Faceted Metadata in Search Interfaces

Marti Hearst
UC Berkeley School of Information

This Research Supported by NSF IIS-9984741.
Focus: Search and Navigation of Large Collections

Example: the University of California Library Catalog
Basic Search: *Entire Collection*  

**Search:**  

**Optional Limits:**  

- **Library:** ALL Libraries  
- **Format:** ALL Formats  
- **Language:** ALL Languages  
- **Year:** From (yyyy) To (yyyy)  

**Words as Phrase**  

- **Search Examples**  
  - Title: old man sea  
  - Title (exact): old man and the sea  
  - Author (last name first): hemingway ernest  
  - Or: hemingway e*  
  - Words as Phrase: genetic engineering  

**Melvyl Search Tip:** Don't like using your mouse in searching? Try Command Search.
Search results: 50229 Item(s)

Searched: Subject= art history
Collection: Entire Collection

1  Full Record
Author  Peyré, Yves.
Title  Art deco bookbindings : the work of Pierre Legrain and Rose Adler / Yves Peyré and H. George Fletcher.
Format  Book
Library  UCD

2  Full Record
Author  Darmon, Reed
Title  Made in China / by Reed Darmon, with assistance from Kalim Winata
Publisher  San Francisco : Chronicle Books, c2004
Format  Book
Library  UCSD

3  Full Record
Author  Maturo, Carol L. (Carol Linda)
Title  Malinche and Cortes, 1513-1521 : an iconographic study / Carol L. Maturo
Publisher  1994
Web Sites and Collections

A report by Forrester research in 2001 showed that while 76% of firms rated search as “extremely important” only 24% consider their Web site’s search to be “extremely useful”.

Johnson, K., Manning, H., Hagen, P.R., and Dorsey, M. Specialize Your Site’s Search. Forrester Research, Cambridge, MA; www.forrester.com/ER/Research/Report/
What do we want done differently?

- Organization of results
- Hints of where to go next
- Flexible ways to move around
- ... How to structure the information?
The Problem With Hierarchy

- Forces a choice of one dimension vs another
  - Either you commit to one path,
  - Or you have to provide many redundant combinations
- Examples
  - Each topic followed by all time periods followed by all locations AND
  - Each topic followed by all locations followed by all time periods AND
  - Each location followed by all topics followed by all time periods … etc
The Problem with Hierarchy

Top: Society (271,246)

- Activism (1,142)
- Advice (75)
- Crime (1,691)
- Death (2,869)
- Disabled (1,159)
- Economics (2,807)
- Education (50,879)
- Ethnicity (6,903)
- Folklore (1,282)
- Future (322)
- Gay, Lesbian, and Bisexual (4,311)
- Genealogy (7,958)
- Government (2,428)
- History (11,903)
- Holidays (2,316)
- Issues (24,798)
- Language and Linguistics (5,561)
- Men (504)
- Military (2,872)
- Organizations (13,859)
- Paranormal (2,422)
- People (19,230)
- Philanthropy (2,739)
- Philosophy (6,700)
- Politics (4,703)
- Relationships (4,511)
- Religion and Spirituality (109,792)
- Sexuality (768)
- Social Sciences (25,273)
- Sociology (1,095)
- Subcultures (1,682)
- Support Groups (291)
- Transgendered (1,205)
- Urban Legends (71)
The Problem with Hierarchy

Top: Society: History (11,909)

- By Region (4,434)
- By Time Period (4,883)
- By Topic (1,893)

- Academic Departments (266)
- Almanacs (12)
- Bibliography (32)
- Booksellers (41)
- Chats and Forums (24)
- Conferences (5)
- Education (105)
- Encyclopedias (9)
- Historians (175)
- Historic Preservation (206)
- Historical Fiction (121)
- Historical Personages (21)
- Journals (46)
- Living History (1,970)
- Magazines and E-zines (12)
- Maps, Historical (62)
- Multimedia (16)
- Museums (763)
- On This Day in History (50)
- Organizations (105)
- Philosophy of History (37)
- Timelines (71)
The Problem with Hierarchy
The Problem with Hierarchy

See also:

- Arts: Literature: World Literature (6,288)
- Science: Social Sciences: Political Science: Comparative Politics (173)

This category in other languages:
- Darish (3)

- All Empires - A database and online community dedicated to historical empires and cultures of the world.
- EDUNet's Timemachine - Travel back to 10,000 years and see what's hot in world history after last ice age.
- Five Epochs of Civilization - Book by William McGaughey about world history as emerging in five civilizations. Includes descriptions and timelines, relating four of them to changes in communication technologies.
- History of the World - Offers an essay giving an overview of world history. Created by history teacher Jeff Cook.
- Horus' History Links - A site for looking up historical information. Indexes sorted by subject, and time.
- HyperHistory Online - "HyperHistory Online navigates through 3000 years of World History with links to important world historical importance: civilization timelines; events and facts; and historical maps."
- World History Project - A site for teaching and learning world history. Includes links to other sites and resources.

