

DEVELOPMENT OF A MUSIC ORGANIZER FOR CHILDREN

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ABSTRACT

Software development for children is challenging; children have their own needs, which often are not met by ‘grown up’ software. We focus on software for playing songs and managing a music collection—tasks that children take great interest in, but for which they have few or inappropriate tools. We address this situation with the design of a new music management system, created with children as design partners: the *Kids Music Box*.

1. INTRODUCTION

Digital documents such as music, movies, and pictures have become widely available; it is not uncommon for an individual’s hard drive to contain hundreds of songs and videos, and thousands of photos. However, both the interface and usability of digital document organizers are aimed for adults, and far less attention has been focused on the development of applications that are suitable for primary school children (six to ten years old). Children are as information thirsty as adults; they want to access their favourite songs and movies as much as adults do, and prize the ability to independently select and enjoy their entertainment ‘just like a big person’. But at present children are forced to use computer software that requires complex interaction, good spelling, and reading skills beyond their current abilities.

A number of music-related systems aimed at children are described in the research literature. They primarily focus on supporting children in creating music (eg, [4]), often in the context of formal music education (eg, [6]). MIR research attention has not yet turned to supporting children in playing, browsing, searching, and organizing collections of *existing* music. This paper describes the design and prototyping of such an organizer, the *Kids Music Box* (KMB). The development of KMB was grounded in previous research on creating software for children (Section 2), and follows the Participatory Design [10] model for software development (Section 3). Structured techniques for matching functionality and interface/interaction design to the target users were also employed (eg, expert review and usability testing). The major contribution of this paper is to demonstrate this principled approach to developing music-interaction software for children.

2. DESIGNING SOFTWARE FOR CHILDREN

Children are not miniature adults [4]; they have different needs, capabilities and expectations of computer technologies. Making cosmetic changes to adult software does not adequately adapt it for children [3]. To guide development of KMB, we first reviewed existing literature regarding software design for children.

2.1. Cognitive Development

Chiasson et al. [3] found that most adult user-interfaces assume that users are proficient readers with fairly extensive vocabularies; most children, however, have not reached this level of proficiency. Older children may not fully understand text-based instructions, while young children may not even know the alphabet. Children are creative spellers and it is hard for an interface to recognise their text input [6]. Given these difficulties in interpreting on-screen text, it is particularly important that icons be meaningful and intuitive. Where possible, the icons should represent familiar, real-world objects [5].

Children expect to see the results of their actions. If nothing happens after an action has been performed, it is very likely that children will repeat their action until there is some response from the application. Although constant visual or audio feedback might be annoying for adult users, children often expect and enjoy it [9].

Young children have difficulty with abstract concepts, and may not be able to navigating complex interfaces. Their most common method for learning to use new software is trail-and-error. Once they have found a method that works, it is very likely that they will keep using it, instead of searching for a more efficient method.

To summarise:

- Interfaces should be strongly visual, avoiding text where possible [4]
- Content specific metaphors are useful in helping children navigate interfaces [4].
- Where possible, allow children to select input from a list rather than directly enter text [6].
- Children are impatient and want instant feedback on their actions [9].
- Icons should be visually meaningful [5].

- Interfaces should take into account the fact that children may not yet understand abstract concepts [4].
- Interfaces should not make use of menus and sub-menus as children may not have the ability to categorize so as to navigate efficiently [4].
- Rollover audio, animation, and highlighting should be used to indicate where to find functionality [4].

2.2. Physical Development

Since children’s motor control skills develop over time, until fully developed, it is difficult to perform tasks such as controlling the mouse and targeting small areas on the screen. For example, tasks requiring them to hold down mouse for extended period are tiring and difficult [5]. Typing on a standard keyboard is also an issue for children as their strategy is “hunt-and-peck”.

Children find it challenging to accurately drag an item on screen [11]. They may also lack the fine-motor control needed to target small items on screen. It is important to have icons big enough for children to identify and at the same time, icons should be spaced to minimise the chance that children accidentally press the wrong button [4].

To summarise:

- Mousing should be as simple as possible [4].
- Screen items should be big enough and distanced from each other to compensate inaccuracy in targeting [4].
- Dragging is difficult for children [5].

3. KMB DESIGN AND DEVELOPMENT

We base our work on the *Participatory Design model*, the essence of which is to respect users as partners in the design process, by giving them a significant role in the design phase [10]. However, it is unreasonable to expect that children can have the same level of explicit input as an adult. Since children are usually unable to clearly verbally articulate their feelings and reactions to software designs, the onus is on designers to identify these reactions from the child partners’ emotional displays and physical actions during participatory design exercises [5]. To that end, we videotaped design exercises.

