

# Search User Interfaces

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PRI 23/24 · Information Processing and Retrieval  
M.EIC · Master in Informatics Engineering and Computation

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Based on Search User Interface Design, Max L. Wilson (2011)

# Outline

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- Introduction
- Early Search UIs
- Modern Search UIs
- Evaluation of Search UIs

# Introduction and Context

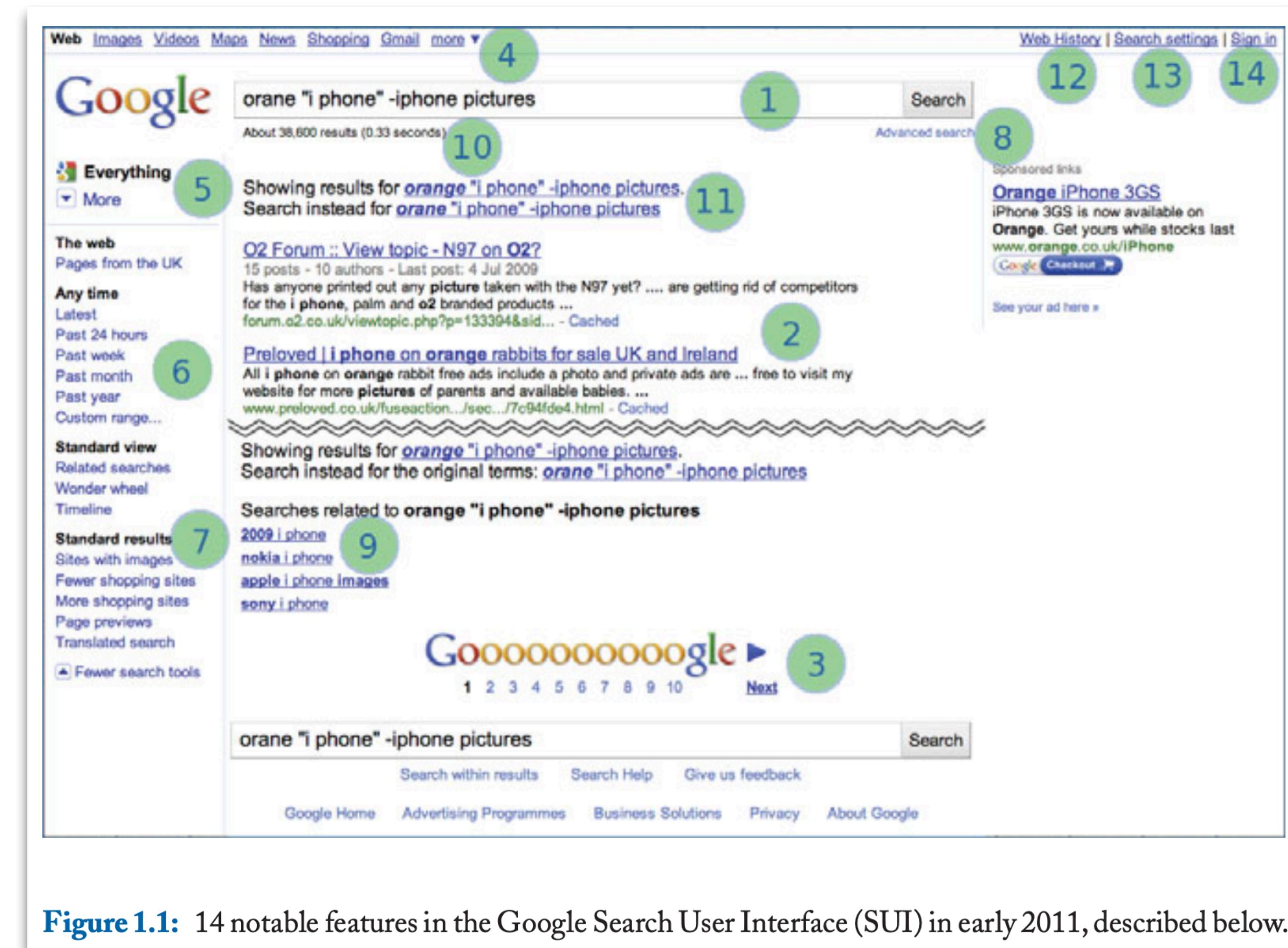
# Introduction

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- Search systems are built to be used by humans, thus a search user interface (SUI) is necessary for users to interact with the system.
- Information retrieval started with a system-centered view, and evolved to a both system- and user-centered view with the observation that more specific queries improved the relevance of results.
- Multiple factors concur to the overall user experience, the implemented algorithms, the existing metadata, the design of the user interfaces, its aesthetics and visual design.
- Search user interface development is a multidisciplinary area, requiring multiple and diverse expertises working together.

# Search in early 2011

1. Search box
2. Results
3. Pagination
4. Specialized search (images, maps ...)
5. Contextual filtering options
6. Scope restriction based on range time
7. Scope restriction based on characteristics
8. Advanced search
9. Related queries
10. Information about the volume of results
11. Automatic correction / suggestion
12. Previous searchers
13. Personalization of search settings
14. User accounts



**Figure 1.1:** 14 notable features in the Google Search User Interface (SUI) in early 2011, described below.

# Search in early 2022

Google  Entrar

Tudo Imagens Maps Notícias Vídeos Mais Ferramentas

Cerca de 2 230 000 resultados (0,75 segundos)

A apresentar resultados para **tore dos clérigos**  
Em vez disso, pesquisar por [tore dos clérigos](#)

<http://www.torredosclerigos.pt> ▾  
**Torre dos Clérigos**  
AOS CLÉRIGOS. Bilheteira. Video Torre dos Clérigos. TORRE DOS CLÉRIGOS. Reserve já a sua entrada nos Clérigos. Comprar Bilhetes · Adoração ao Santíssimo.

**Torre, Museu, Igreja**  
O conjunto arquitetónico Clérigos, classificado Monumento ...

**Bilheteira**  
VISITAS DE GRUPOS, Preço. Visita guiada ao Museu dos ...

**Tower**  
WELCOME TO CLÉRIGOS. Ticket Office. Video Torre dos Clérigos ...

[Mais resultados de torredosclerigos.pt »](#)

[https://pt.wikipedia.org/wiki/Igreja\\_e\\_Torre\\_dos\\_Cl%C3%A9rigos](https://pt.wikipedia.org/wiki/Igreja_e_Torre_dos_Cl%C3%A9rigos) ▾  
**Igreja e Torre dos Clérigos – Wikipédia, a encyclopédia livre**  
A Igreja e Torre dos Clérigos (século XVIII) é um notável conjunto arquitetónico situado na cidade do Porto, Portugal, sendo considerado o cartão-postal ...

Início da construção: 1732 Arquiteto: [Nicolau Nasoni](#)  
Estilo dominante: [Barroco](#) Função atual: Religiosa; cultural

[Historial · Igreja dos Clérigos · Casa da Irmandade · Torre dos Clérigos](#)

  
Igreja e Torre dos Clérigos  
Igreja ornamentada com campanário  
Clérigos

[Ver fotos](#) [Ver exterior](#)

**Igreja e Torre dos Clérigos**  
Website Direções Guardar  
4,5 ★★★★ 9 934 comentários no Google  
Igreja católica no Porto

A Igreja e Torre dos Clérigos é um notável conjunto arquitetónico situado na cidade do Porto, Portugal, sendo considerado o cartão-postal dessa cidade. O conjunto localiza-se no topo da Rua dos Clérigos, entre as ruas de São Filipe Néri e da Assunção.  
Wikipédia

Endereço: R. de São Filipe de Nery, 4050-546 Porto  
Horário:  
Aberto · Fecha às 17:30 · Volta a abrir às 21:30 · Atualizado pela empresa há 2 semanas  
Telefone: 22 014 5489

Altura: 76 m Arquiteto: [Nicolau Nasoni](#)

Deques e torres de observação • Igrejas e catedrais. Fechado agora 9:00 – 19:00 ... A Torre dos Clérigos é o ex-líbris do Porto. Abriu as suas portas em ...  
★★★★★ Classificação: 4,5 · 8.636 comentários

Qual é o horário de funcionamento de Torre dos Clérigos?

