AMERICAN WEST PROTOTYPE: COMPARATIVE ANALYSIS AND HEURISTIC EVALUATION

INTRODUCTION

The American West (AmWest) Project provided CDL designers with the opportunity to explore the feasibility of using faceted browse as a discovery tool. CDL developed a faceted hierarchy consisting of three facets: era, subject, and geography. Within each facet, there are at most two sub-levels. The first sub-level consists of *labels*. Below these labels are *sub-labels*. The goal of faceted browse is to allow site visitors to quickly and easily explore large information spaces such as the AmWest collection and find what they are looking for.

American West Prototype Screenshots

Below are three screenshots of the AmWest prototype. Figure 1: Homepage is the AmWest prototype home page with the faceted browse choices in the right-hand column. Figure 2: Results shows the first results page that users receive clicking a browse term (in this case "1800-18090: Frontier"). In the right-hand column, the browse facets relevant to the users search term are presented. Figure 3: Drilling Down is the screen the users will see after they have selected a facet browse option, in this case the subject term Business & Industry.

Figure 1: Homepage

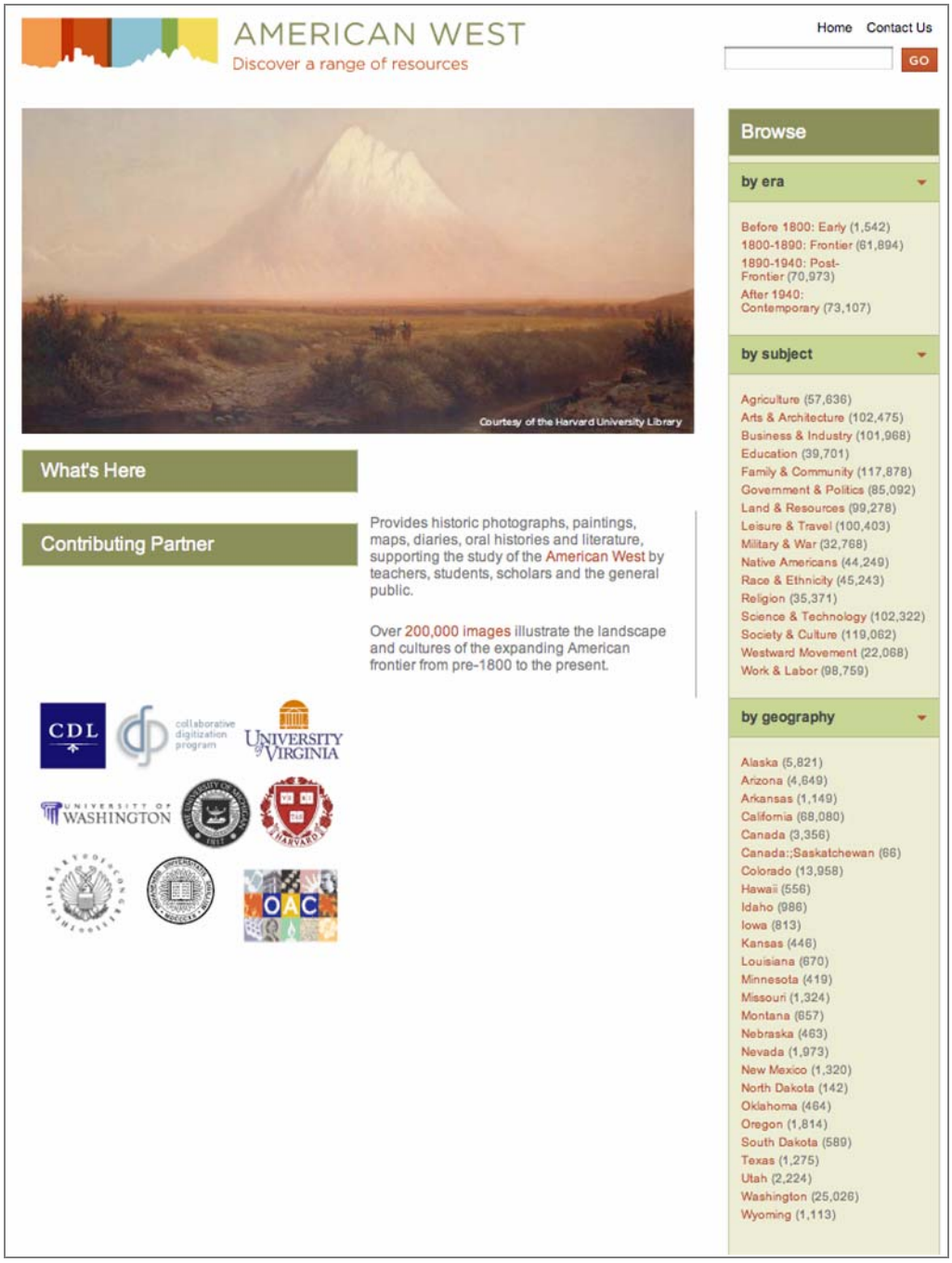


Figure 2: Results

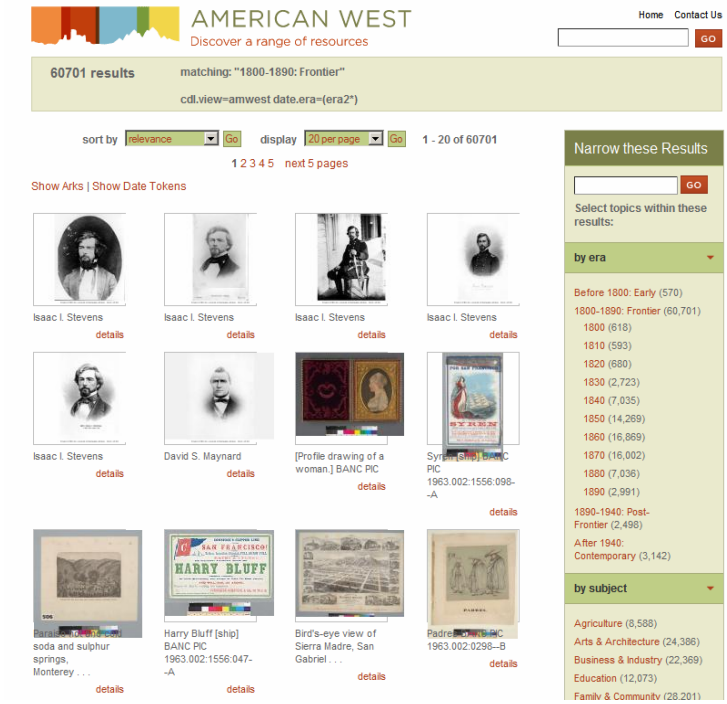
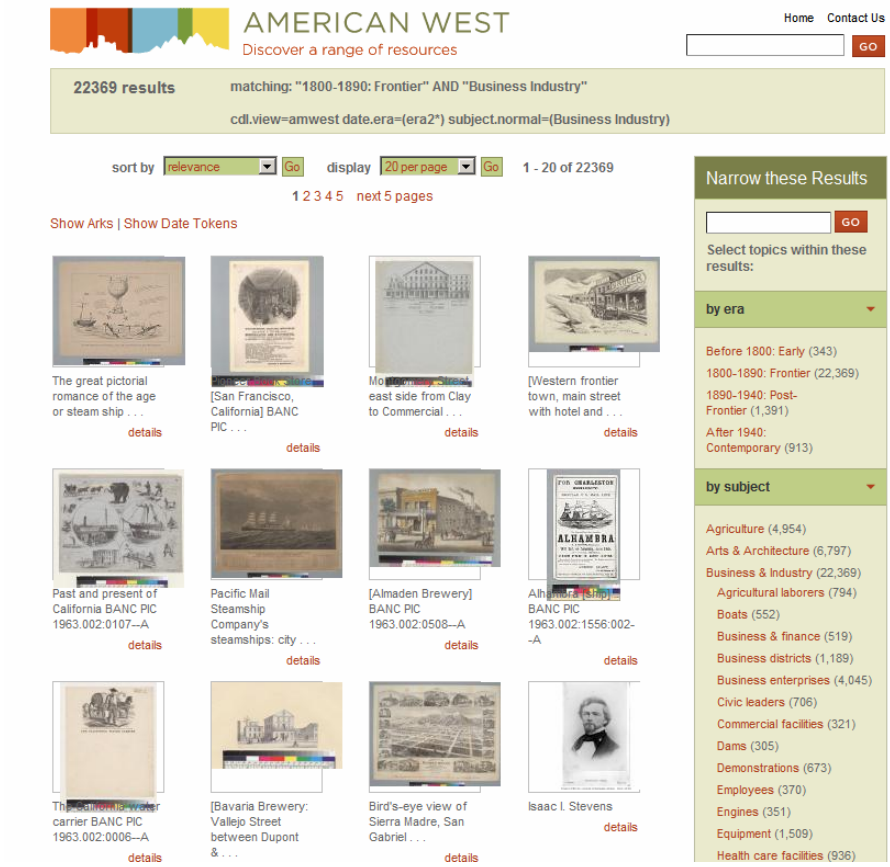