That said, it is also central to the Participatory Design model to empower the users to negotiate team decisions with the designers. This can be a significant issue when working with children, as the children must learn to trust that adults will listen to their contributions, and adults must learn to elaborate on children’s ideas rather than dismissing them [1].

3.1. Evaluation of suitability of existing organizers

Our initial step was to evaluate existing digital music organizers for their suitability with our target age group (6

to 10 years old). We identified one organizer intended specifically for children (*KidsPlayer*, developed by SororSoft); for contrast, we also examined the suitability of two organizers intended for adults (*Windows Media Player v10* and *iTunes v7.01*).

These three organizers were investigated in a focus group study involving eight participants aged between six and ten years old. Three of the participants were female and five were male; the average age was 7.8 years. All participants had regularly used a computer. For the study, the participants used all three organizers to: import songs; manage a playlist by deleting songs, assigning genre and ratings, and so forth; loading a saved playlist; and selecting and playing one or more songs. These tasks include the minimum requirements of a digital music organizer. The study included a debriefing, and ‘homework’ in the form of an opportunity to draw a design for an ideal music organizer.

This evaluation study uncovered significant usability problems in all three organizers. The most significant barriers were in importing music and creating a new playlist, primarily because these require the user to understand the Windows file system. All participants required assistance from the researcher to locate specific folders for songs—a difficulty corroborated by the children in the debriefing. When asked the question, “*Do you look after the songs on your computer yourself?*”, all participants responded that their parents or other family members help them look after both their physical (CDs and tapes) and digital music.

The children liked *KidsPlayer*’s big and colorful buttons, corroborating suggestions in the literature review that children prefer vibrant colors and large controls [6]; the *iTunes* interface was dismissed as ‘*boring*’ with its small buttons and grayscale windows. However, *KidsPlayer* uses a ‘bubble wrapping’ effect on buttons that causes them to look like part of the background graphics, and the children had difficulties in identifying its clickable objects. An attractive interface must still adhere to basic usability principles—and in particular, the children had difficulty with small fonts, small buttons and ‘handles’, right clicks, drag-and-drop, and double-clicking.

A major difficulty with the products designed for adults (*Media Player* and *iTunes*) is that they provide too much information and functionality for children. Children simply do not know what to focus on when too many details are presented to them—and so, for example, the presentation of many columns of metadata turned the task of locating a single song by its title into a frustrating chore. The children also responded positively to the ‘clear and simple’ layout of *Media Player*, which more cleanly groups related features than do the other two organizers.

The children were particularly enthusiastic about two functionalities: the ability to rate songs in *iTunes* (“*So I can give five stars to my favourite songs!*”), and the *Media Player* visualization that synchronizes with the music (“*I*

like to see those colourful and moving graphics when I play my song”).

3.2. Prototyping and Expert Review

Based on the background research into effective interface/interaction designs for children (Section 2) and the evaluation of existing music organizers (Section 3.1), a list of essential design requirements emerged: clear navigation paths; access to visualizations and games while listening to music; features grouped by functionality, and clear guidance through multi-step processes; use of point-and-click rather than double-clicking, right-clicking, or drag-and-drop; and a colorful design with large clickable areas. These principles guided the creation of a C# based horizontal prototype (ie, a largely non-functional demonstration of the design) [7].

With adult users, at this point a ‘walkthrough’ of Use Cases is staged with a group of potential users to refine the interface and interaction design. Children, however, find it overwhelmingly difficult to provide feedback from a non-functional prototype, particularly when the most engaging design aspects (eg, playing songs, viewing visualizations) are not supported. For this reason the initial design was instead the subject of an expert evaluation [7] by two design experts with significant experience in creating interfaces for children. The expert review identified many minor improvements to the interface design (for example, in the choice of colors and shape of the frames distinguishing spaces within a window). The most significant changes were to further simplify the interface and clarify the interaction flow, and to support a variety of ‘skins’ for KMB (discussed in Section 3.4).

3.3. Design Overview and Implementation

Kids Music Box was developed with C#, MySQL and Macromedia Flash. C# was selected for its support of rapid development. MySQL database was used to store all the account and song information and to provide responses to user queries. Macromedia Flash was used to construct all the interactive features, such as the buttons and the ‘playground’ of games and visualizations.