Precisa reservar sua visita a Torre dos Clérigos com antecedência?

Último lugar para esta do lado de Jesus Cristo

Vale a pena pela vista, pois para uma família a entrada fica cara!

Ver todos os comentários da Google

**Pesquisas relacionadas**

Torre dos Clérigos história Clérigos  
Torre dos Clérigos por dentro Torre dos Clérigos preço  
Torre dos Clérigos Porto Bilhetes Torre dos Clérigos  
Torre dos Clérigos wikipédia Torre dos Clérigos curiosidades

Goooooooooooooogle >  
1 2 3 4 5 6 7 8 9 10 Próximo

Portugal • Porto - Com base na sua atividade anterior - Atualizar localização

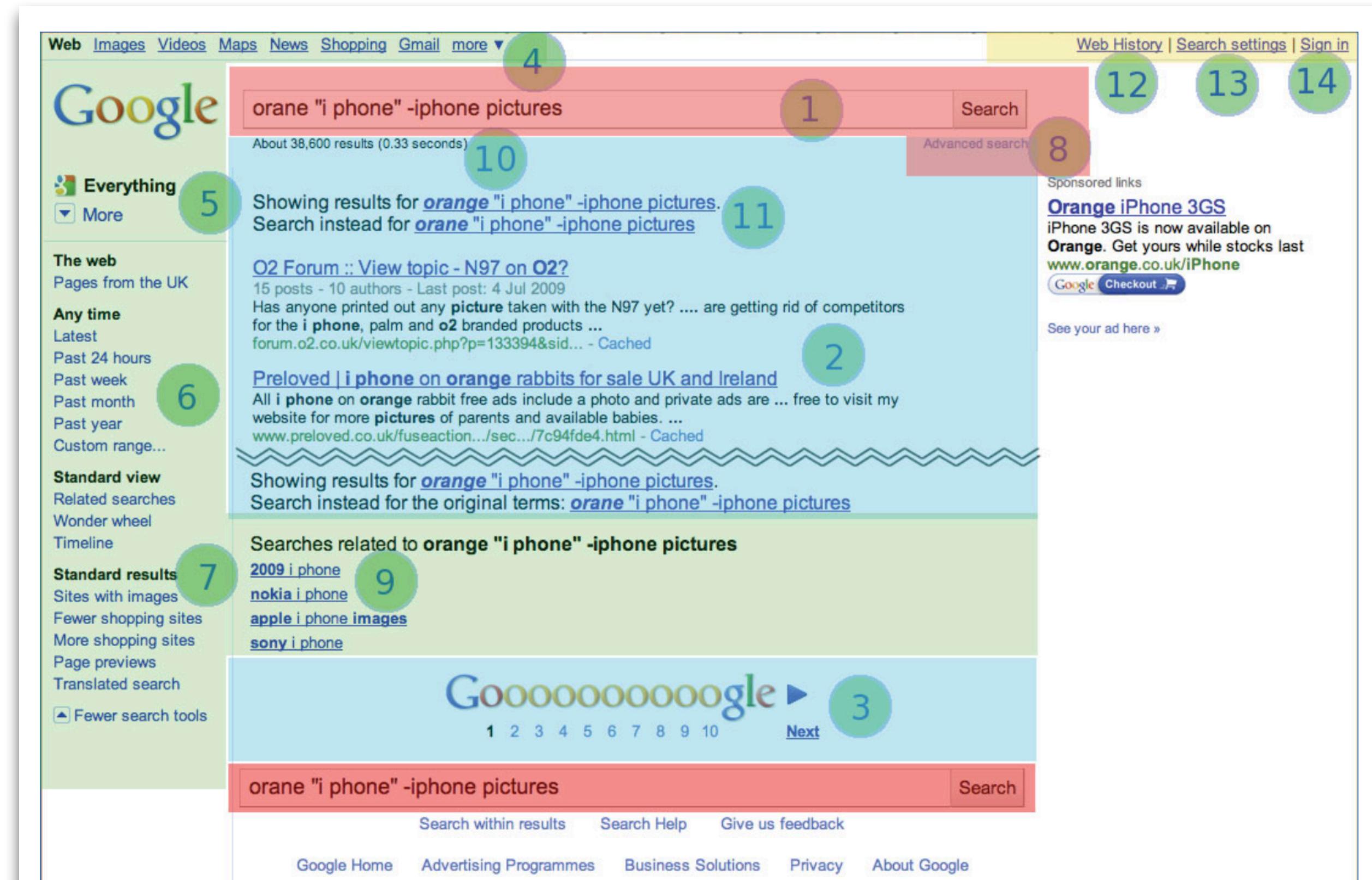
Ajuda Enviar feedback Privacidade Termos Acerca destes dados Feedback

# A Framework for Thinking About Search Features

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- Max L. Wilson proposes a framework to help on the discussion of search user interfaces, elements and features.
- It divides the elements of a search user interface in 4 main groups:
  - **Input** - features that allow the searcher to express what they are looking for.
  - **Control** - features that help searchers to modify, refine, restrict, or expand their input.
  - **Informational** - features that provide results or information about results.
  - **Personalization** - features that relate specifically to searchers and their previous interactions.

# Features in Google SUI (early 2011)



**Figure 1.2:** The Google SUI, from early 2011, zoned by the different types feature categories: Input as Red (including features #1 and #8), Control as Green (#4–#7, #9), Informational as Blue (#2, #3, #10, #11), and Personalisable as Yellow (#12–#14).

# Features in Google SUI (early 2022)

The screenshot shows the Google search interface with the query "tore dos clérigos" in the search bar. Below the search bar are navigation links for "Tudo", "Imagens", "Maps", "Notícias", "Vídeos", and "Mais". A green banner at the top says "A apresentar resultados para **tore dos clérigos**". The main results include a link to the official website (<http://www.torredosclerigos.pt>) and a detailed card for "Igreja e Torre dos Clérigos". The card features a thumbnail image, a snippet about the church being the ex-libris of Porto, and sections for "Visitas", "Horários", and "Como chegar". It also includes a summary from Wikipedia and contact information.

The screenshot displays a search results page with a tab-based navigation bar at the top: "Informational" (blue), "Control" (green), "Input" (orange), and "Personalization" (yellow). The "Personalization" tab is active. The main content area includes a snippet about the church's history and opening hours, followed by two expandable sections: "Qual é o horário de funcionamento de Torre dos Clérigos?" and "Precisa reservar sua visita a Torre dos Clérigos com antecedência?". Below this is a "Pesquisas relacionadas" section with cards for "Torre dos Clérigos história", "Clérigos", "Torre dos Clérigos por dentro", "Torre dos Clérigos preço", "Torre dos Clérigos Porto", "Bilhetes Torre dos Clérigos", "Torre dos Clérigos wikipédia", and "Torre dos Clérigos curiosidades". At the bottom, there's a "Goooooooooooooogle" footer with page numbers 1-10 and a "Próximo" button, along with links for "Portugal", "Porto", "Ajuda", "Enviar feedback", "Privacidade", and "Termos".