Figure 3: Drilling Down



The first section of this document highlights points from Dr. Marti Hearst's publication on design recommendations for faceted browse. Dr. Hearst has conducted numerous research studies on faceted browse and human-computer interaction. Her findings provide a basis for good interface and interaction design. The second section of this document provides recommendations for change to CDL's current AmWest prototype based on Dr. Hearst's recommendations. The third section lists open questions pertaining to faceted browse, and the fourth presents the findings from the heuristic evaluation of the prototype.

1 NOTES FROM HEARST: "DESIGN RECOMMENDATIONS FOR HIERARCHICAL FACETED SEARCH INTERFACES"[1]

We chose to review the work of Marti Hearst because she is a recognized expert in user interface design research, and she has held numerous studies on search and faceted browse systems. The following is a brief biography from her website:

> Dr. Marti Hearst is an associate professor in the School of Information at UC Berkeley, with an affiliate appointment in the Computer Science Division. Her primary research interests are user interfaces and visualization for information retrieval, empirical computational linguistics, and text data mining. She received BA, MS, and PhD degrees in Computer Science from the University of California at Berkeley, and she was a Member of the Research Staff at Xerox PARC from 1994 to 1997. Prof. Hearst is on the editorial boards of ACM Transactions on Information Systems and ACM Transactions on Computer-Human Interaction and was formerly on the boards of Computational Linguistics and IEEE Intelligent Systems, and was the program co-chair of HLT-NAACL '03 and SIGIR '99. She has received an NSF CAREER award, an IBM Faculty Award, an Okawa Foundation Fellowship, and two student-initiated Excellence in Teaching awards.[2]

This section presents our notes from a paper Dr. Hearst present at an ACM SIGIR workshop in August 2006. We have used her recommendations in evaluating the AmWest prototype's interface.

1.1 DESIGN GOALS

1. "Allow users to navigate in several hierarchies simultaneously"
2. "Display the query as it is built up"
3. "Present the query previews"
4. "Support flexible navigation"
5. Support "seamless integration with directed (keyword) search"
6. Support "fluid alternation between refining and expanding"
7. Support "avoidance of empty results sets"
8. "And at all times retaining a feeling of control and understanding"

1.2 NAVIGATION

[1] *Design Recommendations for Hierarchical Faceted Search Interfaces*, Hearst, ACM SIGIR Workshop on Faceted Search, August 2006. http://flamenco.berkeley.edu/papers/faceted-workshop06.pdf, accessed 7 November 2006.
[2] http://www.ischool.berkeley.edu/~hearst/, accessed 7 November 2006.

- Users prefer "being allowed to navigate in multiple hierarchies"
- "Fly-away" (mouse-over) menu
    - "Exposes entire facet subhierarchy… allows user to see all options beneath label"
    - Does not work well if number of choices is large: "query previews must be computed for every level of the hierarchy"; precludes progressive disclosure of hierarchy, which helps users understand contents of the collection
- Flamenco[3] uses step-by-step drill-down method. Immediate children of a label displayed in a tooltip on hover.

