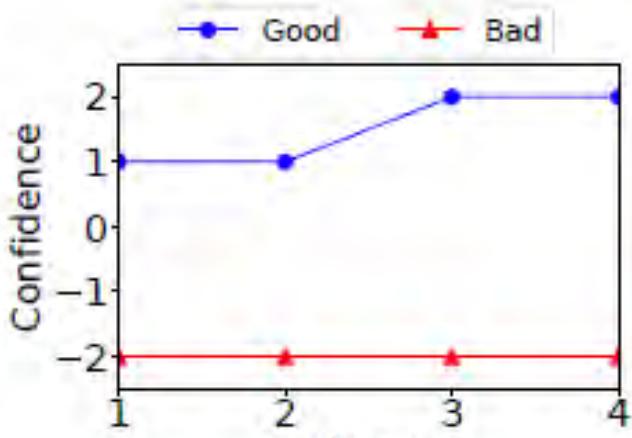


Figure: Overall confidence

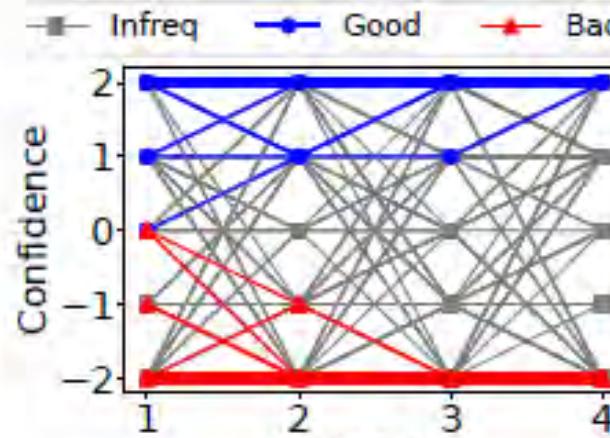


Figure: Common trends

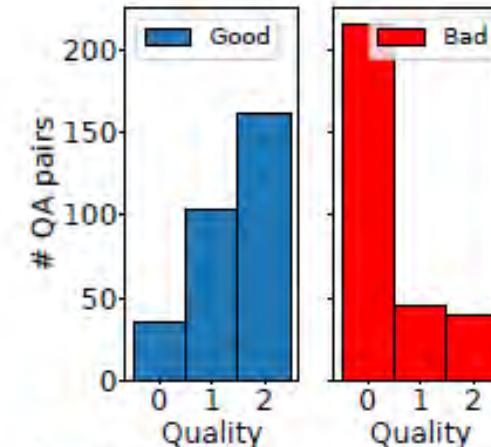


Figure: Confidence ratings for the second setting

Question: Why is ice less dense than water?  
Passage: The molecules of water are closer together and constantly moving, whereas the molecules of ice are in a crystal lattice, meaning they're in a rigid formation. When water freezes, the molecules spread out a little more to form the crystal lattice. Since density is mass over volume, and ice has takes up more volume than water, the density of ice is lesser than that of water. Which makes ice float on water.  
Highlighters: Positive: Negative:   
Quality:

Figure: An illustration of the highlighting interface

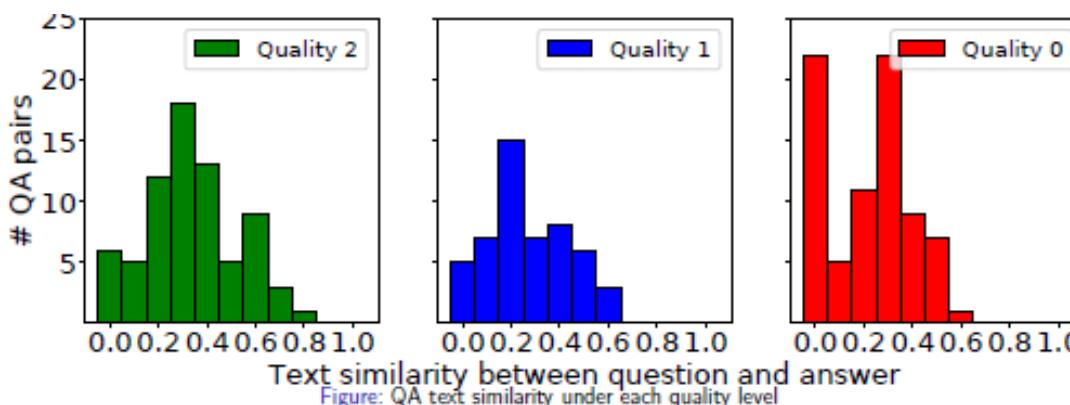


Figure: QA text similarity under each quality level

Qu, Yang, Croft, Scholer, and Zhang. 2019. Answer Interaction in Non-factoid Question Answering Systems.

# QA Test Collections

- TREC QA: 1.5K factoid questions with 60K paired potential answer sentences
- Yahoo L6 Webscope: 4.5M questions and associated answer passages from CQA service (Manner Questions subset: 150K “how” questions)
- WikiQA: 3K factoid questions with 30K answer sentences from associated Wiki page
- MS MARCO: 1M factoid questions from Bing log with 9M “companion” passages and 180K manually generated answers
- SQuAD: 100K manually generated questions with associated answers that are text spans in 530 Wikipedia articles
- WebAP: 8K text span answer passages (av. 45 words) from relevant documents for 80 TREC Gov2 questions
- Yahoo nfL6 subset: 85K non-factoid question and answer pairs
- WikiPassageQA: 4K non-factoid queries and answer passages created from 860 Wikipedia pages
- ANTIQUE: 2.5K questions from nfL6 with more complete relevance judgments

# Conversation Test Collections

- Ubuntu (UDC): 1M conversations from technical support chat logs
- QuAC: 14K crowdsourced QA dialogs based on Wikipedia articles
- MSDialog: 35K conversations from MS technical support forum, 2K labelled with utterance intent
- AliMe: 63K context-response pairs from commercial online help chatbot (Chinese)
- Qulac: 10K crowdsourced clarifying question-answer pairs related to 200 TREC topics (see talk at conference)
- Amazon: Simulated product purchase conversations based on product facets
- MSMARCO Conversational Search: 45M user sessions containing 340K unique queries
- TREC CAST: New TREC track building on MSMARCO, others