Mambo: A Facet-based Zoomable Music Browser

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ABSTRACT
Current mobile music players and managers rely on scrolling long and hierarchically structured lists of items. They do not scale well to various screen sizes. As a solution, this paper introduces Mambo for browsing personal music collections on mobile and other devices. Songs, albums, or artists can be browsed and filtered according to different hierarchical metadata facets such as time, genre, or alphabet. The FacetZoom widget constitutes the basic metaphor and combines visual faceted browsing with zoomable user interfaces. To search, browse, and filter data in a consistent way, we contribute both a continuous multi-scale and a discrete tap-and-center navigation which is especially suited for mobile devices. A 24-subject formative user study was conducted, investigating the first prototype under PDA and Ultra Mobile PC display conditions using two design variants. The results indicate that the facet-based zooming approach scales well to various display sizes.

Categories and Subject Descriptors
H.5.2 [**Information interfaces and presentation**]: User Interfaces – *Graphical User Interfaces.*

General Terms
Design, Human Factors.

Keywords
Zoomable User Interface, faceted browsing, animation, graphics, interaction technique, music browser, mobile media management.

1. INTRODUCTION
The tremendous growth of personal digital media collections results in the challenge to design intuitive user interfaces (UIs) for their management and use. Searching and browsing of media data should work on a variety of devices with heterogeneous display and interaction capabilities ranging from tiny mobile phones to Ultra Mobile PCs (UMPC) to desktop PCs. In this work, we concentrate on the domain of digital music collections. With state-of-the-art mobile music players, hierarchically arranged lists of songs, albums, or artists are the predominant way of browsing music. Due to limited screen sizes and interaction capabilities, scrolling of these long lists is often tedious and filtered views of the collection are insufficiently provided. These problems will increase with ever growing media collections. Considering the trend towards fully-fledged media players, more advanced filtering and management functionality is required as is partly available with desktop-based music managers, but not on mobile devices. Faceted browsing is a promising approach which allows looking at the same data from different conceptual dimensions. It permits an incremental refinement of a structured data set by restricting the metadata facet's values, such as names of artists or price ranges. The inherent hierarchical structure of many facets is rarely reflected in UIs of current facet browsers, thinking for example of locations: continent → country → state → city. Furthermore, they do not scale well to mobile devices, since it is difficult to show all values of facet hierarchies at once on limited screen space. Depending on the music management task (e.g. looking for all modern Jazz music), users want to use different granularities of faceted metadata which is usually not supported.

To address the problems mentioned above, we have developed *Mambo* (Mobile fAcet-based Music BrOwser), a zoomable user interface (ZUI) for browsing personal music collections on various devices. The novel multi-scale widget *FacetZoom* constitutes the basic metaphor of Mambo. With it, we combine a ZUI with faceted music browsing. Songs, albums, or artists can be visually arranged according to various facets, such as time or genre (see Figure 1 for the improved prototype as a result of our user study). Each FacetZoom widget simultaneously displays several levels of a hierarchical facet in a space-filling and comprehensible manner. We contribute a continuous multi-scale and discrete tap-and-center navigation allowing for an efficient traversal of the facet tree in all directions. While searching or browsing a music information space by constraining facet values, the visualized data set is seamlessly refined above the space-structuring widget. The system was implemented as a PDA and desktop version and evaluated in a formative user study comparing two different display conditions and two layout principles. The results indicate the scalability of the approach in terms of display size and interaction modes on various devices.

The remaining paper is organized as follows. First, related work in the field is presented. Then the Mambo system is introduced with its underlying zooming widget and implementation. Section 4 presents the user study we conducted, followed by a discussion of the results in section 5. Finally, the paper ends with a conclusion and outlook on future work.

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Figure 1. The Mambo interface with all albums displayed for genre *Alternative.*

2. RELATED WORK

Music Browsers. Most of today's mobile music players offer hierarchical lists to browse collections by artist, album, song, genre, or playlist. The iPod/iTunes feature *visual CoverFlow* nicely demonstrates the use of cover art for browsing albums, but still relies on flipping through a complete list of album covers. There is no quick shortcut navigation within these hierarchies or filtering functionality. Desktop-based music managers (e.g. iTunes) improve on that, but also display potentially long lists of items resulting in tiny scroll bars. The table display usually allows a rearrangement according to specific metadata, but no advanced filtering possibilities. Our approach attempts to be suitable for mobile music players and more complex music managers alike.

Among the research approaches is the artist map [3]. It is a visual playlist creation method by specifying regions of interest for the attributes mood, genre, year, and tempo. Users can specify the type of music they like for their playlists. This explorative way is however limited to playlists and does not support specific search and overview tasks.