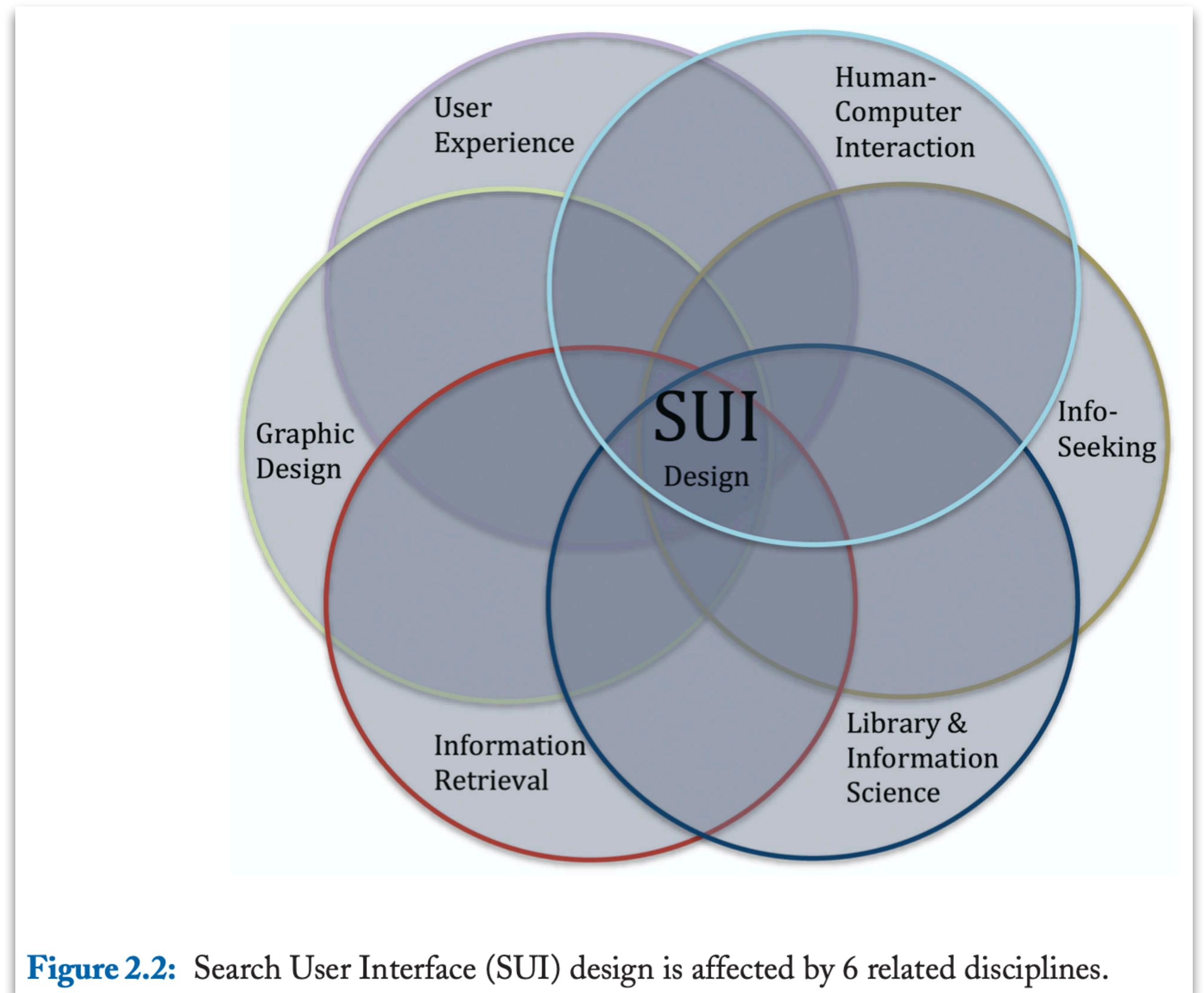
# SIGARRA Search

The screenshot shows the "Pesquisa de Informação sobre Pessoal" (Personal Information Search) page. The header includes the U.PORTO logo, a search bar, and links for "En", "?", "Documentos", and "Sessão". A banner at the top right says "IX FOTOGRAFA CIVIL DEZEMBRO PELA MINHA LENTE". On the left, a sidebar lists categories like "Boas vindas", "Órgãos de Gestão", "Departamentos", "Serviços", "Estudantes", "Pessoal", "Cursos", "I&D e Inovação", "Cooperação", "Candidatos", "Alumni", "Empresas", "Notícias", "Pesquisa", "Autenticação", "Utilizador:", "ssn", "Senha", "Iniciar sessão", "Esqueceu-se da senha?", and "AAI". The main form has fields for "Nome", "Código", "Sigla", "Unidade", "Categoria", "Vínculo", "Orgão", "Cargo", "Estado" (set to "Ativo"), "Sala", "Telefone", "Email", and "Área de Interesse". A "Pesquisar" button is at the bottom. An "OPÇÕES" section on the right includes a link to "Ementa da Cantina".

The screenshot shows a search results page with a header for "retrieval" and links for "Todos", "Notícias", "Cadeiras", and "Ferramentas de Pesquisa". It includes a "Feedback" button. The main content displays search results for various topics, each with a title, a "Notícia" link, and a brief description. Examples include "Palestras do DEI: 'Entity-Relationship Retrieval over the Web'", "Provas de Doutoramento: 'Entity Retrieval and Text Mining for Online Reputation Monitoring'", "Recuperação da Informação", "Recuperação de Informação", "Bolsa de investigação FEUP | Sibila - information retrieval", and "Tópicos Avançados em Ciência de Dados". Each result has a "Cadeira" link followed by a green dot and a URL.

# Related Disciplines

- Six disciplines, or factors, contribute to the design of a search user interface.
- User Experience
- Graphic Design
- Information Retrieval
- Library & Information Science
- Info-Seeking
- Human-Computer Interaction



**Figure 2.2:** Search User Interface (SUI) design is affected by 6 related disciplines.

# Impact Factors

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- Organization and properties of the data sources, e.g. available metadata.
- IR algorithms adopted, considering both speed and effectiveness.
- Graphic design, aesthetics impact how people judge the trustworthiness of a website. Simple use of color and other simple visual cues can have significant impact on SUI success.
- How people search for information – field of Information Seeking Behavior – also impacts on search user interfaces design.

# UI Design Principles (1)

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- General users interface design guidelines from the HCI and UX communities.
1. **Visibility**, keep the user informed about what is happening at any given time. Example: keep the current search terms in the query box.
  2. **Language**, adopt language that the user can understand. Example: instead of 'query' use the term 'search', or instead of 'query expansion' use 'related searches'.
  3. **Control and freedom**, do not block users in a hole or fixed pathway, instead provide mechanisms for users to recover from them. Example: highlight spelling errors or mistakes but do not force them on users.
  4. **Consistency**, adopt a consistent design that follows the same conventions. Example: always use 'search' and not 'query' or 'keyword search' in other places.

# UI Design Principles (2)

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5. **Error prevention**, make it hard to do unproductive things, i.e. avoid the need to undo actions.
6. **Support recognition**, help users not have to remember what they have done or need to do. Example: provide related searches, keep the query in the search box.
7. **Flexibility and efficiency**, provide features and shortcuts for experiences users to be more productive and efficient. Example: let users navigate search results with keyboard shortcuts.
8. **Aesthetics and minimalism**, keep design simple and minimalist; make sensible use of white space.

# UI Design Principles (3)

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9. **Clear error messages**, provide informative and useful error messages. Example: not only state the lack of results, but provide alternative searches.
10. **Help and documentation**, provide help as documentation, FAQs, and examples.

→ Other UI design principles:

- Shneiderman's "Eight Golden Rules"  
<https://www.cs.umd.edu/~ben/goldenrules.html>
- Bruce Tognazzini's "First Principles of Interaction Design"  
<https://asktog.com/atc/principles-of-interaction-design/>
- Jakob Nilsen's "10 Usability Heuristics for User Interface Design"  
<https://www.nngroup.com/articles/ten-usability-heuristics/>

# Early Search User Interfaces

# Conversation and Dialogues

→ Given the UI limitations, early (1970s) SUIs were modeled around conversations or dialogues.