Marti Hearst: UC Berkeley SIMS
Search Engines: Technology, Society, and Business
The Problem with Hierarchy

Top: Society: History (11,909)

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- Conferences (5)
- Education (105)
- Encyclopedias (9)
- Historians (175)
- Historic Preservation (206)
- Historical Fiction (121)

Top: Society: History: By Time Period (4,893)

- Ancient (823)
- Middle Ages (519)
- Pre-Columbian Caribbean (2)
- Pre-Columbian North America (85)
- Prehistory (173)

- Eighteenth Century (307)
- Nineteenth Century (631)
- Seventeenth Century (79)
- Sixteenth Century (6)
- Twentieth Century (2,523)

See also:

- Recreation: Living History: By Time Period (140)
- Society: History: On This Day in History (50)
The Problem with Hierarchy

Top: Society; History; By Time Period: Eighteenth Century (307)

- Fashion (3)
- French Revolution (30)
- Industrial Revolution (15)
- People (4)
- Slavery (27)
- 18th Century British Literature (11)
- Wars and Conflicts (211)

See also:

- Society; History; Education (105)

This category in other languages:

German (12) Italian (30) Spanish (2)
Swedish (7)

- American Weekly Mercury - Transcriptions of selected issues of Philadelphia's first newspaper from February 1722 to
  Also provides information about early newspapers and their operation, biographies, and related links.
- C18-L's Selective Readings - An online running international bibliography of scholarly work in 18th-century studies in
How to Structure Information for Search and Browsing?

- Hierarchy is too rigid
- Hierarchical faceted metadata:
  - A useful middle ground
- Full meaning is too complex
What are facets?

- Sets of categories, each of which describe a different aspect of the objects in the collection.
- Each of these can be hierarchical.
- (Not necessarily mutually exclusive nor exhaustive, but often that is a goal.)
Facet example: Recipes

- **Cooking Method**: Stir-fry
- **Course**: Main Course
- **Ingredient**: Chicken, Red Bell Pepper, Curry
- **Cuisine**: Thai
Example of Faceted Metadata: Categories for Biomedical Journal Articles

1. Anatomy [A]
2. Organisms [B]
3. Diseases [C]
4. Chemicals and Drugs [D]

1. Lung
2. Mouse
3. Cancer
4. Tamoxifen
Goal: assign labels from facets
Description: 19th c. paint horse; saddle and hackamore; spurs; bandana on rider; old time cowboy hat; underchin thong; flying off.
Motivation

Description: 19th c. paint horse; saddle and hackamore; spurs; bandana on rider; old time cowboy hat; underchin thong; flying off.

By using facets, what we are not capturing?

The hat flew off;
The bandana stayed on.

The thong is part of the hat.

The bandana is on the cowboy (not the horse).
The saddle is on the horse (not the cowboy).
Hierarchical Faceted Metadata

• A simplification of knowledge representation
• Does not represent relationships directly
• BUT can be understood well by many people when browsing rich collections of information.
How to Use in an Interface?

- Users don’t like new search interfaces.
- How to show lots of information without overwhelming or confusing?
- There are many ways to do it wrong.
  - Say I want unabridged nonfiction audiobooks
  - Audible.com, BooksOnTape.com, and BrillianceAudio:
    - no way to browse a given category and simultaneously select unabridged versions
  - Amazon.com:
    - has finally gotten browsing over multiple kinds of features working; this is a recent development
    - but still restricted on what can be added into the query
Nonfiction

New & Notable

- Life Among the Serial Killers by Helen Morrison, M.D., with Harold Goldberg
- Founding Mothers by Cokie Roberts
- What Went Wrong (Unabridged) by Bernard Lewis

Best Sellers in Nonfiction

1. My Life by Bill Clinton
2. The Wisdom of Crowds (Unabridged) by James Surowiecki
3. The Lexus and the Olive Tree (Unabridged) by Thomas L. Friedman
4. Naked in Baghdad (Unabridged) by Anne Garrels
5. Plan of Attack by Bob Woodward
6. The Making of Modern Economics (Unabridged) by Mark Skousen
8. The Devil in the White City (Unabridged) by Erik Larson
9. Lies and the Lying Liars Who Tell Them (Unabridged) by Al Franken
10. To the Best of Our Knowledge, 1-Month Subscription by Jim Fleming

Editor's Pick

- The Hot Zone (Unabridged) by Richard Preston

Browse

- Anthropology
- Economics
- Gender Issues
- News Events
- Philosophy
- Politics
- Social Sciences
- True Crime
- Unexplained Phenomena
- Writers Reading

Search

- Nonfiction

Top-Rated Titles

1. The Hot Zone (Unabridged) by Richard Preston
2. True Notebooks (Unabridged)
3. Takedown
4. Mountains Beyond Mountains (Unabridged)
Unabridged Titles

Listed by Audible release date (newest to oldest):

1. **The Last Juror (Unabridged)**
   by John Grisham
   In 1970, one of Mississippi's more colorful weekly newspapers, *The Ford County Times*, went bankrupt... [More]
   **Price:** $32.95
   **Audio Length:** 12 hours
   **Available Formats:** 1 2 3 4 5
   **Average Customer Rating:** 4.11
   **Based on 197 votes**

2. **Dejados Atras [Left Behind] (Unabridged)**
   by Tim LaHaye and Jerry B. Jenkins
   The gripping, phenomenal first book in a series that has become the best-selling inspirational series of all time... [More]
   **Price:** $51.95
   **Audio Length:** 13 hours
   **Available Formats:** 1 2 3 4 5
   **Average Customer Rating:** 2.0
   **Based on 4 votes**

3. **An Unpardonable Crime (Unabridged)**
   by Andrew Taylor
   Educating Reno is an American dream... [More]
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NEW TITLES
Newest titles as of Saturday, June 26, 2004:

<table>
<thead>
<tr>
<th>B.O.T Exclusive! — Brothers in Arms</th>
</tr>
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| By K. Abdul-Jabbar and A. Walton. Read by Richard Allen (Amer.) - Kareem Abdul-Jabbar tells the story of the first all-black tank battalion in WWII.

