Mambo: A Facet-based Zoomable Music Browser

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Motivation & Summary

With state-of-the-art mobile music players, hierarchically arranged lists of songs, albums, or artists are the predominant way of browsing music. Because of limited screen sizes and interaction capabilities, scrolling of these lists is often tedious.

More advanced filtering and management functionality is required to browse bigger collections. Faceted browsing is a promising approach which allows looking at the same data from different conceptual dimensions. With existing solutions it is difficult to show all values of facet hierarchies at once on limited screen space; different granularities are required.

As a solution we present Mambo *(Mobile fAcet-based Music BrOwser)*, a zoomable user interface (ZUI) for browsing music collections on various devices. We employ hierarchical metadata facets associated with data items, such as time, genre, alphabet (names, titles). Mambo allows to visually arrange music items according to these facets and to browse and filter them by constraining facet values. The novel multi-scale widget *FacetZoom* constitutes the basic metaphor.

A 24-subject formative user study was conducted, investigating the prototype under PDA and Ultra Mobile PC (UMPC) display conditions using two design variants. The results indicate that the facet-based zooming approach scales well to various sizes.

Basic Widget FacetZoom

FacetZoom is an interactive tree visualization. Each level of a hierarchy is rendered as a horizontal bar subdivided into as many cells as nodes are available on this level, e.g. all available sub genres of Pop. Conceptually, the whole widget is a stack of 1D treemaps, where the maximum N levels of a hierarchy are vertically stacked. The widget does not visualize the whole hierarchy at once; the number of displayed levels can be configured. Weighted level heights lead to a vertical fisheye effect while maintaining a consistent overall widget height.

Changing hierarchy levels by one of the interaction modes results in a smooth animation, where new level bars appear and others disappear on the top or bottom (see Figure 1 depicting four different zoom states of a lexical FacetZoom). The alphabetical zoom widget is used in Mambo for browsing artists, albums, or songs by their names. FacetZooms for genre, time, or other hierarchical metadata facets are treated equally.

FacetZoom has several design degrees: number of displayed levels, fisheye distortion factor, cell size, usage of labels or icons, level colors, basic widget orientation. For the cells, an intelligent labeling using dynamic zooming and label inheritance was implemented.

Tabular Data Display

- Available data items are displayed in columns above the corresponding facet value cell. We suggest a space-filling layout algorithm which calculates the biggest rectangle for each item so that all items fit into the available space.
- If not all items fit into the column, an additional item "… N more" is displayed. Alternatively, a semantic zooming algorithm or an adaptable cell width can solve this problem.

Navigation and Interaction

- *Continuous multi-scale:* Horizontal panning by directly dragging the widget to the left or right, automated panning if the cursor is close to the edges. Changing the current hierarchy level by moving the cursor or pen vertically.
- *Discrete tap-and-center:* Clicking on any cell of the widget centers it and expands it to occupy the available x-dimension which allows a stepwise navigation through the hierarchy. Horizontal panning by clicking neighboring cells on the same level and diagonal navigation by tapping cells in the corners.
- *Level widget* (on the right): allows a quick navigation between hierarchy levels, permits jumping directly to the center of any facet level.

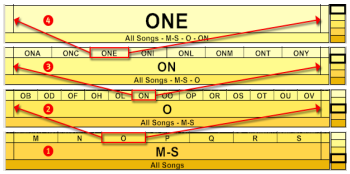

Figure 1: Four zoom levels of a Lexical FacetZoom.

Figure 2. Mambo screenshots, starting from the top: All albums | albums starting with "W" plus filter menu | facet changed to time (same albums) | detailed album view for playing music

The Mambo Prototype

The Mambo UI is composed of four areas (see Figure 3):

- The FacetZoom Widget (1)
- The data display grid containing songs, albums, or artists (2)
- Buttons for changing facets (3)
- A display for the filter history path (4)

Currently, the following facets are supported: *Alphabetical* and *Genre* views of artists, albums and songs; *Time* views of albums and songs. Pressing one of the facet buttons results in a facet change where all available data items are being displayed (compare the screenshots at the top of Figure 7).

Mambo also offers a *combined filtering mode* to achieve more expressive searches (see Figure 7). The currently refined set of data items is kept the same when this mode is activated, but can now be filtered in a different facet. To actually choose a data item one can directly click on it anywhere to zoom to a detailed view and play the music. See Figure 5 for Mambo running on a current UMPC operated by pen or finger touches.

Figure 3. Mambo as a Pocket PC simulation with user interface areas.

User Study

With the formative user study we wanted to get usability feedback for Mambo and the underlying zooming metaphor, compare user performance and subjective preference with different display conditions, and compare two design variants concerning the column layout.

Hypotheses

- H1: Users will perform significantly better on a typical UMPC resolution (800x480) in comparison to a standard PDA phone resolution (320x240).
- H2: Users will perform better in comparison tasks given the flexible column layout (driven by the number of data items).

Method

The study used a 2 by 2 between subjects design: column width (variable vs. equal spacing) x display size (320x240 for PDA vs. 800x480 for UMPC). 24 participants in 4 sets completed 13 tasks in a single session: four simple search/ selection tasks, three comparison tasks, three simple filter tasks, and three complex filter tasks.

Experimental measures: task completion time, distinct cell selection, facet and filter button interaction, dragging distances plus subjective satisfaction responses by user questionnaires.

Materials: Both display conditions on a TabletPC operated with a digital pen. The MP3 data collection used in the study contained 1518 songs on 144 albums by 98 different artists.

Results

- *Task Time:* no significant performance differences between large and small displays. Mean overall time of all tasks was even less for PDA users. Difficult to select very narrow columns especially on PDAs. See Figure 4 for results.
- *Questionnaire response:* Highest agreement found for pleasure-to-use, the least for the look of the system. Users liked the ideas of using facets and hierarchical refinement.
- *Usage Observations:* No preference of a particular technique. The tap-and-center navigation was used most.

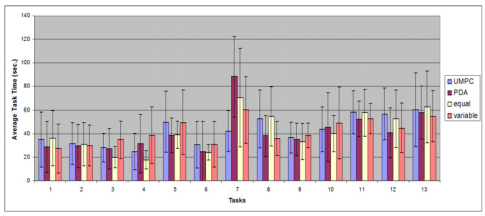

Figure 4. Mean completion time (sec.) for each task (all UMPC, PDA, equal, variable) with standard deviation

Discussion & Conclusion

H1: Surprisingly, on average users performed equally well on the larger and smaller display conditions, which is an important finding probably indicating the scalability of the proposed solution to various display conditions.

H2: Was not supported, i.e. the flexible column layout does not help to indicate the number of data items and getting an overview. We conclude to equally distribute the cells, especially under small display conditions.

We introduced Mambo, an interface for browsing music collections on mobile and other devices. It eliminates the need for scrolling long lists of items and textual keyboard input. The basic metaphor is the multi-scale widget FacetZoom for visually arranging data items according to hierarchically subdivided metadata facets. It combines faceted browsing with a ZUI. Users can perform search, browse, and filter tasks by using either a continuous pan-and-zoom navigation or a tap-and-center interaction.

Figure 5: Mambo running on an Ultra Mobile PC

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