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Kid's Music Box:
A digital music organizer
designed with children for
children

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Master of Science at the University of Waikato.

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Abstract

This thesis is an investigation of software development for children aged six to ten years old. This is a challenging area; despite the trend for children to be exposed to computer technology at an earlier age, they often struggle to utilize it effectively. Children are not merely miniature adults; they have their own needs which are often not met by traditional software. In particular, this thesis focuses on the task of music management: a task that children take much interest in but for which they are given few tools. We address this with the design of a new music management system: the *Kid's Music Box*.

The development of *Kid's Music Box* is documented in four main parts: background research, requirements gathering, design and implementation, and evaluation. Background research identifies the strengths and weaknesses of conventional music organizers with respect to young users. Requirements gathering took the form of a focus group study, which aimed to overcome the distinct challenges of obtaining input from children. The design of *Kid's Music Box* builds on this work, by incorporating functionality, metaphors and design elements that suit the needs and capabilities of young children. Expert evaluations and formal evaluation from children users showed promising results, which concluded that *Kid's Music Box* is better than other organizers in terms of managing music for children.

Chapter One

Introduction

Children are a growing user group of computer technology [1]. Increasing recognition of this emerging group has led to more digital products being produced for children, such as digital music (www.freekidsmusic.com) and computer games (www.kidsgames.org). With children's digital media collections growing rapidly, organization becomes important. One real world analogy for this problem is between children and their toys – a child's 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 again when needed and the house is not filled with toys. Digital organizers in many aspects are the counterpart to storage boxes and drawers that hold children's toys.

Most of the currently existing digital organizers, such as *iTunes* from *Apple Computers* and *Music Organizer* from *Primasoft* were designed for adults. It is generally accepted that children are not miniature version of adults and their motor skills, computer capabilities and their expectation of information technology are different to adults, thus what is right for adults are not always right for children [2].

“How do you work this thing? It looks complicated.”

Jonathan Harkness, 10 years old

This is a quote from one of the participants of this thesis, describing the difficulties when using one of the existing digital music organizers that were designed for adults.

This thesis is an investigation on design and implement of a digital music organizer for children aged six to ten years old, with children as design partners.

1.1 Why a Digital Music Organizer for Children?

Nowadays, a growing body of information such as digital music, pictures and movies are becoming more available in digital format. Consequently, digital organizers are being developed to organize the digital collection. However, both the interface and usability of the organizers are aimed for adults, and far less attention has been focused on the development of applications that are suitable for primary school children (five 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. Nevertheless, children are forced to use computer software that requires complex interaction, good spelling and reading skills which are beyond their currently developing abilities [3].

New technologies for children continually emerge. From technology-enhanced toys such as actimates Barney, to toilets that flush with the help of sensors, technology is becoming ubiquitous in children's lives. How this technology is developed, and who is involved in the process can vary greatly. Often, children are not consulted until the end of the design process, if at all. While there are many roles that children may play in the design of new technology, we believe that children can and should be an integral part of the design process in developing new technology as equal stakeholders throughout the design process.

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There are many advantages in developing a digital organizer especially for children. The most important being it will be possible for children to express their true intentions when performing actions on the software, rather than expressing what the adult designers thought children wanted.[3]. Consider the following scenario:

Jack (eight years old) uses *iTunes* to organize his digital music. One time, while he was importing music into a specific playlist in *iTunes*' music library, he accidentally imported the songs into a wrong playlist. After he realised what he had done, Jack wanted to move the songs to the intended playlist.

At this stage, most adult users might consider right clicking on the file menu or the songs to bring up more options in order to move the songs into the intended playlist. However, the common steps described above will be difficult for most children users to achieve, restricted by their limitations (See Section 2.3). A child's approach to solve this same problem might be to delete all the songs and then try to import them again.

This is the case because both adults and children have a different perspective on how things should work, based on their experiences and their knowledge [2]. By designing a digital organizer with children and specifically for children, the emphasis of the application will focus mainly on the requirements, limitations and capabilities of children – and thus children will find it easier and effective to use.

1.2 Challenges of Digital Music Organizer for Children

The main challenge in designing and developing a digital music organizer for children is to bridge the gap between the users' actual needs and the software's capabilities, while keeping the users' limited skills and knowledge in computer technology in mind. Thus, a focus group study of eight children participants aged from six to ten years old was completed, with the goal of determining the users' wants and expectations of a digital music organizer (see Section 3.3). More importantly, it was also a chance for the participants to offer their point of view on the design of the organizer.

A digital music organizer for children must be balanced. It cannot be overloaded with functionalities that children will not be able to comprehend, and at the same time it cannot be all about the interface, as a simplified interface with hidden functionalities are a challenge for children [4]. The interface and the functionalities of the application must strike a balance – functionalities that are essential to the meaning of digital music organizer are included, and, the interface should be intuitive, interesting and fun in order to engage the users in utilizing the functionalities offered by the organizer.

1.3 Thesis Statement

Currently, there are many digital music organizers available both as commercial product and free-of-charge, such as *iTunes* from *Apple*, *Windows Media Player* from *Microsoft* and *KidsPlayer* from *SororSoft*. However, these organizers either do not see children as their potential user group and subsequently ignored this user group completely, or simply assert what they think is right for children without much research [5]. For example, websites like *Ask Jeeves Kids* and *Yahoo!Kids* are portals that are designed for children to find age-appropriate contents from the internet. However, recent studies [6] show that these websites are aimed more towards users who can spell, type, read, navigate and select small icons and links. All these are skills that young children do not have.

Thus, the central goal of this thesis is to design a digital music organizer for children aged six to ten years old, with children as design partners. In addition, this research will also look for new approaches and new ideas for improving the interface and usability experience so that it is better suited for children. The following avenues for improvement are explored in the development of this system:

- Since this thesis is about designing a computer application for children, it is natural to include children not only as test subjects, but also to give them the chance to express their ideas on what they want and do not want in a computer application. A focus group study was conducted to determine the design requirements. This focus group was based on the *Participatory Design* model to respect users more as partners in the design process by giving them an equal role in the design phase.
- Significant changes are made to both the initial interface design and the usability of the organizer in comparison to existing organizers. Specifically, the interface of the final design will focus more on the use of colour theory and non-rectangular shaped in order to make the application more appealing and interesting.

- The software created for this thesis does not simply extend or modify features from currently existing organizers; this software incorporates new ideas such as creating and receiving gifts, a multipurpose interactive area to display pictures, visualising music and games. The application also has the capability to accept different skins.
- In order to provide a more interesting, consistent and responsive environment for using the organizer, *Macromedia Flash*, *C#* and *MySQL* are used in implement the organizer.

The music organizer is named *Kid's Music Box*. It is hoped that this name will evoke a better conceptual understanding that this system is about music in boxes, much like toys in boxes.

1.4 Thesis Structure

Both Chapter Two and Three describe the background information and rationale behind the research, including relevant technologies and previous approaches. Chapters Four, Five and Six focus on the design, implementation and evaluation of the system itself. Chapter Seven is a summary of lessons learned and implications for future work.

Chapter Two

Background Information

The goal of this thesis is to design and implement a digital music organizer for children aged six to ten years old. This chapter elaborates on the goal of the research by explaining the motivation behind it, as well as presenting the underlying structure of digital music organizers.

The two other issues that will also be discussed in this chapter are of particular importance to achieving the goal of this research. The first issue is relevant concepts and technologies for children, where the section will examine two currently available technologies that were designed for children: the *International Children's Digital Library* and *YahooKids!* websites. The second issue is about working with children, why it is important and useful to work with children as design partners and the techniques for working with children as design partners.

2.1 Motivation for Digital Music Organizer for Children

The motivation to design and implement a digital music organizer for children is to address two issues. Firstly, the lack of digital music organizers designed for children. Secondly, the challenge for children to utilize some of the currently available digital music organizers to organize their music – children are restricted by their limited cognitive and physical development and knowledge in computer technologies. This limitation prevents them from fully utilising currently available digital music organizers that are designed for adults (see Section 3 of this chapter, which provides a more in-depth discussing regarding these limitations).

In order to understand the extent of the issue, consider computer usage by children. The use of computers and the Internet among children has greatly increased during the last ten years. In the 2001 report prepared by the *U.S. Department of Education* on Computer and Internet Use by Children and Adolescents [1], a US-based survey found that 80.5% of children surveyed aged 5 to 7 use computers either at home or at school. 90.5% of children surveyed aged between 8 to 10 years use computers, either at some or at school. The report shows not only that most children use computer related technology, but that children also begin the use of computer technology at an early age: approximately 75% of children aged 5 have used a computer.

In recognising the growing market of younger computer users, the computer games and music industry are targeting younger audiences. This has contributed to the increased number of computer games and music for children [7]. For example, there are growing number of internet websites that offers free and legal children music for download – www.freekidsmusic.com is a good example.

This research has found that most children relied on their parents to organize their music collection (see Chapter 3). One of the main reasons children needed the help of their parents is that there is not much software that are designed for children to organize their music collections. The popular existing music organizers are too complicated for children to use (see Chapter 3).

The fundamental problem is the gap in children's initial perception on the way they want to organize music and the approaches taken by existing music organizers in organizing music. This problem is made more difficult by the age of targeted audience, who have limited computer skills. Hence, the motivation of this research is to design and implement a digital music organizer that is easy and fun-to-use for children.

2.2 Underlying Structure of Digital Music Organizer

Digital music organizers are similar to other desktop document organizers such as photo organizers, in terms of helping the user manage, modify and play digital media on the computer. Digital music organizers are an essential part of personal computers nowadays because of two major factors: the rise of the Internet in the last decade and the invention of the *mp3* media format. It has become easier for average computer users to download a substantial amount of music onto their computers and as a result, people have very large number of songs – thousands is not uncommon. Thus, computer users often find it difficult to remember where songs were stored or what songs they have on their computers. This problem highlighted the importance of digital music organizers to organize big music collections and to make music more accessible when needed.

There are many digital music organizers available at present, both commercial and free-of-charge. Consequently, there are many different approaches in both the design and implementation phases for different digital music organizers. In essence, the majority of digital music organizers fall into two groups: those with and without database support. Digital music organizers with database support have the ability to store information for all the songs that exist in the organizer. Most of the features in importing, modifying and loading from database are automated in the sense that the organizer performs those tasks for the user. Users do not have to be concerned about how the organizer works or where the information is saved. In contrast, digital music organizers without database support tend to be lightweight and focus more on playlist management. Users are required to know where playlists in the form of computer files are saved, in order to load the playlist from the location where it was saved. More

detailed analysis of different organizers will be elaborated in Chapter Three of this research.

Digital music organizers have diverse functionality, ranging from playing songs to purchasing music from internet stores. However, not all these functionalities will be examined closely in this thesis: the only features and functionalities that are relevant to this research are *importing music*, *music management*, *locate songs*, *play music* and *browsing*. As such, these will be the only features examined.

Importing music

Before a digital music organizer can begin organising songs, songs have to be imported into the music organizer either manually or automatically. The manual approach is for the user to select the specific folder or music files from the file system – usually with help from an open file dialog box. Once the destination of the music files are confirmed, the organizer will then import all the desired music into the organizer library. In the automatic approach, the organizer scans through the file system for matched media types or extensions such as .mp3, usually during the software starting up stage. All the files that matched the targeted extension will be added to the organizer library.

Music management

Music management is referring to managing playlists and songs. Once songs are imported into the organizer, they can be assigned to one or more playlists. Songs within the organizer can be manipulated in various ways as well; for example, the user can assign ratings, display attributes of the songs and modifying its metadata. There are many reasons why playlists are both important and practical for music organizers, one obvious reason been that songs can be grouped together for different occasions – party songs, driving songs, etc.

Locating

Because a personal music collection can be enormous, it is vital that users have quick and straightforward access to the songs from their music collections; otherwise, it would defeat the purpose of having an organizer – to make music more readily available when needed. For most of the existing digital music organizers, there are

many ways where users can locate songs, not only by *song title*, but by other attributes as well, such as *artist*, *rating*, *year*, and *genre*. The process of locating songs is usually performed by the user typing in the search terms that are related to the sought after song; the more detailed the searched terms are, the more accurate the results.

Playing Music

Digital music organizers are not used only to manage music, but also to play songs. Songs can be played individually or in a playlist. Other common music play options are *pause*, *next song*, *previous song*, and *stop*.

Browsing

Allowing users to browse through their music collections efficiently and easily is an important functionality of digital music organizers. It serves two main purposes: The first being that, users do not always know what type of music or songs they want to listen to; by browsing through their collection, it is very likely, that the user will find songs of interest. The second purpose is to allow users to browse through their collection. Often people find it interesting to look through their digital collections just to see what they have[8]. Moreover, people enjoy memories associated with the songs.

The above functionalities are relevant to this research because the goal of this research is to design and implement a digital music organizer for children. It is not reasonable (see Section 2.3) to expect the target audience to be able to use all the functionalities from existing organizers. Instead, only the most important and essential requirements of digital music organizers will be implemented and hence, examined.

2.3 Understanding Children's Limitations

Because children are not miniature adults [9], they have different needs, capabilities and expectations of computer technologies. In addition, since the needs of children cannot necessarily met by adult tools, it is not logical to simply scale down designs and techniques that are for adults to suit children [2]. Recently, Chiasson et al. [2]

investigated the cognitive and physical development of children to determine the principles behind designing software to meet their needs.

Cognitive Development

Chiasson et al. [2] 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. Hutchinson [10] also noted that children are creative spellers and that it is hard for an interface to recognise their text input.

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, it is necessary and children often expect it [11].

On screen icons need to be meaningful and intuitive. The icons should represent familiar real-world items and be intuitive for children to understand. For example, use a rubbish bin for deleting items [13].

The investigation also found that younger children have difficulty with abstract concepts, and may not have the in-depth content knowledge required for navigating complex interfaces. The most common method for children tends to be trail-and-error. Once they have found a method that works, it is very likely that they will keep using the same method, instead of searching for a different or more efficient method.

Strommen [12] pointed out that children are good at playing make-believe, and most will readily immerse themselves in pretend situations, acting as if they were presented with the situation in real life, and when metaphors are used, children expect the on screen objects to behave as they would in real-life.

To summarise the key points in this section regarding children's cognitive development are:

- Interfaces should be strongly visual, avoiding text as much as possible and reducing cognitive load [3].
- Content specific metaphors are useful in helping children navigate interfaces [3].
- Instructions should be easy to comprehend and remember [13].
- Children are impatient and want instant feedback on their actions [11].
- Icons should be visually meaningful to children [13].
- Children’s interfaces need to take into account the fact that children may not yet understand abstract concepts [9].
- Interfaces for children should not make use of menus and sub-menus as children may not yet have the ability to categorize or have the content knowledge required to navigate efficiently [9].
- Rollover audio, animation, and highlighting should be used to indicate where to find functionality [9].

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 of time are tiring and difficult [13]. Typing on a standard keyboard is also an issue for children as their strategy is “*hunt-and-peck*”, making typing a simple sentence a time-consuming task. There have been numerous attempts in finding alternatives for children, such as pen based interfaces, although these technologies can be error-prone for children’s writing [14]. For young children whose co-ordination is not fully developed, a touch screen is used instead of mouse and keyboard [9]; however, touch screen are very uncommon on home computers, hence this approach is not feasible, other ways in simplifying mouse and keyboard interactions are desirable.

Dragging an item on screen is a challenge for child [12] and this was also evident from the focus group study – where the participants were asked to drag a song from one playlist to another (see Section 3.3). Hence, alternatives to dragging were investigated, such as clicking on an item on screen to attach it to the cursor then

clicking to drop the item in the desired location [13]. Inkpen [15] found that while playing the same game, children were more motivated and solved significantly more puzzles using a point-and-click interface versus one that used drag-and-drop.

Children may lack the fine-motor control needed to target small items on screen such as traditional buttons and icons used in interfaces for adults. It is important to have icons big enough for children to identify and at the same time, icons should be spaced on screen to minimise the chance that children accidentally press the wrong button [3].

Despite the fact that children might be disadvantaged by the above limitations, children nevertheless are fast learners [9]. In many situations, they have the advantage of being more adjustable and open to new experiences and challenges than adults.

To summarise the key points in this section regarding children's physical development are:

- Mouse interactions should be as simple as possible [3].
- Screen items should be big enough and distanced from each other to compensate inaccuracy in targeting [3].
- Dragging is difficult for children [13].

2.4 Relevant Technologies

The goal of this research is to design and implement a computer application for children: specifically, a digital music organizer. Consequently, it is natural to examine currently existing technologies that are relevant to this research, not only limited to music organizers. In order to determine the effective approaches in design and implementing computer application for children and to avoid mistakes that hindered the existing designs. The first relevant technology examined was the *International Children's Digital Library* (<http://www.childrenslibrary.org/>). Two key points contributed to this website being chosen as the primary relevant technology. Firstly, its target audience is within the scope of this research, which is for children aged between six to ten years old. Secondly, the root objective of this research is about

organizing digital music collections, and the website has a similar goal: organizing digital books. The other relevant technology this chapter elaborates on is the website *Yahoo!Kids* (<http://kids.yahoo.com>). The *Yahoo!Kids* website was chosen because it is one of the most popular place for children to perform internet searches, listen to music, play online games and also a place to study. The lessons learned from these websites will be discussed in Section 2.5.

2.4.1 International Children’s Digital Library

The book selection criteria for children is different from that of adults [16]. Children tend to place more emphasis on the books appearance such as the colour of the cover, the thickness and the shape [10]. These criteria do not fit into the physical libraries, or the adult digital libraries which are built based on physical libraries. Thus, finding the desired book in a physical library is a frustration experience for children [17].

The *International Children’s Digital Library* is a five-year research project aimed at solving this problem. One of its missions is to develop new interface technologies that will make digital library more accessible and easier to use for children [5], see Figure 2.1.

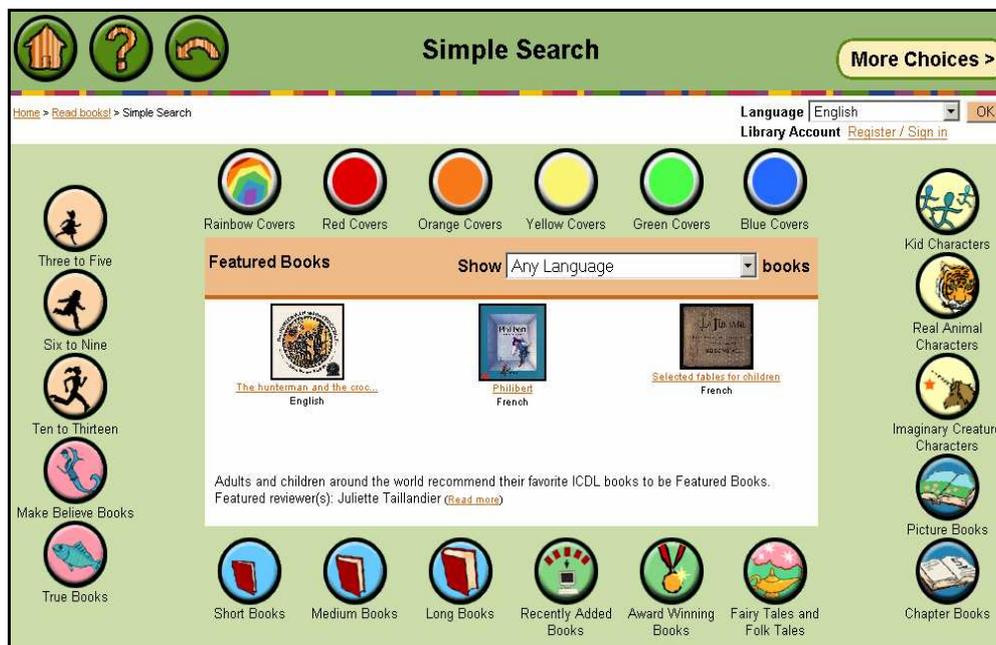


Figure 2. 1: International Children’s Digital Library

In order for children to navigate the *ICDL* website to look for books effectively, a number of new design approaches were apparent. The new approaches were evident in the layout and appearance of the website, how the book collection is organized and accessed, the book locating methods, and the hyperlink representation.

Layout and appearance of the website

The layout and structure of the website is intuitive and easy to navigate, which is essential for children to browse through the book collection. In most cases, a digital book can be opened with only two or three mouse clicks. The *ICDL* website also recognises the importance of shortcuts [18] and includes three permanent shortcuts (*Home, Question, Back*) at the top of the screen. Hyperlinks to books are no longer lined up one after another in the traditional approach; instead, they are grouped by relevance and are positioned around the screen, which makes it easier for children to navigate [10]. Hyperlinks are no longer represented in text format; instead, large buttons with image are used to represent the link. In addition, the colour selection for the website is based on the *Complementary Colour Scheme* [19], where colours were selected from opposite sides from the colour wheel. This results in the website looking vibrant and lively, which is important to keeping children interested.

Collection organization and access

The *ICDL's* approach in organising book collections is different to the traditional methods (collections are organised by attribute such as *title, author, category* etc). The *ICDL's* approach places more emphasis on children's needs. Books on *ICDL* are organized by the colour of the cover, the size of the book, type of book (picture or text), the age group, and the content of the book (such as whether it is a *make believe* or a *true* book). The new approaches in *ICDL* are more satisfying for children because they are mimicking the physical attributes that children look for when searching for books in real life, which differs from the common adult approach, by looking for book title and author. Hutchinson et al. found that children often use criteria that are different to adults to locate books in physical libraries, such as colour, shape, size, feelings and type of book [10].

Search methods

In recognising children’s cognitive, motoring and computer skills vary greatly [2], the *ICDL* offers a number of different search methods. These search methods can be grouped into two main groups: basic and sophisticated. The basic search group includes keyword search, and a set of predefined collections (such as books with red covers, books for children aged three to five, long books, and picture books); see Figure 2.2.



Figure 2. 2: Simple search screen

The sophisticated search group includes search for books based on the book’s origin, and advanced search. See Figure 2.3.



Figure 2. 3: Advanced search screen

2.4.2 Yahoo!Kids

The *Yahoo!Kids* website was designed for children aged seven to twelve years old. Its primary role is to allow users to perform searches on its modified version of the *Yahoo!* search engine. See Figure 2.4. Other features included are games, music, movies and study zone. These features can be accessed from the main menu bar.