<table>
<thead>
<tr>
<th>I, Robot</th>
</tr>
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</table>
| By Isaac Asimov. Read by Scott Brick (Amer.) - The finest robot stories in the history of science fiction.

<table>
<thead>
<tr>
<th>Coal Run</th>
</tr>
</thead>
</table>
| By Tawni O'Dell. Read by Daniel Passer (Amer.) - A sidelined ex-football player in coal country must wrestle with his past.

AUDIO SAMPLE
Use the FREE RealPlayer to listen to our featured audio sample:
Non-Fiction Audio Books

Subject(s) that matched your query:

1. All Books (336 books)
2. Africa (5 books)
3. American (4 books)
4. American Experiences (49 books)
5. Animal Life (9 books)
6. Art & Architecture (1 book)
7. Asia (other than Middle East) (14 books)
8. Australia & Oceania (3 books)
9. Battles & Military (2 books)
10. Biology & Evolution (6 books)
11. Business & Industry Giants (5 books)
12. Business Economics (1 book)
13. Business Management & Marketing (1 book)
14. Business Management & Success (3 books)
15. Business Success Stories (1 book)
16. Crime (11 books)
17. Cultural Anthropology (3 books)
18. Ecology & the Environment (1 book)
19. Economics (3 books)
20. Entertainment (2 books)
21. Essays - Miscellaneous (5 books)
22. Europe (10 books)
23. Foreign Experiences (6 books)
24. Geology & Geography (4 books)
25. Health, Medicine & Medical Practice (3 books)
26. INSPIRATIONAL (2 books)
27. Immigrants (2 books)
28. Industrial Giants (6 books)
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30. Law, Lawyers and Law Enforcement (3 books)
31. Life Experiences-American (11 books)
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Read by Linda Greenlaw

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Read by Mel Foster

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A veterinarian's experiences with wild animals in all corners of the world.
Read by Jim Bond

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The miraculous true-life story of Elizabeth Smart's kidnapping and return home.
Read by Sandra Burr Mel Foster

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The powerful re-creation of the Hartford circus fire of 1944.
Read by Dick Hill

Country Matters by Michael Korda
The hilarious transformation of a city slicker into a country squire.
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  Design, Museums, Art History...
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  Books on Cassette
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  Books on CD
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  Tax Planning, Management, Personal Investing...
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  Classics, Fairy Tales, Series, How It Works...
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- **Home & Garden**
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- **Religion & Spirituality**
  Christianity, Judaism, New Age, Occult...
- **Romance**
  Contemporary, Historical, Time Travel, Series...
- **Science**
  Biology, Mathematics, Physics...
- **Science Fiction & Fantasy**
Nonfiction

Browse Nonfiction

- Audiobooks
- Automotive
- Crime & Criminals
- Current Events
- Economics
- Education
- Government
- Holidays
- Law
- Philosophy
- Politics
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by William Langewiesche
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From Publishers Weekly
"Our world is an ocean world, and it is wild," Langewiesche writes. He then poses a powerful question: have the industrialized nations of the world given up control of the shipping industry to the... Read more (Rate this item)
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   by Ronald Reagan (Rate it)
   Price: $12.60 You Save: $5.40 (30%) Used & new from $11.47

3. The Purpose-Driven Life [UNABRIDGED]
   by Rick Warren (Rate it)
   Price: $29.99 Used & new from $15.38

4. Living History [ABRIDGED]
   by Hillery Rodham Clinton, Hillary Clinton (Rate it)
   Price: $17.68 You Save: $8.32 (32%) Used & new from $7.00

   by Eckhart Tolle (Rate it)
   Price: $20.96 You Save: $8.99 (30%) Used &

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House of Bush, House of Saud
by Craig Unger, James Naughton (Rate it)
Price: $17.68 You Save: $8.32 (32%)
A Solution (The Flamenco Project)

- Incorporating Faceted Hierarchical Metadata into Interfaces for Large Collections
- Key Goals:
  - Support integrated browsing and keyword search
    - Provide an experience of “browsing the shelves”
  - Add power and flexibility without introducing confusion or a feeling of “clutter”
  - Allow users to take the path most natural to them
- Method:
  - User-centered design, including needs assessment and many iterations of design and testing
Nobel Prize Winners Collection
The Nobel Prize is an international award given yearly since 1901 for achievements in physics, chemistry, medicine, literature and for peace. In 1968, the Bank of Sweden instituted the Prize in Economic Sciences in Memory of Alfred Nobel, founder of the Nobel Prize.

The Prize Winners are announced in October every year. They receive their awards (a prize amount, a gold medal and a diploma) on December 10, the anniversary of Nobel’s death.