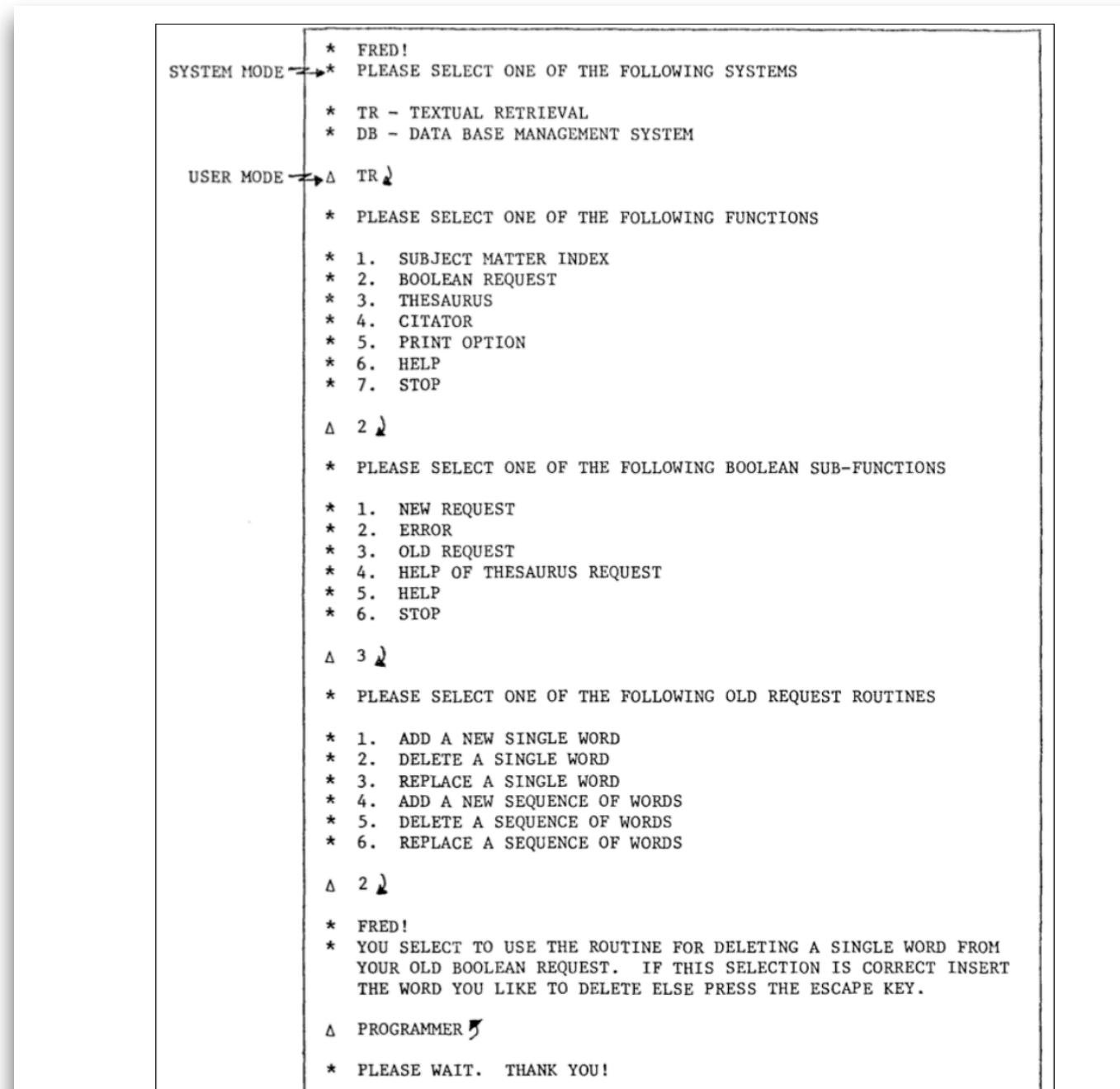


Figure 3.1: A series of dialogue-style questions aimed to help the searcher describe what they are searching for; taken from [179].