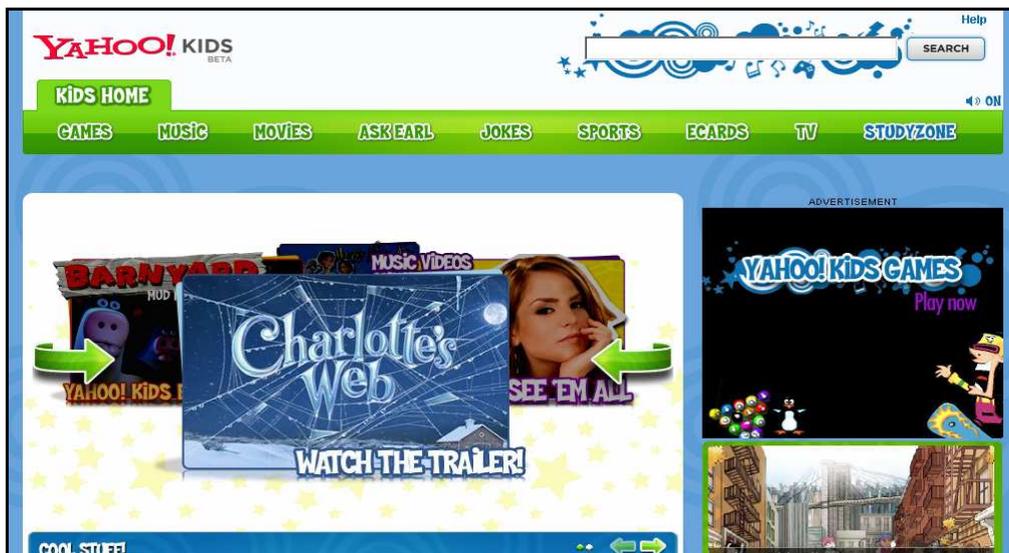


Figure 2. 4: The Yahoo!Kids website

Similar to the *ICDL* website, the *Yahoo!Kids* website is clear and very easy to navigate: only two or three mouse clicks are required to get to most of the features. The first impression of this website is that it is very colourful, full of graphics, animations and images. There is not much text used throughout the whole website; instead images are used to represent the meaning. This approach is important in that because children have limited cognitive skills (see Section 2.3), it will be a lot faster for children to obtain meaning from images rather than text.

The *Yahoo!Kids* website was also simple and easy to use. For example, all the online games required little or no configuration from the user. All the user has to do is click on the *Play* button. This approach will not scare children away from using features offered by the site.

Another interesting fact of *Yahoo!Kids* is that it utilises various programming languages such as *Macromedia Flash* and *Java* to handle different tasks. *Macromedia Flash* was used primary for handling animations, movie clips and some games, while the majority of the games were created with *Java*. This approach ensures that features and designs from the website were created with the appropriate tools and not some “patch-up” work.

2.5 Lessons learned

Both the *ICDL* and *Yahoo!Kids* website provided many important and valuable insights into developing technologies for children. To summarise, lessons learned are:

Balance Innovation and access

A balance between innovation and public access must be struck when designing computer technologies for children. Many of the features from both the *ICDL* and *Yahoo!Kids* website were relatively new and innovative, such as the location search method and the way books are displayed on screen for *ICDL*. As a result, the system requirement to access the website is higher (*Java runtime*, 256 MB RAM) than desired. Druin [20] argues that because of the high system requirements, many users

were frustrated because they were not able to use the website. Thus, it is important to have a fine balance between innovation and access.

Cater for users with advanced computer skills

The advanced search option is a prime example of this lesson learned. The default search method employed by *ICDL* is keyword search. To locate a book by keyword search, all the user has to do is key in words that are related to the book they are looking for. The advanced search on the other hand was designed for more advanced users, where books can be located based on finer attributes such as type, age and shape.

An Intergenerational team is necessary

The *ICDL* website is an intergenerational effort [3]. Simply having an adult team to design and implement the website and then asking children to evaluate it is not enough: their evaluation will be useful, but it will be too late to affect any major change, and it is not likely that children's suggestions will be accepted by adults [21]. A team made up of children and adults is important in the sense that team members who are children understand what children look for in books, and what interface tool are easy or difficult to use, fun or not fun [10].

2.6 Working with Children as Design Partners

“Working with group of young people intensively informed us about how we could improve services...”

Deborah Taylor, School & Student services Coordinate,
Enoch Pratt Free Library

This project is essentially about designing an application for children. Because of the generation gap [3] between the researcher and the target audience, it is important to include children in the design and evaluation phase of the research – Not only as testers to provide feedback, instead, to also include children as design partners to

provide insight into the needs and expectations of child users. This section elaborates on why it is important to work with children as design partners, followed by how to work with children as design partners and then the difficulties in working with children.

2.6.1 Why work with children as design partners

Despite children being one of the largest computer user groups [1], they are a marginalised group [3]. Children are seldom studied to understand their needs and expectations [22]. In libraries, when it comes to creating new services for children, adults generally talk about children, but rarely talk to them either in the planning of resources and services or in the evaluation of resources [23]. However, according to many recent studies, children want their opinions to be heard [24, 25]. Yohalem and Pittman point out that libraries need to change the focus from work for young people to working with them [26].

Children are most useful in helping design the motivating and fun aspects of software [21]. Because of the significant generation gap between the researcher and target audience, and because the needs and expectations of children are greatly different to those of the researcher, it is both natural and beneficial to work with children as design partners in this project.

2.6.2 How to work with children as design partners and difficulties

In order to work with children as design partners effectively, it is essential to find a suitable design model. The conventional *User Centred Design* (UCD) approach is often used to test and evaluate prototypes for designers [27]. The idea of this approach is that user is placed in the reactive role while the designer acquires feedback from the reactions from a user. Müller [28] argues that feedback from this approach is more about reaction, rather than initiation. Another problem with the UCD model is that the designers themselves might not be open to new ideas or discard their own ideas [29]. These issues hindered the successful application of the UCD model in certain cases [21]. Because of the limitations of the UCD model, this research has taken the *Participatory Design model*.

The *Participatory Design model* in essence is to respect users more as partners in the design process, in the form of giving them an equal role in the design phase. This approach hoped that users can jointly work together with the designer to develop a system that will fit their needs [30]. The *participatory design* was first used in Norway in the 1970's when computer professionals worked with members of the *Iron and Metalworkers Union* to enable the workers to have more influence on the design and introduction of computer systems into the workplace [31]. Greenbaum and Kyng [32] identify four issues for design:

- The need for designers to take work practice seriously—to see the current ways that work is done as an evolved solution to a complex work situation that the designer only partially understands.
- Recognize that we are dealing with human actors, rather than cut-and-dried human factors—systems need to deal with users' concerns, treating them as people, rather than as performers of functions in a defined work role.
- The idea that work tasks must be seen within their context and are therefore situated actions, whose meaning and effectiveness cannot be evaluated in isolation from the context.
- The recognition that work is fundamentally social, involving extensive cooperation and communication.

Even though children are the design partners of this research it is unreasonable to assume they will have the same level of input and responsibility due to their age. Hence, a new guideline for working with children must be introduced to accommodate this problem.

The first guideline is to be selective on children's ideas. Being selective is important in the sense that ideas from children are not always sound, and how does one know if what the child came up with is of any value or if it can be implemented in real world applications? What knowledge do children have that adults do not? Moreover, it is possible that children are just emulating existing designs and ideas [33]. Hence, it is important to be selective and know when to say *Yes* and when to say *No* to children's

ideas. While the decision of saying *Yes* or *No* should be based on the research's pedagogical and *HCI* based evolving design [34].

The second guideline is to understand who is in charge, the researcher or the children. The fact is that both are in charge, both parties should negotiate team decisions. This approach was preferred over the conventional idea where the researcher is in charge, based on two points. The first point is that the goal of this research is to design software for children and that giving children more voice over the design will be beneficial for this research. The second point is that children must learn to trust that adults will listen to their contributions, and adults must learn to elaborate on children's ideas, rather than only listening possessively or not at all [35].

Previous digital music organizers and their shortcomings for children

The previous chapter described some of the background information on this research. It identified the motivation for the research: it revealed why it is important to design and implement a digital music organizer for children. In addition, the previous chapter also explored the underlying structure of currently existing digital music organizers, relevant technologies such as *International Children's Digital Library*, and how to work with children as design partners.

In order to determine the strengths and weaknesses of conventional music organizers with respect to young users, this chapter describes the procedure and results from evaluations of the three selected digital music organizers.

The first part of the chapter will explain why these digital music organizers were chosen, followed by a brief overview of the organizers. The second section describes the participants and the process for evaluating these organizers. This takes the form of a focus group study, which aimed to overcome the distinct challenges of obtaining input from children. Finally, the results and the problems encountered during the evaluation will be detailed in the final section.

3.1 The Digital Music Organizers

Digital music organizers for children are rare or hard to find. The initial objective of this project is to evaluate previous digital music organizers for children aged six to ten years old. However, changes were made because there simply are not many digital music organizers for children available, both open source and commercial applications. After extensive search on *Google* and other search engines, *KidsPlayer* (Beta Version) was the only music organizer software that was designed for children. Consequently, it was decided that this project would also evaluate other popular digital music organizers intended for adults, to find out their shortcomings for children and try to build on the useful features. Hence, this project will be focusing on evaluating *KidsPlayer* and as well as two other existing and popular digital music organizers for adults: *Windows Media Player* and *iTunes*.

The three organizers will first be described in Sections 3.1.1 to 3.1.3, and Section 3.2 will discuss the evaluation procedure for the organizers. Results of the evaluation are discussed in Section 3.3.

3.1.1 Windows Media Player (Version 10)

Windows Media Player (WMP) is a proprietary software digital media player and media library application developed by *Microsoft* that is used for playing audio, video and images on personal computers running the *Microsoft Windows* operating system. The main features for *Media Player* include playback of audio and video, along with fast forward, reverse, seek and time compression and dilation. It supports local playback, streaming playback and progressive download as well. *Media Player* also provides full media management, via the integrated media library, which offers cataloguing and searching of media. Media can be arranged according to *album*, *artist*, *genre*, *data* etc (*Wikipedia.com*). See Figure 3.1.

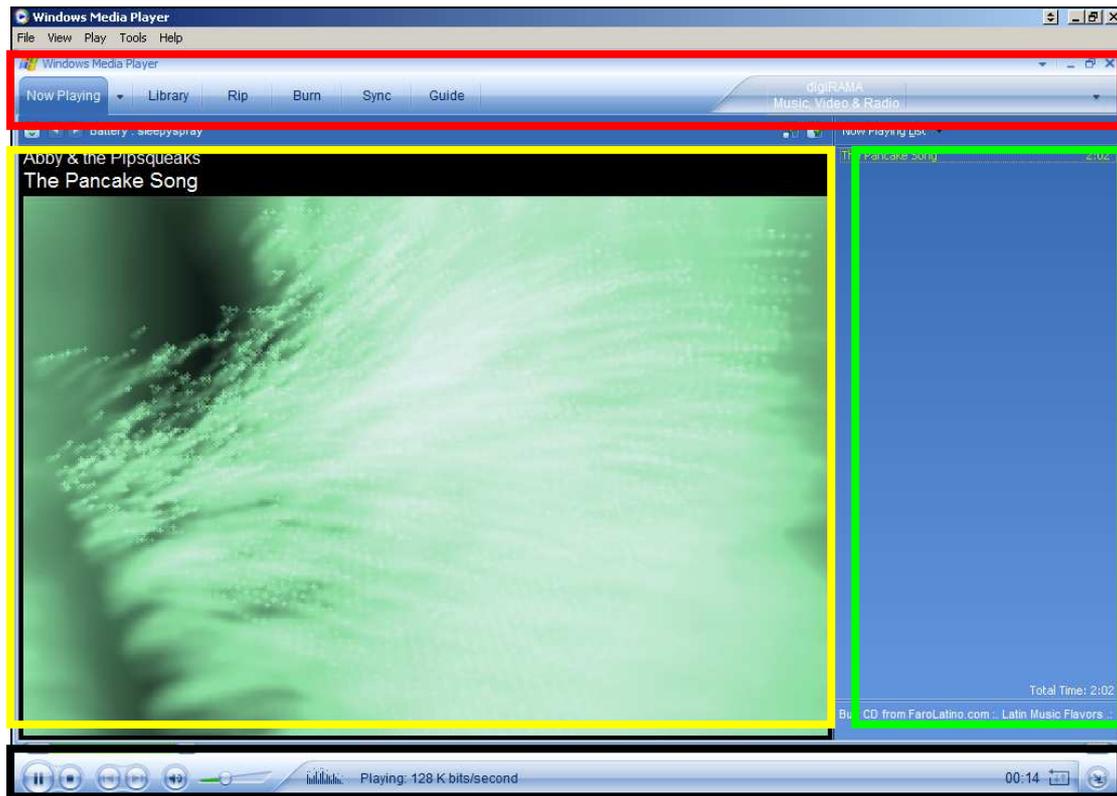


Figure 3. 1: The main screen of Media Player

In addition to being a media player, *Windows Media Player* also contains advanced functionality such as purchasing and downloading music from the Internet, burning music to CD and synchronising with handheld devices such as mp3 players. However, these advanced features are complicated and in most cases, beyond the needs and abilities of this project's target audience, therefore, the advanced features will not be examined further.

The main window of *Windows Media Player* has four sections (Figure 3.1): The first section is the tab containing shortcuts to other advanced functionalities such as access to the library window, ripping music from CDs, burning music to CDs and synchronizing with handheld devices. The tab is fixed on top, which means it is always accessible to the user regardless of which feature is in use. The second section is the visualisation area, occupying the largest screen area of the application. It displays animations that move in accordance with the currently playing music. The third section is the playlist manager area. The playlist manager area displays all the songs that are currently in the *Now Playing* playlist. A particular song can be played by double clicking its title. Alternatively, the user can also use the play button in the

playback control area. The last section contains the playback buttons. The fixed playback buttons area offers users control over music with playback functionalities such as *Play*, *Stop*, *Pause*, *Previous*, *Next* and *volume control*. Since this area is also fixed, it will be possible for user to assert control over the playback of music at any time. See Figure 3.1.

Recall not all the features on *Media Player* will be evaluated: apart from the main window, this project will also be focusing on the *Library window*. See Figure 3.2.

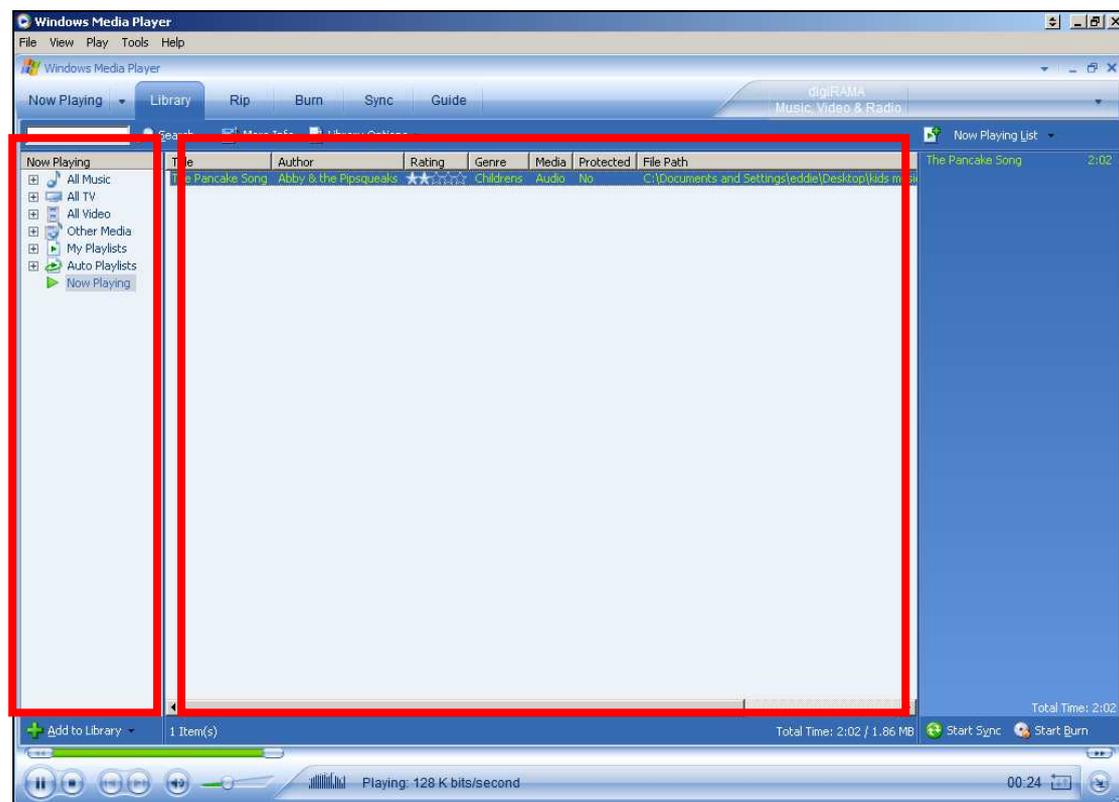


Figure 3. 2: The Library window of Windows Media Player

The *Library window* introduces two new areas: the playlists library (on the left) and the songs library (in the middle of the application). The playlist library contains various playlists, either automatically generated or manually added, while songs that belong to the selected playlist are displayed on the *songs library*. Songs can be played either by double mouse clicks or by clicking on the *Play* button of the playback control bar. Songs that are on display are represented by their attributes, such as *title*, *artist*, *duration*, *ratings*, and the file path of the song.

3.1.2 Apple iTunes (Version 7.01)

iTunes is a digital media player application, introduced by *Apple Computers* in January 2001, for organizing and playing digital music and video files. Additionally, *iTunes* can connect to the *iTunes Store* in order to download purchased digital music, music videos, television shows, *iPod* games and feature length films. Similar to *Windows Media Player*, *iTunes* is freely downloadable, bundled with all *Mac* computers and some *iPods*, and supplied with *Mac OS X*. It is also offered as part of *Apple's iLife* suite of multimedia applications (www.apple.com). See Figure 3.3.



Figure 3. 3: The Apple iTunes main window

In contrast to *Windows Media Player*, *iTunes* places more emphasis on organizing music collections, than on serving as a media player. This was evident in the overall layout of the main window. The *iTunes* interface can also be separated into three major areas: the playback control area, the library and playlist management area and the display area.

The playback control offers user the ability to play the selected songs, or if no songs were selected, it will play all the songs in the current playlists. It contains only three

buttons: *Previous*, *Play/Pause/Stop* and *Next*. The library and playlist manager positioned on the left shows all the features as well as playlists that the user can select from. The content (songs) of the selected playlist is then displayed on the large display area and ready for the user to play. Songs are represented on the display area by their attributes, such as *song title*, *artist*, *ratings*, *duration*, *album* and *genre*, and are separated with different background colours (light blue and white). Due to the scope of this project, only the *Music Library* feature will be examined.

3.1.3 KidsPlayer (Beta Version)

KidsPlayer was developed by *SororSoft*. It is a small standalone 32bit windows application with all familiar video/audio players' capabilities. The target age group of *KidsPlayer* is unclear (No details were given from the developers website); however, the look and feel of the interface suggests that *KidsPlayer* was designed for children aged ten and under.



Figure 3. 4: The main window of KidsPlayer

One of the fundamental differences between *KidsPlayer* and the previously described music organizers is that it was designed specifically for children. Because of this, it is not full of features like *Media Player* or *iTunes* – children will not find features, like

buying music from online stores, useful or necessary. *KidsPlayer* in general is a simple audio and video organizer.

The main window of the *KidsPlayer* consists of two parts: the playlist manager sidebar, and main playback window where the screen is embedded. Songs are displayed in the playlist manager window, represented by the title of the song. There are two ways to import songs into the playlist manager: the user can either drag and drop music files onto the playlist, or use the import button to locate songs on the file system with the help of the file open dialog. The main playback window allows the user to control the playback of songs with functions such as *Play*, *Stop*, *Pause*, *Previous* and *Next*.

In essence, *KidsPlayer* is more or less just a *Windows Media Player* “skin” that was designed specially for children. Most of its functionalities are directly from *Windows Media Player*. With the exception of being colourful and non-rectangular shaped, *KidsPlayer* failed to address the problems that children face in using computer applications (See Chapter Two).

3.2 Evaluation of Digital Music Organizers

A focus group [36, 37] is an informal technique that can be used to assess users needs and feelings both before the interface has been designed and after it has been in use for sometime. Participants are brought together to discuss new concepts and identify issues. It is also from the users’ perspective and participants should feel free to talk about their ideas. Because of this, focus group often brings out users’ spontaneous reactions and ideas through the interaction between the participants [18].

As part of the *Participatory Design model*, all three of the digital music organizers were evaluated by the focus group in May 2006. The evaluation was an empirical, controlled user study which compared all three of the organizers. It sought to evaluate both the usability and usefulness of the organizers and had three main goals:

- To determine the useful features of the organisers.
- To determine the ineffective features of the organisers.
- To determine children's needs and expectations of digital music organisers.

The study involved eight participants, all of whom were students in *Puketaha Primary School* in Hamilton and aged between six and ten years old. Three of the participants were female and five were male; the average age is 7.8 years old. All participants have regularly used a computer either at home or at school.

For the study, participants were asked to utilize all three organizers to perform some tasks. It was intended that the order of organizers and tasks were to be randomly selected to avoid the effect of partiality and transfer learning. However, this was not possible because some of the tasks needed to be completed before others and random selection of tasks was not possible. For example, songs must be loaded into the library before they can be played.

Before participants performed the required tasks, some question regarding their computer skill and background was first be asked to assess the computer skills of the participant. The researcher asked for participant's thoughts and impressions while they were performing the given tasks. After each organizer was evaluated, the participants were asked a series of questions regarding the organizer. A debriefing was held at the end of the session to provide the opportunity for further expansion of ideas. Tasks to perform were:

- Import songs from a specific folder onto the organizer
- Managing playlist: delete songs, assign genre, assign rating, etc.
- Load a saved playlist
- Play one or more songs

The tasks were designed to simulate all the basic minimum requirements of digital music organizers, such as importing songs into the music library, managing songs within the music library and playing songs within the music library. Since all three of the organizers were unique in their design and structure, there are different ways to

perform the same task. By observing how children respond to the different approaches on different organizers, this project will be able to build on the features that children liked and are capable of, while at the same time, avoiding features that are not well received or the children have difficulty performing.