YOUR QUESTION ON NOBEL MINDS!
Your question could be one of those answered by the Prize Winners participating in the SVT/BBCW production "Nobel Minds," broadcasted on BBC World December 17.

776 NOBEL PRIZE WINNERS SO FAR
Who is the youngest Laureate ever? Has any individual or organization received the Nobel Prize more than once? More Prize Winner facts.

"... AND THE NOMINEES ARE ..."
Can I nominate someone for a Nobel Prize? Find out about the nominations.
The Nobel Prize in Literature

The Nobel Prize in Literature has recognized the whole spectrum of literary works including poetry, novels, short stories, plays, essays and speeches. Starting off with the first prize in 1901 to the poet and philosopher Sully Prudhomme, author of *Stances et Poèmes* (1865), the Prize has distinguished the works of authors from different languages and cultural backgrounds. It has been awarded to unknown masters as well as authors acclaimed worldwide.

Laureates
Find out facts about all Nobel Prize Laureates in Literature through press releases, biographies, Nobel lectures, interviews, etc.

Articles
Read articles written by Nobel Laureates and other invited authors.

Educational
Listen to the Nobel Literature radio or play a game.
The Nobel Prize in Literature - Laureates

Jump down to: 1900 | 1960 | 1940 | 1920 | 1901

2005 Harold Pinter
2004 Elfriede Jelinek
2003 J.M. Coetzee
2002 Imre Kertész
2001 V.S. Naipaul
2000 Gao Xingjian
1999 Günter Grass
1998 José Saramago
1997 Dario Fo
1996 Wislawa Szymborska
1995 Seamus Heaney
1994 Kenzaburo Oe
1993 Toni Morrison
1992 Derek Walcott
1991 Nadine Gordimer
1990 Octavia Butler
The Nobel Prize in Literature 1993

"who in novels characterized by visionary force and poetic import, gives life to an essential aspect of American reality"

Toni Morrison
USA
b. 1931
Faceted Metadata Approach
## Nobel Prize Winners

**1901 to 2004**

### GENDER
- female (33)
- male (698)

### COUNTRY
- Argentina (3)
- Australia (8)
- Austria (12)
- Belgium (11)
- Burma (1)
- Canada (9)
- Chile (2)
- China (2)
- Colombia (1)
- Costa Rica (1)
- Czechoslovakia (2)
- Denmark (13)
- more...

### AFFILIATION
- Allied Reparation Commission (1)
- Argentinian (3)
- Australia (2)
- Austria (6)
- Belgium (7)
- Berlin University (1)
- Briand-Kellogg Pact (3)
- Brussels (1)
- Canada (8)
- Committee for the Defense of National Interests and International Conciliation (1)
- Conseil national économique (1)
- Costa Rica (1)
- more...

### PRIZE
- chemistry (138)
- economics (55)
- literature (10)
- medicine (182)
- peace (108)
- physics (168)

### YEAR
- 1900s (57)
- 1910s (40)
- 1920s (54)
- 1930s (66)
- 1940s (43)
- 1950s (72)
- 1960s (79)
- 1970s (103)
- 1980s (87)
- 1990s (88)
- 2000s (56)
Nobel Prize Winners
1901 to 2004

Refine your search further within these categories:

**GENDER (group results)**
- female (10)
- male (31)

**COUNTRY (group results)**
- Australia (1)
- Austria (1)
- Belgium (1)
- Chile (2)
- Colombia (1)
- Czechoslovakia (1)
- Denmark (3)
- Egypt (1)
- Federal Republic of Germany (2)
- Finland (1)
- more...

**AFFILIATION (group results)**

**PRIZE: all > literature (group results)**

**YEAR**
- 1900s (10)
- 1910s (9)
- 1920s (6)
- 1930s (11)
- 1940s (14)

These terms define your current search. Click the × to remove a term.

**101 items** (view ungrouped items)

**1900s** (10)
- Bjørnstjerne Bjørnson 1832-1910
- Frédéric Mistral 1830-1914
- Giosuè Carducci 1835-1907
- Henryk Sienkiewicz 1846-1916

**1910s** (9)
These terms define your current search. Click the × to remove a term.

**PRIZE:** literature

**YEAR:** 1920s

### Nobel Prize Winners

These terms define your current search. Click the × to remove a term.

**PRIZE:** literature

**YEAR:** 1920s

#### 10 results

- **Anatole France** 1844-1924
- **George Bernard Shaw** 1856-1950
- **Grazia Deledda** 1871-1936
- **Henri Bergson** 1859-1941

Group by: prize, year

Sort by: usual name, year of birth, year of death, country

---

Refine your search further within these categories:

**GENDER**

- female (2)
- male (8)

**COUNTRY**

- France (2)
- Germany (1)
- Ireland (1)
- Italy (1)
- Norway (2)
- Poland (1)
- Spain (1)
- United Kingdom (1)

**AFFILIATION**

**PRIZE:**

- all > literature

**YEAR:**

- all > 1920s
These terms define your current search. Click the × to remove a term.