Image Browsers. Since album covers are images, we also analyzed work in the field of photo management on mobile systems. Pocket PhotoMesa [6] is a commercially available zoomable image browser for PDAs using treemaps [4] to layout thumbnails on a single screen and a ZUI to navigate through images. Unlike Mambo it only employs folder groups as the organizing aspect and does not separate the data from the interface. In [7] many issues in improving photo searching interfaces are investigated. Their significant finding is the importance of pre-organized photo collections for photo searching which encouraged us in developing our facet-based, structured approach.

Faceted Browsing. FacetMap [9] displays multiple facet hierarchies and related data items according to a space-filling layout in a scalable, joint visualization space. Animated result set refinements are triggered by single-clicks on facet values. We aim for an equally simple interaction but separate the structuring widget from the result space. This saves valuable screen estate by permitting a more efficient data layout. With FaThumb [5], a facet-based interface for mobile search was introduced which offers iterative facet-based data filtering. The interface shows a list of results which can be further restricted by pressing keys corresponding to facets shown in a 3x3 grid.

Zoomable User Interfaces (ZUIs). DateLens [1] combines the concept of fisheye views with compact overviews in a calendaring application on mobile devices. The concept of enlarging calendar cells by simple click interactions influenced our tap-and-center navigation. TimeZoom sketched in [2] is an interactive time-line widget to be combined with a tabular display of data. Different time levels are vertically stacked and can be smoothly zoomed, which influenced the more generalized FacetZoom.

3. MAMBO

For the design of Mambo (Mobile fAcet-based Music BrOwser) we conceived a novel way of arranging and browsing music data using a visual zooming approach. We employ hierarchical metadata facets associated with data items, such as time, genre, alphabet (names, titles), folksonomies etc. Mambo allows to visually arrange music items according to these facets and to browse and filter them by constraining facet values. For this explorative interaction we developed FacetZoom as the basis. See for example Figure 1, where a *genre* FacetZoom widget zoomed to "Alternative" is displayed at the bottom. This widget will be explained in the next subsection before describing the overall Mambo system.

3.1 Design of the Basic Widget *FacetZoom*

FacetZoom was conceived as a means of subdividing a set of data items according to hierarchically organized facets. On the one hand, implicit hierarchies of quantitative metadata (e.g. time) exhibit an equal and repeated distribution on each level and an equal subdivision of all siblings on that level. On the other hand, explicit hierarchies including taxonomies, i.e. nominal or ordinal data, consist of single-valued, hierarchical metadata facets [10] associated with data items. These hierarchies always contain lexical units and do not need to be well balanced.

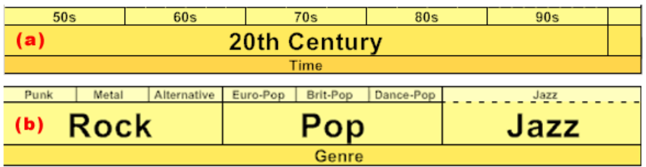

Figure 2. FacetZoom widgets *Time* (a) and *Genre* (b).

3.1.1 The widget design

At the core, the FacetZoom widget 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 in Figure 2 (b). Usually, only a subset of nodes on a level is displayed at once. The maximum N levels of a hierarchy are vertically stacked starting with the first level or root node at the bottom, see for example the widgets in Figure 2. Conceptually, the whole widget is a stack of 1D treemaps [4]. As opposed to many tree visualizations, the goal of Facet-Zoom is not to visualize the whole hierarchy at once, but to allow a fast interactive traversal while showing neighboring nodes. Therefore, usually only a subset of all levels will be displayed at the same time, thereby providing sufficient context. The number of displayed levels N_D can be configured ($1 < N_D \le N$). As shown in the figures, a number of three is recommended to see current, previous and next level at once and to optimize the space consumed by the widget especially for tiny screens. In addition, we propose weighted level heights using a vertical fisheye effect while maintaining a consistent overall widget height. For unbalanced hierarchies often found in taxonomies, we suggest a solution to avoid gaps caused by leaf nodes on a level $l < N$ which simplifies navigation. Cells for such nodes are re-instanced on all subordinate levels $l+1$ to N. See for example the repeated cell *Jazz* in Figure 2 (b).

Graduated background colors for each level further provide visual distinction, thus facilitating orientation and navigation. Changing hierarchy levels by one of the interaction modes explained below results in a smooth animation, where new level bars appear and others disappear on the top or bottom depending on the zoom direction. Take for example Figure 3, which depicts four different zoom states of a lexical FacetZoom containing a hierarchy of letters. The small rectangle within the level bar on the right side indicates the zoom level. This alphabetical zoom widget is very versatile and is used in Mambo for browsing artists, albums, or songs by their names. As you can see in Figure 2, FacetZooms for genre, time, or other hierarchical metadata facets are treated equally.