At the end of the session, participants were given an opportunity to help the design of the new music organizer by designing their own as “homework”. All the participants agreed to do the extra design work and were asked to draw their design on a blank piece of paper and note down the functionalities that their design would be capable of.

In addition to questionnaires and debriefing, the behaviour and their interaction with different organizers were also noted on paper. Each session was also audio-recorded.

3.3 Evaluation

The evaluation on *Windows Media Player*, *iTunes* and *KidsPlayer* revealed many problems that children face when using organizers that are not designed for them. However, many features from the evaluated organizers were useful for children. In general, evaluations on the three organizers were hindered by significant usability problems, and the success rate on some of the tasks were low, such as importing music into the music library and creating a new playlist. These problems will be described in more detail in this section, which is divided into overall task performance, encountered problems and features which were well received by the participants.

3.3.1 Overall task performance

Import songs from a specific folder onto the organizer

The participants performed poorly in terms of importing music from a specific folder into the organizers. All participants required assistance from the researcher to locate the specific folder in order to import songs from it. This problem was also revealed in the questionnaire; 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.

Managing playlist: delete songs, assign genre, assign rating, etc.

iTunes was the favourite and the most efficient in managing playlists, mainly because playlists are both saved and loaded automatically; whereas *Media Player* and *KidsPlayer* require the user to save the playlist as a file and find a place on the file system to store the playlist file.

Load a saved playlist

All the participants preferred to let the organizer to manage playlists in terms of saving playlists and loading existing playlists. An interesting fact is that seven out of the eight participants did not understand the term “Playlist” or the concept of a playlist. In order to carry on with the study, the researcher had to explain to participants the concept of a playlist with the example that different songs can be played under different playlists; happy songs playlist, walking songs playlist and homework songs playlist. The participants understood and accepted the playlist concept easily, and agreed that they would use it to organize songs.

Play one or more songs

The debriefing revealed that the participants found the playback control in *KidsPlayer* the easiest to use, and the playback control in *iTunes* the most difficult to use. The questionnaire also exposed the same fact, in that *KidsPlayer* was the most preferred in controlling playback of songs, mainly due to *KidsPlayer*'s large and colourful buttons. Children like buttons to be big and colourful [10]. This was also the main reason why *iTunes* was the less liked: the buttons on *iTunes* are small and only in black and white colours.

In general, participants responded best to *Media Player*, with the exception of importing music into the organizer, which all participants performed poorly on in all three organizers. *Media Player* was the easiest for participants to perform most of the tasks. Four participants specifically pointed out that the layout structure, colours and visualisation of the *Media Player* made the tasks fun and hence easier to perform.

3.3.2 Problems encountered

During the study, participants experienced many problems with all the three music organizers. The causes of these problems range from the participants lack of computing skills to the limitation of features in systems.

Unable to locate and import songs from specific folder

Songs are imported into the organizers either by using the file open dialog to locate the folder or the music files or by dragging and dropping songs directly onto the interface of the organizers. The folder that contains the music for the study was placed in the root directory of the Windows drive, in order to make it easier for the participants to locate. However, all participants failed to locate the folder, and so assistance had to be given by the researcher. One possible cause of this problem is that children do not fully understand the file system of the operating system. Hence it was difficult for the participants to locate songs from the folder specified.

Playlist management was difficult

This is a particular problem for *Media Player* and *KidsPlayer*. After songs are imported and displayed on the playlist window, both the organizers do not provide any intuitive measure such as shortcuts to playlists to help user in managing the playlist with tasks like moving a song to another playlist, deleting songs and adding more songs into the current playlist.

In *iTunes*, however, it is easier for the user to perform the described tasks. Playlists are shown on the left to give the user a summary of all the available playlists. Therefore it is easier for the user to assign songs to different playlists. However, one major problem is that to rearrange or remove songs from the playlist, the user will have to use the right mouse click button, which will bring up a list of options. See Figure 3.5.



Figure 3. 5: List of options for managing playlists

Most of the options contained in this list are difficult for children to comprehend, so therefore this list creates confusion.

Saving and Loading of playlist was difficult

Both *Media Player* and *KidsPlayer* require the user to save any changes to a playlist, otherwise the changes will be lost. To save a playlist the user must first understand the file structure of the operating system they are using. Otherwise loading the saved playlist will be difficult to retrieve since the user has to navigate to the appropriate folder. Once again, this problem was better handled by *iTunes*. Instead of forcing the user to save or load playlists manually, *iTunes* manages the playlist for the user. See Figure 3.3. Playlists are automatically saved when they are created and loaded automatically when *iTunes* started up.

Unable to locate buttons on the interface

Participants had trouble locating all the buttons on the interface, especially for *KidsPlayer* and *iTunes*. *KidsPlayer* has a colourful interface with highlights. Buttons are wrapped in “bubble” shaped objects to draw attention. However, the bubble wrapping makes the button look like part of the background interface, and therefore participants had trouble in differentiating buttons from background graphics. In contrast, *iTunes* does not have a colourful interface, and was described by some of the participants as “Boring”. The buttons on *iTunes* were small, and unattractive, hence it was hard to take the attention of the user.

Information overload

Windows Media Player and iTunes provides too much information that is unnecessary for children. For Windows Media Player, unnecessary information is displayed such as the media type, whether the file is protected and the file path. iTunes goes further by providing the number of times that the song has been played and the last time the song was played. See Figure 3.6.



Figure 3. 6: Too many attributes are displayed on Media Player and iTunes

The problem with so many attributes displayed is that children will easily become confused and disoriented. Children simply do not know what to focus on when so much information is presented in front of them. This problem was made obvious during the one of the tasks, which was to find a song according to its title. This simple task turned out to be a challenge for many participants. The main problem was that participants did not know where to look for the specific song title. For adult users, it is intuitive to look for songs title under song title column. However, this was not the case for the participants of this project; they looked for the song title in all the attribute columns. Clearly, the problem is that when too many attributes are presented, children easily get lost in the sea of information.

Font size too small

The font sizes used in all three organizers were too small. All of the studies were conducted on 1024 * 768 resolution, which is the standard for computer monitors. Questionnaires revealed that four out of eight participants were unable to read the text properly and had to move closer to the screen for a better view because the fonts were too small.

Mouse problems

The study revealed that some of the younger participants had trouble using the mouse to perform actions such as double clicks, right click and drag & drop. Nearly all the participants attempted playing a song by double clicking on the text that represented the song in the music library. However, most of the participants failed this attempt because their double clicking speed is either uncoordinated or too slow. Children also find it difficult to distinguish the difference between a left and a right mouse click, with the most common misconception being that both the mouse buttons have the same functionality. Another problem is when using to the drag & drop technique to move songs from windows folder into the music library or moving songs from one playlist to another. Both of the described tasks were not executed well, with the problems such as inaccurate dropping and unintentional premature release of the button.

3.3.3 Features that children liked

The study revealed many problems with children using music organisers. However, many features from the described music organizers were well endorsed by the participants, as well as features that participants would like the organizers to have.

3.3.3.1 Windows Media Player

Windows Media Player was well liked among the participants, with four out of eight participants rating it as their most preferred organizer. This was mainly due to its interface layout and colourful visualisation that moves in synchronisation with music. All participants (including those that did not rate *Media Player* as their preferred organizer) agree that visualisation is an important feature for organizers. “*I like to see those colourful and moving graphics when I play my song*”, one of the participants commented. The interface layout of *Media Player* was another positive for the

participants. The participants liked the “clear and simple” layout where different functionalities of the organizers are positioned appropriately, for example, the visualisation window in the middle of the screen, songs are displayed on the right and playback controls are on the bottom. Following are the summary of the features that participants liked in *Windows Media Player*.

- Visualisation
- Clear interface layout
- Tool tip text assistance
- Buttons that have related functionalities are grouped together
- Volume control
- Handles playlists
- Seek bar

3.3.3.2 *iTunes*

None of the participants selected *iTunes* as their preferred music organizer, despite *iTunes* currently being the dominant music organizer for adults. However, the participants still pointed out number of features that they liked in *iTunes*, with clear interface layout, light blue and white background, and its rating system being the most noticeable features. Similar to *Windows Media Player*, participants also like *iTunes*' interface layout: Songs are displayed in the middle, playlist displayed on the left and playback controls positioned on the top. Participants also commented that the light blue and white background does an excellent job in separating songs from each other, thus the list of songs does not look convoluted and jumbled up. Participants also like the ability to rate songs in *iTunes*: “*So I can give five stars to my favourite songs!*”, one of the participants commented. Following is a summary of features that participants liked in *iTunes*.

- Clear interface layout
- Similar functionalities grouped together
- Blue and white colour used to separate songs – easier to see
- Song slider
- Rating System

3.3.3.3 KidsPlayer

The other four participants picked *KidsPlayer* as their most preferred music organizer. This was mainly because the interface of *KidsPlayer* is made up of bright colourful shapes and big buttons with highlights. Children are fascinated by bright colourful designs [10]. The interface design of *KidsPlayer* suggests that the designer understood this fact. Participants became interested in *KidsPlayer* during evaluation as soon as they saw the *KidsPlayer*: they became proactive in exploring all the features in *KidsPlayer* to find out what they can do with it, which was not the case for *Windows Media Player* and *iTunes* where participants were reluctant to search for and explore new features. The big buttons with highlights also help participants in recognizing it as a button, and hence, can be clicked. Following are the summary of features that participants liked in *KidsPlayer*.

- Bright and colourful interface
- Buttons that have related functionalities are grouped together
- Large buttons
- Playlist manager can be hidden away
- Use of object and shapes in interface to present functionalities

3.3.3.4 Features participants want

One of the questions for participants was “*What other features do you want to have in a music organizer?*”. It turned out that most of what participants wants are already in the three described music organizers, such as the ability to rate songs, make new playlist and watch visualisation. The only feature suggestion that was not included in the current organizers is the ability to play games while listening to music. Participants explained that they wanted to do something while they listen to music, and wanted something other than watching the visualisation all the time.

3.4 Conclusion

The evaluation phase was generally positive. It illustrates both the flaws of the organizers for children and features that children liked in *Windows Media Player*,

iTunes and *KidsPlayer* as music organizers. More importantly, two key points were revealed. Firstly, children do not like matters to be complicated – more is not better for children. They often are confused and lost when too much information is presented. *Windows Media Player* and *iTunes* best demonstrated the problem of information overload. Secondly, with the first key point in mind, emphasis however, cannot be solely placed on the look and feel of the interface. What is more important is to the underlying structure of the application that is easy for children to manage and navigate. These two key points are very important as they helped to shape the design and the structure for all the future designs.

Kid's Music Box: a digital music organizer for children

The motivation for creating a digital music organizer for children has been described in Chapter Two, as has the potential benefits the software would offer to children aged between six and ten year-olds. In order to find out what children want in a digital music organizer, three popular digital music organizers have been identified and examined in Chapter Three. Hopefully, the *Kids Music Box* can inherit the positive and avoid the negative ideas from those similar digital music organizers. This Chapter presents the final design of the *Kid's Music Box*. The goal of this chapter is to illustrate all of the functionalities of the system. This is done by describing the usage of the system, in terms of use cases of intended usage. The design rationale of the final design is then discussed in Chapter Five. Evaluations by experts and children on *Kid's Music Box* are examined in Chapter Six.

4.1 Description and Usage



Figure 4. 1: The main window of Kid's Music Box

Kid's Music Box is developed with *C#*, *MySQL* and *Macromedia Flash*. The programming language *C#* was preferred over other language such as *Java* is because it offers more *rapid development*. This means that the interface of the application can easily be previewed and modified. *MySQL* database was used to store all the account and song information and to provide feedback to queries made by users. *Macromedia Flash* was used to construct all the interactive functionalities of *Kid's Music Box*, such as interactive buttons and the playground in the visualisation area. Figure 4.1 shows the organizer window of the *Kid's Music Box*.

The underlying structure

The backbone of *Kid's Music Box* is developed in the *C#* programming language. The main window of the system is based on a modified standard window form to allow non-rectangular windows and custom interfaces. The interfaces are designed in *Adobe Illustrator* and exported to *C#* as the background of the system. System components

such as *Windows Media Player*, *Picturebox*, *Listview*, *Text box*, *Flash objects* and custom *Listview* are then added on top of the background.

MySQL database support

The *MySQL* database is used to store songs and playlists called ‘favourites’ in *Kid’s Music Box*. A database is created for each new account and a new table is created for each playlist, while songs are entries within the table. A connection to the database is opened when a command to run *Kid’s Music Box* is executed. Once the connection is successful, all the relevant information is returned to the system; all the accounts are displayed in the *Login Window*, all the playlists are displayed on the *Playlist Library*, and all the songs are displayed on the *Music Library*.

Metadata extraction

In order to import songs into the music library in *Kid’s Music Box*, the user is required to point the application to the folder where songs are kept. All songs within the selected directories are imported into the music library recursively. The actual content of the song is not imported into the organizer; instead, only the song’s metadata is extracted and the information is then added to the music library (*song title*, *artist*, *album*, *genre*, *duration* and the *absolute file path*). Once all the required information is extracted from the music file, a new entry is made in the *Music Library*.

The Music Library

The *Music Library* where songs are displayed is essentially a custom *Listview*. It was necessary to modify the *Listview* to allow dropdown boxes for assigning playlists and ratings, multiple background colours, custom images and a custom sort routine.

The Playlist Library

The playlists displayed in the *Playlist Library* are essentially database entries. When a playlist is selected, a *MySQL* query containing the name of the selected playlist will be sent to the database. The result of the query is then collected and formatted to be displayed on the *Music Library*. The same principle applies when deleting playlists; a delete command which contained the name of the to-be deleted playlist is sent to the database. All the song entries belong to this playlist are deleted first, followed by the removal of the playlist entry.

The Interactive Area

The *Interactive Area* consisted of three components in different layers: the *Picturebox*, *Windows Media Player*, and the *Flash Objects*. The *Picturebox* is used to display images from album and gifts. *Windows Media Player* is used for media playback and visualisation. The *Flash Objects* are used as a platform for hosting *Flash* games. Only one layer is visible to the user at a time, see Figure 4.26.

The Flash objects

Flash objects are utilised extensively in *Kid's Music Box*, in the form of buttons and interactive games. The *Flash Objects* are first developed in *Macromedia Flash* and then exported as a stand-alone executable file. Because C# and Flash are different programming languages, a significant amount of time was spent on finding out how to communicate between the two languages. Therefore, when a button is clicked on the *Flash* object, an appropriate command message is sent to C# to execute the action.

4.1.1 The Login Window

The Login window will appear first when the application is executed. See Figure 4.2.



Figure 4. 2: The Login Window

The *Login window* allows multiple users to create their own account for the organizer. Hence all the users will have their own collections of music, and users can organize music the way they like and will not have to worry about other users.

The *Login window* consists of a *Macromedia Flash* object that is boxed in *Section B* and is positioned on the bottom of the window. This *Flash* object contains three interactive buttons. On the right side of the window, the *Section A* box contains a panel that is used to show all the currently existing accounts. For example, Figure 4.2 contains three accounts: *Public*, *Edmond*, and *Kelly*. The Main functionalities for the *Login window* are to configure *Parental settings*, *create account*, *remove account*, *login* into the *Main window* and exit the program.

Before a user can access their organizer window by logging into in their account, parental settings must be configured. To open and configure the *Parental settings* window, click on the *Parental Setting* interactive button. This action will bring up a new window see Figure 4.3.

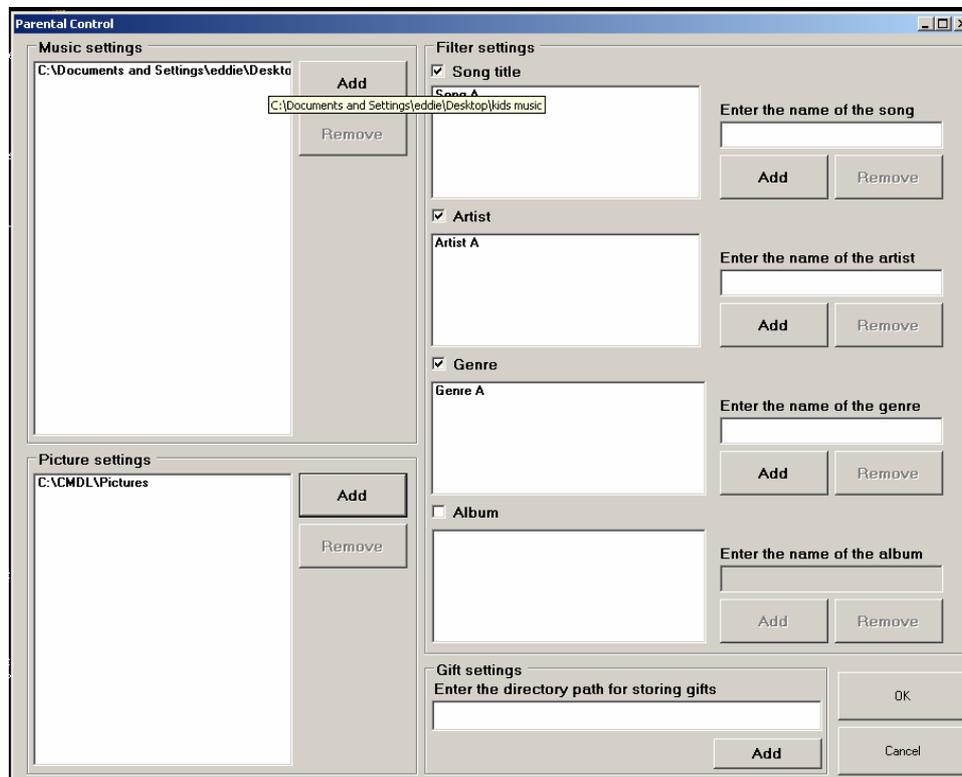


Figure 4. 3: The Parental Settings window.

Since the *Parental Settings* window is designed for adults, the interface is built as a standard windows form. Parents are expected to know the directories where songs for their children are stored, as well as appropriate pictures.

There are four key sections within the *Parental Setting* window: *Music settings*, *Pictures settings*, *Filter settings* and *Gift settings*. The *Music settings* section allows users to add or remove folders. Since only songs stored within these folders are imported to the organizer window automatically, this setting aids children in importing music into their organizer. At the same time, parents will have some control over what is, and what is not allowed for their child. To add a music folder, the user must first click the *Add* button, and a file open dialog will subsequently appear. The user then selects the folder where the music is stored. To remove a music folder, the user selects the music folder and then clicks on the *Remove* button. Songs that are stored in the music folders will be automatically imported to the users' account next time the user logs into their account.

The *Picture setting* is similar to *Music settings*. It is a tool to help children with importing pictures and at the same time allow the parent to have some degree of control over the content of the music and pictures allowed. Folders with the appropriate images can be added to this list by clicking on the *Add* button, and be removed by selecting the folder and clicking on the *Remove* button. See Chapter Five for reasons why pictures are important in a music organizer.

The *Filter settings* allow parents the option to prevent songs that are not suitable to their children by using the restricted list against the song's metadata before importing. Only songs which pass the checking procedures can be added to the organizer. The filter options are *Song title*, *Artist*, *Genre* and *Album*. These settings are disabled by default; to enable these settings, the tick boxes above each of the filters will have to be checked. See Figure 4.3.

The final section is the *Gift settings*. A gift is essentially a single file which included text, image, and songs made by *Kid's Music Box* for another *Kid's Music Box* to open. The purpose of this setting is to allow parents to predefine the default directory where gifts are to be stored. When all the settings are configured and the *OK* button is

clicked, all information is saved to a file. The next time when *Parental Settings* button is clicked, setting variables are loaded into the form from the saved file. Any changes made will be saved on top of the old saved data.

After the parental settings are configured, the actual user of the music organizer can now log into the *main window*. But first, a new account must be created first. See Figure 4.4.



Figure 4. 4: Creating a new account

To create a new account, the user assigns a name to the account and picks a picture to represent their account on the *Login window*. Pictures that are on displayed in this window are from the folders that were added by parents in the previous section. If the user wants to have more pictures to choose from, and is comfortable with the file structure of their computer, they can use the *Get more pictures* button, or just ask their parents for help. A file open dialog will appear and prompt the user to locate the pictures.

The other three buttons are *Cancel*, *Reset* and *OK*. Clicking on the *Cancel* button will take the user back to the *Login window* and does not create a new account. The *Reset* button will reset both the name and the picture selected for the new account. The *OK* button confirms the name and the picture selected for the new account and creates a new account.

After the account is created, it is then displayed on the *Login window* and is represented by the picture that was chosen when creating the account. With the account shown in the *Login window*, the user can login to the organizer window by left mouse clicking on the picture that represents the account. Once the picture is clicked, the *Login window* will disappear and the organizer window will appear. In the case of removing an unwanted account, the user is required to right mouse click on the picture that represents the account to be removed. A confirmation box will appear for the user to confirm the remove account action.

The *Login window* also contains the *Exit* button, where the user can terminate the music organizer application.

4.1.2 The Organizer Window

Before the *main window* is displayed on screen, the music organizer will load all the songs from the music folders that were added from the *Parental Settings* window into the *Music Library*. The *main window* can be categorised into four groups; *music box* (Playlists) manager, *music manager*, *visualisation* and *global control*. See Figure 4.5. Buttons are implemented in *Flash*, to give an interactive effect: whenever a mouse cursor rolls over a button, the size of the button increases to inform the user that the mouse cursor is currently on top of a button. Tool tip text is also available for all the buttons to provide feedback on the functionalities of the button selected.



Figure 4. 5: The Organizer window

4.1.2.1 Music Box Library

The main function of the music box library is to display all the music boxes (Playlists) that are currently available. 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 on the *Music Library*. To change to another box, the user simply clicks on a different box, and consequently songs that belongs to this newly selected box will also be updated in the music library.

There are four buttons located next to the music boxes, these buttons leads to four different functionalities of the organizer. These functionalities are *remove music box*, *search for songs*, *make a new music box* and *get songs from CDs*. See Figure 4.6.