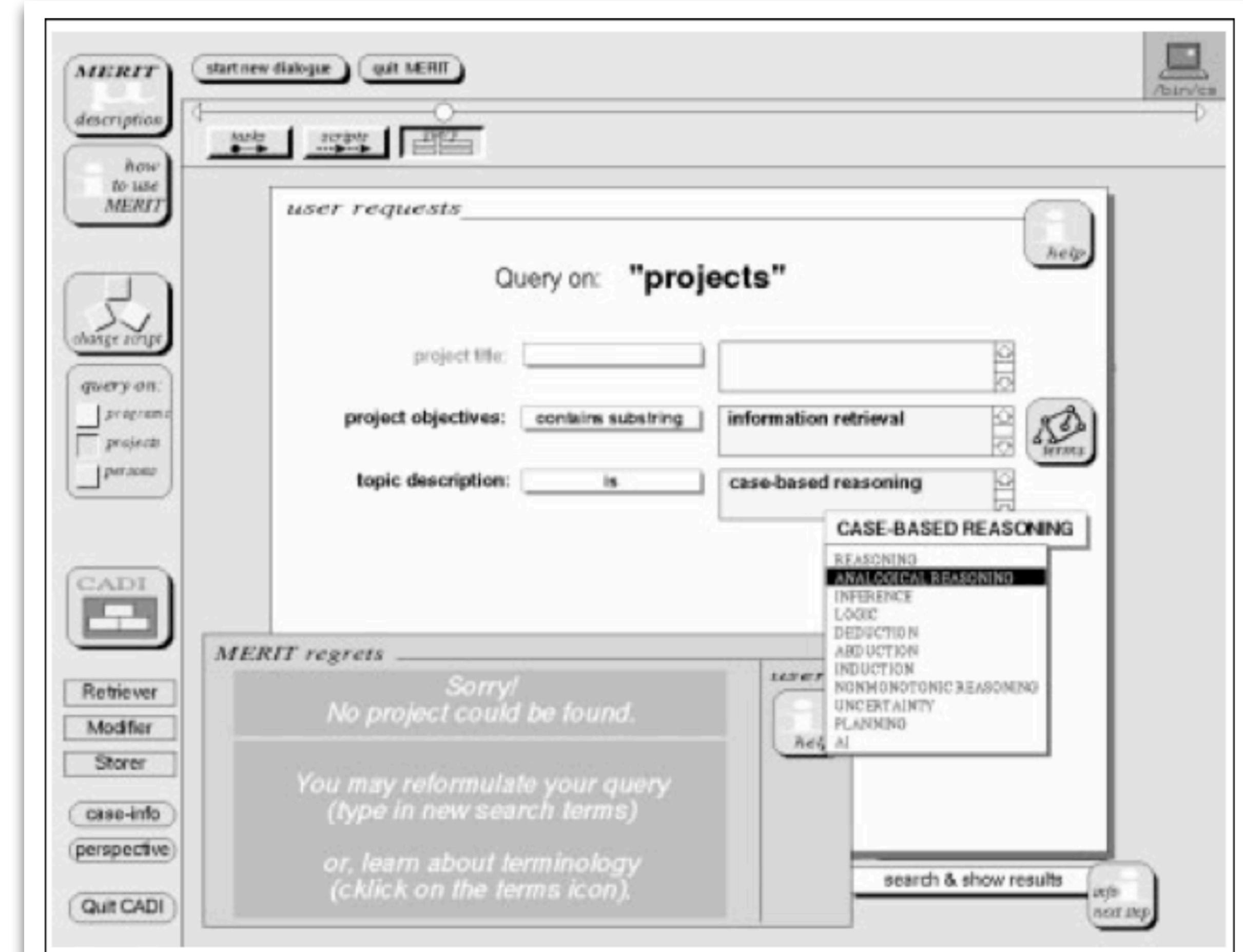
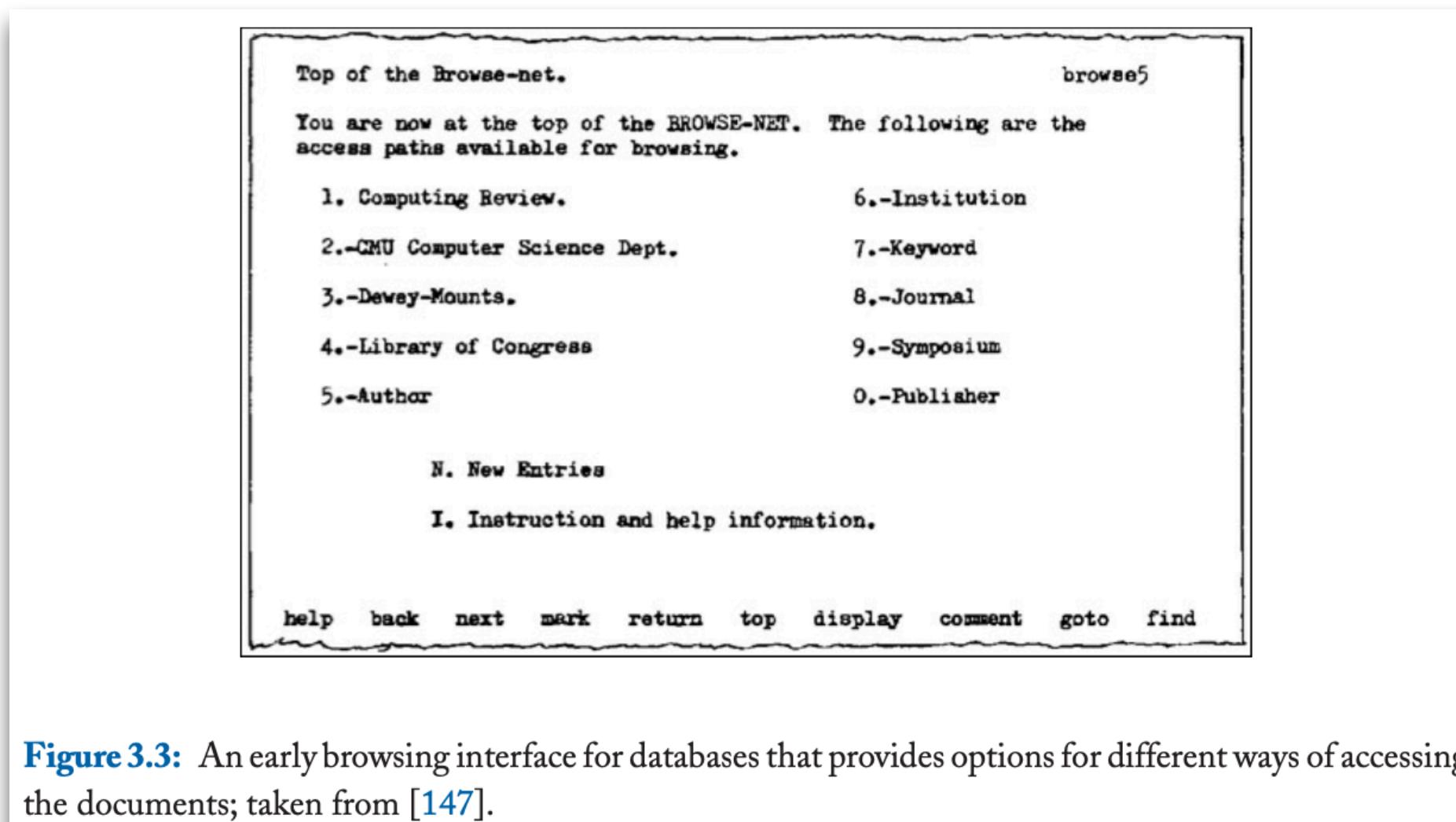


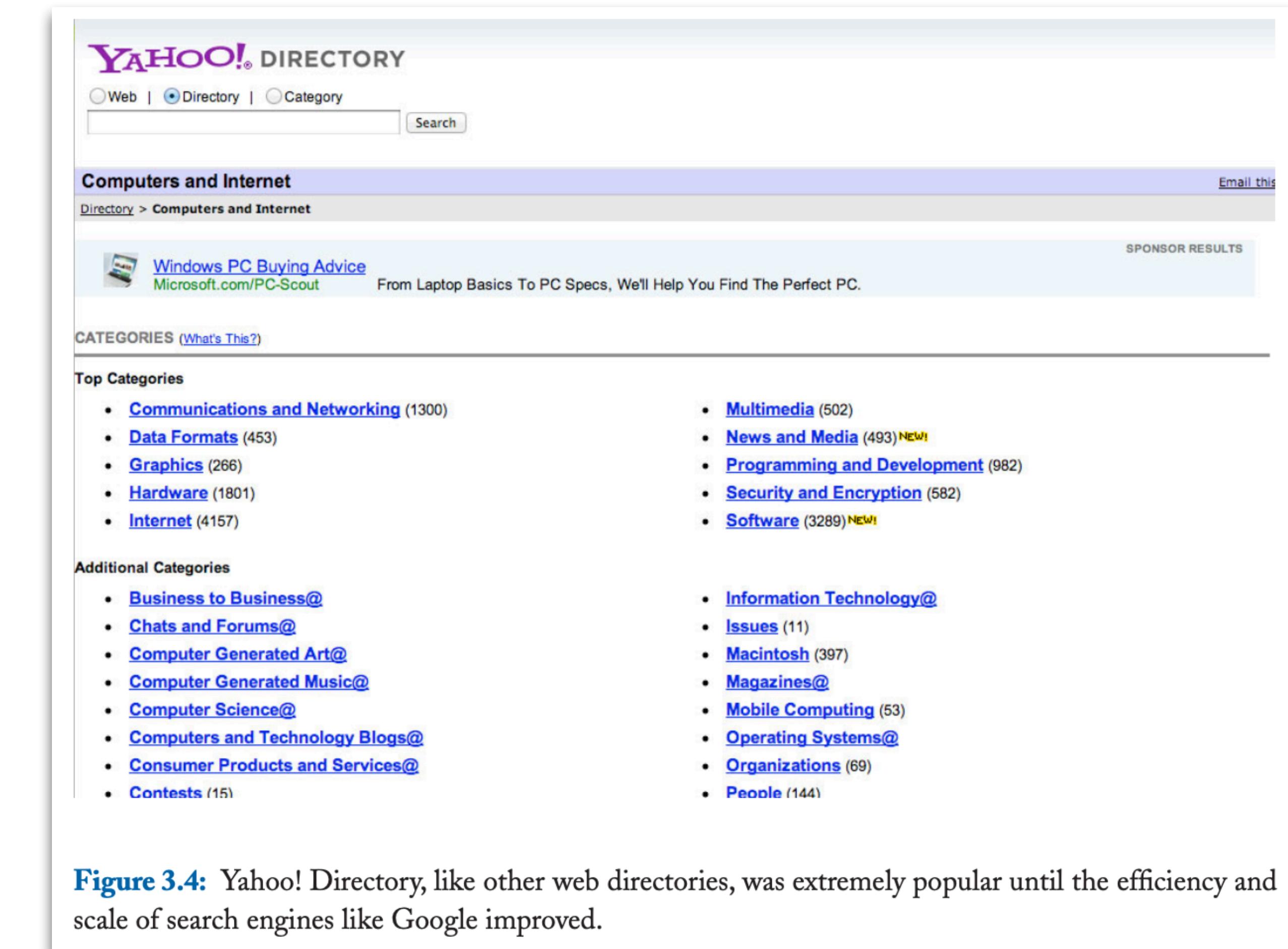
Figure 3.2: An advanced IIR SUI, called Merit, that responds based on a complex model of human conversations; taken from [16].