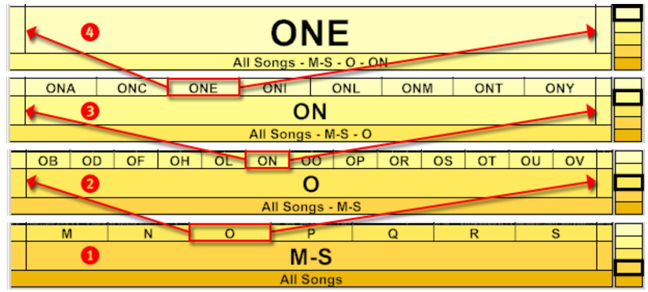

Figure 3. Four different zoom levels of a *Lexical* FacetZoom.

There are several degrees of freedom for designing and scaling FacetZoom widgets, among them the number of displayed levels, the fisheye distortion factor, cell size, usage of labels or icons, and level colors. Besides, the basic orientation of the widget can be changed from a horizontal to a vertical orientation which is especially useful for data items consisting of longer text. As for the labeling of the cells, we implemented an intelligent labeling using dynamic zooming and label inheritance. With it, lower levels no longer displayed pass their label information down to their children. This information is added there to provide as much contextual information as possible. See for example the bottom line “All Songs – M-S – O” in Figure 3 (3).

3.1.2 Tabular Data Display

As you can see in the Mambo application (Figure 1), FacetZooms are not used as pure hierarchy visualizations but as widgets to arrange data items associated with facet values. Due to the space-structuring nature of FacetZoom, a grid view of the data items lends itself as the visual display. Initially, all available data items are displayed and ordered in columns above the corresponding facet value cell, e.g. a certain time, artist, or letter. FacetZoom then allows for selecting a subset of adjacent music data items.

With a larger data set, the space within a column is not sufficient to show all items, especially on mobile devices. We therefore suggest a space-filling layout algorithm which calculates the biggest possible rectangle for each item so that all items fit into the available space up to a certain threshold, e.g. 6x6 pixels. If not all items fit into the column, an additional item “… *N* more” is displayed (see for example Figure 4). As an alternative, a semantic zooming algorithm can solve this problem. Similar items can be summarized with only one representative being displayed.

A design decision also had to be made for the width of cells and columns. Equal spacing of siblings was chosen, regardless of the number of data items associated with a facet’s value. Taking the treemap idea [4] as a basis, we also implemented an alternative solution to have an adaptable cell width according to the number of data items. An example is depicted in Figure 4, where one can see considerably more songs starting with “Ho…” than with for example “Hi…”. This design option was further investigated in the user study of Mambo.

3.1.3 Navigation and Interaction

To allow for simple browsing of hierarchically structured music data or quickly searching and filtering data items, we combine both a *continuous multi-scale* and a novel *discrete tap-and-center navigation*. These techniques not only allow a branch-wise up-and-down traversal of a facet hierarchy, but also to reach other nodes across branches very quickly. For the continuous operation,