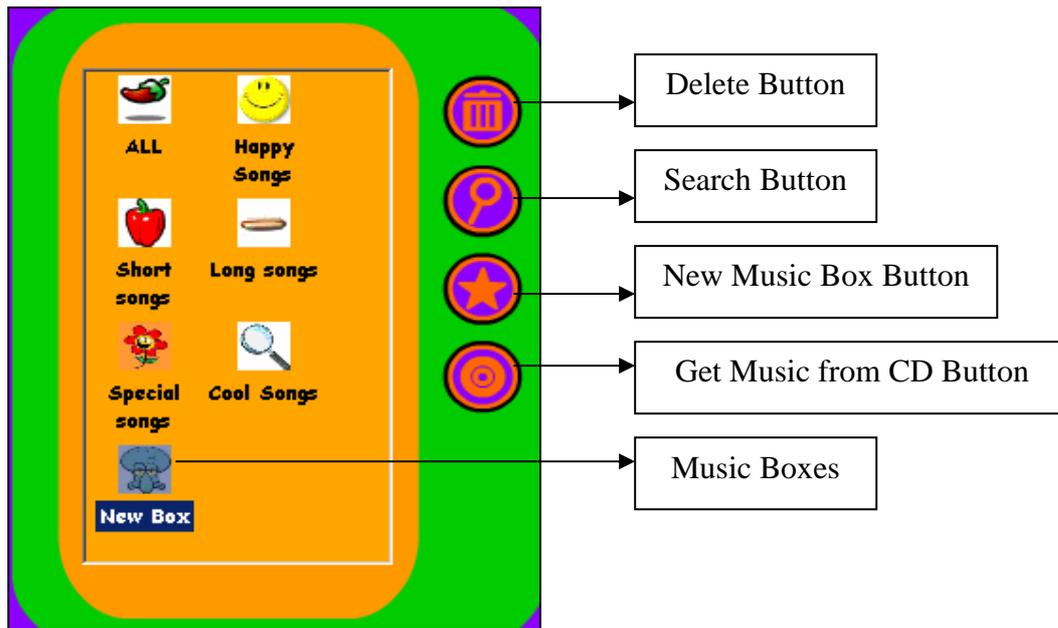


Figure 4. 6: The Music Box Section.

Initially, *Kid's Music Box* has only one music box called *ALL*; the songs that are imported at the loading phase are imported and placed under the *ALL* music box. It is then up to the user to rearrange their songs in a way that they want. The box *ALL* displays all the songs within the music library, not just a particular one. Figure 4.5 demonstrates all the songs in the music library.

The topmost button is the *Remove* button. To remove a music box, the music box that is to be removed must first be selected, and then clicks on the *Remove* button. This action will also trigger the removal of all the song entries from the music library.

The *Search for songs* button allows the user to search for songs across all the music boxes. To search for songs, the user will have to click on this button and a new *Search for songs* window will appear. See Figure 4.7.

The name of the song:

Singer:

- Trout Fishing in America
- Liz Buchanan?0?t???
- The Tomato Collection Friends
- Joe Thompsonake My Toys Away
- Bill Crosby
- Teacher And The Rockbotsng T
- Katherine Dines
- Joe Thompsone Bathroom?

In which music box:

Song rating:

Figure 4. 8: Search by artist

Since all the artists available from the dropdown box were extracted from the currently existing songs, there will at least be one song for any artist. In this example, the artist “*The Tomato Collection Friends*” was chosen and the result is then displayed. See Figure 4.9.

Search for songs 

The name of the song:

Singer:

In which music box:

Song rating:

*	Name	By	Rating
 ALL	Little Man Jay	The Tomato Collec...	😊
 ALL	Sweet Pea Emily	The Tomato Collec...	😊

Figure 4. 9: Search for songs by Artist

Another alternative way to search for songs is by the music box that songs belong to. The playlist dropdown box contains all the existing music boxes for the user to choose from. See Figure 4.10.

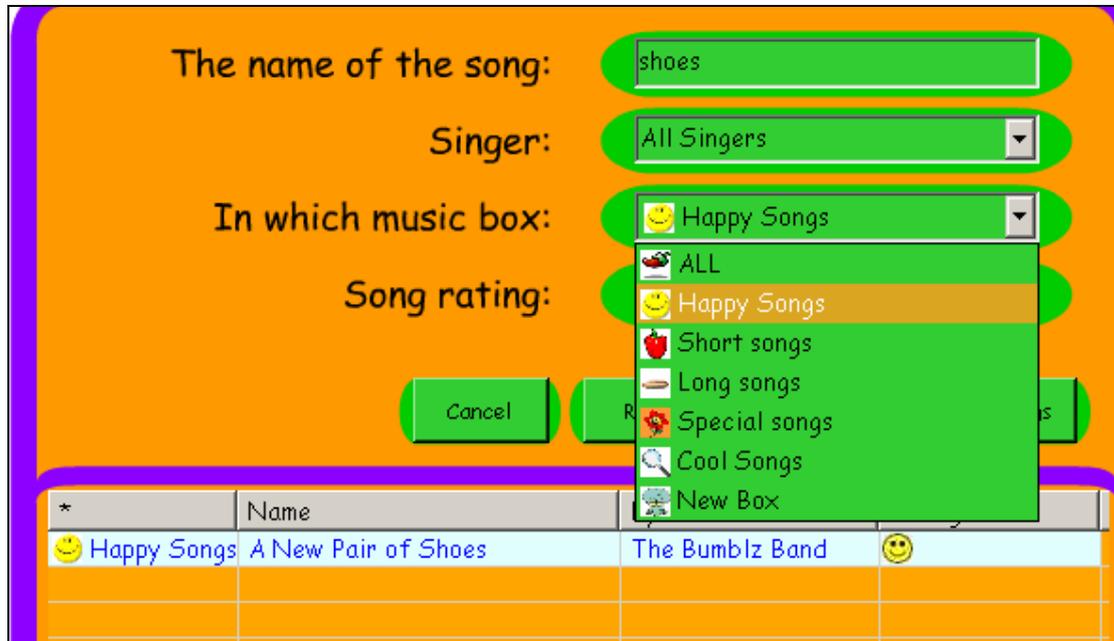


Figure 4. 10: Search for songs in specific music box

For example, in Figure 4.10 the user wants to find all the songs that contains the titles contains the term “shoes” and at the same time, only from the “Happy Songs” music box. After the *Search button* is clicked, the results are then displayed.

The final alternative way to search for songs is by song ratings. See Figure 4.11.

The name of the song:

Singer:

In which music box:

Song rating:

*	Name	By	Rating
😊	Happy Songs: A New Pair of Shoes	The Bumblz Band	😊😊😊😊😊
😊	Happy Songs: beebo - browniemonsterman.m...		😊😊😊😊😊
🎸	Special song: Chugga chugga ding ding	Liz Buchanan	😊😊😊😊😊
🎧	Long songs: downbythedocks - makesound...		😊😊😊😊😊

Figure 4. 11: Search by ratings

In Figure 4.11 the user is looking for songs of any name, any artist, in all the music boxes, which have rating of 5 smiley faces. After the search results are returned and displayed, the user will have the option to *Reset* the search terms – to reset all the variables and start from all default variables. Or the user can exit the search window by clicking on the *Cancel* button. Finally, the returned search results can be saved, and stored in the organizer window as another *Music box*. This can be done by clicking on the *Keep Songs* button. If the user decided to keep the results as another *music box*, a window will appear prompting the user to assign a name to the new music box. See Figure 4.12.

Give it a name!

Please enter a name for this new music box!

Figure 4. 12: Prompts the user to enter a give for the new music box

Since the search was for all the 5 star songs, the name “5 stars” was assigned to the music box. Once the OK button is clicked, the search window will disappear and the organizer window with the newly added 5 stars music box will appear. See Figure 4.13.



Figure 4. 13: The newly added music box

In Figure 4.13, the music box “5 stars” is selected; by selecting this music box will trigger all the songs that is associated with this music box to be displayed in the music library, which are the songs of 5 star ratings

Creating a new music box is the next functionality to be discussed. This allows user to create music boxes to organize songs. To create a new music box, the user will have to click on the *Add a Music Box* button. See Figure 4.6. A wizard style window will appear to get all the required information to make the new music box. See Figure 4.14.



Figure 4. 14: Creating a new music box

This window is exactly the same as the *create new account* window from the *Login Window*; the difference here is that this is used for making a new music box, whereas the other window was used for the creating new accounts. Similarly, the user is required to enter the name for the music box, and select a picture to represent the music box. The *OK* button is to confirm creating the music box. The *Reset* button is to restart the music box creation by resetting all the fields back to default values. The *Cancel* button is to cancel creating music box. After the *OK* button is clicked, the program will take the user back to the organizer window. Now the organizer window will have the newly added music box called “*New Box*”. See Figure 4.15.

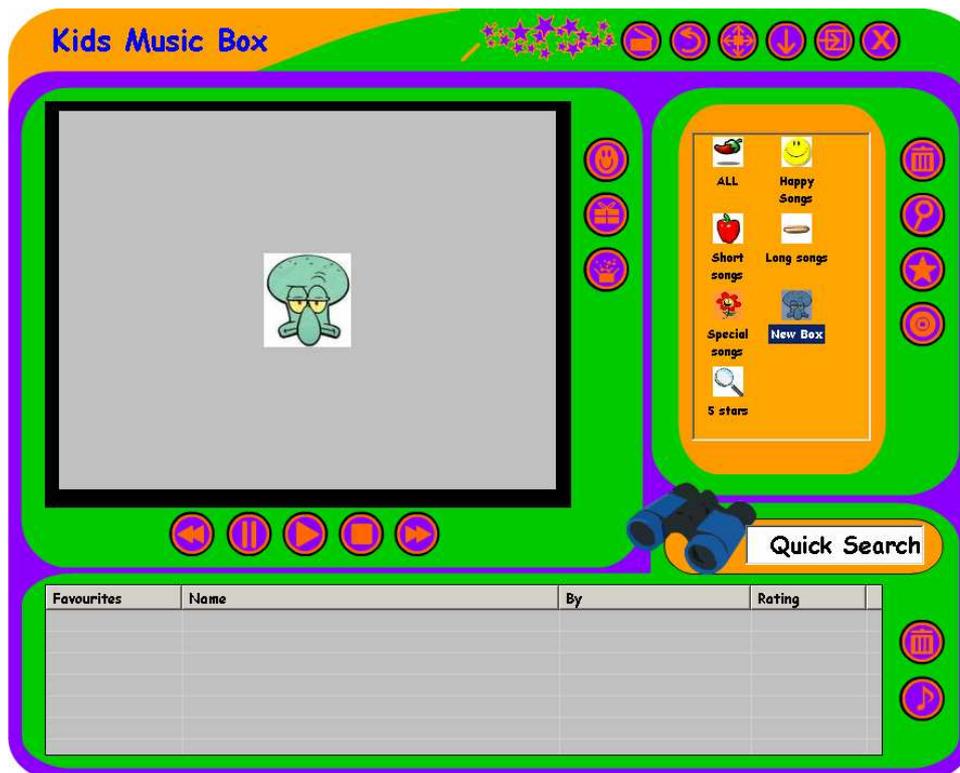


Figure 4. 15: The Newly added music box “New Box”.

Figure 4.15 shows the initial state of the music box “*New Box*”, which contains no songs and the album art displayed on the visualisation area. Additionally, this newly added music box is now ready for users to allocate music into it.

The last functionality from the music box library is extracting music from CDs. In order to extract music from CD, user have to make sure the CD is inserted into the CD-ROM drive. Once the CD is ready, the user clicks on the *Music from CD* button. A message will appear informing user that extracting music from CD is only legal if the user owns the CD. After user confirming that the CD is in fact legal, a wizard guides the user in extracting the songs from CD. See Figure 4.16.



Figure 4. 16: The music-from-CD wizard

In order to extract music from audio CDs, the user is required to perform three simple tasks. The first task is to select the CD-ROM where the CD is inserted. The second task is to assign a name for the CD box. Thirdly, user must choose the appropriate picture to represent the CD box. In this example, the CD is inserted into E drive and consequently E drive was selected. The name for the CD box is called “*COOL CD*” and finally, a picture is selected to represent the CD box.

The reset button will reset all the enter information to empty strings. The Cancel button will terminate extracting music from audio CDs. The *OK* button confirms to extract music from audio CD. In this example, the *OK* button was clicked; a progress window will appear to inform users on the progress. See Figure 4.17.



Figure 4. 17: The music extraction progress

The procedure of music extraction is essentially split into three steps. The first step is to copy the raw format of the songs onto the hard drive. The second step is to convert all these raw and large music files into smaller *MP3* files. The third and final step is to add the newly converted songs to the organizer, with the assigned name and the chosen picture to represent the music box.

The *STOP* button is provided to allow the user to terminate the procedure at anytime. Once both the extraction and conversion procedures are completed, both the wizard and *Getting Music From CD* window will disappear and the organizer window will appear. See figure 4.18.



Figure 4. 18: All the songs extracted from CD are placed in a music box

Figure 4.18 shows that the newly added music is called “*COOL CD*”, the picture that represents the music box is displayed on the visualisation area, and all the songs extracted from CD are displayed on the Songs section.

4.1.2.2 Music Library

The music library displays all the songs that are contained in the currently selected music box. The main functionalities for the *Music Library* are: *rearrange songs to different music boxes, assign ratings to songs, performing the quick search function, import songs and remove songs.*

Each song is displayed by their attributes: the music box it belongs to, the *song title*, the *artist* and the *song rating*. Songs can be sorted by all the above attributes. For example, if the user wants to sort songs by the boxes they belong to, the user has to click on the *Favourites* header. The same applies to the *name*, *artist* and *rating* headers as well, which can be ranked in both ascending and descending order. See Figure 4.19.

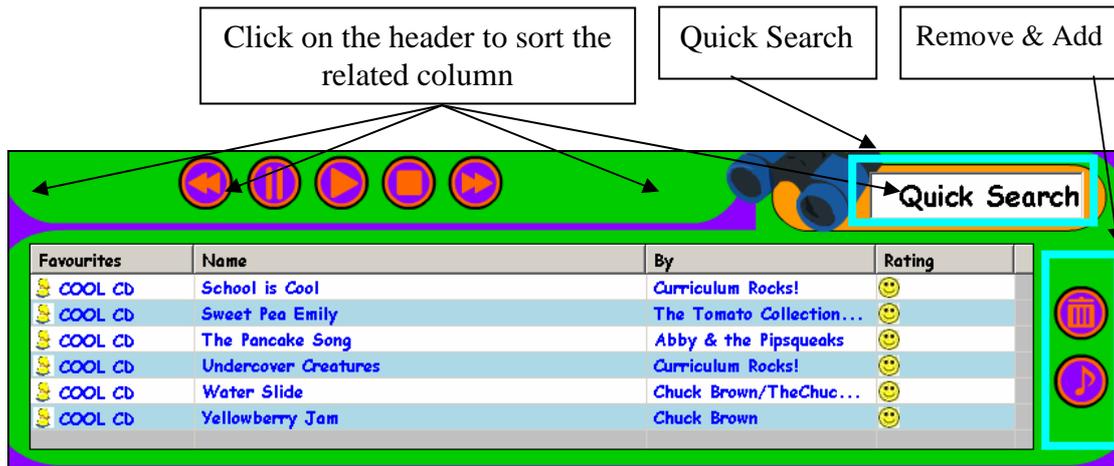


Figure 4. 19: The music library

Apart from sorting songs by their attributes, the user also has the ability to rearrange songs to other music boxes and to rate songs. Recall that songs displayed in the music library belongs to the selected music box; for example in Figure 4.19, all the songs are from the “*COOL CD*” music box. Moreover, if the user wants to move one or more of the songs to another music box, all that is required is click on the picture that represents the current music box that the song belongs to, and to select (from the drop down box) the other music box that the song is intended to be stored in. See Figure 4.20.



Figure 4. 20: Choosing another music box for the song

All the available items from this drop down box are extracted from the currently available music boxes. The organizer uses the same principle to support the assigning of ratings for songs, as well. Songs are rated by the user. The options are one to five smiley faces. See Figure 4.21.

Favourites	Name	By	Rating
COOL CD	School is Cool	Curriculum Rocks!	☺
COOL CD	Sweet Pea Emily	The Tomato Collection...	☺
COOL CD	The Pancake Song	Abby & the Pipsqueaks	☺☺
COOL CD	Undercover Creatures	Curriculum Rocks!	☺☺☺
COOL CD	Water Slide	Chuck Brown/TheChuc...	☺☺☺☺
COOL CD	Yellowberry Jam	Chuck Brown	☺☺☺☺☺

Figure 4. 21: Assign rating to songs

Additional songs can be imported to the music library. To import one or many songs, user will first have to decide which music box that the songs will be imported into. For example, if the user wants to import songs to the “Cool CD” music box, the first step is to select the “Cool CD” music box. All the songs that are already exist in the music box are then displayed (see Figure 4.19). The second step is to click on the *Import music* button. A file open dialog will appear. The user will have to navigate through this dialog to locate songs that are to be imported. After clicking on the *OK* button to confirm the songs to be imported, all the selected songs will then added to the “Cool CD” music box.

To remove one or many songs from the *Music library*, the first step is to highlight the song by selecting it, then to click on the *Remove button*. See Figure 4.19.

The last functionality of the *Music Library* is to allow users to perform quick searches for songs. The fundamental differences between the Search function from the *Music box Library* and the *Quick Search* from the *Music Library* is that the *Quick Search* only searches in the currently open music box, where as the *Search function* from the music box library searches from all music boxes. The *Quick search* function also gives instant feedback on results based on currently entered search information. For example, if the user wants to search for a song that contains the term “School” in the song title, they have to type in the word “School” in the quick search box. See Figure 4.22.

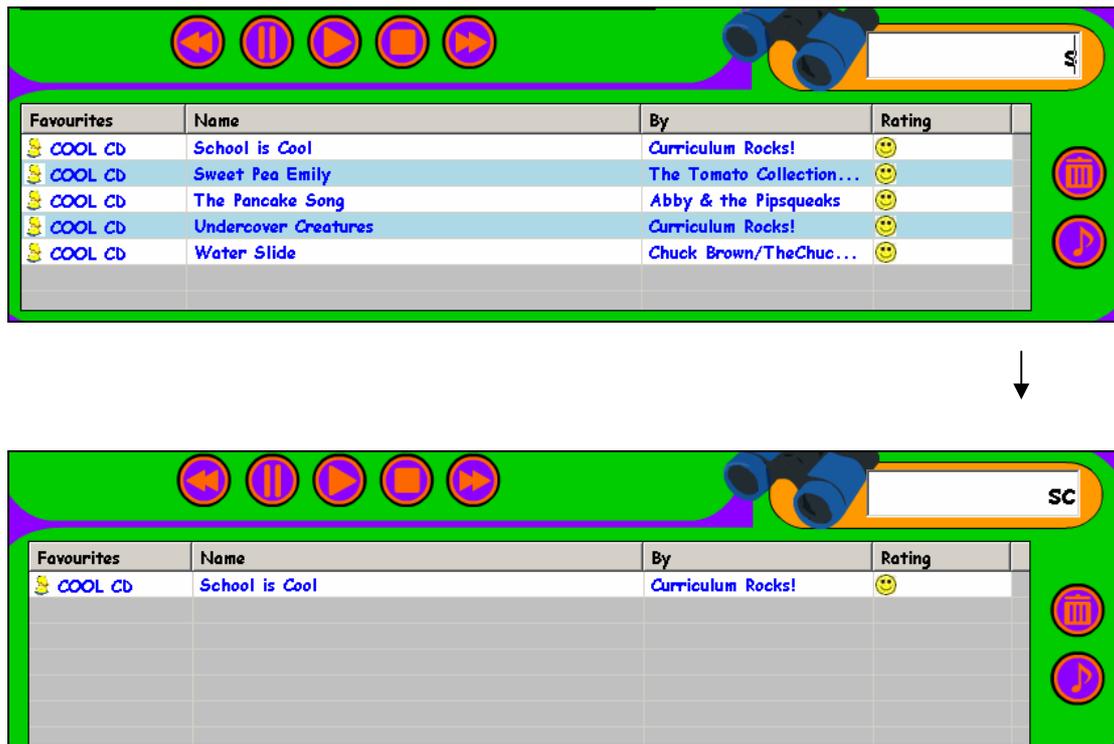


Figure 4.22: The Quick Search Function

As more and more of the search term is entered in the *Quick search box*, the result list is filtered down, and the result is then displayed to the user instantly.

4.1.2.3 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 visualisation* by using the embedded *Window's Media Player*. See Figure 4.23. The games and visualisation are essentially samples – in a non-prototype version, it would be more appropriate for users to manually insert their own games (see Section 7.2).

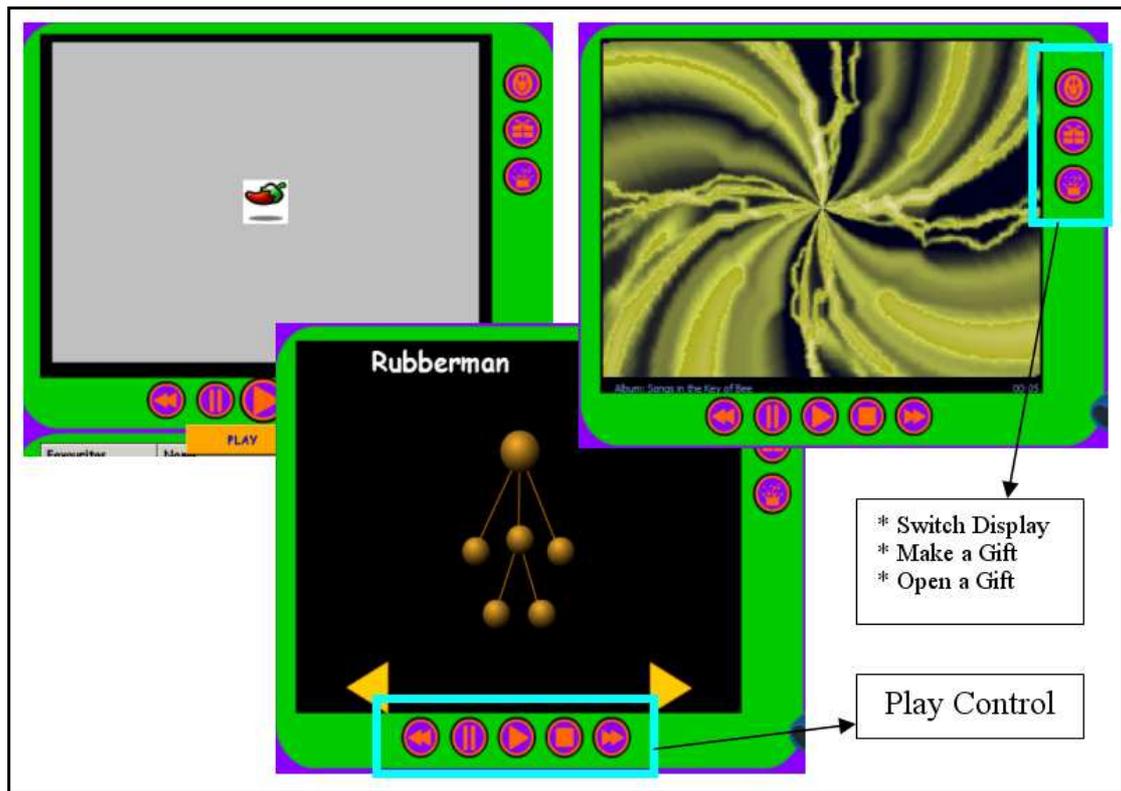


Figure 4. 23: The Visualisation window

By default, the image that represents the current music box is displayed. The image changes when a different music box is selected. To change the visualisation area from the image viewer to the *Playground*, user will have to click on the *Switch Display* button. The *Playground* is made up of several miniature *Flash* games. These games can be changed by using the yellow arrows. See Figure 4.24. The *Rubberman* game used in this research, with the author's permission, was from the Flash Kit website (www.flashkit.com).