1.3 LAYOUT OF LABELS WITHIN FACETS

- Preference for column-oriented layout
- If some labels are long and others short, "forcing a uniform choice for number of columns leads to wasted space or wrap-around views."
- Preference for "predictability of a well-known ordering"
- "… in those cases in which there is room for only a few of many labels to be shown, it can be useful to show either the most salient or most frequently occurring in the initial view, with a link to see more choices which are then shown in a predictable order."

1.4 FACET EXPOSURE

- When learning about the category structure and full exploration of the collection is a high priority, expose all facets.
- Users should be able to see results immediately after initial query

1.5 INCORPORATING KEYWORD SEARCH

- Flamenco: keyword search incorporated into query breadcrumb in same way as link selections
- Search within results is an open problem. Modal selection: "setting is easily forgotten or overlooked"

1.6 BREADCRUMB DESIGN

- Typical breadcrumbs keep track of sequence of user's actions. Faceted systems should keep path within each facet in a separate visual component. No mixing and matching fields. "This both reinforces the notion of the query consisting of a conjunction of different categories at different levels of hierarchy, and allows for the flexible expansion of the query, since the user can eliminate an entire facet…."

1.7 TERMINOLOGY

Facet: top level category that reflects a characteristic of the items in a collection, e.g. Medium
Label: a value or category within a facet, e.g. Painting or *Sculpture*
Sub-label: a more refined category within a label, e.g. Oil or *Watercolor*

Example: Media > Painting > Watercolor

[3] Flamenco is a web-based interface for browsing large collections of items such as documents or photographs. It was created by Dr. Hearst and her team (more information available here: http://flamenco.berkeley.edu/)

2 RECOMMENDATIONS FOR THE AMWEST PROTOTYPE INTERFACE

Marti Hearst's work, which is outlined in the previous section, provided the heuristics on which we based our evaluation of the AmWest prototype interface. The following recommendations are the outcome of this heuristic evaluation:

1. Distinguish facets by assigning each a different color. Use same colors for respective query blocks.
2. Let facets and labels dominate space on the homepage to give users an overview of the collection.
3. Query blocks, which reflect user's choices, should appear above the results pane.
4. Each block should have an "x" button that allows the user to remove that query block/parameter.
5. Limit the vertical size of each facet so that all three are visible above the fold.
6. Move navigation to the left side of the interface.
7. Collapse era sub-labels into century units, i.e., 1500-1599, 1600-1699, etc.
8. Remove term "by" from all facet headings.
9. Only allow user to drill down to one label per facet.

PRIMARY PROBLEMS OF THE AMWEST PROTOTYPE INTERFACE:

1. No indication of user's choice.
2. No clear way to go back up the facet hierarchy.
3. Listing by decade in Level 2 takes up too much vertical space. (See Recommendation 7.)
4. Wrapping text and lack of whitespace makes labels difficult to read.
5. Leaving non-selected facet labels in Level 2 complicates the interaction and UI response, leading to the following display in the query pane:

2.1 QUERY TERM DISPLAY

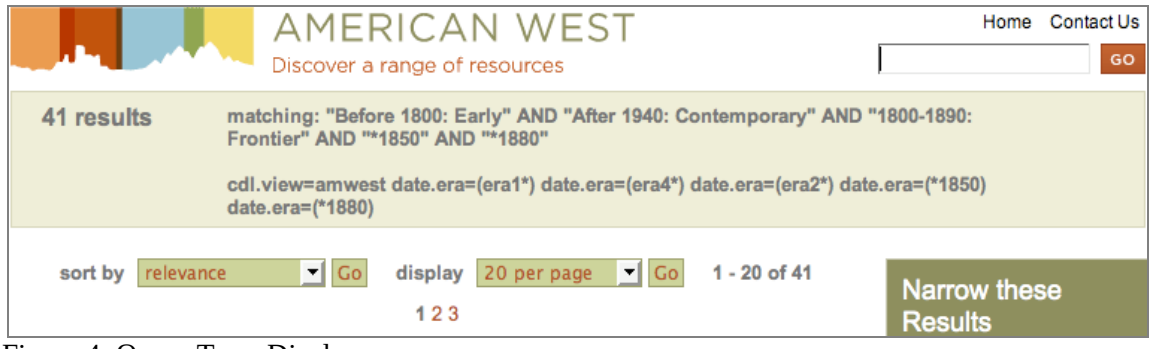


Figure 4: Query Term Display

In this instance (see Figure 4 above), the user has executed the following sequence of clicks: Before 1800: Early → After 1940: Contemporary → 1800-1890: Frontier → 1850 → 1880

The current query term display mimics a click-path, or pseudo-breadcrumb, but there is no clear indication of where the user is or how to go back.