The ‘box’ was chosen as the primary visual interface metaphor for KMB. The real world analogy is to children and their toys – children are taught early that toys cannot be scattered all over the house; they needed to be sorted in a box or a drawer, so the toys can be retrieved when needed and the house is not cluttered. Digital organizers in many aspects are the counterpart to storage boxes and drawers that hold children’s toys.

KMB has a multi-coloured and non-rectangular interface; children from the focus group study have agreed that colours and shapes were more interesting. The main display area has multiple functionalities; it is able to display both pictures and text, display visualisations and it is also an interactive playground. The main reason why MediaPlayer’s visualisation was so well received in the

initial user study (Section 3.1) is that it offered children “something to do” while listening to music [7]; children are not interested in sitting quietly and listening to songs. One real-world example occurs in music classes for kids, which often involve several activities (dancing, clapping, games) while singing or listening.

Children enjoy making and receiving presents: every parent’s refrigerator is covered with art given proudly by their child, school art classes help children create cards and gifts for every occasion, and children (particularly girls) exchange handmade tokens of friendship. Music-related gifts hold a special position for adult, who may give gifts of songs and CDs or create elaborate and emotionally meaningful playlists or compilation CDs [4]. To support this behavior, users can create a ‘gift’ music box that can be opened by another KMB.

Participants in the study of existing organizers (Section 3.1) liked the idea of organizing their songs as playlists or groups of ‘favorites’, but found it difficult to manipulate files. KMB takes an approach to managing playlists that is similar to that of iTunes (the playlist manager that the children found to be most usable): users do not have to know where the playlists are stored, since both saving and loading is handled by the organizer.

The final KMB interface relies heavily on images—each button or functional area has an associated icon. Children aged 6 – 10 are often still learning to read, and find it easier to process information from pictures rather than text. Tool tips and brief onscreen explanations clarify the functions attached to icons, and support the children in associating images with functionality. The Comic Sans MS font in 14 point is used in KMB, as it is the font that is most attractive and easiest/fastest to read for children [2].

3.4. Expert and Participant Design Review

A second expert review was conducted on an ‘alpha’ prototype of KMB, uncovering a few minor issues with functionality (eg, the lack of an exit button) and icons (the rating system was changed from stars to an image more familiar to children: the smiley face). Appropriate modifications were made, to create a ‘beta’ prototype.

All participants in the initial design evaluation study (Section 3.1) took part in a formal review of the KMB beta. The goals were: to uncover remaining usability problems; to investigate how well the KMB design addresses the issues and desires raised by the children in the initial study; and to examine the ‘learnability’ of KMB (the extent to which it can be used without formal training) [7]. Learnability is particularly important for entertainment-oriented software—struggling through a tutorial detracts from the user experience.

Again, minor usability problems were uncovered. The most significant insights gained were in the use of skins, the suitability of the icons, the song metadata displayed, and the box metaphor. One of the older participants (10 years old), dismissed all of the skins provided as being

“*too kiddie*” and “*not cool*”; the boys thought that some skins were “*too girly*”. A child’s interests and tastes change dramatically from six to ten, as the child begins to aspire to a more mature appearance and activities. A full version of KMB should allow the user many more possibilities for tailoring the interface to support their emerging image of themselves.

For each of the icons, the participants were asked to speculate on the functionality represented. All of the participants were able to identify the function represented by most of the icons, and the children felt that any remaining uncertainty could be easily cleared up by reading the tooltips text.

Another concern was the minimal song metadata displayed by KDM (song title, artist, and user-provided rating). The expert reviewers speculated that children might wish to view additional descriptors. The participants, however, were emphatic that they found the larger amount of metadata to be confusing.

Participants did not find the ‘box’ metaphor to be compelling; given that users do not physically drag items into a box, the analogy is indeed weak. Two of the children did, however, suggest reinforcing the visual link to the metaphor by always including an image within box outlines—a suggestion that we adopted.

4. THE KMB INTERFACE

4.1. Login Window and Parental Settings

The *Login window* allows multiple users to create their own account for the organizer—each user will have their own music collections, and can organize music the way they like. Before a user can access KMB by logging into in their account, the parental settings must be configured (Figure 1). Only songs stored within the folders specified in the *Music settings* section folders are imported to the organizer window automatically; this aids children in importing music into their organizer while giving parents control over the songs that KMB contains. The *Picture setting* similarly restricts the images used in KMB (for to identify playlists and users). Parents can further restrict the import of songs whose metadata contain terms specified in the *Filter settings*. *Gift setting* identifies the default directory where KMB ‘gift boxes’ are to be stored. The grayscale, standard ‘adult software’ appearance of the Parental Settings window was deliberately chosen to make the adults feel more comfortable using that part of the software, and to make it less appealing to children.