GENDER: female
YEAR: 1920s

2 results
Group by: gender, year
Sort by: usual name, year of birth, year of death, country

Grazia Deledda
1871-1936

Sigrid Undset
1882-1949

Recently Viewed Items
Go to Item History
Art History Images Collection
<table>
<thead>
<tr>
<th>Media</th>
<th>Built Places</th>
<th>Objects</th>
<th>Themes</th>
<th>Shapes, Colors, and Scenes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Book (309)</td>
<td>Bridge (431)</td>
<td>Clothing (6013)</td>
<td>Military (2600)</td>
<td>Color (4149)</td>
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<tr>
<td>Ceramic (896)</td>
<td>Building (2571)</td>
<td>Containers (2632)</td>
<td>Mortality (423)</td>
<td>Decoration (1680)</td>
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<tr>
<td>Drawing (1547)</td>
<td>Built open space (912)</td>
<td>Food and meals (3680)</td>
<td>Nautical (1381)</td>
<td>Scene (6526)</td>
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<tr>
<td>Glass (403)</td>
<td>Dwelling (1528)</td>
<td>Fuel (453)</td>
<td>Religion (4142)</td>
<td>Shape (1566)</td>
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<td>Part of building (3159)</td>
<td>Lighting (386)</td>
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<td>Road (1204)</td>
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<td>1 - 1000 a.d. (136)</td>
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<td>19th century (7551)</td>
<td>Containers (2632)</td>
<td>Mortality (423)</td>
<td>Decoration (1680)</td>
</tr>
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<td>13th century (1)</td>
<td>20th century (1667)</td>
<td>Food and meals (3680)</td>
<td>Nautical (1381)</td>
<td>Scene (6526)</td>
</tr>
<tr>
<td>14th century (3)</td>
<td>21st century (14)</td>
<td>Fuel (453)</td>
<td>Religion (4142)</td>
<td>Shape (1566)</td>
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<tr>
<td>15th century (76)</td>
<td>B.c. (240)</td>
<td>Lighting (386)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16th century (1225)</td>
<td>more...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17th century (3058)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
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<tr>
<td>Africa (101)</td>
<td>Middle east (60)</td>
<td>Oceania (72)</td>
<td>Scene (6526)</td>
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<td>North america (3034)</td>
<td>Roman empire (4)</td>
<td>Shape (1566)</td>
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<tr>
<td>Australia (5)</td>
<td>Oceania (72)</td>
<td>South america (158)</td>
<td></td>
<td></td>
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<tr>
<td>Central america (57)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Europe (17758)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Flamenco Fine Arts Search

Images from the Collections of the Fine Arts Museums of San Francisco; Legion of Honor and de Young Museums, [http://www.thinker.org](http://www.thinker.org)

Questions or Comments? Email Kevin Li (kevinli@sims.berkeley.edu)

### Media

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Book</strong></td>
<td>309</td>
</tr>
<tr>
<td><strong>Ceramic</strong></td>
<td>896</td>
</tr>
<tr>
<td><strong>Drawing</strong></td>
<td>1547</td>
</tr>
<tr>
<td><strong>Glass</strong></td>
<td>403</td>
</tr>
<tr>
<td><strong>Metalwork</strong></td>
<td>134</td>
</tr>
<tr>
<td><strong>Objects</strong></td>
<td>1689</td>
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<tr>
<td><strong>Painting</strong></td>
<td>115</td>
</tr>
<tr>
<td><strong>Photograph</strong></td>
<td>333</td>
</tr>
<tr>
<td><strong>Print</strong></td>
<td>18206</td>
</tr>
<tr>
<td><strong>Sculpture</strong></td>
<td>193</td>
</tr>
</tbody>
</table>

### Date

- **1 - 1000 a.d.** (136)
- **12th century** (3)
- **13th century** (1)
- **14th century** (3)
- **15th century** (76)
- **16th century** (1225)
- **17th century** (3058)

- **18th century** (2287)
- **19th century** (7551)
- **20th century** (1667)
- **21st century** (14)
- **B.c.** (240)
- **more...**

### Location

<table>
<thead>
<tr>
<th>Region</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>101</td>
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<tr>
<td>Asia</td>
<td>945</td>
</tr>
<tr>
<td>Australia</td>
<td>5</td>
</tr>
<tr>
<td><strong>Central america</strong></td>
<td>57</td>
</tr>
<tr>
<td>Europe</td>
<td>17758</td>
</tr>
<tr>
<td><strong>Middle east</strong></td>
<td>60</td>
</tr>
<tr>
<td><strong>North america</strong></td>
<td>3034</td>
</tr>
<tr>
<td><strong>Oceania</strong></td>
<td>72</td>
</tr>
<tr>
<td>Roman empire</td>
<td>4</td>
</tr>
<tr>
<td><strong>South america</strong></td>
<td>168</td>
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</tbody>
</table>

### Built Places

<table>
<thead>
<tr>
<th>Place</th>
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<tbody>
<tr>
<td><strong>Bridge</strong></td>
<td>431</td>
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<tr>
<td><strong>Building</strong></td>
<td>2571</td>
</tr>
<tr>
<td><strong>Built open space</strong></td>
<td>912</td>
</tr>
<tr>
<td><strong>Dwelling</strong></td>
<td>1528</td>
</tr>
<tr>
<td><strong>Part of building</strong></td>
<td>3159</td>
</tr>
<tr>
<td><strong>Road</strong></td>
<td>1204</td>
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</table>