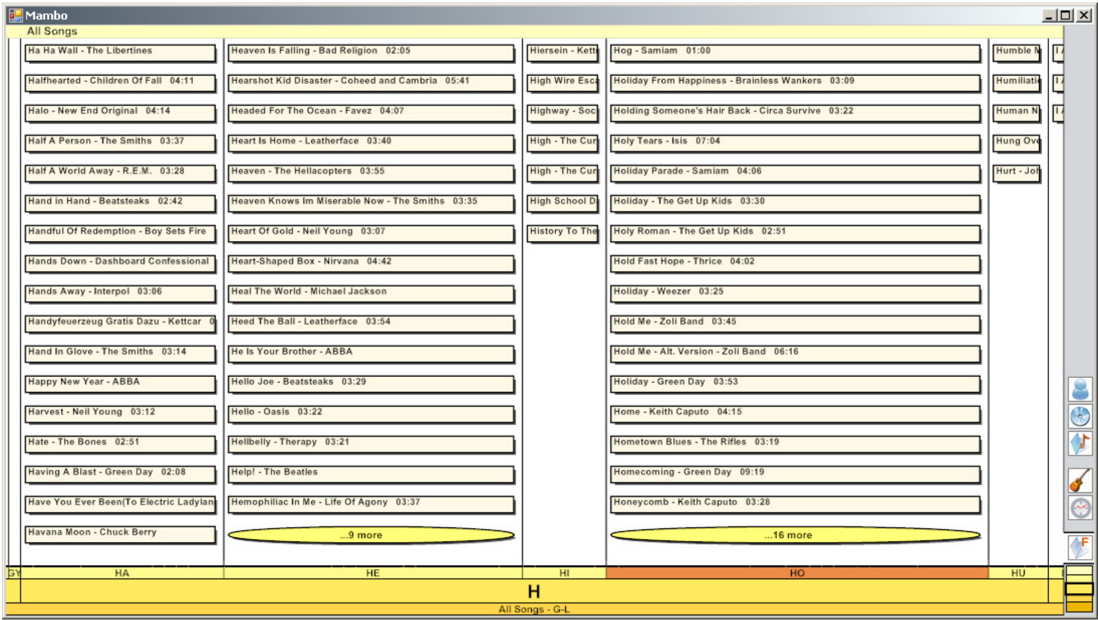

Figure 4. Design alternative with flexible cell width (example: *Lexical* FacetZoom for songs)

horizontal panning (i.e. visiting all nodes on one level) can be done by directly dragging the widget to the left or right. If the cursor or pen is close to the edges, automated panning is started with a distance-dependent speed adjustment. Changing the current hierarchy level can be done by vertically moving the cursor or pen within the widget. Alternatively, a jog dial or similar device can be used. Zooming is always performed relative to the cell below the current x position of the cursor or pen.

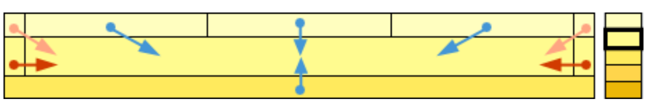

Figure 5. Cell-based *tap-and-center navigation*; *level widget*.

The *tap-and-center navigation* is a discrete cell-based approach allowing for stepwise navigation through and within levels, thus entirely eliminating panning. A click on any cell of the widget results in adjusting the view so that the cell is centered and expanded to occupy the available x-dimension. Only parts of the neighboring cells are displayed at the edges. After a click in these cells, the widget is horizontally panned as indicated by the horizontal arrows (see Figure 5). In contrast to the free panning mentioned above, the neighboring cell is always scaled to fit into the available screen space. Clicking on a cell in an upper or lower level results in a zoom in or out action as indicated by the blue arrows. Compare Figure 3 (starting from the bottom) for a series of clicks within a lexical FacetZoom. Tapping diagonal cells in the upper corners results in panning to that cell and zooming in. To facilitate a comprehensible user interaction, all transitions are smoothly animated together with the data displayed above. Besides the direct manipulation of FacetZoom and as an alternative to directly tapping cells, one can use cursor keys, navigation pads or similar directional input devices for stepwise panning (left/right) and zooming (up/down).

As an optional part, the level widget on the right allows for a quick navigation between arbitrary hierarchy levels by tapping the corresponding rectangle (see Figure 5). Whereas the tap-and-center navigation only allows for a stepwise navigation, the level widget permits to directly jump to the center of any facet level.

The scalable design of FacetZoom combined with different navigation techniques supports a number of input modalities depending on the devices used. Special care has been taken to support mobile devices with their discrete or continuous interaction offered by mini joysticks, jog dials, click wheels, multi-way buttons etc. The tap-and-center navigation is presumably well suited for mobile devices, whereas the continuous interaction lends itself to pen-/mouse-operated systems. Due to the variable size of the zoom widgets we also envision a direct touch interaction with the user's finger as is available with recent mobile devices.

Figure 6. Mambo as a Pocket PC simulation.

3.2 The Mambo Prototype

We built a prototype of the Mambo system for browsing personal music collections using different facets. Mambo uses a simple interface layout, composed of four areas as depicted in Figure 6: (1) the FacetZoom area described in section 3.1; (2) the data display grid containing either songs, albums, or artists; (3) buttons for changing facets and activating the filter menu; (4) a display for the filter history path. Currently, the following facets are supported: an alphabetical view of artists, albums, songs (i.e. lexical FacetZoom) which can be activated by the upper three buttons of region (3). In addition, the two buttons below activate the FacetZooms genre and time, both applied to albums. Pressing one of the five facet buttons always results in a facet change where all available data items are being displayed. Starting with these views, users can then either browse the data set and get an overview of the music collection or search for a specific artist, song, or album by using the facets time, genre, or alphabet for names. This is for example illustrated in Figure 7 a) and b) for two different zoom ranges of alphabetically grouped albums. Zooming into a certain area or restricting facet values already constitutes a basic kind of filtering.