4.2. The Organizer Window

Before the primary organizer window displays, KMB loads all the songs from the music folders that were added from the Parental Settings window into the Music Library. The Organizer window comprises the *music box*

(Playlists) manager, the *music library* display, *visualisation* and *global control* (Figure 2).

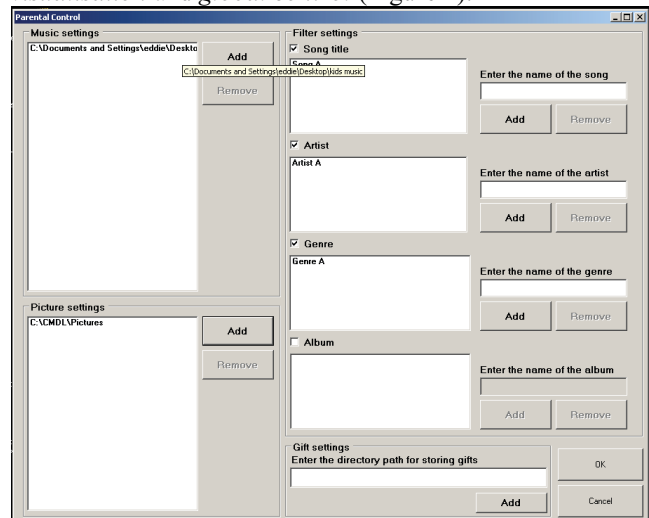


Figure 1. Parental Settings Window



Figure 2. The Organizer window

The main function of the *Music Box* area is to display all the music boxes (playlists) that the user has created. The music boxes are displayed by a picture along with the name for the box. There will always be one box that is selected. All the songs that belong to this box will be displayed in the *Music Library* area. To change to another box, the user simply clicks on the box’s icon.

The four vertical buttons in the Music Box area are, from top to bottom, the *remove music box*, *search for songs*, *make a new music box* and *get songs from CDs*.

4.3. Searching for songs

Users can search for songs by the title, artist, playlist (“music box”), and song rating (Figure 3). Search fields that are not expected to include very large numbers of values (artist, music box, and rating) prompt the user with a pull-down list of values. Metadata for songs matching the query are listed immediately below the query.



Figure 3. Searching for songs by The Tomato Collection Friends

4.4. The Music Library area

The music library displays all the songs that are contained in the currently selected music box. The main functionalities for the *Music Library* are: *sort songs within a music box, move songs to different music boxes, assign ratings to songs, performing the quick search function, import songs and remove songs* (Figure 4a)

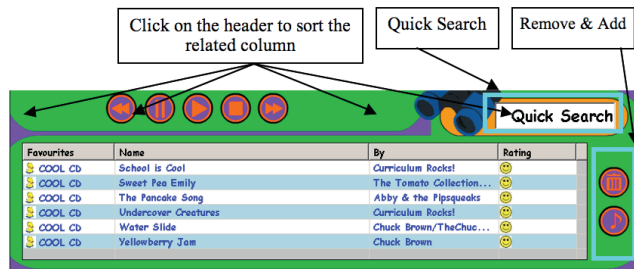


Figure 4a. The Music Library area

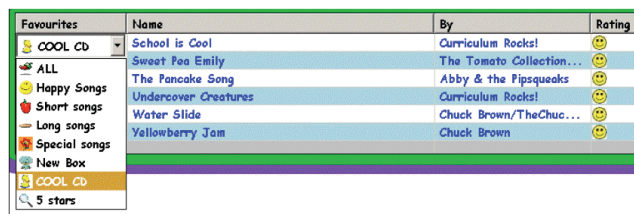


Figure 4b. Move a song to a different music box

Song metadata is limited to *song title*, *artist* and the *song rating*. Songs can be sorted by all these attributes. To move a song to a different music box, the user clicks on the Favourites label for the song and selects a new music box from the drop down box (Figure 4b). Users can similarly assign ratings (smiley faces) to individual songs. To remove a song, the user clicks on the song to select it and then clicks the Remove button. A song is added by clicking the Add button, and then following through the import dialog that appears.