# Browsing

- Another type of system, given the command line technology available, was represented by browsing SUIs.
- Directories were a popular solution for SUIs in the 1990s, with the growth of the web.



**Figure 3.3:** An early browsing interface for databases that provides options for different ways of accessing the documents; taken from [147].



**Figure 3.4:** Yahoo! Directory, like other web directories, was extremely popular until the efficiency and scale of search engines like Google improved.

# Form Filling

- SUIs became more interactive with the emergence of Graphical User Interfaces (GUIs) in the 1980s.
- The "form filling" paradigm, that we still use today, became popular.

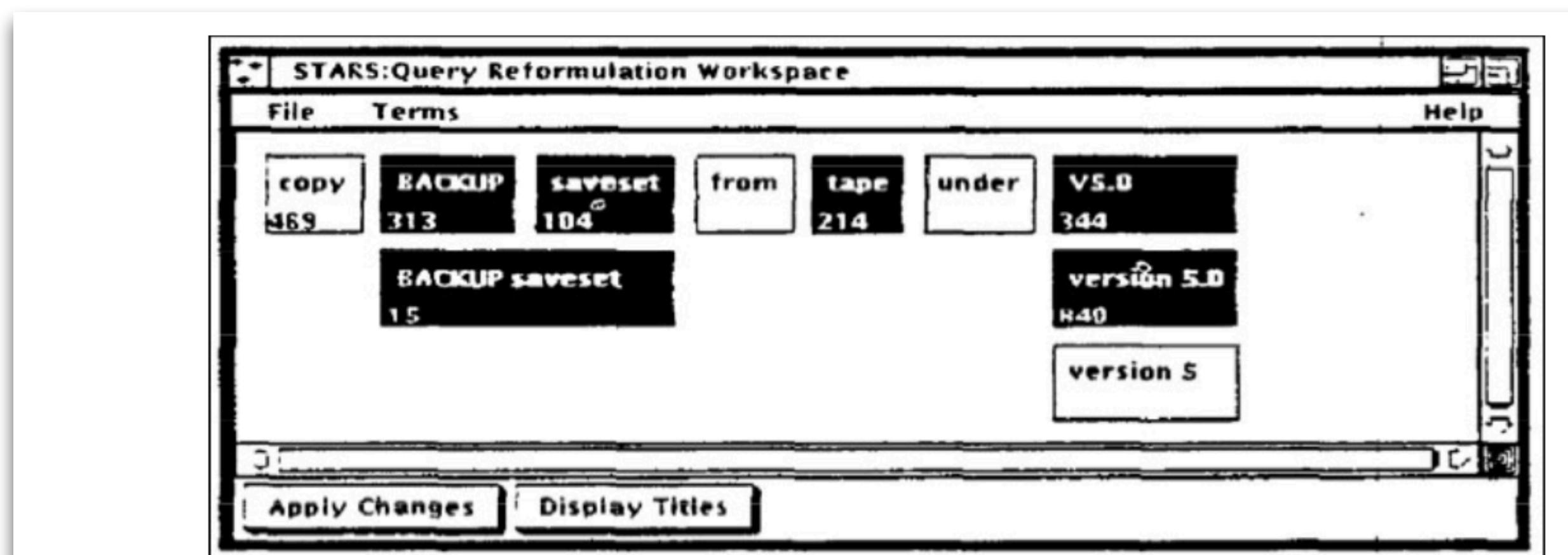
*Query form for Report*

<i>Authors:</i>	<input type="text"/>
<i>Title:</i>	<input type="text"/>
<i>Date:</i>	<input type="text"/>
<i>Institute:</i>	<input type="text" value="Mathematical Institute, Copenhagen University"/>
<i>Folders:</i>	<input type="text"/>
<i>Theorem:</i>	<input type="text"/> <i>Number:</i> <i>Title:</i> <i>Text:</i> local regularity AND polyhedra
<hr/>	
<i>Text:</i>	<input type="text"/> Within structure ↑ Anywhere ↓
<hr/>	
<b>Find Next</b> <b>Find Previous</b> <b>Find All</b> <b>Cancel</b>	

**Figure 3.5:** The EUROMATH interface had custom forms for each type of record in the system; taken from [123].

# Boolean Searching

- Boolean queries are one of the early advancements in the way users can specify their needs, e.g. [ kings OR queens ]
- The advent of GUIs provided an opportunity to help people construct Boolean queries more easily and visually.
- Boolean search is still prevalent in modern search user interfaces.



**Figure 3.6:** The query builder in the STARS interface allowed searchers to arrange query terms in a 2D space to build a Boolean query. Items aligned vertically are ORed and items aligned horizontally are ANDed; taken from [7].

# Modern Search User Interfaces

# Modern Search User Interfaces

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- Advances in modern search user interfaces designs are described according to the framework presented before, where elements and features are grouped in: input; control; informational, and personalization.
- For each search user interface design, examples and design recommendations are highlighted.

# Input Features

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- Input features typically try to provide either suggestions for keywords searchers, or metadata that can be browsed.
- The **search box** pervades search user interfaces and users expect to find a white text field to insert their search terms into.
  - Advantages: extremely flexible, and uses the searchers language.
  - Search box also informs the user of the search being made, thus an informational feature.
  - Additionally, keeping the search box visible allows users to use it as a control feature too.

# Adding Metadata

- Metadata provided by the user can vary in both depth and complexity.
- Metadata can provide input, control, and informational support.
- An example is faceted metadata, e.g. grouping results in multiple different dimensions (facets).

The screenshot shows a Mozilla Firefox browser window with the title bar "median - Categorized Search - Mozilla Firefox". The address bar contains the URL "http://localhost:8080/Service2/src/WebSearch25.jsp?q=median&c=100&uid=unknown&el=". The search query "median" is entered in the search bar, and there is a "Search" button. Below the search bar, a message says "Top 100 results containing median".  
The results are categorized into facets:

- Topic Category:** Science (24), Reference (19), Arts (7), Kids and Teens (6), Society (6), Business (6), Computers (5), Health (4), Home (3), News (3), Sports (1).
- Geography:** North America (18), Europe (2), Oceania (1).
- Last Visited:** Before Last Week (6), Never Visited (94).

Each category has a link to a detailed result page. For example, the "Median" result has a description: "The median is the middle of a distribution: half the scores are above the ... The median is less sensitive to extreme scores than the mean and this makes it ...". Other results include "Mean and Median", "Median", "Introduction to Statistics: Mean, Median, and Mode", "Mean, Median and Mode Discussion", "CancerGuide: The Median Isn't the Message", and "Median - Wikipedia, the free encyclopedia".

Figure 4.8: SERVICE provides faceted browsing over generic web search results.

# Control Features

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- Control features can affect either the search that was being submitted, or can organize or rearrange the results.
- Examples of control features:
  - Interactive query changes, e.g. "related searches", "more like this".
  - Corrections, e.g. auto-correcting errors.
  - Sorting, e.g. provide features that allow users to re-order results.
  - Filters, e.g. filter results based on properties.