Mambo also offers a combined filtering mode to achieve more expressive searches, such as looking for all jazz albums from the sixties. Thereby, the currently refined set of data items is kept the same when the facet is changed. An example of the filter menu is shown in Figure 7 b). Since the facet *time* was chosen, the album covers with “W” are now being rearranged according to time as shown in Figure 7 c). This data set can now be refined by further restricting the desired time range. As shown in Figure 6 region (4), the breadcrumb-type filter history facilitates the overview of the active facet filters. In this example the user gets an overview of all artists starting with G-L, who have published an *Alternative* album in the 21st century.

Finally, to actually choose an album one can directly click on it anywhere or move a highlight rectangle with directional keys to the desired item. Figure 7 d) depicts the detailed view of a selected album. Songs can be played in this album view as well as in any other facet view where they appear (e.g. in Figure 4).

On mobile devices without a pen or cursor, one can cycle through the three interface regions (1)-(3) by using directional buttons. Within the FacetZoom widget (1) tap-and-center navigation is available, within the data view (2) items can be selected with a highlight rectangle, and in the button region (3) buttons can be highlighted and activated. To switch an area, the selection/confirmation button of a device can be used. Alternatively, available number or letter keys can be mapped to the facet views. Currently, we have not studied these mobile interaction modes to their full potential.

a)

b)

c)

d)

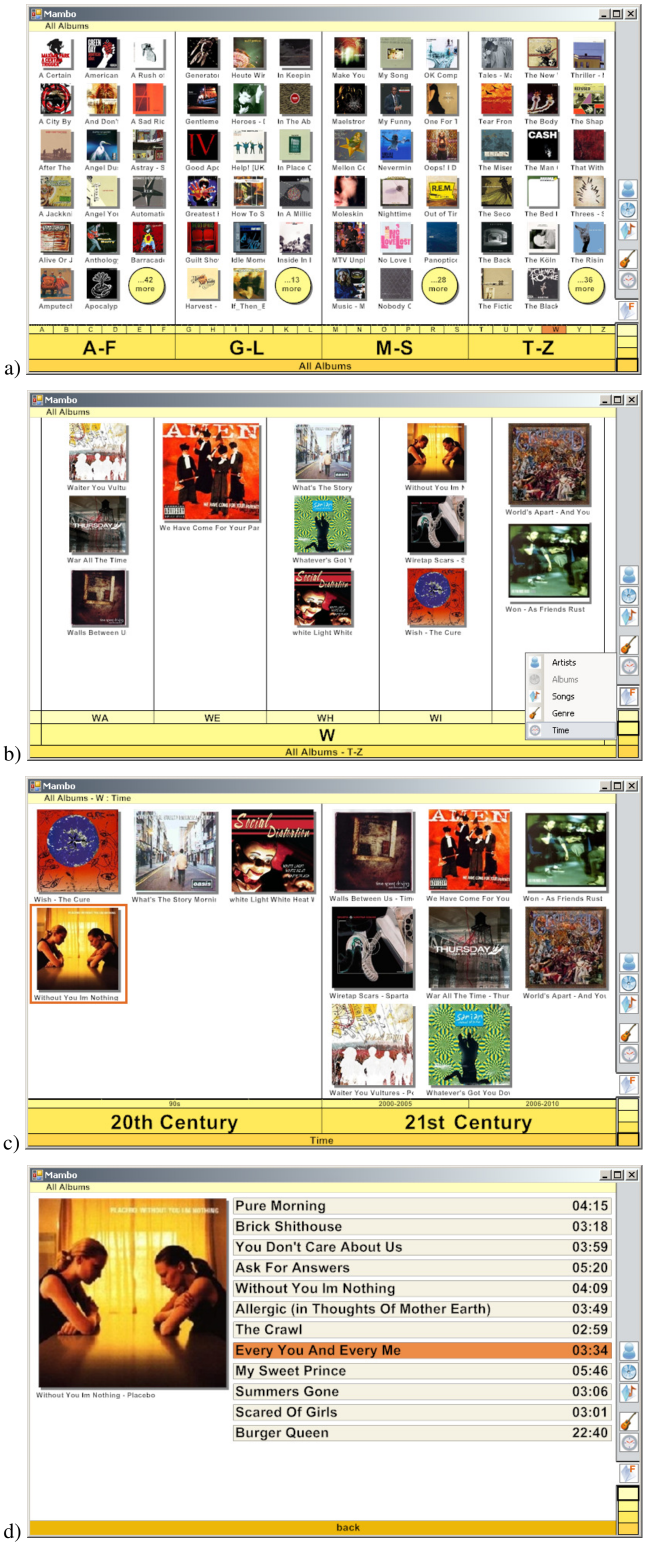

Figure 7. Mambo in UMPC display size.
a) all albums b) albums starting with “W” + filter menu, c) facet changed to time (same albums), d) detailed view.