2.2 DRILLING DOWN: CURRENT SITE BEHAVIOR

The current faceted browse for the AmWest prototype behaves in an inconsistent manner between levels (see Figure 5). When going from Level 1 to Level 2, i.e. selecting a label within a facet, the navigation pane expands to show the sub-labels, but it also retains the other (Level 1) labels. Then, after selecting a sub-label, the decades in the century of the chosen year remain and all other links disappear. This behavior along with the lack of visual indications of the user's selections makes it difficult to follow what the interface is doing.

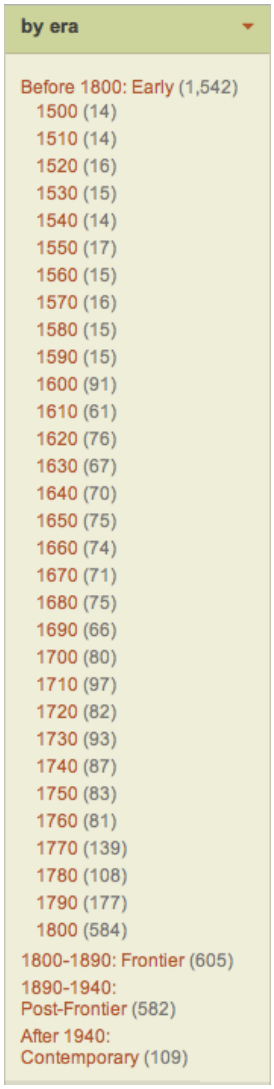
	Level 1	**Level 2**	**Level 3**
State	Original state	After clicking "Before 1800: Early"	After clicking "1500"
Action	Click "Before 1800: Early"	Click "1500"	
Query Pane Text	N/A	Matching: "Before 1800: Early"	Matching: "Before 1800: Early" AND "*1500"
Navigation Pane Response			

Figure 5: Current Drilling Down Solution

2.3 DRILLING DOWN: RECOMMENDED INTERFACE/INTERACTION DESIGN

	Level 2	**Level 3**	**Level 2**
State	After clicking "Before 1800: Early"	After clicking "1500-1599"	After clicking "Before 1800"
Action	Click "1500-1599"	Click "Before 1800"	
Query Pane	ERA: all > Before 1800 x	ERA: all > Before 1800 > 1500-1599 x	ERA: all > Before 1800 x
Navigation Pane Response	**ERA:** all > Before 1800 1500-1599 (14) 1600-1699 (2) …	**ERA:** all > Before 1800 > 1500-1599	**ERA:** all > Before 1800 1500-1599 (14) 1600-1699 (2) …