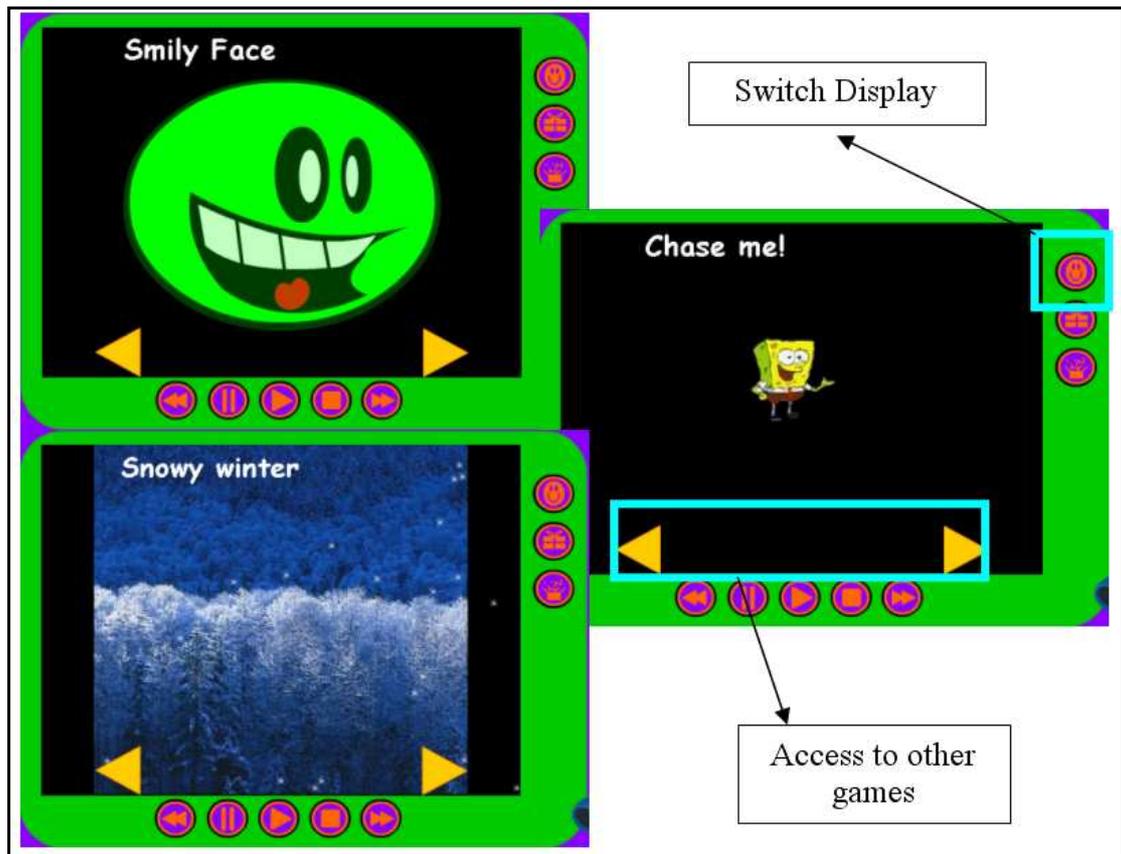


Figure 4. 24: A range of Flash games

While the visualisation area is displaying *Flash* games, the user can click on the *Switch Display* button to change the display area into music visualisation. The music visualisation is showing from the embedded *Media Player*. The visualisation displays various animations that are synchronised with the currently playing song. See Figure 4.25.



Figure 4. 25: Music visualisation

While showing visualisations, if the user clicks on the “*Switch Display*” button again, the visualisation area will returns to the *Album art* display window. See Figure 4.26 for the structure of the visualisation area.

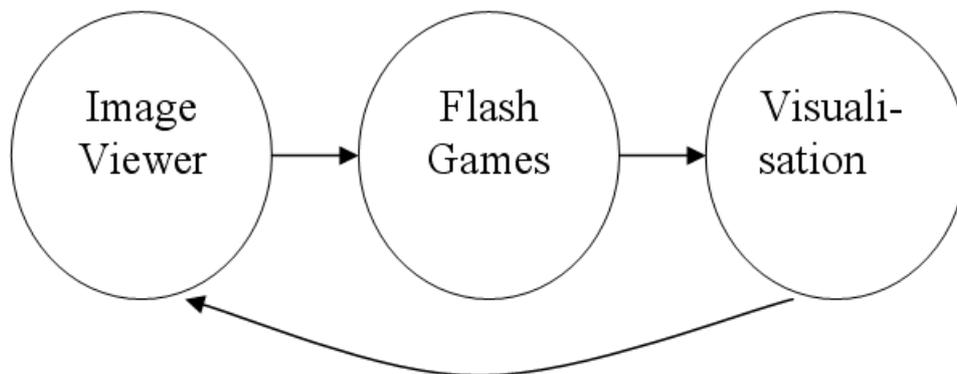
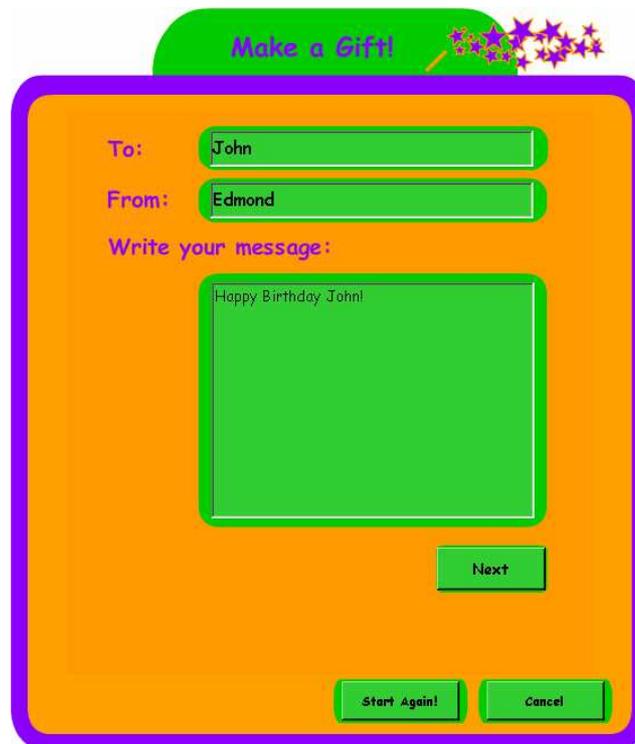


Figure 4. 26: The visualisation area

The next feature of the *Music box* that can be access from the visualisation area is making a gift. The final product of the gift is combined into one file, where it can be opened on any other *Kid’s Music Box* music organizers. To make a gift, the users click on the *Make a Gift* button See Figure 4.25. The organizer window will be minimized to the tool bar and a new wizard window called *Make a Gift* will appear.

This window acts as a wizard for guiding the user through the procedure of making a gift. See Figure 4.27.



The image shows a graphical user interface for a 'Make a Gift!' wizard. The window has a yellow background and a blue border. At the top, there is a blue banner with the text 'Make a Gift!' and a small graphic of purple stars. Below the banner, there are three input fields: 'To:' with the value 'John', 'From:' with the value 'Edmond', and a text area labeled 'Write your message:' containing the text 'Happy Birthday John!'. At the bottom right, there is a 'Next' button. At the bottom center, there are two buttons: 'Start Again!' and 'Cancel'.

Figure 4. 27: Make a gift wizard

The first window of the wizard will ask the user to enter all the required information for the gift; these details includes the name of the receiver, the name of the sender and the message to the receiver. In this example, the receiver is *John*, sender is *Edmond*, and the message is “*Happy Birthday John*”. The user can now proceed to the next window by clicking on the *Next* button, or reset the form using the *Start Again* button.

The next part of the wizard is to select the songs that are to be included in the gift; the *Next* button is clicked to get to the next part of the wizard. See Figure 4.28.



Figure 4. 28: Add songs to the gift

Initially, the wizard window shows all the songs from every music box. Instead of showing all of their attributes such as genre, artist etc, only the song titles are displayed, along with an image of a green tick or red cross. A green tick next to the song symbolises that the song is to be included in the gift, whilst by default, all of the songs were assigned with a red cross, indicating that they are not going to be included in the gift.

In the case of the *Music library* containing too many songs, or if the user is confident with the *Music Box program*, the *Advanced Options* button is provided. The idea of the *Advanced Options* is to allow user to narrow down the songs to choose from in the wizard window. By default, the advanced options are hidden to avoid confusing the user with too many boxes to fill in. The *Advanced Options* can be accessed by clicking on the *Advanced Options* button. See Figure 4.29.



Figure 4. 29: The advanced options

In order to limit the number of songs showing in the wizard window, the search function is integrated with the *Make a Gift* wizard. The search function works exactly as the normal search function that was explained in section 4.1. The user can search by the song title, artist, music boxes and song ratings. In this example, the song title “*School*” was entered, while all other fields are left unchanged. In the results fields, the only song that contains the word “*School*” in either the title or the artist name is displayed, coupled with a cross next to it. To include this song, the user has to click on the red cross to change it to a green tick, which means the song is included.

After the songs are selected, the user can proceed to the next step by clicking on the *Next* button, the *Go Back* button to go back to the previous window, or the *Start Again* button to restart the whole procedure.

The last part of the wizard is for the user to choose a cover picture to represent the gift. See Figure 4.30.



Figure 4. 30: Selecting a picture as a gift cover

The user selects a picture from the display area. To add more pictures to the display area, user can use the “*add more pictures*” feature to import more pictures from other folders on the computer into the display area. Once a picture is selected, the user can now proceed to generate the gift or go back to the previous wizard window to start all over again, or exit the wizard.

In this example the “*Make Gift Now*” button is pressed. Recall at the *Parental control* settings, one of the entries is for the user to define the directory of where the finished gift is going to be stored. The gift generation phase is basically combining all the information provided, such as the sender details, receiver details, the message, the picture and songs into a single file. The file is then stored in the pre-defined gift directory. See Figure 4.31.

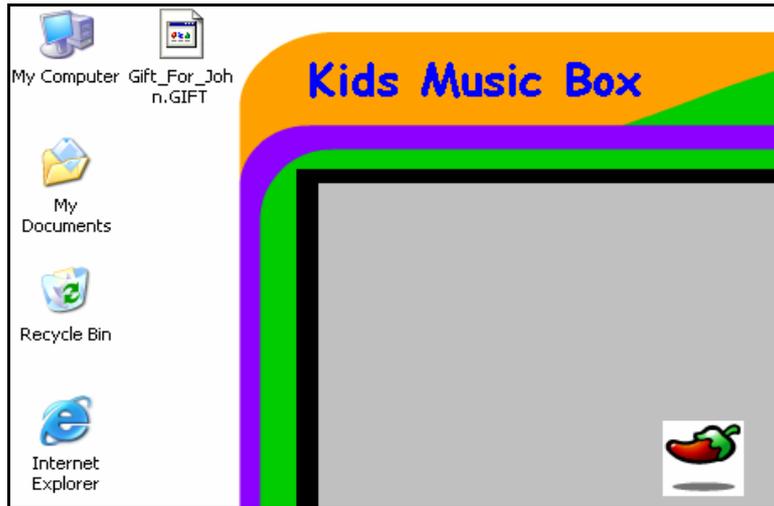


Figure 4. 31: The gift file is place on the desktop

To open the gift after receiving it from someone, the user clicks on the *Open a Gift* button. See Figure 4.25. A file open dialog will appear, prompting the user to provide the location of the gift. After a gift file is located and opened, all the information will be extracted from the gift file and stored in a temporary folder. Then the application will create a new music box called “*Gift from the sender*” and add it to the music box library. See Figure 4.32.

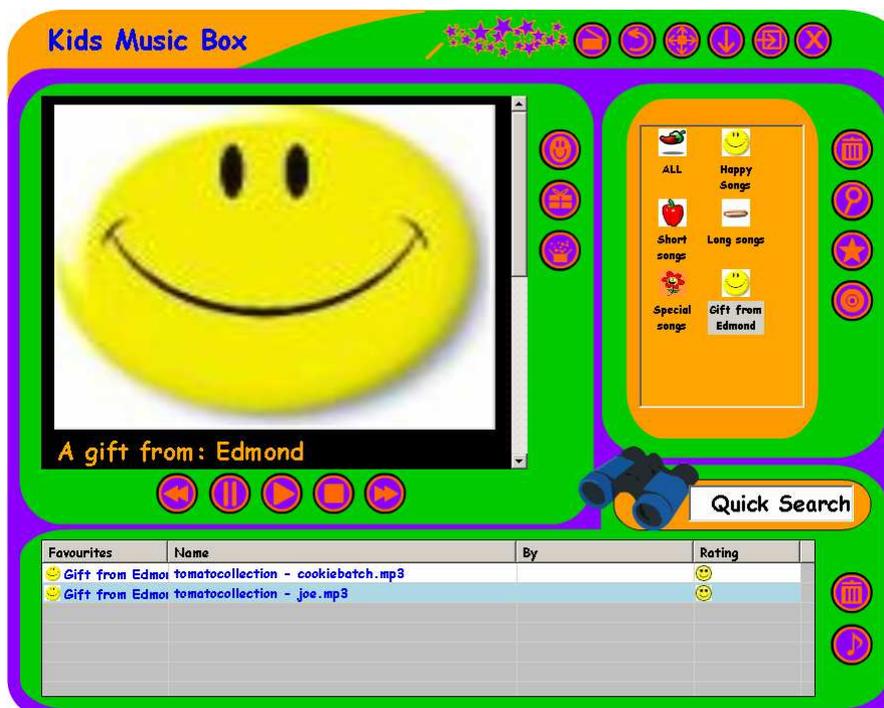


Figure 4. 32: An opened gift

The picture that represents this music box is the one that was chosen by the user during the gift generation phase. The songs that are included along with the gift have been added to the giftee's *Music Library*. The picture is also displayed on the display area along with the gift message. See Figure 4.33.



Figure 4. 33: The message from the gift

Fundamentally, the extracted gift is just like another music box. The user can now *add songs, remove songs, and rearrange the songs in it*; it will also stay in the music box library until the user deletes it.

The other major functionality of the visualisation area is concerning with the actual playing of songs. The five functionalities provided are *Previous, Pause, Play, Stop* and *Forward*.

4.1.2.4 Global Options

The global options are located at the top of the *Organizer window*, to emphasize that it has overall control. It is designed to offer users control over the organizer. The major functionalities are: switching between accounts by taking the user back to the *Login window*, *undo action*, both *maximize and minimize window*, *change the interface* and most importantly, *terminating the application*. See Figure 4.34.

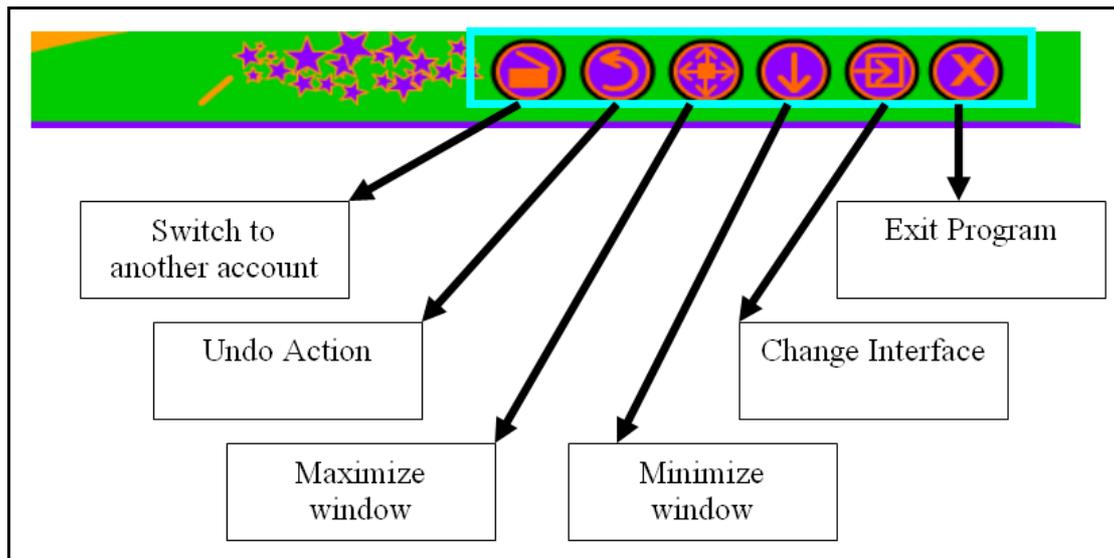


Figure 4.34: The Global options

By clicking on the *Switch Account* button, the application will log the user out of the current account and the *Login window* will appear, hence user can choose a different account. A confirmation message will appear before logging the user out of the current account, to confirm the action.

Undo is provided in case of accidental deletion of songs or music boxes. By clicking on the Undo button, the user can undo actions right back to the beginning of the program (*The login screen*). This is possible because actions such as importing songs, removing songs, removing music boxes are recorded right from the start of the program into a *First In Last Out list*. Therefore it is possible to un-do this recorded action list from the latest entry to the first.

Initially, the Music Box is not displayed in the full screen format. However, if the user wishes to use the *Music Box* in full screen mode, this can be done by clicking on the Full Screen button. See Figure 4.35. This design decision was made after the researcher realised that all participants like to view the organizers in full-screen mode, during the focus group study.



Figure 4. 35: Music box in full-screen mode

The music box can also be minimized to the toolbar by clicking on the *Minimize* button.

To change the interface, all that is required of the user is to click on the *Change Interface* button. The *Music box* has three pre-defined interfaces that the user can use. See Figure 4.36.

Chapter Five

Design Rationale

The goal of this section is to describe the gradual progress of design and building the *Kid's Music Box* from the initial design towards the final design. This section will discuss both the rationale of the interface and the data structures behind the *Kid's Music Box*.

This section will first discuss the initial design, its flaws and ideas gained from it. Secondly, this section will clarify the *Music Box* concept, what it was based on and why the *Music Box* concept was used. Thirdly, this section will explain the layout of the *Music Box*, the use of design conventions and other techniques such as the use of colours and non-rectangular windows. Finally, this section will discuss all the problems encountered in the design and implementation phase, and solutions to those problems.

The design refinement steps for *Kid's Music Box* are: *focus group* (Section 3.2), *prototype implementation* (Section 5.1), *expert review on prototype* (Section 5.2), *use cases and paper design* (Section 5.3.1), *Kid's Music Box implementation* (Chapter 4), *expert review* (Section 6.1), *pilot test* (Section 6.21), and *user evaluation* (Section 6.22, 6.23, 6.24). See Figure 5.1.

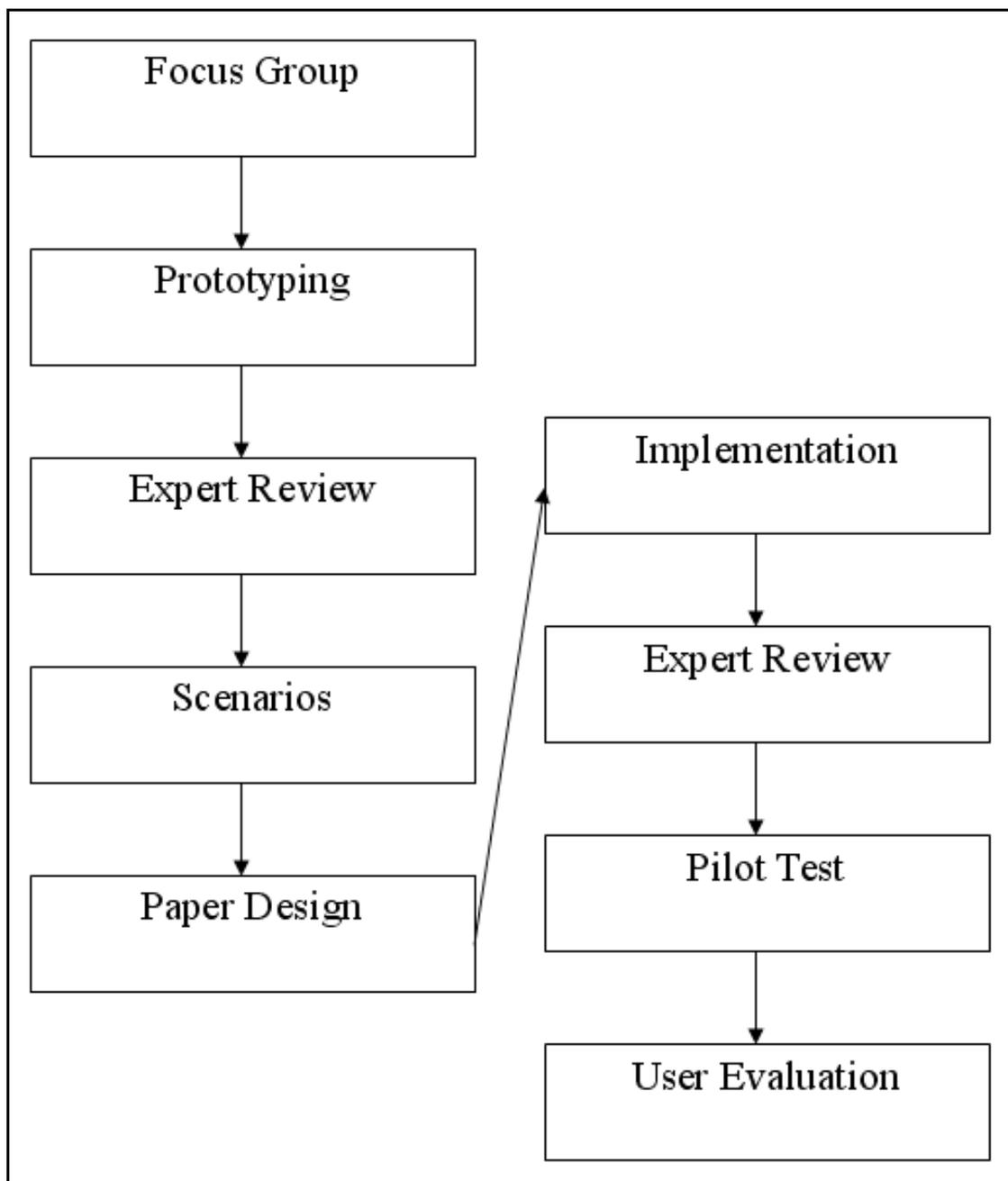


Figure 5. 1: Design refinement diagram

5.1 The Initial Design

The initial interface for the *Kid's Music Box* was designed after the group study with children from *Puketaha Primary School* (discussed in Section 3.2). It was the first attempt in creating something that this project believes is right for children. The initial design aims to avoid problems that children face in using other similar software, and to build on features that the children like.