3.2.1 Implementation

The Mambo prototype was implemented on top of Piccolo.Net (C#), a toolkit for ZUIs [8]. It was chosen due to its support of zooming and animation as key design elements of Mambo. Beside this version running on a tablet PC, a second version was implemented with PocketPiccolo.Net for mobile devices and tested on a PDA Phone. However, for conducting the user study described below, the performance of the mobile prototype was not satisfactory and still needs to be improved. The interface was successfully tested with a data set of almost three thousand MP3 songs.

4. USER STUDY

The goal of the formative study was to examine the design principles behind Mambo, in order to evaluate the basic zooming metaphor and to get usability feedback for the prototype. We were comparing user performance and subjective preference for a variety of tasks using different display conditions. In addition, we wanted to compare two design variants concerning the column layout as a basis for further design iterations. The first hypothesis we developed is that users will perform significantly better on a typical UMPC resolution (800x480) in comparison to a standard PDA phone resolution (320x240). Another hypothesis was that users would perform better in comparison tasks given the flexible column layout considering the number of data items.

24 subjects (6 female) participated in the study, all of them were right-handed and use computers on an every workday basis, most of them hold a university degree and are between 26 and 35 years. Concerning their experience with mobile devices (excluding laptops) users had to indicate their proficiency on a scale of five choices. 21% stated they had no experience at all, 25% some knowledge, 33% fair knowledge, and 21% good knowledge. Nobody considered himself or herself an expert. 29% of all subjects are using an MP3 player regularly (between 1 to 5 days a week), 25% once a week up to once a month, one user less then once a month, and 42% of the subjects never.

4.1 Method

The evaluation used a 2 (different layout versions, between subjects) by 2 (different display resolutions, between subjects) design. The tested layouts were a variable column width (depending on the number of associated items) vs. equal spacing. For the display size we used resolutions of 320x240 (QVGA) and 800x480 pixels, typical for UMPCs. Six subjects were randomly assigned to each group.

Tasks. Each subject completed a total of 13 tasks in a single session. The experimental tasks were grouped into 4 sets starting from simpler tasks to more complex ones: four *simple search tasks* such as choosing a specific album or subsequent search for two specific titles; three *comparison tasks,* e.g. number of albums with "T…" compared to "S…"; three *simple filter tasks*, e.g. number of titles of a specific album or search for a punk band starting with "H…"; three *complex filter tasks*, among them interprets of pop-albums from the 90s. Besides including tasks carried out frequently by users of MP3 players, we deliberately added complex tasks requiring filtering or extended navigation between items, e.g. for counting. These were specifically designed to test the user's ability to navigate the collection, and to better explore the value of the approach for complex media managers. The order of tasks was fixed to allow for the same training effects for all users.

Experimental Measures. For each task the Mambo software automatically recorded a range of events including: time to complete task, distinct cell selection, facet and filter button interaction, and the dragging distances. Each participant was also asked to fill out a questionnaire asking for a few demographic data and the user's familiarity with mobile devices. For the in-between part of the questionnaire the user was required to judge the difficulty of each task group on a scale ranging from 1 (very difficult) to 5 (very easy). Finally, we collected subjective satisfaction responses about the overall system as well as its specific features using a Likert scale ranging from -3 (strongly disagree) to 0 (neutral) to +3 (strongly agree). See Figure 10 for the list of statements.

Materials. For both display conditions the study was conducted on an Intel Core Duo 2.0GHz TabletPC equipped with 2GB RAM, an Intel Graphics Media Accelerator 950, running the Windows XP Tablet PC Edition 2005. Since the implemented PDA phone version of the Mambo prototype was not yet optimized for speed, we decided to run the entire study on a TabletPC with a digital pen to assure the same basic performance for both tested display conditions. Figure 8 shows the setup of this experiment in a university lab. As a data set a typical medium-sized personal MP3 collection was used containing altogether 1518 MP3 songs on 144 albums by 98 different artists. As opposed to the previous figures, the data display (albums, titles, artists) was deliberately kept simple and abstract with plain rectangles containing text to allow full concentration on the facet zooming bars.

Figure 8. Setup of the study with PDA condition displayed.