### Objects

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clothing</strong></td>
<td>6013</td>
</tr>
<tr>
<td><strong>Containers</strong></td>
<td>2632</td>
</tr>
<tr>
<td><strong>Food and meals</strong></td>
<td>3680</td>
</tr>
<tr>
<td><strong>Fuel</strong></td>
<td>485</td>
</tr>
<tr>
<td><strong>Lighting</strong></td>
<td>386</td>
</tr>
<tr>
<td><strong>Musical instruments</strong></td>
<td>634</td>
</tr>
<tr>
<td><strong>Timpieces</strong></td>
<td>73</td>
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<tr>
<td><strong>Vehicles</strong></td>
<td>3457</td>
</tr>
<tr>
<td><strong>Weapons</strong></td>
<td>1498</td>
</tr>
<tr>
<td><strong>Writing tools</strong></td>
<td>3636</td>
</tr>
</tbody>
</table>

### Themes

- **Military** (269)
- **Mortality** (423)
- **Music, writing, and sport** (5499)
- **Nautical** (1381)
- **Religion** (4142)

### Shapes, Colors, and Scenes

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Color</strong></td>
<td>4149</td>
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<tr>
<td><strong>Decoration</strong></td>
<td>1680</td>
</tr>
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<td><strong>Scene</strong></td>
<td>6526</td>
</tr>
<tr>
<td><strong>Shape</strong></td>
<td>1566</td>
</tr>
<tr>
<td><strong>Metal</strong></td>
<td>256</td>
</tr>
</tbody>
</table>
Flamenco Fine Arts Search

Images from the Collections of the Fine Arts Museums of San Francisco, Legion of Honor and de Young Museums, http://www.thinker.org

Search Engines: Technology, Society, and Business
Marti Hearst: UC Berkeley SIMS

sword

These terms define your current search. Click the x to remove a term.

Themes: military > war

698 items (Ungroup items)

Media (group results)
Book (16)  Objects (6)
Ceramic (3)  Painting (2)
Drawing (29)  Photograph (3)
Glass (1)  Print (634)
Metalwork (6)  Sculpture (1)

Date (group results)
1 - 1000 a.d. (1)  19th century (188)
15th century (6)  20th century (49)
16th century (46)  B.C. (2)
17th century (131)  Date unknown (5)
18th century (35)  Multiple centuries (236)

Location (group results)
Asia (19)  North america (76)
Europe (602)  

Occupations (group results)

brawl

(One from )The N... Callot 1635
(One from the se... Slevogt 19th - 20th cent...
(One from the se... Slevogt 19th - 20th cent... all 269 items...
These terms define your current search. Click the X to remove a term.

**Keyword** "sword"  

**Themes:** military > war

66 items  

**Anonymous**  

Killing the Buff...  
Anonymous  
19th century

**Baur, Johann Wilhelm, 1600 - 1640**  

St. Paul  
Anonymous  
19th century
Current search (start a new search):

Artists: Goltzius, Hendrik, 1558 - 1617

Themes: military > war

keyword: "sword"

Select any link to see items in a related category.

more general categories

MEDIA
- print (#562)

LOCATION
- Europe (23321)
  - Holland (1174)

DATE
- date ranges spanning multiple centuries (6326)
  - 16 - 17th century (883)

THEMES
- military (3237)
  - soldiers and fighters (1363)
  - war (854)
  - weaponry (1808)

PLACES AND SPACES
- dwellings (1709)
  - castle (268)

PEOPLE
- men (7374)
  - men (1810)

SHAPES, COLORS, AND MATERIALS
- decorations (1444)
  - metal (273)
  - plume (62)
  - metal (133)

ARTISTS
- Goltzius, Hendrik, 1558 - 1617 (189)

RECORD NUMBER:
- 8501

OBJECT TITLE:
- Titus Manlius (armed for battle)

DESCRIPTION:
An heroic Roman soldier on horseback viewed from behind, bearing shield, sword, metal helmet with plumes, spurs, sandals. Men on horseback battle near castle and military encampment.

ARTIST NAME:
- Hendrik Goltzius, 1558 - 1617
These terms define your current search. Click the ❌ to remove a term.

**Built Places:** Dwelling > castle ❌

**Items 1 - 40 of 247 results** (Group by Built Places)

<table>
<thead>
<tr>
<th>#</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17th century Set o... Meyerinck 17th - 18th cent...</td>
</tr>
<tr>
<td>2</td>
<td>17th century Callot 1623</td>
</tr>
<tr>
<td>3</td>
<td>18th century Kimbel circa 1890</td>
</tr>
<tr>
<td>4</td>
<td>19th century Marillier 18th - 19th cent...</td>
</tr>
</tbody>
</table>

Refine your search further within these categories:

**Media** (group results)

- **Book** (5)
- **Ceramic** (2)
- **Drawing** (16)
- **Objects** (1)
- **Print** (223)

**Date** (group results)

- **15th century** (6)
- **16th century** (16)
- **17th century** (29)
- **18th century** (23)
- **19th century** (67)
- **20th century** (5)
- **Date unknown** (1)
- **Multiple centuries** (101)

**Location** (group results)

- **Asia** (5)
- **Europe** (228)
- **North america** (11)