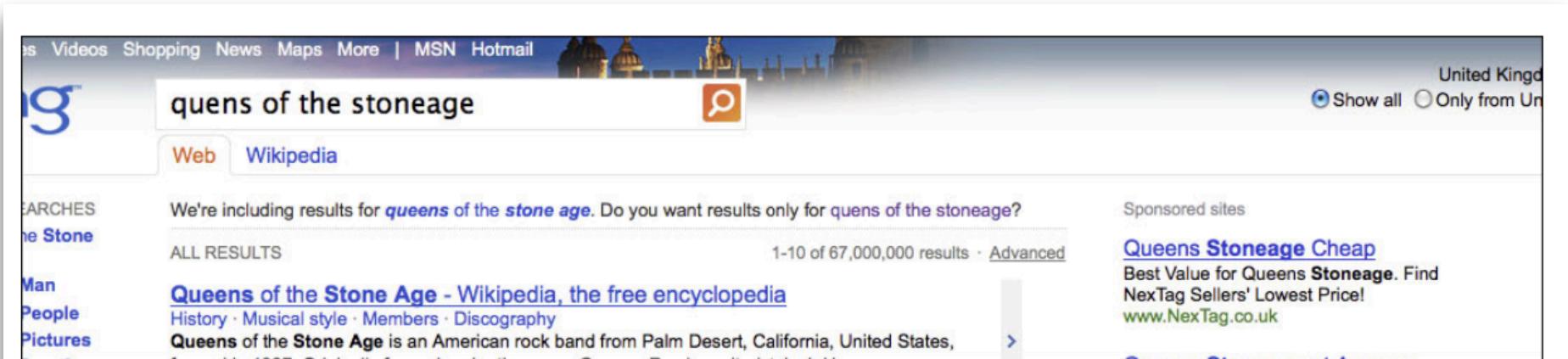
# Interactive Query Changes

(a) Bing – IQEs on left of SERP      (b) Google – IQEs for some searches at the bottom of the results.

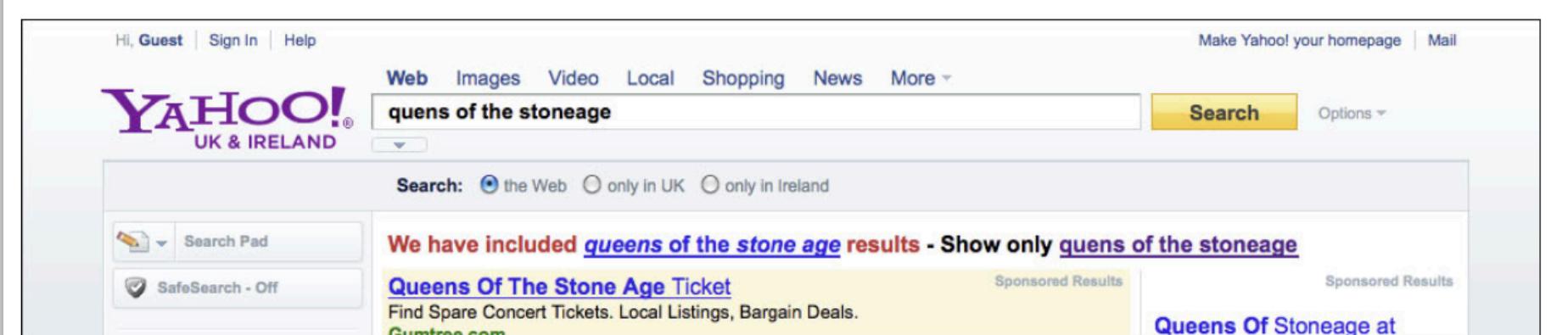
(c) Amazon provides fewer IQEs above the results.

**Figure 4.10:** Interactive Query Suggestions (both refinements and alternatives) are a familiar sight in most search systems.

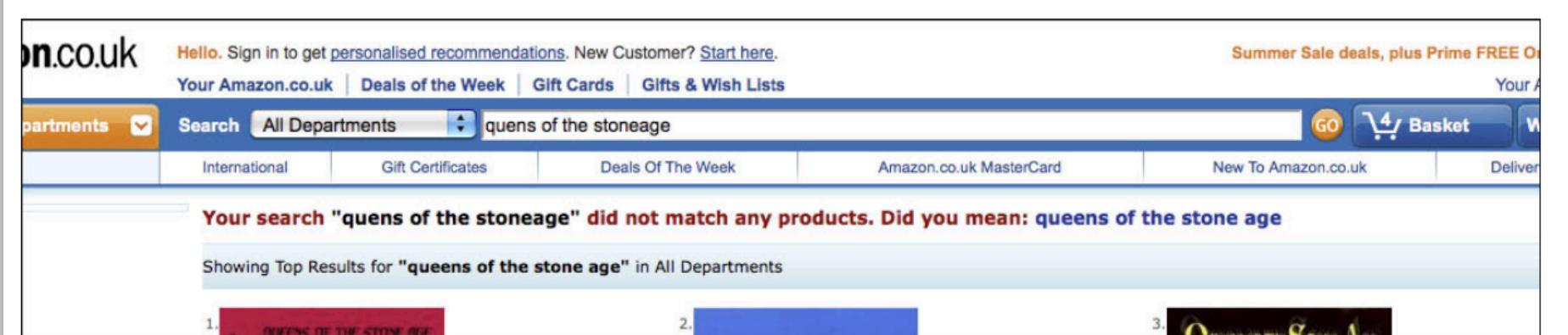
# Corrections



(a) Bing (shown here) and Google often auto-corrects errors, but provides a link to results on the exact query, if it is confident that the corrected version is more likely.



(b) Yahoo! currently only auto-corrects errors, but provides a link to results on the exact query.



(c) Amazon says it cannot find results for an incorrect query, but provides a link and example results for a corrected version.

**Figure 4.11:** Correcting errors in searcher queries to avoid dead ends.

# Sorting

The figure displays three screenshots of e-commerce websites demonstrating sorting functionality:

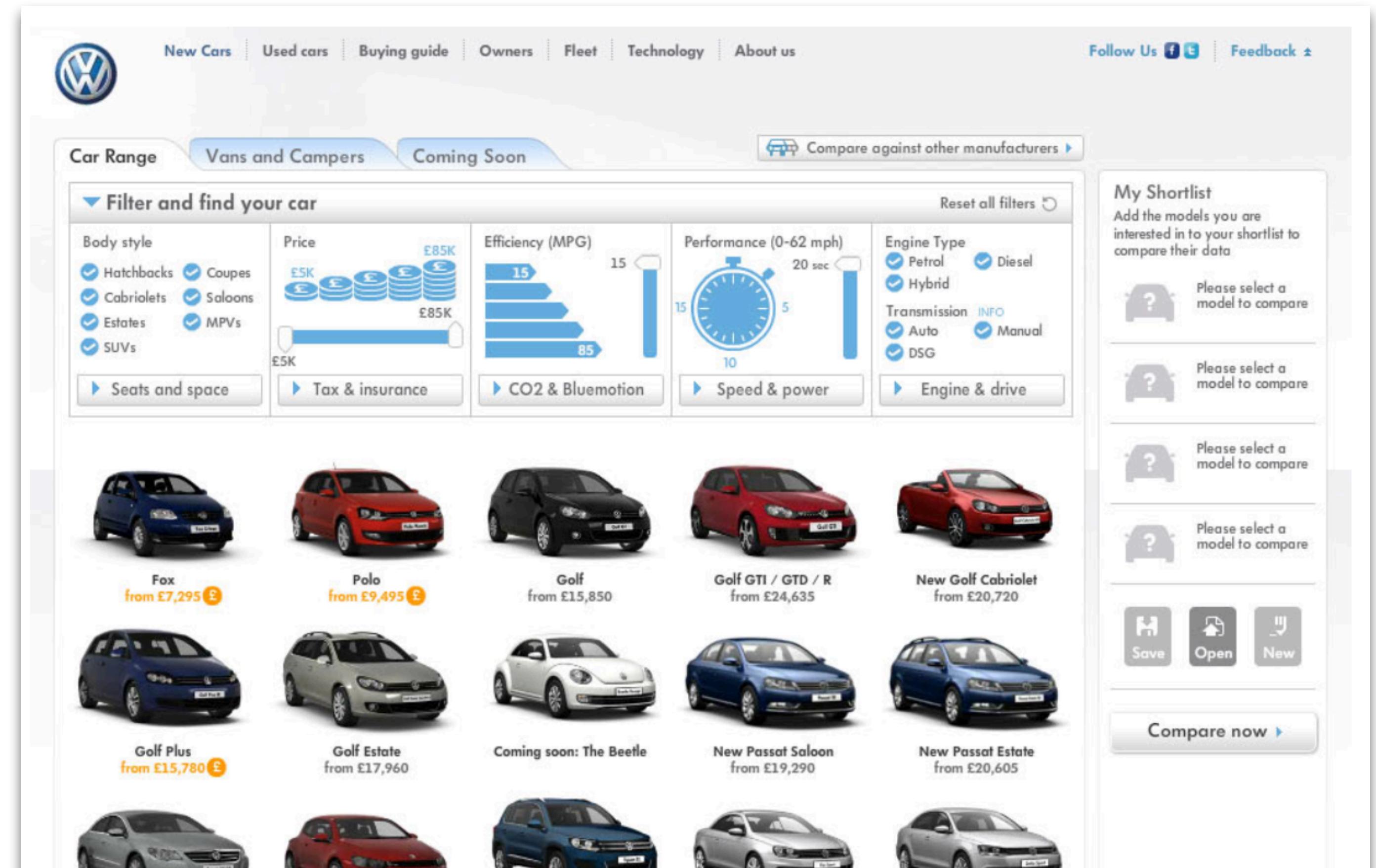
- (a) Sorting in Amazon:** Shows a dropdown menu titled "Sort by" with options: Relevance, Bestselling, Price: Low to High, Price: High to Low, Avg. Customer Review, and Release Date. The "Relevance" option is currently selected.
- (b) Sorting in Walmart:** Shows a dropdown menu titled "Sort by:" with options: Relevance, Price High to Low, Price Low to High, Top Rated, Best Sellers (which is highlighted), New, Alpha A-Z, and Alpha Z-A. The "Best Sellers" option is currently selected.
- (c) Sorting in Yahoo!:** Shows a dropdown menu titled "Sort By:" with options: Best Match, Product (A - Z), Product (Z - A), Price (Low - High), Price (High - Low), and Customer Rating. The "Best Match" option is currently selected.