4.2 Procedure

After an initial briefing, subjects completed part one of the questionnaires. Afterwards the operation of the interface was briefly demonstrated. There was no training on specific tasks, but subjects were given at most 5 minutes to become familiar with the system. Each participant then completed 13 tasks in 4 task sets and assessed their difficulty. After having completed all tasks, subjects continued with filling out rating their agreement to given statements. Finally, users filled out the post-questionnaire and were also asked for additional verbal remarks. The average duration of a session was 31 minutes.

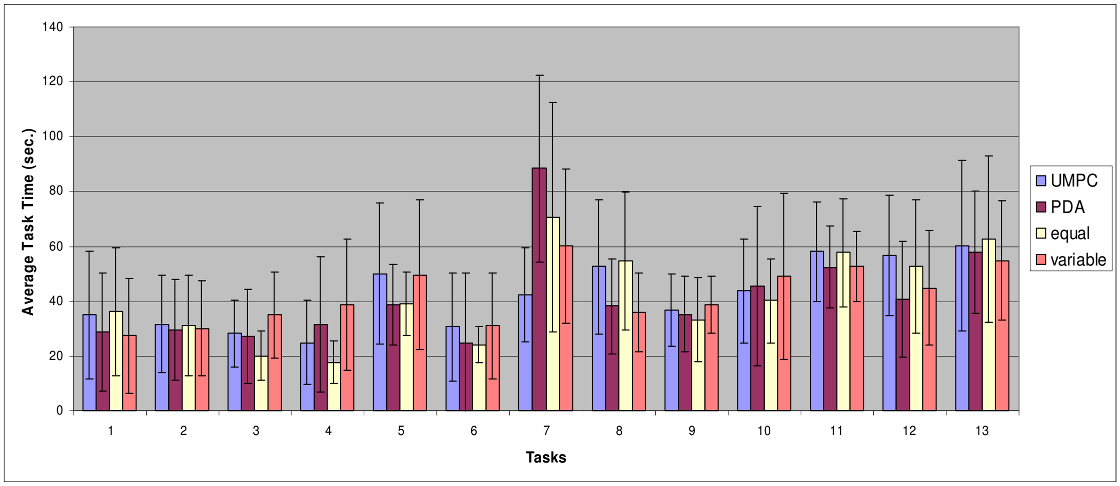

Figure 9. Mean completion time (sec.) for each task (all UMPC, PDA, equal, variable) with standard deviation

4.3 Results

For each subject the following results were analyzed: task completion times, subjects' task group assessments and questionnaire responses, as well as verbal protocols.

Task Times. For the experiment, we were using the two independent variables display size and column width, resulting in four possible combinations of task completion times. Figure 9 depicts the mean time (and standard deviation) of all subjects from one level of an independent variable, i.e. of all UMPC, PDA, equal, and variable width subjects.

A two-way (between-groups) ANOVA with a 2 (display size) x 2 (column width) design was carried out on the completion times for all tasks. Surprisingly, there were no significant performance differences between large and small displays. The mean overall time of all tasks was even less for PDA users (537.8 seconds) than for UMPC users (545.7 seconds). Looking at the individual task completion times, they are very similar for most of the tasks. However, the factorial ANOVA also revealed several main effects. Main effects of factor column width were observed in task 3 (equal: 20.13s, variable: 35.04, $F = 7.541$, $p = 0.01$) and task 4 (equal: 17.62s, variable: 38.65, $F = 8.225$, $p = 0.01$). It was obviously difficult to select very narrow columns especially on PDAs, what we expected. For task 7 (number of albums with "T…" compared to "S…") there was a main effect of display size; PDA users were highly significant slower than UMPC users ($F = 16.852$, $p < .001$). That means, comparing the number of data items was more difficult on small screens. Subjects using interfaces with variable column widths also performed better for this task (equal: 70.69s, variable: 60.07s), but this result did not reach significance.

Ease of use ratings. As a result of the users' assessments of task set difficulties on a scale of 1 (very difficult) to 5 (very easy), the mean responses of all users were 3.8 (simple search tasks), 3.7 (comparison tasks), 3.6 (simple filter tasks), and 3.2 (complex filter tasks). Since the task sets were designed to start with easier tasks, this result was basically expected. For task set 2 (containing task 7) the subjective results also confirm the main effect found for the factor display size.

Questionnaire responses. Figure 10 depicts the mean results of the subjective ratings of all users. Looking at the overall satisfaction with the system, the highest user agreement was found for the pleasure-to-use statement (2.2), the least for the look of the system (0.8). Looking at the ranking of features, users liked the ideas of using facets (2.3) and a hierarchical refinement (2.2) most. Participant ratings were, on average, the least favorable for the feeling of overview (0.6). Looking at the responses for this statement in detail, it is striking that all subjects with "variable width" condition assigned the worst average rating (0.25) of the whole questionnaire.