**Occupations** (group results)

- **Combatant, guard** (19)
- **Entertainer** (4)
- **Professional** (4)
- **Worker** (10)
"river" appears in these category names:

- Heaven and Earth > riverbank
- Heaven and Earth > famous rivers
- Heaven and Earth > river
- Heaven and Earth > Rivers, Lakes, Seas
- Artists > Rivera, Diego, 1896 - 1957
- Artists > Rivers, Larry, 1923 -
- Artists > Rivera, Gustavo Ramos, 1940 -
- Location > Congo > Mouth of River Congo
- Location > Gabon > Ngounie River
- Location > Gabon > Ogowe River
- Location > Nigeria > Benue River Valley
- Location > Nigeria > Ibibio Cross River
- Location > Nigeria > Idoma, Cross River
- Location > ... > Niger River, prob. Agbargho village
- Location > Zaire > Lower Zaire River
- Location > ... > Queensland, Diamantina River
- Location > Columbia > Middle Caucua River Valley
- Location > United States > California > Kern River
- Location > ... > Washington > Columbia River
- Location > Melanesia > Irian Jaya > Pomatj River
- Location > ... > Papua New Guinea > Sepik river
- Location > ... > Amazon > Mato Grosso > Jurunue River

These terms define your current search. Click the ✗ to remove a term.

Refine your search further within these categories:

**Media (group results)**
- Book (4)
- Ceramic (6)
- Drawing (36)
- Glass (1)
- Objects (16)
- Painting (2)
- Photograph (4)
- Print (625)
- Sculpiure (3)

**Date (group results)**
- 15th century (2)
- 16th century (10)
- 17th century (98)
- 18th century (60)
- 19th century (266)
- 20th century (49)
- Date unknown (5)
- Multiple centuries (195)

Items 1 - 40 of 691 results

1 41 81 121 161 201 241 281 321 361 401 ... 681 691

- (#12 from) Set of... Meyerinck 1700
- (copy after) The ... Rosa (after) 1730
- (Landscape with ... Boissieu 1763
- (Landscape wit Boissieu 1763

sort by: Object Title, Date
7 boats on lake, houses with orange and purple roofs
The terms define your current search. Click the X to remove a term.

**Media:** Print > woodcut

**Objects:** Vehicles > boats and ships > boat

**Location:**
- Asia (38)
- North America (2)
- Europe (10)

**Occupations:**
- Entertainer (7)
- Worker (3)
- Leader (12)

**Animals and Plants:**
- Birds (6)
- Mammals
- Fish and molluscs (49)
- Hoofed (3)
- Mammals

**Items 1 - 40 of 48 results**

1. Boats on lake, Anonymous post World War II
2. Boats on lake, Anonymous post World War II
3. Boats on lake, Anonymous post World War II
4. Boats on lake, Anonymous post World War II

Sort by: Object Title, Date, Artist
Information previews

• Use the metadata to show where to go next
  – More flexible than canned hyperlinks
  – Less complex than full search
• Help users see and return to previous steps
• Reduces mental work
  – Recognition over recall
  – Suggests alternatives
• More clicks are ok iff (J. Spool)
  • The “scent” of the target does not weaken
  • If users feel they are going towards, rather than away, from their target.
What is Tricky About This?

- It is easy to do it poorly
- It is hard to be not overwhelming
  - Most users prefer simplicity unless complexity really makes a difference
  - Small details matter
- It is hard to “make it flow”
Search Usability Design Goals

1. Strive for Consistency
2. Provide Shortcuts
3. Offer Informative Feedback
4. Design for Closure
5. Provide Simple Error Handling
6. Permit Easy Reversal of Actions
7. Support User Control
8. Reduce Short-term Memory Load

Most Recent Usability Study

- **Participants & Collection**
  - 32 Art History Students
  - ~35,000 images from SF Fine Arts Museum

- **Study Design**
  - *Within-subjects*
    - Each participant sees both interfaces
    - Balanced in terms of order and tasks
  - Participants assess each interface after use
  - Afterwards they compare them directly
    - Data recorded in behavior logs, server logs, paper-surveys; one or two experienced testers at each trial.
    - Used 9 point Likert scales.
    - Session took about 1.5 hours; pay was $15/hour
The Baseline System

- Floogle
- Take the best of the existing keyword-based image search systems
Enter keywords to search the collection for:

sword

Shasta is a searchable image and text database of 35,000+ objects from the collections of the Fine Arts Museums of San Francisco (the de Young Museum and the Legion of Honor).

The ImageBase does not contain a wealth of art-historical information, terminology, or analysis, but you can search an artist, title, date, medium and descriptive keywords. Searching on multiple words introduces an AND between words.