Neilson [18] pointed out that one should not start full-scale implementation efforts based on early user interface design. Instead, early usability evaluation can be based on prototypes of the final design, as prototypes are cheaper and can be developed faster. Thus, lessons can be learned from evaluating the prototypes before implementing the final design.

Based on the background research described in Chapter Two and results from the focus group study (Section 3.2), a list of essential requirements for the initial design was constructed. These are:

- *Intuitive interface to support easier navigation*
- *Multi-functional and Multi-purpose (Visualisations and games)*
- *Functionalities grouped by relevance*
- *New approach to organize favourites*
- *Colourful interface and big buttons*

The initial interface was designed closely according to the list of essential requirements. See Figure 5.2.

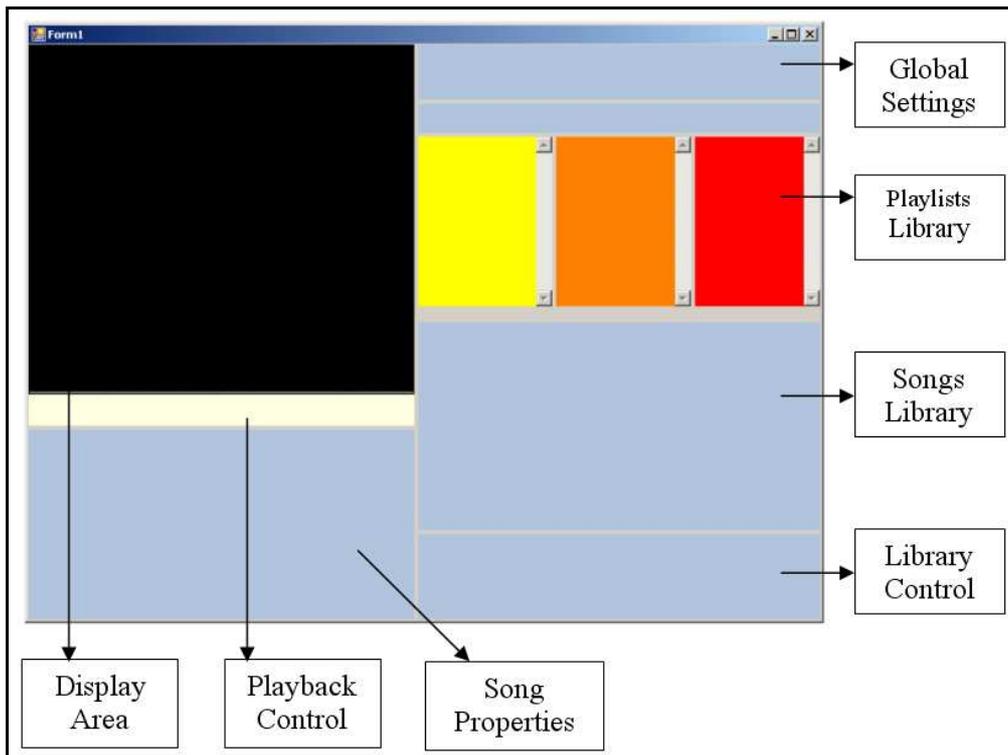


Figure 5. 2: The initial design

Intuitive interface to support easier navigation

In recognising children’s cognitive development (Section 2.3), the first criteria in the essential list of requirements was to make it easy for the kids to navigate around the music organizer. The initial design satisfies this criteria in the sense that all the features and functionalities are presented right in front for the user – functionalities are not hidden away in menu bars, which sometimes can be hard to find.

Multi-functional and Multi-purpose

The initial interface was also designed to be multi-functional. The focus group study showed (see Section 3.3.3.4) that children do not only want something to listen or organize their music, but that they also wanted to be able to perform tasks such as rate songs, make new playlist, play games and watch visualisations (See Chapter Two). The initial interface is capable of such features (see Figure 5.2). Firstly, it contains a large area intended to be the *Display area*, which is the multi-purpose display area. The largest area of the initial design was dedicated for the *Display Area*. The intention for this area is to be a playground, music visualisation and photo viewer. The three functionalities of this area are inter-changeable by a single click of a button.

Functionalities grouped by relevance

In the focus group study, one of the features that the participants like of *Windows Media Player* is that similar functionalities are grouped together (Section 3.3.3.1). This idea was incorporated in to the initial design of *Kid's Music Box*. The playback of music is controlled by the *Playback* area; the user can perform tasks such as *Play*, *Stop*, *Pause*, *Previous* and *Next* from this are, as well as manipulating the *Display* area. Underneath the *Playback* area are the *Song properties*; it is intended that when a song is selected, all the property of the song is then displayed here, such as *Title*, *Artist*, *Genre*, *Duration* and *etc.* On the right of the interface lies the *Global settings* area; this area is primary used to manage different accounts and to resize the window. Finally, the last area is the *Library control*. This area is intended to hold buttons such as import music, create new playlist, remove songs and remove playlist.

New approach to organize favourites

Balancing innovation and access was one of the most important lessons learned in Section 2.5. The lesson leaned heavily influenced the design of the playlist manager, which is beneath the global settings area. It was intended that the users will utilize the given three boxes to organize their music. Figure 5.3 demonstrates how to use these separate boxes to organize songs into playlists.

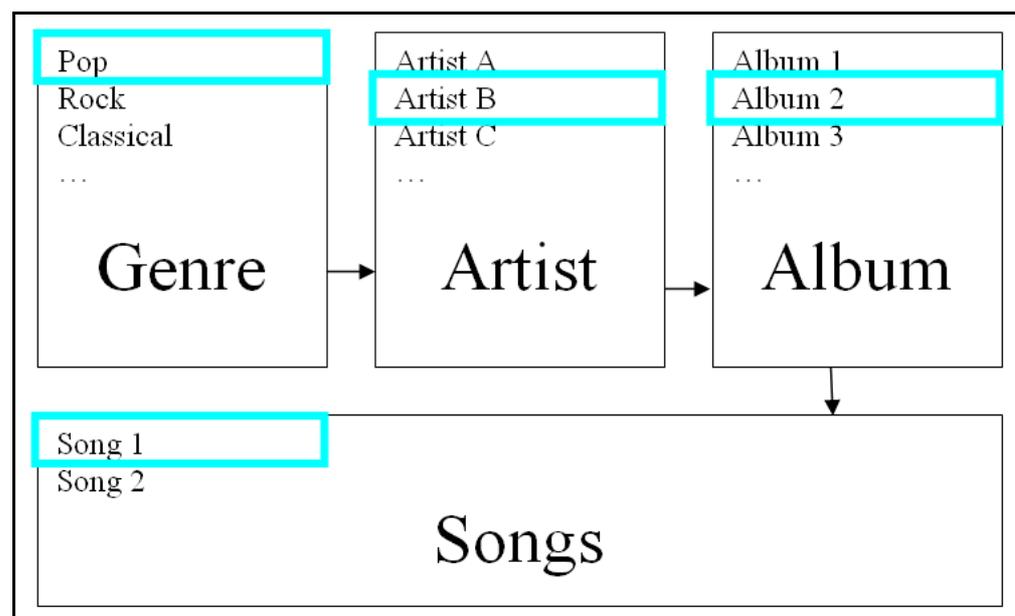


Figure 5. 3: The initial concept in organizing songs

The idea was for the user to select the genre in the *Genre* box first, then select or enter the name of the artist in the *Artist Box* and finally, select or enter the album name in the album box. All the songs are then displayed on the songs library; at the same time, since this is the current folder, any newly imported songs will be tagged with the selected genre, artist and album.

In Figure 5.3 for example, “*Song 1*” is stored under Pop->Artist B->Album 2. To get to “*Song 1*”, the user will have to first select the correct *Genre*, followed by the correct *Artist*, and then the correct *Album*. The song is then displayed in the music library for the user to play. The song library displays all the songs that belong to the selected playlist. The song library updates itself when a new playlist is selected from the playlist library.

Colourful interface and big buttons

Half of the participants liked KidsPlayer not because of its functionalities or features, but its colourful interface and large buttons. This fact heavily influenced the look and feel of the initial design. The idea was to assign different colours to different parts of the system (see Figure 5.3). Large, bright and colourful buttons will also be used.

5.2 Expert Evaluation on the Initial Design

The expert evaluation approach was chosen to evaluate both the prototype and the final design of the system because of the many advantages it offers, such as a typical expert evaluation only involves a small number of users, who are expert in their field. Another advantage is that they can provide accurate assessment about the system, to determine the correctness of the design rationale and to outline weakness and strengths [18].

The first expert evaluation was conducted after the prototype was developed. This study involved two graphics design lecturers from *The University of Waikato*. At that stage of the development, it was crucial to determine the validity of the design rationale, hence the reason of having graphics design lecturers involved in the first

evaluation. Additionally, both lecturers have backgrounds in designing interfaces for children, this make them valuable contributors.

The background and the goal of the research was first explained to the experts by the researcher, followed by a demonstration of the prototype where the researcher demonstrated all the functionalities that were available at the time. The evaluated system was similar to the prototype demonstrated in Figure 5.3. Notes were taken during the study, and the results take the form of general impression and specific problems rather than empirical measures.

The results of this study had a major impact on the final version of system. These will now elaborated on – both the problems encountered and possible improvements to the system.

The interface was rectangular, and non-colourful

Both experts pointed out that in general, in order for children to use any types of computer applications, it is essential for them to be interested in it. One of the key components of attracting interest is the interface of the application. If the interface is not interesting, children will not have as much patience as adults in persisting with it. In order for children to discover the features embedded in the organizer to utilize them, it was important to make the interface attractive. Expert B pointed out that what children are interested in is colourful and non-rectangular windows. Expert A also pointed out that the colour selection of the prototype was meaningless and lacks energy; it seemed to him that colours were assigned randomly. To improve the colour selection for the research, Expert A offered the researcher a colour circle [38], which the researcher later employed to base the colour selection using principles from the colour circle.

The interface does not have a focus area and lacks structure

Both experts agreed that the interface lacks structure; it looked like all the features of the organizer are placed together and fit into a rectangular window. There is not a central position that the user can automatically focus on. The prototype did not have a focus area largely because the display area is simply not big enough to attract attention. Figure 5.3 shows that even though the *song attributes area* was not one of

the priority features of this music organizer, it occupied a large screen area. The experts pointed out that it is vital that when user looks at the application there should be an area or feature that grabs the attention of the user. For example, the visualisation area in *Windows Media Player* provides a focus for that application.

In addition, they also pointed out that the purpose of the *Library control* area shown in Figure 5.3 is to manage both the playlist and music library, with functionalities such as add or remove songs or playlist from their respective libraries. However, the interface tells a different story. The songs music library where songs are displayed is positioned right above the *Library control* area; this is fine since it gives the impression that the two areas are connected. The problematic part was the playlist area, since it was positioned above the *songs library*; therefore it does not make any visual connection between the playlist and the library control area.

The initial design does not support inter-changeable interfaces.

The prototype only supports a single interface, where the default interface is the only choice. This can be an issue for this project's target audience. The fact is that children like new things; they do not liked to be restricted to the same environment all the time. To address this issue, the researcher recommended including different themes to the interface, such as sports theme, summer theme, beach theme and plenty of other possibilities.

Is the song attributes area necessary?

The initial intention of the song attributes area is to be informative to the user; users will be able to know more about songs, such as song title, artist, song duration, the number of times the song has been played, and other similar information. Since this area displays many attributes, it occupied a lot of screen area of the music organizer. However, both experts disagree with the researcher on the use of the song attribute area. They point out that too much visual space is used for this song attribute area, considering that its purpose is to display song properties. This problem was resolved later by replacing the attributes area with a multipurpose *music library* in the final version of *Kid's Music Box* (see Figure 5.5).

In addition, the icon design was another problem identified. Icons used in the prototype are the same – all have the same colour, shape and size. The only way to tell them apart is by looking at the text beneath the button (see Figure 5.4). Expert B pointed out that icons should be symbolic and different to represent different functionalities. Users should be able to gain an idea on the purpose of the button by looking at it.



Figure 5. 4: Buttons from prototype

Expert A also explained that it was hard to interpret these coloured dots as buttons, because these dots do not stand out as buttons and users might simply see them as graphics and not of any purpose. In addition, the experts state that the use of white text to represent the functionality of the button was not efficient: fonts are too small and children are not good at extracting meaning from short phrases.

In conclusion, many ideas and concepts rose from the initial design was valuable, such as the multi-purpose display area. At the same time many aspect of the design were disappointing, as it was pointed out in this section. Nevertheless, it has given this project the foundation to work from; the final music organizer was able to build on what is good while avoiding or changing the disappointing aspects from the initial prototype of the music organizer.

5.3 Kid's Music Box

The goal of this section is to explain all the relevant techniques and concepts that made *Kid's Music Box* unique. The first part of this section will discuss use cases and requirements for *Kid's Music Box*. The second part presents the rationale for the design of *Kid's Music Box*, with the main focus on explaining the fundamental

differences between *Kid's Music Box* and other currently available digital music organizers. The third and final part of this section will discuss problems encountered during the design and implementation phase.

5.3.1 Use cases and Requirements

Use cases document system behaviour from the users' point of view; it does not focus on how those functions are delivered. According to Bittner and Spence [39], use cases, stated simply, allow description of sequences of events that, taken together, lead to a system doing something useful.

Before any attempts in designing for the *Kid's Music Box*, an important question was asked; "*What is necessary for the music box and what is not?*" The reason why the question was asked is because one must know what to have before making it. This might sound simple or even naïve, but many designers are still falling into the trap of creating the product first, then altering the design to fit the finished product [18]. For *Kid's Music Box*, a number of use cases were constructed. Consequently, a list of requirements for these use cases has been derived. The plan behind making a set of use cases is to help identify all the functionalities that the system needs. This approach also eliminates non-essential functionalities; simple is good, especially for children.

Following are the use cases (see Appendix A for the use cases) for *Kid's Music Box*.

- Opening application and Loading existing data
- Parental control features
- Add/Remove accounts
- Song playbacks
- Managing songs
 - Add songs
 - Remove songs
 - Rate songs
 - Assign songs to playlists
- Managing Gifts

- Creating gifts
- Open gifts
- Removing gifts
- Managing playlists
 - Add playlists
 - Remove playlists
- Managing the Multi-display area
- Searching for songs
- Quitting application and saving

From the above use cases, all the necessary requirements were established (see Chapter 4 for all the features of the organizer). It was then possible to include all the required features in the final design for the *Kid's Music Box*. The UI navigation diagram (see Appendix B) of the system was plotted out on paper in the paper design phase.

Paper design is used instead of a running computer system. They are made into functioning prototypes by having a human “play computer” and decide the next steps in the interaction between the user and the system. The idea behind prototyping is to cut down on the complexity of implementation by eliminating parts of the system. Since use cases are small, changing frequently is affordable; hence, use cases are a way of getting quick feedback of the design [18]

5.3.2 Rationale for Design and Data Structure

This section will revisit the interface that was described in earlier section. Having discussed the initial interface and the requirements for the final music box, the reasons behind the final design can now be elaborated.

Look and Feel

Kid's Music Box has a multi-coloured and non-rectangular interface. The interface was deliberately designed to be like this because children from the focus group study have agreed that colours and shapes were more interesting (see Section 3.3.3.3).



Figure 5.5: The main window

Figure 5.5 shows the make-up of *Kid's Music Box* followed the “*Group by relevance*” idea that the participants like in Section 3.3.3.1, in which similar functionalities are grouped together: *The Display Area*, *The Playlist Area* and *The Music Library Area*.

The Display Area

The *display area* has multiple functionalities; it is able to display both pictures and text, display visualisations and it is also an interactive playground. Recall that results from focus group study shows all of the participants liked visualisations (see Section 3.3.3.4) that were offered by *Media player*. The main reason why visualisation was so well received is that it offered children “something to do” while listening to music [42]; children are not interested in sitting quietly and listening to music, interaction with the application or activities in general is also very important. One real-world analogy of this is music classes for kids – these classes often involve several activities (dancing, clapping, games) while singing or listening. This project extends the interaction concept further, by including more than just visualisation, but also integrating interactive *Flash* games into the display area. A button is provided within the display area for the user to easily switch between photo viewer, music visualisation and interactive playground.

The Playlist Area

During the focus group study, participants liked the idea of displaying all the existing playlists on the organizer (3.3.3.2). However, they also complained that the icon that represented the playlists was too small and “looked the same”. The review on the *International Children’s Digital Library* revealed many important lessons in designing collection organizer and access for children (see Section 2.4.1) – lesson being that children like large buttons (see P.83) displayed with images with relevant meanings. In order to accommodate this fact in *Kid’s Music Box*, users will be able to custom make their playlist icons with their own images and text. The *Kid’s Music Box* approach to managing playlists is similar to that of *iTunes*; users do not have to worry about where the playlists are saved on the file system (which was proven to be a difficult task in Section 3.3.2), since both saving and loading of playlists are handled by the organizer.

The Music Library

Songs are displayed by the *music box* it belongs to, *song title*, *artist* and *rating*. Songs are separated with different background colours; blue and white, as separation colours. This is similar to *iTunes*, which was well like by the participants (Section 3.3.3.2).

The final implementation (see Figure 4.1) to the music library was preferred over the attributes window idea from the initial design. Recall the experts did not like the *attribute area* (see Section 5.2) in the initial design, because it occupied a large portion of screen space for displaying song properties. The current approach is the modified version of the initial design; attributes are still displayed, but only important ones such as the song title and the name of the artist. Because of children’s physical development (Section 2.3), tasks such as *drag & drop* and *double-click* are difficult for them. An intuitive *point-and-click* system was implemented on the column displaying which *Playlist* that the song belongs to, and on the column that shows the rating of the song. This allows both of the columns to be editable; the Playlist column allows the user to change the selected song to other music boxes. The rating column offers the same kind of concept, with the exception that stars ratings of 1 to 5 is assigned to a song. More on this is presented in the *problems encountered & solution* section of this Chapter (Section 5.4).

Colour Selection

Because the focus group study revealed that children like interfaces to be colourful (Section 3.2), colours are used extensively on both the initial and final design. In the initial design, random colours were assigned to the interface and the colour selections were poor. This was largely due to the fact that little investigation had been done on how to use colours on interface effectively. In order to find the right colours for the interface, expert advice was sought, and a colour wheel was used to determining the colours [19]. The *triadic colours scheme* was used to design the interface. The *triadic colour scheme* uses three colours equally spaced around the colour wheel. This scheme is popular among designers because it offers strong visual contrast while retaining harmony and colour richness [38]. Another colour scheme considered was the *Complementary colour scheme*: the use of two opposite colours to create contrast. However, the *triadic colour scheme* was used because it is more balanced and harmonious.

The key to the *triadic colour scheme* is to utilize primary colours the most, along with less use of the two opposite colours. In the final design of the interface, the colour green was the primary colour and was used heavily, while the colours orange and violet were the opposite colours, hence they were used less.

The reliance on pictures

Kid's Music Box relies heavily on pictures – *User accounts* displayed on the *login screen* and *playlists* on the *main screen* are represented by pictures. This design approach was deliberate based on the following two factors.

Firstly, the background research (Section 2.41, 2.42) and focus group study (Section 3.2) revealed that children prefer pictures to text in computer applications – children find it easier to communicate through pictures. Secondly, it is faster for human beings to process information from pictures than text [40]. Humans are extremely good at processing pictures, but not text. When looking at images, it is possible to detect features and characteristics from the image immediately. However, when looking at a text, it will no longer be intuitive, as information is coded within text, which means that the text must be understood first.

Fonts

The only font used in *Kid's Music Box* is 14-point *Comic Sans MS*. This font was chosen based on a research done by Bernard [41]. The research compares other fonts such as *Times New Roman*, *Courier New* and *Arial* to *Comic Sans MS*, and concludes that *Comic Sans MS* in 14-point size was the most attractive, easiest to read and is the fastest to read for children.

Relevance

Another important design concept used was relevance [5]. Where screen items with similar functionalities or meanings are placed together to create cohesion – for example, buttons that are related to playlists are placed right next to the playlist area, and the same also applied to the *music library* and *visualisation area*, as well.