4.5. The Visualisation area

The *Visualisation area* occupies largest screen area of the interface. This area has multiple functionalities: *image viewer, a playground with a number of Macromedia Flash games and music visualisations* by using the embedded *Window's Media Player* (Figure 5). The games and visualisations in the current KMB are essentially samples – in a non-prototype version, it would be more appropriate for users to manually insert their own games. The user can switch between different image albums, games and visualizations by clicking on the Switch Display button or using the large arrows to scroll between possibilities. The music playing buttons (play, pause, go to beginning/end) are included in this area to reinforce the connection between the song and the playground activity. Note that we use the conventional music/video player icons; while these are not intuitive, it seems more reasonable to support children in learning standard icons than to require them to learn controls idiosyncratic to KMB.

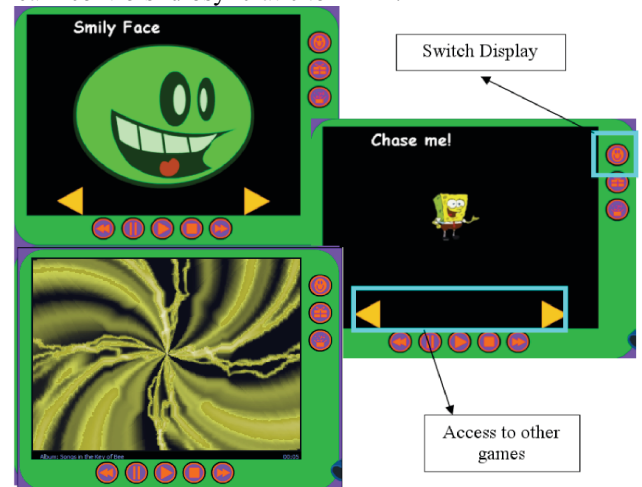


Figure 5. A range of games, image albums, and visualizations

4.6. Making a Gift

Clicking on the Make a Gift button (middle vertical button in the Music Library window) invokes a wizard that guides the user through selecting the songs, cover image, item for the visualization area, and a message to the recipient (Figure 6). The gift is packaged as a single file that is transferred to the recipient's computer. When opened, the gift is stored in KMB as a new music box within the recipient's music box library.

5. CONCLUSIONS

This paper has described the design, and the design process, for a music organizer for children. The most significant design features to adapt the organizer concept

for children are: a ‘playground’ to interact with while listening to songs; a set of themed interface skins to allow children to tailor the interface to their own tastes; a parental assistance window to support the child’s caregiver in ensuring that appropriate images/music are included in KMB; the movement of difficult file management tasks from the user to the system; and an appealing and usable interface and interaction design.



Figure 6. An opened gift

However, the true test of a design lies in its use (or lack of use) over time [7]. To further evaluate the acceptability of KMB to its target users, it was installed on three of the participants’ personal computers in their homes for a month, together with a logging application. The logging software created a timestamped log entry for each user action, and also created a screenshot every 20 so that the researchers could manually clarify ambiguous log states. This version of KDM also included popups triggered by starting up and exiting the software; the popups contained brief questions about why the child was using the system and the quality of the user experience.

The three participants engaged in a total of 85 sessions, with a median session length of about 15 minutes. The users’ first few sessions were with their parents, but they began using KMB independently as they became more familiar with it. This pattern was expected, as parental assistance is necessary to set up the songs and images that the children can use. Tooltips were used extensively in earlier sessions, but then their display rapidly tapered off—indicating that the icons are indeed well linked to functionality, and that the system learnability is acceptable. For over 80% of the usage sessions, the participants reported that KMB was fun and easy to use.

The ‘playground’ was well received; for 33 of the 85 sessions the main reason for using KMB was to play with the games, rather than to organize or listen to music. In retrospect, this should not have been surprising—adults frequently listen to music as they play computer games or browse the Web [8]. This does point to the need for a variety of games and visualizations—and perhaps to make

it easier to run KMB in the background to other games or physical activities.

None of the participants used the ‘make a gift’ feature, likely because a KMB gift can only be opened by another KMB. Evaluation of this feature has to wait until a significant user base develops—or the gift feature is redesigned to be compatible with conventional organizers.

Participant Design has enabled us to create a music organizer tailored to the eight children who worked with us in this study. The next step is to test our design with a larger pool of potential users. To this end, we plan to make KMB available as Open Source, perhaps as a One Laptop Per Child resource (www.olpc.org).

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