Figure 6: Recommended Drilling Down Solution

2.4 PROPOSED RESULTS PAGE LAYOUT

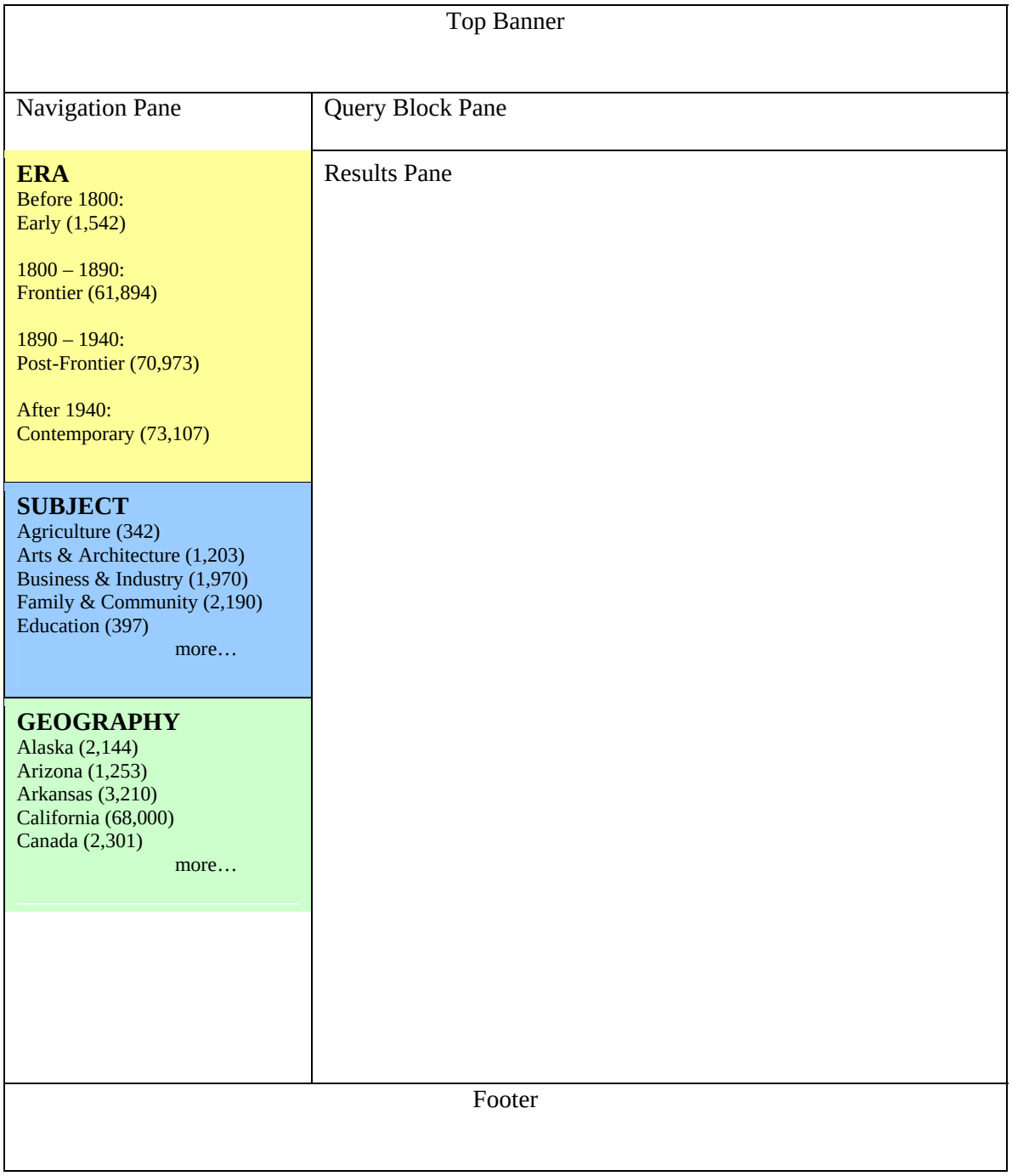


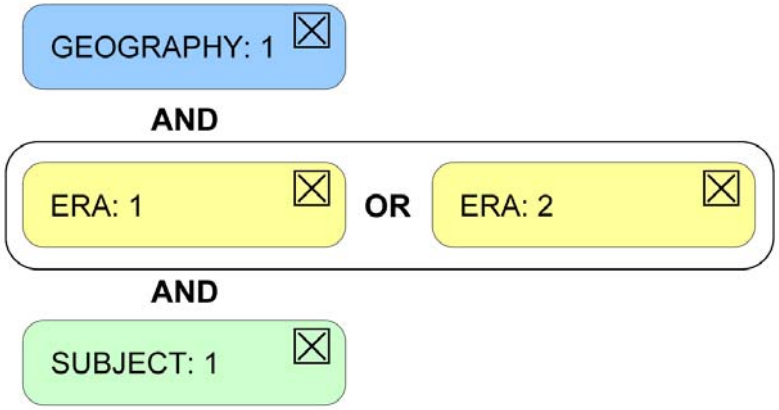
Figure 7: Proposed Results Page Layout

3 OPEN QUESTIONS

The following issues were not specifically addressed in Marti Hearst's paper[4] and require further exploration.