Mouse Interactions

Children find it difficult to perform tasks with a mouse that are seen as easy for adult users (Section 3.3.2) [6], such as double mouse clicks and *Drag and drop*. During the focus group study, participants were asked to use the mouse to select and play a song from the music library, but only two of the eight participants managed to complete the task. The low success rate for this task occurred because all three organizers employed the double click approach to play a song. To avoid this problem, it was decided that all the functionalities of *Kid's Music Box* will be accessible by single mouse click.

Buttons

Buttons are designed to be interactive. Standard stationary buttons often confuse children; they simply do not know whether the mouse over item is in fact a button or background graphics. This problem was solved by including interactive buttons. The advantage of having an interactive button is that it will provide instant feedback to inform the user that it is a button.

Making gifts

Gift-making is common in primary school classes. One fun and useful feature of *Kid's Music Box* allows children to create and receive gifts. The idea is that a user will be able to create a gift which is embedded with a message, picture and songs. The

receiver will be able to use *Kid's Music Box* to open the gift. At that point the content of the gift will be displayed on the display area, the gift will be added to the music box library as a music box, and its songs will be added to the music library. Since songs can be embedded into the gift, sender will be able to, for example, create a gift of his favourite playlist of songs and send it to friends; thus the friends will be able to listen to the sender's favourite playlist.

Managing Playlists

Evidence from the focus group (Section 3.3) suggests that children do not fully understand the playlist concept offered by music organizers such as *Media Player* and *iTunes*. However, once the researcher explained the purpose of playlists and how they can be useful, participants then became interested and were very keen on the playlist concept. Nevertheless, most children were not able to manage playlists on their own (see Chapter Three); the researcher often had to provide assistance in simple tasks such as creating a new playlist. Therefore one goal of the initial design was to come up with an approach that would help children in managing their music by using playlists.

The first attempt at designing a playlist management system for children was the approach planned for the prototype (see Figure 5.3). The playlist management system poses many challenges for children. The system was not intuitive and hard for the user to organize music; the main problem with the initial approach was that it was hard for children to organize their music according to the provided information. For example, if the user wants to add a song to the music library, the user will have to decide on which genre to put the music into, then the artist and album. In many cases however, a user does not know the artist and the album, and even what the genre should be, which creates confusion. The other problem with the initial playlist management system is that there are three different boxes that users have to adjust before getting to the music. This is slow and the user must remember the *genre*, *artist* and the *album* before getting to the music. Children do not like to be confused; clearly, a new playlist management system needed to be planned.

The way *Kid's Music Box* organizes playlists is similar to *iTunes*. Recall that both *Windows Media Player* and *KidsPlayer* use the same concept in regarding with

playlists: songs are added to a list, and the list is then saved as a file onto the hard drive. This poses many problems for children, one of the most significant being that most children do not have enough computing knowledge to browse through the file system structure. The other significant problem is that changes to the playlist are not automatically saved; the user is required to save their changes. While this is less of an issue for adult users, children often forgot to save their changes to the playlist, and so lose their work. *iTunes*, in that respect, is easier for the kids to organize their music – playlists are saved without the need of the user to choose the destination to save the playlist to. In recognising these advantages, the playlist system in *Kid's Music Box* is implemented similar to *iTunes*.

Playlists are also grouped and displayed by the *Source toolbar* in *iTunes*. Through the *Source toolbar*, users can add, remove or edit playlists. Another advantage that *iTunes* has over *Media player* and *KidsPlayer* in terms of playlist management is that changes to the playlist are saved automatically. However, since *iTunes* is not designed for children, playlists are represented mainly as text. During the focus group study (Section 3.3.3), children found that the clutter of text to be confusing and the font to be too small.

The playlist management system for *Kid's Music Box* offers many important features that are designed for children and have many advantages.

Firstly, recall that it was difficult for the participants to save and load playlist in *Media Player* and *KidsPlayer* (see Chapter Three). *Kid's Music Box* users are no longer required to care about where playlists are stored on the hard drive, or where to look for playlists when loading new playlists, as loading and saving of playlists are handled automatically.

Secondly, because of their computer and cognitive skills limitations (see Chapter Two), children find it difficult to use tools that are designed for adults. Hence, it is not reasonable to expect them to be able remember what they have done or changes they have made on a computer application, any changes to the playlist are instant and final. This means that the user will no longer need to worry about saving the update to their music box. Moreover, an undo feature was also implemented. In the case of an error

by the user, accidentally deleting a song for example, the action can be reversed by clicking on the *Undo* button.

Thirdly, pictures were used to present playlists, instead of plain text. The reason for this approach is that humans can generally recognise images faster than text[40]. By representing a playlist with a specified picture, the user will be able to recall the rough content of the playlist, in terms of the genre, artist or album. In addition, because the organizer designed for younger children, it is natural to include less text and more pictures, as their reading skills are not fully developed.

Fourth, the playlist management system is multi-purpose. Recall that *Kid's Music Box* offers many more features than simply organizing songs into playlists. Features such as getting music from CD, creating and opening a gift and searching for songs are included. In order to extract songs from a CD, the user is required to provide a name and a picture for the CD playlist. Both the picture and name provided will be used for creating a new playlist, and consequently all the songs extracted from the CD will be saved to this playlist. The same applies when receiving gifts and handling search results. When a gift is opened, the image that was included in the gift and the name of the sender is used to create a new playlist; all the songs that came with the playlist will be added to the newly added playlist. Results of searches in the Search window can be returned to the organizer window and saved as another playlist.

In summary, the playlist management system for *Kid's Music Box* is designed specially for children. Large amount of time and effort were spent on the concepts that are different to other digital music organizers.

5.4 Problems Encountered and Solutions

This section revisits the current music box design and data structure. Having discussed the initial and current music box design of the interface and the rationale behind the designs, this section focuses on the problems encountered during both the

design and implementation phases of the project, and how those problems were resolved.

Open file Dialog

One of the most important tasks for digital music organizers is the ability to import songs from hard drives to the organizer. This is normally handled in other digital music organizers by using a file open dialog. See Figure 5.6.

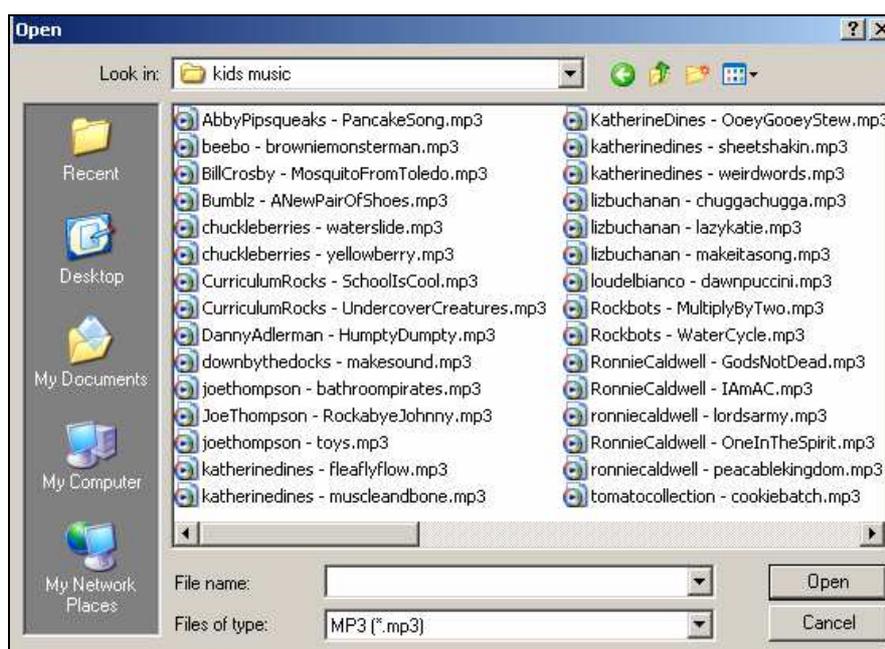


Figure 5. 6: File Open Dialog

The user is required to navigate around the file structure to locate the songs that are to be added to the organizer. Importing songs by using a file open dialog is the preferred method for all three of the digital music organizers that were studied in this report. While this approach is acceptable for most adult users, it poses a major problem for children; during the initial focus group study, most of the participants required assistance in the task of importing songs from a specific folder.

Initially, *Kid's Music Box* was designed to use the *file open dialog* to importing songs into the organizer. However, this project encountered the same problem in the pilot test (see Chapter Six), it was difficult for children to import music into the organizer.

The initial solution to this problem was to scan the whole hard drive and look for all available songs. This would eliminate the need for *open file dialogs*, since all the songs would be shown so the user could select the songs to be added to the organizer. One major problem with this approach is that many unwanted songs would also be imported as well as the desired ones. This is a particular problem for kids – a parent might not even want them to know some songs are on the hard drive.

To solve this problem, it was decided that some parental input is required. Recall the *Parental Settings window*; parents are required to include the folders where songs are stored. After the *Parental Settings* is completed, *Kid's Music Box* will load all the songs that are stored in the predefined folders. This approach is not perfect, because parental inputs is required when ever new songs are to be imported to the organizer; however, it goes some way in solving the problem of file open dialogs for children.

Since the user is required to use pictures in representing *accounts, playlists, and gifts*, pictures are essential for *Kid's Music Box*. The initial approach was to automatically load pictures from a default folder – the *My Pictures* folder within the *My Documents* directory was one of the options. The problem is that only machines running on *Windows XP* contains the *My Pictures* folder by default. Even if the machine is running *Windows XP*, it is not guaranteed that the pictures contained within the *My Pictures* folder are acceptable for children. To solve this problem, parental assistance was required again. Similar to predefining music folders, parents are required to selected folders which contain pictures for their child. Once the folders are selected, all the available pictures will be displayed in a thumbnail format for users to choose from.

Drag and Drop Versus Point and Click

Songs are organized by boxes within *Kid's Music Box*. When songs are first imported into the music library, they are assigned to the currently active music box. To accommodate users in relocating songs into different music boxes, the initial plan was to use the *Drag and Drop* concept, where songs are dragged from the music library to a different music box. Once again this poses the same problem as double mouse clicks: children have trouble in accurately selecting an item and dragging to somewhere else.

In order to solve this problem, a new music management system had to be designed. The goal for this management system is to allow user the ability to rearrange songs into different music boxes easily, and only require single mouse clicks. The solution is to display the picture that represents the playlist that the song belongs to in the music library. To change a song from the current music box to another, all the that is required of the user is to click on the picture of the song that is to be moved. This will bring up a dropdown box which contains all the available music boxes. By choosing one of the available boxes, the system will move the song to the newly selected music box. See Figure 4.20. This approach eliminated the need to drag and drop and also is intuitive enough for children to perform during the evaluation on the final design (see Section 6.2.2).

Metadata extraction

The approach described in Section 4.1 in finding out more information about a song by using metadata is satisfactory only if the metadata actually contains the required information. However, based on personal experience in extracting metadata from music files, most music files do not contains any metadata – only empty strings. This is a problem because the system can not construct any meaningful new song entries based on empty strings.

If the extracted metadata fields do not contain any useful information or blank strings, the organizer will ignore the metadata and will use the file name from the actual file as the title of the song. See 5.7; in this example, the file name “*RonnieCaldwell – OneInTheSpirit.mp3*” is used for representing the song because no metadata is extracted from the actual file.

Favourites	Name	By	Rating
ALL	Ooey Gooye Stew	Katherine Dines	😊
Long songs	Pirates in the Bathroom?	Joe Thompsone Bathro...	😊😊😊😊😊😊😊😊
ALL	Rock-a-bye Johnny	Joe Thompson	😊
Gift from Edmoi	ronniecaldwell - lordarmy.mp3		😊😊😊😊😊😊😊😊
ALL	RonnieCaldwell - OneInTheSpirit.mp3		😊😊😊😊😊😊😊😊
ALL	ronniecaldwell - peacoblekingdom.mp3		😊😊😊😊😊😊😊😊
All	School is Cool	Curriculum Rocks!	😊

Figure 5. 7: The three boxed songs does not contain any metadata

The solution to this problem as implemented in *Kid's Music Box* is not perfect; however, it allows the songs to be added to the music library and blank strings are not an issue.

What is an account?

“What is an Account?” This is the first question asked by a participant during the pilot test. At that stage, the term “*account*” was used to represent different user accounts in the *Login window* and the term “*favourites*” was used to represent playlists in the *Organizer window*.

The term Account is easily understood for adults; however, this was not the case for children. It was realised after the pilot test that a new naming convention is required for *Kid's Music Box*. The goal is to transform the digital music organizer into something that children can understand and therefore be able to relate to, by avoiding unfamiliar software terms.

To solve this problem, special attention was paid to observe how children store their physical items such as action figures, Lego blocks and dolls. The most common approach for children to store and manage physical items is by placing them into boxes. This led to the solution for the problem – Accounts being represented by boxes, as well as playlists. Instead of opening an account, a user is opening their boxes which contain their music collections. Songs are also placed into different boxes within the larger box. Figure 5.8 demonstrates boxes of music concept.

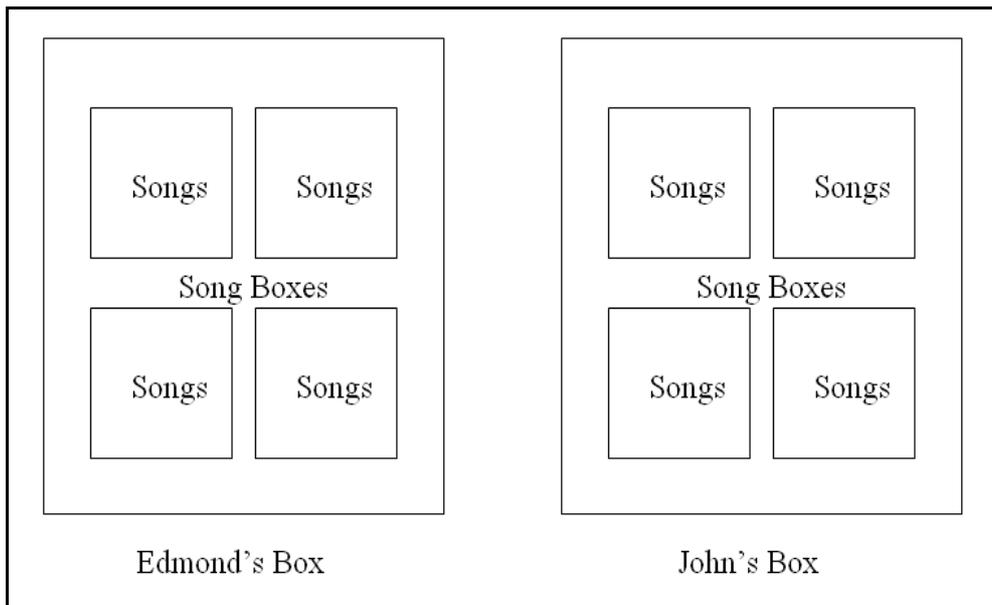


Figure 5. 8: The Boxes of Music Concept

By using the boxes of music concept, children are able to have a conceptual understanding of the hierarchical structure for *Kid's Music Box*, and therefore able to manage their music collection effectively.

Chapter Six

Evaluations

The previous chapter described the design rationale for *Kid's Music Box*, a new digital music organizer built on designs, functionalities and ideas that were endorsed by children. In doing so, *Kid's Music Box* attempts to achieve the goal of this research: to design and implement a digital music organizer with functionalities that are suitable for children aged six to ten years old. The purpose of this chapter is to describe the final steps of this research, where weaknesses and strengths are identified, the system is compared to other similar applications, to determine how closely *Kid's Music Box* has approached the goal of this research.

It is vital to test user interfaces with both novice and expert users separately, with the same and some different test tasks [18]. Two different types of evaluations were performed on *Kid's Music Box*: expert evaluations and a controlled user study. Graphics design lecturers conducted the first expert evaluation after the completion of the initial prototype (described in Chapter Five), evaluating both the design and layout of the interface. A second expert evaluation was conducted by a usability expert after the final version of the system was completed, to rationalise both the design and functionalities of the system (see Section 6.1).

A pilot test was carried out prior to the empirical, controlled user study which compared *Kid's Music Box* to other similar systems (see Section 6.2.1). This evaluation was intended to provide the research with more insights on how *Kid's Music Box* performs with real users and their impressions when using it.

6.1 Expert Evaluations

A second expert evaluation was conducted after the first attempt at implementing the final design of the *Kid's Music Box*. The goal of this evaluation is to understand the usability side of the system, to pinpoint functionalities that are useful, and those that are not. Hence, for this evaluation, a usability expert from *The University of Waikato* was chosen as the sole participant.

The evaluated system was similar to the version that was described in detail in Chapter Five, but lacking some functionality and some changes in design that were not included prior to this evaluation. These differences were:

- Quick search function was included.
- Images of stars were used to represent song ratings, rather than smiling faces.
- Once a user logged into the system, there was no way to return to the login window.
- Some of the panel and buttons were given different labels; user account was still known as accounts, while playlists were known as favourites.

The results of the study are elaborated below, by describing the specific problems identified and the solutions to the problems.

Icons needs to be reviewed

The icons in the final version are different to those in the prototype. Instead of having only one colour for all the icons and white text underneath to represent the functionality, an image is used to represent the functionality of the icon. The theory behind this approach is that children are faster at processing information when they are presented with images rather than text. See Figure 6.1.



Figure 6. 1: Buttons are represented by images, with tool tip text

Tool tip text was also utilized to display the purpose of the button. Therefore, if the user places the cursor over the button for more than a predefined amount of time, the text will appear underneath the button.

In order to determine whether children will understand the meanings of the button images, the expert recommended printing all the buttons on paper and showing them to the target audience. The result of this experiment is described in Section 2 of this chapter.

Inconsistent font sizes

After looking at both the main and search windows, the expert pointed out that the font sizes and font styles in both the main window and the search window were different. Consequently, this problem was resolved by correcting the fonts in the search window.

No 'logout' feature

On the system that was evaluated, once the user had logged into the main window from the login window, it was not possible to log out of the current user account and login as a different user. In order to change user accounts or “boxes” from the main window, the user had to terminate and restart the program. This problem was resolved by the inclusion of a button called “*Change music box*” in the global settings. By clicking on this button, the program will take the user back to the login window, where the user can login as a different user or open a different music box.

Use smiley faces instead of stars to represent ratings

Initially, images of stars were used to represent the rating of songs, and songs can be rated from one to five stars. This design approach was heavily influenced by *iTunes*

and *Windows Media Player*, which both use the image of a star to represent the rating of songs. The expert noted that star is too vague and might not be understood well by children. To address this problem, an image that is more familiar to children was chosen to replace the star: a smiley face icon.

Drag & Drop

During the task of moving one of the songs from the current box to a different one, the first approach the expert tried was to *drag and drop* the specific song to the destination box. Since this approach was not supported, the expert recommended that the researcher should evaluate more on the possibility of using *drag and drop* for moving songs to different music boxes, instead of the current *point and click* approach. The researcher explained that during the initial evaluation, children find it difficult to drag and drop items accurately, hence *Kid's Music Box* employs a more child friendly, *point and click* technique.

The positions of the playback controls

The playback control buttons are grouped with the visualisation area. The expert recommended that, since the playback buttons are controlling songs within the music library area, the buttons should be bounded with the music library area instead of the visualisation area. The recommendation was considered, but was not taken. The playback controls are grouped with the visualisation area to make the area appear as a television on the interface, and the buttons are used for controlling the television. If the playback controls are moved down to the music library area, the visualisation area will not be seen as a television or an interactive area.

Investigate Left and Right mouse clicks for children

To accommodate all the required functionalities in the login window, both left and right mouse clicks were required. A left mouse click on a box will log the user into the selected box, while a right mouse click on the box will remove the box from the *Login window*. The expert recommended more investigation into the use of left and right mouse clicks, because it is possible that children will find it confusing. The evaluation results will be elaborated in Section 2 of this chapter.

Playlist and rating changing was difficult

To change the rating of a song or to assign the song to a different music box, the user clicks on the specific column to bring up the drop box in order to choose a different rating or different music box (Figure 4.20). The expert explained that it was hard to know which is the correct column to click even though that they are represented by an image already. However, the researcher does not think this is a problem, as it is something that the users can adapt to (See Section 6.2.3.1).

Search function might be too complicated for children

While performing some search for songs, the expert complained that the four input fields might be too complicated for children to deal with. The researcher explained that it is not necessary to enter information into all the four input fields. The expert recommended implementing a quick search box in the music library area, where the user can search for songs more easily.

Additional song properties

The evaluated system did not provide any in-depth song attributes. The available attributes are the playlist that it belongs to, the artist, the title and the rating. The expert explained that it might be beneficial to have some way to show additional details of songs such as the duration, genre and the media format of the song. The researcher explained that it would be confusing and the majority of the children participants did not want to see more in depth detail on songs. However, the need for additional song properties was asked again in the final user evaluation, which is discussed in Section 6.2.2.

In general, the expert was impressed by the system. Many of the features were pointed out as excellent, for example, the music box concept, the use of colours in interface, and the interchangeable interface design.

The expert agrees with the researcher that children find it difficult to relate to designs that were targeted at adults. By introducing the *music box concept*, children can conceptualise the organizer as two items they can relate to: a music box that plays music and a box for storing and organizing music.

The inter-changeable interface design was well liked by the expert, and the expert also recognised the potential of this feature that the researcher also had; of being able to change themes. The idea is that themes can be designed by the user; and the design tool can also be integrated into the visualisation area of the organizer, hence making it a game to design and use your own interface.

6.2 User Studies

Appropriate changes were made to the system, in accordance with the two rounds of expert evaluations. The modified *Kid's Music Box* was described in Chapter Five. In order to find out whether the *Kid's Music Box* is better than other similar software that was described in Chapter Three, *Kid's Music Box* was formally evaluated in September 2006 in an empirical and controlled study. The primary goal of the user evaluation is not only to find out whether if the participants liked *Kid's Music Box* more than the other organizers for children, but also to determine the strengths and weaknesses of the system for children. The evaluations was aimed at determining whether the system has solved problems identified from earlier studies and also to expose more usability problems in the new system. Prior to the formal evaluation, a pilot test was carried out in preparation for the formal evaluation.

6.2.1 Pilot Test

A pilot test is essential for the overall success of formal user study. Since many things can go wrong in a study, it is important to perform a preliminary trial or pilot test to identifying potential problems in user studies, for which only a small number of participants are required (only one participant for this pilot test). These participants then go through everything starting from informed consent to debriefing [18].