(a) Sorting in Amazon

(b) Sorting in Walmart

(c) Sorting in Yahoo!

# Filters



**Figure 4.14:** Volkswagen use a dynamic and interactive set of sliders and checkboxes to filter their cars.

# Informational Features

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- Informational features relate to how results are organized and displayed.
- Individual results are presented in a Search Engine Results Page (SERP).
- An individual result typically includes: (1) the title of the result; (2) a snippet of text; and (3) the URL for the result.

[https://pt.wikipedia.org › wiki › Recupera%C3%A7%C3%A3o\\_de\\_infor... ▾](https://pt.wikipedia.org/wiki/Recupera%C3%A7%C3%A3o_de_inform%C3%A1ticas)

**Recuperação de informação – Wikipédia, a encyclopédia livre**

É uma ciência de pesquisa sobre busca por informações em documentos, busca pelos documentos propriamente ditos, busca por metadados que descrevam documentos e ...

[Histórico acadêmico](#) · [Palavras-chave](#) · [Principais passos](#) · [Esquema global](#)

[https://www.marilia.unesp.br › EduardoFernandes ▾ PDF](https://www.marilia.unesp.br/EduardoFernandes)

**Recuperação de Informação**

14/08/2018 — de **recuperação de informação** dos sistemas gerenciadores de bancos de dados, estudados e implementados no âmbito da Ciência da Computação.

26 páginas

# Personalization Features

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- With personalization features the search experience is tailored to the searcher.
- Personalization can be based on:
  - Individual data, e.g. previous user interactions, previous searches, user location;
  - Aggregated data, e.g. based on activity profiles, location data, topical data.
- Personalization can impact:
  - Results ranking;
  - Search suggestions;
  - Search engine features.

# Evaluating Search User Interfaces

# Evaluating Search User Interfaces

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- Three approaches: IR style, empirical user studies, analytical approaches.
- IR style
  - Traditionally, IR systems are evaluated within a TREC-style environment, based on datasets, specific tasks, and known 'best results' for each task (calculated by human experts).
  - Given the success of the TREC approach, an interactive track was created to take search interaction into account. But success was limited. Simple evaluation measures like precision and recall were not sufficient.
- Other approaches are: empirical and analytical.

# Empirical User Studies

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- HCI user studies methods instead focus on how well a system, including the SUI, allows searchers to complete a task.
- It became common to evaluate search systems by creating user studies using tasks that are specifically oriented towards search.
- Empirical methods are about observing and recording actual user performance.
- Common measurements used in user studies: number of searches, number of terms per search, number of results visited, search times, task accuracy, etc. Qualitative methods such as interviews and observations are also possible.
- Designing and conducting user studies is hard. Results can be impacted by many factors such as the motivation of participants, software bugs, and even small user experience differences, e.g. slight differences in colors.

# Analytical Approaches

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- In analytical approaches, typically low-cost or "discount" inspection methods are used to allow evaluators to assess a design and make well informed predictions about SUI.
- There are many analytics methods for UI and UX – e.g. heuristic evaluation, cognitive walkthrough – , but fewer specifically designed for SUI.
- Analytical approaches can leverage the wealth of models and experience previously developed by experts.
- Analytics methods can only make estimates about how suitable a design is, before a formal evaluation.

# Choosing an Evaluation Approach

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- The HCI community has developed the DECIDE process to help on this decision:
  - D - Determine the goals of the evaluation;
  - E - Explore the specific questions to be answered;
  - C - Choose an evaluation paradigm, such as systematic IR or empirical user studies;
  - I - Identify practical issues in performing such an evaluation;
  - D - Decide how to deal with any ethical issues;
  - E - Evaluate, Interpret, and present the data.

# Summary of Design Recommendations

# Summary of Design Recommendations (1)

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1. Keep the search box and the current query clearly visible for the searcher at all times.
2. Help searchers to create useful queries whenever possible.
3. Make it clear how results relate to metadata in your system, to help searchers to judge the results and make sense of the whole collection.
4. Carefully curated metadata is better than automatically generated, but both are better than no metadata at all.
5. If appropriate, support searchers in reviewing their decisions and their options quickly and easily.
6. Always return results based on the first interaction, as subsequent interactions may never be needed.
7. Never let searcher reach a dead end, where they have to go back or start over.
8. Help searchers avoid mistakes wherever possible, but do not force that help upon them.

# Summary of Design Recommendations (2)

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9. Give searchers control over the way results are ordered.
10. Make sure it is obvious exactly how results are ordered and which, therefore, are most important.
11. Avoid unnecessary information, which can be distracting during search.
12. Searchers rarely scroll, so get 'important' information above the first-scroll point.
13. Provide actionable features in the SERP results directly so that searchers do not have to interrupt their search.
14. Images and Previews can help searchers make better browsing decisions.
15. Make sure the dimensions and layout of a visualization are clear and intuitive to the searcher.
16. Guiding numbers help searchers to make better browsing decisions.

# Summary of Design Recommendations (3)

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17. Animation should be used carefully and purposefully to convey a message, such as change.
18. Track and reuse information about the behavior of a system's searchers.
19. Help searchers to return to previously viewed SERPs and results.
20. Help searchers to recover their previous search sessions, as they may be back to finish a task.

# Summary

# Summary

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- **Multidisciplinary**, addressing these challenges requires knowledge and expertise from multiple areas, e.g. information science, visual design, human-computer interaction.
- **Different types of features**, search user interfaces features can be grouped in different types – input features; control features; informational features; personalization features.
- **Heuristics**, existing guidelines and best practices can help on the design of successful search user interfaces.
- **User studies**, evaluation of search user interfaces is done by observing users conducting specific tasks.

# References

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  - Chapter 2: User Interfaces for Search + Slides