3.1 CHOOSING MORE THAN ONE LABEL PER FACET

The interaction design required for this capability is complex. The following represents the suggested query pane design:



3.2 DISTINGUISHING "NEW SEARCH" FROM "SEARCH WITHIN RESULTS"

This question will need to be researched and addressed using thoughtful interface design.

3.3 DEALING WITH LARGE CATEGORIES

One way to address this issue is by exposing all facets and categories on the homepage so that users can see what the collection offers as a whole. Then on subsequent results pages, long lists may be abbreviated with a link to the complete listings.

4 HEURISTIC EVALUATION

"Heuristic evaluation is done as a systematic inspection of a user interface design for usability. The goal of heuristic evaluation is to find the usability problems in the design so that they can be attended to as part of an iterative design process."[5] It is a proven method for finding usability issues quickly and cost effectively. The results of CDL's heuristic evaluation of the AmWest prototype's faceted browse are presented in the table that follows. Each violation has been categorized and assigned a severity level. In addition, a corresponding design goal from Marti Hearst's recommendations has been added where relevant.

[4] *Design Recommendations for Hierarchical Faceted Search Interfaces*, Hearst, ACM SIGIR Workshop on Faceted Search, August 2006.
[5] http://www.useit.com/papers/heuristic/, Accessed 17 January 2007.

Heuristic	Violation	Design Goal[6]	Severity
H1	Drilling down 1 level expands list to include children, but there is little indication of what you have chosen. This action also forces user to scroll further down page to see the remaining facet(s).	2	3
H4	Drilling down 2 levels removes other labels within the given facet.	4	2
H3	There is no way to undo a facet label selection.	6	4
H1	It is not obvious that the three facet categories may be used in conjunction.	8	3
H8	The geography facet is not visible without scrolling.	8	3
H8	Variable height of navigation column makes it difficult to work with facets and labels that get pushed below the fold.	4	3
H1, H6	There is no visual, user-friendly query display. The current location of query information is too far from the navigation column. Also, the eye has to travel from right to upper left, which is not as natural as left to right.	2	4
H3	It is unclear how to start over.	6	3
H1, H7	There is no breadcrumb, which gives user a sequential history of her actions.	6	2
H4	It is difficult to keep track of what is going on with the navigation as you drill down, because the labels and numbers change in unexpected ways.	4	3
H2	"Show Arks" and "Show Date Tokens" – Specialized vocabulary may not be familiar to users.	8	2
H4	Facet headings are hyperlinked but do not perform any action.		2
H4	Triangle icon next to facet heading does not expand/collapse category.		2

Heuristic Categories

H1: Visibility of system status
H2: Match between system and the real world
H3: User control and freedom
H4: Consistency and standards
H5: Error prevention
H6: Recognition rather than recall
H7: Flexibility and efficiency of use
H8: Aesthetic and minimalist design
H9: Help users recognize, diagnose, and recover from errors
H10: Help and documentation

Severity Levels

0 Not a usability problem at all
1 Cosmetic problem only
2 Minor usability problem
3 Major usability problem
4 Usability catastrophe

[6] See section 2.1.

TEN USABILITY HEURISTICS[7]

H1: Visibility of system status [H5 Feedback]
The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

H2: Match between system and the real world [H2 Speak the User's Language]
The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

H3: User control and freedom [H6 Clearly Marked Exits]
Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

H4: Consistency and standards [H4 Consistency]
Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

H5: Error prevention [H9 Prevent Errors]
Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

H6: Recognition rather than recall [H3 Minimize User Memory Load]
Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

H7: Flexibility and efficiency of use [H7 Shortcuts]
Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

H8: Aesthetic and minimalist design [H1 Simple & Natural Dialogue]
Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

H9: Help users recognize, diagnose, and recover from errors [H8 Precise Error Messages]
Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

H10: Help and documentation [H10 Help and Documentation]
Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

[7] http://www.useit.com/papers/heuristic/heuristic_list.html, Accessed October 3, 2007.