0.83 sec
Current Search: sword

Item 6 of 522 (back to results)

(One of) Five Of The Set Of Cardinal Virtues - Justicia

Details about this image:

| Media:    | print                |
| Location: | Germany              |
| Date:     | 16th century         |
| Themes:   | sword                |
| People:   | woman                |
| Artists:  | Beham, Barthel, 1502 - 1540 |
| Record Number: | 55649                |

Object Title: (One of) Five Of The Set Of Cardinal Virtues - Justicia

Description: Before a low masonry wall a winged woman stands, unsheathed sword in her right hand, and a balance in her

Artist Name: Barthel Beham, 1502 - 1540

Media Detail: Engraving

Perform search on relevant keywords:

16th century
Beham, Barthel, 1502 - 1540
Germany
print
sword
Evaluation Quandary

• How to assess the success of browsing?
  – Timing is usually not a good indicator
  – People often spend longer when browsing is going well.
    • Not the case for directed search
  – Can look for comprehensiveness and correctness (precision and recall) …
  – … But subjective measures seem to be most important here.
Hypotheses

- We attempted to design tasks to test the following hypotheses:
  - Participants will experience greater search satisfaction, feel greater confidence in the results, produce higher recall, and encounter fewer dead ends using FC over Baseline.
  - FC will perceived to be more useful and flexible than Baseline.
  - Participants will feel more familiar with the contents of the collection after using FC.
  - Participants will use FC to create multi-faceted queries.
### Post-Test Comparison

<table>
<thead>
<tr>
<th>Which Interface Preferable For:</th>
<th>Baseline</th>
<th>Faceted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find images of roses</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Find all works from a given period</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>Find pictures by 2 artists in same media</td>
<td>1</td>
<td>29</td>
</tr>
</tbody>
</table>

**Overall Assessment**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Faceted</th>
</tr>
</thead>
<tbody>
<tr>
<td>More useful for your tasks</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Easiest to use</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>Most flexible</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>More likely to result in dead ends</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>Helped you learn more</td>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>Overall preference</td>
<td>2</td>
<td>29</td>
</tr>
</tbody>
</table>
Post-Interface Assessments

All significant at $p<.05$ except simple and overwhelming.
Perceived Uses of Interfaces

What is interface useful for?

- Useful for my coursework: 6.44
- Useful for exploring an unfamiliar collection: 5.47
- Useful for finding a particular image: 6.64
- Useful for seeing relationships b/w images: 4.21

Baseline

FC
Advantages of the Approach

- Honors many of the most important usability design goals
  - User control
  - Provides context for results
  - Reduces short term memory load
  - Allows easy reversal of actions
  - Provides consistent view
- Allows different people to add content without breaking things
- Can make use of standard technology
Advantages of the Approach

• Systematically integrates search results:
  – reflect the structure of the info architecture
  – retain the context of previous interactions

• Gives users control and flexibility
  – Over order of metadata use
  – Over when to navigate vs. when to search

• Allows integration with advanced methods
  – Collaborative filtering, predicting users’ preferences
Disadvantages

• Does not model relations explicitly
• Does it scale to millions of items?
  – Adaptively determine which facets to show for different combinations of items
• Requires faceted metadata!
Usability Studies

• Usability studies done on 3 collections:
  – Recipes: 13,000 items
  – Architecture Images: 40,000 items
  – Fine Arts Images: 35,000 items

• Conclusions:
  – Users like and are successful with the dynamic faceted hierarchical metadata, especially for browsing tasks
  – Very positive results, in contrast with studies on earlier iterations.
Opportunities

• New opportunity: Tagging, folksonomies
  – (flickr de.lici.ous)
  – People are created facets in a decentralized manner
  – They are assigning multiple facets to items
  – This is done on a massive scale
  – This leads naturally to meaningful associations
My little brother visits San Francisco and the Golden Gate Bridge for the first time.

Comments

Emerald2810 says:
Bobby looks brilliant with the golden gate bridge in the background. My Daddy has been to San Francisco and thinks it's a fabulous city. I would like to visit one day!

Posted 3 months ago. (Permalink)
This Doesn’t Solve Everything

- Harder to determine what’s related to more complex terms
- Still not good for finding a recipe using potatoes
Search Engines: Technology, Society, and Business
Marti Hearst: UC Berkeley SIMS
Linking Metadata Into Tasks

• Old Yahoo restaurant guide combined:
  – Region
  – Topic (restaurants)
  – Related Information
    • Other attributes (cuisines)
    • Other topics related in place and time (movies)
Yellow: geographic region
Green: restaurants & attributes
Red: related in place & time
Other Possible Combinations

- Region + A&E
- City + Restaurant + Movies
- City + Weather
- City + Education: Schools
- Restaurants + Schools
- …
Creating Tasks from HFM

- **Recipes Example:**
  - Click Ingredient > Avocado
  - Click Dish > Salad
  - Implies task of “I want to make a Dish type d with an Ingredient i that I have lying around”
  - Maybe users will prefer to select tasks like these over navigating through the metadata.
Summary

- Flexible application of hierarchical faceted metadata is a proven approach for navigating large information collections.
  - Midway in complexity between simple hierarchies and deep knowledge representation.
  - Perhaps HFM is a good stepping stone to deeper semantic relations
  - Currently in use on e-commerce sites; spreading to other domains
Opportunities

- Creating hierarchical faceted categories
  - Assigning items to those categories
  - Adaptively adding new facets as data changes

- A new approach to personalization:
  - User-tailored facet combinations

- Create task-based search interfaces
  - Equate a task with a sequence of facet types

- Make use of folksonomies data!
Acknowledgements

• Flamenco team
  – Brycen Chun
  – Ame Elliott
  – Jennifer English
  – Kevin Li
  – Rashmi Sinha
  – Emilia Stoica
  – Kirsten Swearingen
  – Ping Yee

• Thanks also to NSF (IIS-9984741)
Thank you!