User Feedback and Usage Observations. We recorded more than a 100 verbal comments, which helped us improving the first prototype. Overall, users liked the system: "The interface is cool.", "nice animations", "better than many other systems currently available", "I would also like to use the system for photos". With regard to the interaction modes we observed no preference of a particular technique. The tap-and-center navigation was used most. Depending on the user, some utilized the level widget heavily, others not at all. Panning was done by most of the users, the automated mode only rarely. Subjects using the interface with variable column width experienced difficulties in perceiving and selecting the very small and sometimes (especially for PDA) almost disappearing columns. Users gave a number of positive comments on the concept of facets, among them "Facets are good starting points", "The hierarchical partitioning was extremely good.", and "It is interesting to be able to change the view".

5. DISCUSSION

Considering the results in the light of the hypotheses we were surprised that 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 (mobile) display conditions. Our second hypothesis concerning the flexible column layout to better indicate the number of data items and getting an overview was not supported by the results. One important reason is that users were not looking at the size of the widget's cells to get a feeling for the number of items contained but almost always looked at the data itself. For two tasks it was even a significant disadvantage to use the flexible width layout, which is supported by many user comments. As a consequence, we conclude to equally distribute the cells, especial-

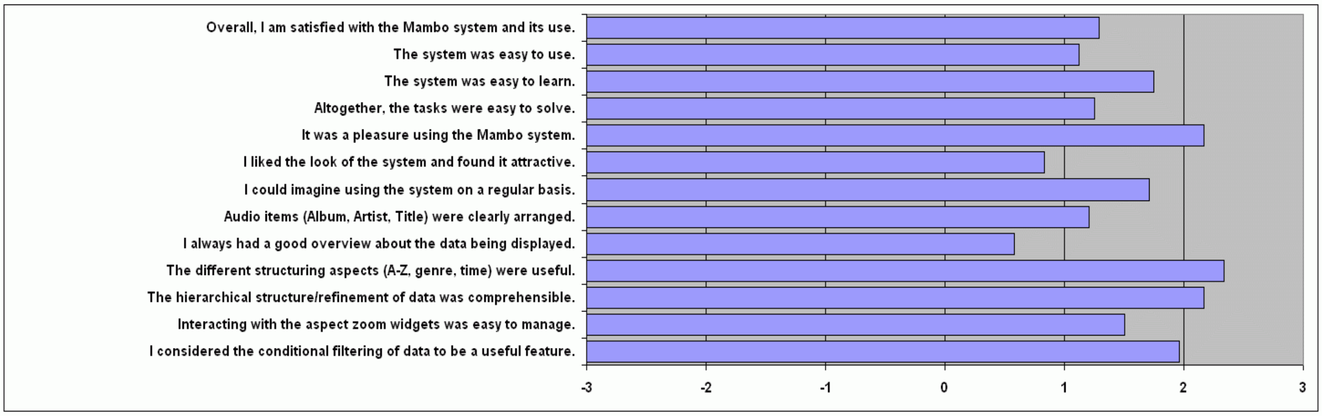

Figure 10. Average User Satisfaction Ratings (-3 = totally disagree, 3 = totally agree)

ly under small display conditions. Looking at the questionnaire satisfaction ratings, the ideas of using facets and a hierarchical refinement as key features were assessed very positively. The usability feedback also revealed a number of problems with the design of the tested prototype. We already improved the initial version of Mambo and developed a second prototype, which is the one presented in the paper.

6. CONCLUSION

In this paper we introduced Mambo, an interface for browsing personal music collections on mobile and other devices. As the underlying metaphor, the multi-scale widget FacetZoom is used for visually arranging data items according to hierarchically subdivided metadata facets. The space-structuring widget combines faceted browsing with a ZUI. With it, users can perform search, browse, and filter tasks by using either a continuous pan-and-zoom navigation or a tap-and-center interaction. In addition, quick jumping of facet levels is supported. The need for scrolling long alphabetic lists of items is eliminated as is textual keyboard input. The fully functional and scalable Mambo prototype was tested in a formative user study. Besides user feedback for further UI improvements, the most interesting result is the scalability of the zooming approach to different display sizes. Since it is not limited to the music domain, other applications might also benefit from it.

We assume the technique to be superior to scrolling long (hierarchical) lists of data items found in current music and media players. However, this still needs to be verified in a follow up user study comparing the two interface types on mobile devices. Further research is also required for the semantic zooming of displayed data on various screen sizes.

7. ACKNOWLEDGMENTS

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