The pilot test study was conducted with a participant from the original focus group. Because the results and implications of the pilot test are included in the final user evaluation, this section only focuses on three aspects of the pilot study:

- 1) The effectiveness of the experiment structure
- 2) The amount of time required for the study
- 3) Problems in the data collection process

The effectiveness of the experiment structure

This is one of the most crucial points of the pilot test. If the procedures of the experiment do not function correctly, the results attended might not be of any use [18]. This relies on the researcher to ask participants questions during the study and at the debriefing stage to look for the effectiveness of the experiment structure.

The amount of time required for the study

Because the target audience of this research are children that are relatively young, it was not reasonable to expect a long period of concentration from them. Hence, the study was designed to be approximately 30 minutes long, which includes the initial explanation of the system to the final debriefing.

- The pilot study confirmed the time required for the study, which was around 30 minutes.

Problems in the data collection process

One of the major problems in the data collection process is that it was easy for children to lose track of the study and focus on something else. For example, during the pilot study, while on the task of re-assigning a song to another music box, the participant would be playing games from the visualisation area, instead of completing the task.

- To address this problem, the order of the tasks for study conducted in the final evaluation (see Section 6.2.2) was re-arranged. All the complex and non-fun tasks are performed first, before fun tasks such as using the visualisation area and playing games, instead of randomising all the tasks in order to counter the effects of bias and transfer learning. The idea is that by the time children discover the visualisation and games, tasks such as re-arranging songs and assigning ratings have been completed.

6.2.2 User study

This study involved all the participants who took part in the focus group study (Section 3.3), with the exception of one participant, who had already contributed in the pilot test. Participants were asked to perform a list of tasks on the *Kid's Music Box* (without training), where the tasks are copied from the original study. However, instead of randomising all the tasks to counter the effects of bias and transfer learning, tasks are ranked in such a way that complex and less fun tasks are completed before interesting tasks. Because *Kid's Music Box* contains many functionalities that were not available in previous software, the list of tasks had to be modified to accommodate the changes. The tasks are:

- Make a music box (new account)
- Remove a music box (delete account)
- Play a song
- Remove songs
- Search for songs
- Make a new songs box (new playlist)
- Assign songs to this songs box
- Make and load a gift
- Rate songs
- Explore the visualisation area
- Change skin

Seven participants completed the study individually. The study includes the 11 tasks described above, and a debriefing session at the end. The total amount of time taken by each participant ranged from 20 to 30 minutes approximately. Due to time constraints, getting music from a CD was not included in the required tasks.

All the icons that were used in *Kid's Music Box* were printed out on paper along with their functionalities. Participants were asked to look and comment on the icons and the functionalities that associated with them, to determine whether if the icons match their functionality and to suggest changes that they wanted to add.

Participants were encouraged to voice their opinion or question during the study. However, since the participants' abilities to express their opinions might be limited by their age and communication skills, the researcher asked questions regarding their thoughts and impressions during the study. A debriefing session at the end of session provided the opportunity for further elaboration. A tape recorder was used to record the audio of the entire session. In addition, the researcher also took note on the proceedings.

The specific goals for the user study were:

- To determine the strengths and weaknesses of the system
- To investigate whether problems identified in the focus group study have been addressed.
- To uncover specific usability problems in the new system.
- To assess the participants' overall impressions and subjective acceptance of the system.

The user evaluation of *Kid's Music Box* was also focused on the “*learnability*” of the system – the extent that users can utilise the system appropriately without proper training [42]. A highly intuitive system is desirable and important, as children are not known for their patience and persistence with software that they do not understand (See Chapter Three). Also, users in general tend to not read or follow manuals for help or seeking directions [18]; the “hands-on” approach is the most preferred.

6.2.3 Evaluation of User Study

6.2.3.1 Problems Encountered

Users experienced many problems while using *Kid's Music Box*. Some of the problems were significant in the sense that they affected the task performance and the overall impression of the system, but most of the problems were minor inconveniences that can easily be overcome.

Impossible to assign a song to two music boxes

Participants did not realise or think that this is a problem: they simply thought it was one of those things that cannot be done. The participants are correct to some degree, that this limitation in many aspects is influenced by the underlying structure and the music box analogy. When a song is imported into the music library, it is assigned to the currently selected box (playlist). Once the song is in the music library, it is possible to re-assign it to a different music box (playlist). However, once the song was assigned to another music box, it will be removed from the previous music box. The problem arises when the user wants to assign the same song to two music boxes. For example the “*cool songs*” and “*sleeping songs*” music box. Currently, to have the same songs on different music boxes, songs have to imported again to the second music box, thus multiple copies of the songs will be stored in the music library.

In *Kid’s Music Box*, to assign the song to another playlist, the cut and paste method is used, hence, it was impossible to assign the same song to two playlists. One approach to address this limitation is simply by following the *iTunes* approach which is to use *copy and paste* instead of *cut and paste*, so the selected song will be in both of the playlists.

Pictures are not enough to represent the concept of a box

A picture is not enough to represent the concept of a physical box. One of the major goals of the system is for children to be able to relate the music organizer to a physical item, hence the concept of boxes of music. The idea of *boxes* were used to represent both the accounts and playlist, via the use of an image to represent the box on the interface. However, two of the participants pointed out that these pictures do not necessarily link the displayed pictures to the ideas of boxes, they are just pictures and not boxes (see Figure 4.1).

This problem was resolved by using a box enclosure on the pictures that user chosen to represent their music boxes. See Figure 6.2.

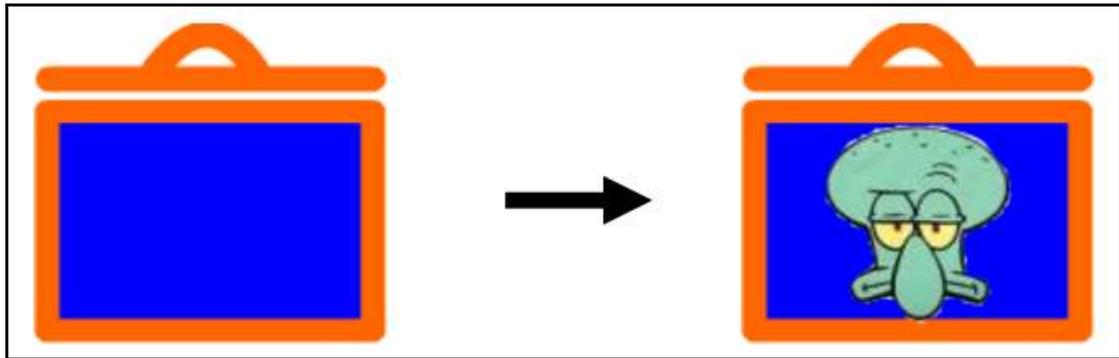


Figure 6. 2: A modified version of music box

The included interfaces are not for everyone

One of the older participants (10 years old), disliked all the interfaces that were included in the final version. He described them as “*Too kiddie*” and “*not cool*”. Even though all other participants liked one or more of the interfaces, this issue raised an important question, which is how to design something that is suited for everyone. The first option might be designing more interfaces into the system, so there are more options for the user to choose. The second option is to include interface design as one of the functionalities of *Kid’s Music Box*, so that the user can design their own interface (See Chapter Seven).

Not enough interactive games

The evaluated system contained six interactive games in the visualisation area. However, nearly all participants asked the researcher if that is all the games included. They expected to have more games than just the six that were provided. More interactive games are clearly desirable, however gaming might be overtaken as the primary objective of using this system if too many games were included. This issue will be discussed more in depth in Section 6.4, in the examination of usage logs.

Quick search filters out songs

The quick search feature in the music library is intended for an easier, faster and more responsive search method that users with limited computer expertise can use to search for songs. Because of those reasons, the quick search only looks for songs in the currently selected music box. Once a match is found, the songs will be displayed in the music library, as long as the searched term “*school*” still exists in the quick search box. The problem arises when the user decided to change to a different music box, but

without realizing that the search term is still entered in the quick search box. The newly selected box would show no songs, even though the user knew there should be songs in the newly selected music box. This limitation was due to the search term remaining in the quick search box, acting as a filter, and hence in this case, only songs where the name contains the word “school” were displayed.

In order to address this problem, the content in the quick search box is cleared whenever a different music box is selected in order to cancel the filter effect.

In addition to the above problems, two of the younger users were unable to figure out where to click when assigning ratings to songs or moving songs to another music box. Participants pointed out that it was hard to distinguish both music box and ratings column from other columns, and it was not intuitive for them to know that a dropdown box of options is available once clicked. However, the participants easily overcame this inconvenience, once the researcher pointed out to click on the image to activate the dropdown box.

6.2.3.2 Unsolved issues from expert evaluation

Recall during the second expert evaluation (see Section 6.1), the expert recommended that the researcher should investigate further on a number of issues: the effectiveness of icons representing the functionality of the button, the use of left and right mouse clicks, and whether to add extra song attributes. These issues were discussed with the participants to determine whether changes are needed to the system.

Icons

All of the participants thought that the icons matched the functionality described and did not think it is necessary to make any changes to the buttons. Four of the participants also pointed out that the *tool-tip-text* was useful because it provided information regarding the functionality of all the buttons.

Mouse Clicks

Kid's Music Box requires the use of both left and right mouse clicks in the *Login window*. The left mouse click was used to log into the user account while the right mouse click was used for the deleting user accounts. The expert commented that this

could be a problem because children might have trouble recognising the difference between left and right mouse click. To find out whether the user is able to tell the difference (functionalities) between the two buttons, one of the tasks was deliberately added, which is to remove an account.

The result for this task was successful; none of the participants had trouble in removing accounts from the login screen. All the participants noted that they simply followed the instruction on how to remove an account on the opposite side of the accounts area (See Figure 4.2).

Extra song attributes

Songs are displayed by the music box it belongs to, the song title, the name of the artist, and its rating. During the evaluation, the expert felt the need to display more attributes for songs, such as the duration, the file size and genre. However, seven out of the eight participants did not think it was necessary to display more attributes. Their main response was that the currently existing attributes such as title and artist are enough to represent songs. Moreover, they also did not want the organizer to become too similar to iTunes, where many song attributes are displayed (See Chapter Three).

6.2.4 Logging actual use

After the user studies, *Kid's Music Box* was installed on three participants' personal computers at their respective homes, in order to log the actual use of the system for a month. The purpose of logging actual use in this research is to collect field use information on the *Kid's Music Box*, as a supplementary method to collect detailed data on how actual users interacts with the system [18]. A CD containing 30 children songs, which was downloaded from www.freekidsmusic.com, was also given to the participants for the purpose of this experiment.

The logging application was implemented within the system, which means the system itself is the recording application; hence, no external software was required. The system employed two methods of recording the actual use: text and images. Text recording shows all the user interactions with the application, along with time

stamping (see Figure 6.3). As with image recording, the system takes a screenshot of the application every 20 seconds, to see what the participant is doing. See Figure 6.3.

```

Time: 6/11/2006 1:56:41 p.m. Current User: kelly Current music box: ALL Program Started!
Time: 6/11/2006 1:57:00 p.m. Question: What are you trying to do this time? Answer: Add songs to music box
Time: 6/11/2006 1:57:02 p.m. Question: Are you using this music box: Answer: By yourself
Time: 6/11/2006 1:57:05 p.m. Current Box changed to: Gift from f
Time: 6/11/2006 1:57:06 p.m. Current Box changed to: Gift from Kelly
Time: 6/11/2006 1:57:06 p.m. Current Box changed to: Gift from edmond
Time: 6/11/2006 1:57:07 p.m. Current Box changed to: Special songs
Time: 6/11/2006 1:57:07 p.m. Current Box changed to: dixie chicks
Time: 6/11/2006 1:57:08 p.m. Current Box changed to: Gift from Kelly
Time: 6/11/2006 1:57:08 p.m. Current Box changed to: Long songs
Time: 6/11/2006 1:57:09 p.m. Current Box changed to: Short songs
Time: 6/11/2006 1:57:12 p.m. Current Box changed to: ALL
Time: 6/11/2006 1:57:13 p.m. Played a song by double clicking
Time: 6/11/2006 1:57:17 p.m. Tooltip showed! CHANGEGUI
Time: 6/11/2006 1:57:18 p.m. Tooltip showed! CHANGEGUI
Time: 6/11/2006 1:57:18 p.m. Current action: Changed GUI!
Time: 6/11/2006 1:57:18 p.m. Tooltip showed! CHANGEGUI
Time: 6/11/2006 1:57:18 p.m. Tooltip showed! CHANGEGUI
Time: 6/11/2006 1:57:19 p.m. Tooltip showed! CLOSEWINDOW
Time: 6/11/2006 1:57:24 p.m. Question: Was the music box program fun to use? Answer: Yes
Time: 6/11/2006 1:57:28 p.m. Question: Was the music box program easy to use? Answer: Yes
Time: 6/11/2006 1:57:30 p.m. Question: Was the music box program useful? Answer: Yes
Time: 6/11/2006 1:57:30 p.m. Current User: kelly Current Box: ALL Program Ended!

```

Figure 6. 3: Log showing actual use of the system

As well as recording all the user interactions with the system, questions were also asked in popup messages prior to opening up the main window and after terminating the main window. This approach were taken because many details cannot be revealed by looking at how a user is using the system, such as whether the user is using the system alone, and the main purpose for using the system at the time. See Figure 6.4

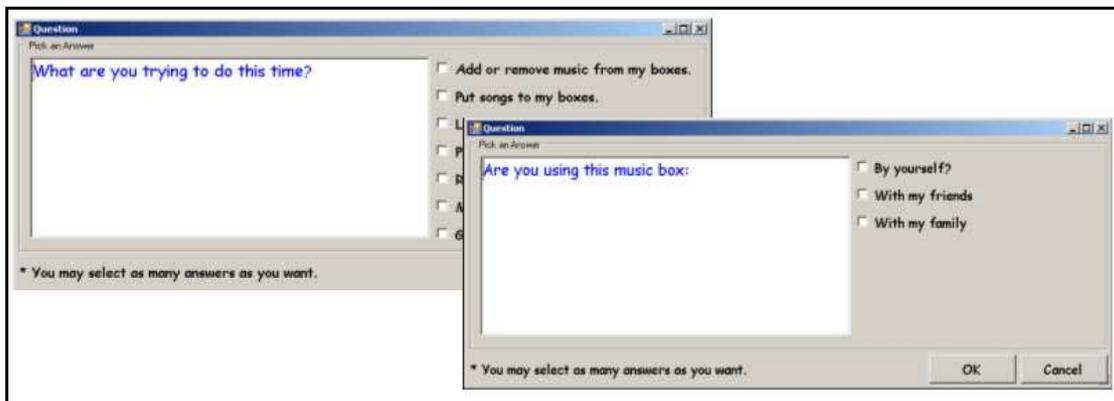


Figure 6. 4: Some of the questions asked in popup windows

By looking at the logs and screenshots, the research hoped to reveal the most used and rarely used features of the system; analysing of patterns of use and details of use; the main purpose of using the organizer; the level of parental assistance given to the user and the users' personal feelings about the system.

Revealing the most used features of the system

The records will be able to show the features that were heavily used. By determining the most frequently used features of the system, the researcher will be able improve the system by optimizing the most frequently used features; either by making them more accessible or making the feature easier to use, since it is used frequently.

Revealing the rarely used feature of the system

The records will also be able to show the features that were used very rarely. This usually means that the feature is not noticeable or the feature is not relevant to the system, which means that it might be removed from the system completely or to re-designed it so it is more obvious and more accessible to the user in future versions of the system.

Analysis of pattern of use and detail of use

Since the entire session of actual use is recorded, it is possible to detect patterns of use. This provides useful information such as what function is always performed after the system started, or the function performed after a song is played. Finally, by studying the detail of use from logs, it will be possible to reveal usability problems that were not possible to expose during user study. The second form of *recording actual use* was in the form of asking questions. This will provide details of the actual use where it is not possible to tell from logs. See Appendix C for the questions and possible responses. The questions were designed to determine issues such as:

The main purpose of using the organizer

The user will be able to choose one or more features of the system as their answer, which are Add or remove songs, play songs, manage music boxes (re-assign songs), rating songs, play games, make or load gifts and extract music from CD. The purpose of this question is to determine the main reason why users choose to use the system, hence, more emphasis can be placed on this feature in future releases.

The level of parental assistance given to the user

Since this application was designed with the intention that the majority of tasks should be able to perform for children aged six to ten years old, the user's answer will either confirm that the system is right for targeted audiences, or otherwise.

The users' personal feelings about the system

After the user terminates the application, more popup messages will ask some questions regarding the user's personal impressions with the system. The questions are:

- Was the *Kid's Music Box* easy to use?
- Was the *Kid's Music Box* fun to use?
- Was the *Kid's Music Box* useful?

6.2.4.1 Results of logging actual use

The experiment period for *Kid's Music Box* was one month (28 September 2006 to 29 October 2006) and each session was recorded separately. From the three participants' computers that the organizer was installed on, 85 sessions were recorded. This section will first discuss the summary of the logs, followed by the key findings from the logs.

6.2.4.2 Log summary

Following are some key statistics from the logs.

- Total number of sessions is 85.
 - For 71 sessions, the users responded that the application was fun to use
 - For 75 sessions, the users responded that the application was easy to use
 - For 39 sessions, the user responded that the application was useful
- The average length of time per session is approximately 9 minutes.
- The median length of time per session is approximately 15 minutes.
- Attempted at making gifts 5 times, but none of the attempts were completed.
- The most used feature was playing songs, followed by playing games and rate songs.

The debriefing revealed why only about half of the sessions where the user thought the application was useful; the main reason being that the users were simply not interested in organising songs.

Played songs	204 times
Played games	183 times
Rated songs	124 times
Stopped songs	112 times
Next songs	102 times
Changed interface	80 times
Previous songs	67 times
Created playlist	51 times
Moved songs	35 times
Quick search	24 times
Undo action	16 times
Removed playlist	13 times

Table 1: Log summaries

Parental assistance

Initially, the logs showed that the users' first few sessions of using the organizer were with their parents (The option "Using the application with family" was selected). However, users became more independent as they became more familiar with the application. This trend is realistic considering parental assistance is needed to set up the songs and images that children can use, and since this application was designed for children, it is also expected that children became more independent with the application easily.

Frequency of application usage

For all three participants, the application was used frequently and relatively extensive in the week after installed on the participant's computer. However, only one participant used it constantly for the entire month, while the other two only used it rarely. In the follow up interview, these latter two participants pointed out that they have lost interested in organizing music and subsequently focused more on other features such as the games on the organizer.

Rarely used features

The gift creation feature was one of the most rarely used features of the system. The logs showed that all three participants attempted to create a gift but the task was not completed (Gift creation wizard cancelled). The most likely reason being that since gifts from *Kid's Music Box* can only be opened by another *Kid's Music box*. Hence, it was not worthwhile for the participants to create a gift for someone who cannot open the gift. Clearly, the prototype status of the system affected the usage of the gift creation feature.

Games over organizing music

The logs showed that the main purpose for users in 33 sessions was not to organize or listening to music; instead, the main intention was to play the games from the interactive area. This is not a problem, in retrospect, this is not be the fault of the system, but merely indicate the trend of adult computer users – Adults frequently play their music while they play games or browse on the Internet [43]. Hence, it is natural for children to play games in the context of listening to music.

Tool-tip-text usage

Recall the *Tool-tip-text* feature was included in the organizer to inform users about the purpose of the button that is highlighted. The logs showed that this technique was used extensively in the earlier sessions, showing by the number of times each tool-tip-text was displayed. However, as participants understand the application better, tool-tip-text is displayed less because buttons are clicked before the text are displayed.

6.3 Summary and implications

The evaluation results of *Kid's Music Box* were satisfying; it was well received by both the experts and participants. Throughout the evaluation, many of *Kid's Music Box's* features and designs were confirmed for younger children. At the same time, the evaluations also revealed many flaws (see Section 6.2.3.1) in the current version of the system, both usability and interface problems. These flaws will help in providing a clear direction in any future development of *Kid's Music Box*.

The expert evaluation by the two graphics design lecturers (see Section 5.2) was important in the sense that their input contributed largely in the final interface design. Many of their ideas were valuable, including the use of colour wheel concept in colour selection, the non-rectangular shaped window and ideas for multiple interfaces. They helped in shaping the interface to be meaningful, intuitive and balanced. The evaluation by the usability expert (see Section 6.1) from *The University of Waikato* helped refine the usability aspect of the system. The expert pointed out the features that are useful, and those that are not. Important inputs includes the use of consistent font sizes, pointed out the problem of the complicated search feature, which consequently lead to the implementation of the quick search box, and also pointed out the need of a return to the login feature in the main window. The expert's contribution made the system more usable and more simplified.

The evaluation study with the original focus group (Section 3.2) provided many insights into what the actual target audience of this study thought about *Kid's Music Box*. All participants agree that *Kid's Music Box* is better than *Windows Media Player*, *iTunes* and *KidsPlayer* for organizing digital music collections. Some of the favourite features such as the visualisation area, games, colourful interface, making a gift and simplicity in use reconfirm the intention and design rationale of this research.

The recorded logs from actual use reveals much information regarding the field use of the *Kid's Music Box*, both positives and negatives of the application. In retrospect, the application should not be installed only based on the availability, age and academic performances; instead, the application should be installed for children who are actually interested in organising their music collections, because not all children are interested in organizing their own digital music collections. This issue was reflected by the frequency of application usage and the intension of application that was discussed in the previous section.

Chapter Seven

Conclusion

The main goal of this thesis is the design and implementation of a digital music organizer for children aged six to ten years old – to support children with organizing and listening to their growing digital music collection. More specifically, it extends on current digital music organizers to build on features that are suitable for children and to avoid features that are not comprehensible for children. This thesis also focused on understanding the real needs and expectations of children and thus gain better insights into the problem. This was done through the design, development and formal evaluation of *Kid's Music Box*.

This chapter will first discuss improvements to previous digital music organizers, where the focus is on the features that made *Kid's Music Box* more suitable for children than previous approaches. The chapter concludes by discussing the implications of *Kid's Music Box* and future work which might lead on from this research.

7.1 Improvements to previous digital music organizers for children

Kid's Music Box makes many improvements to current digital music organizers for children. Improvements are both in the form of new features and of changes to existing features which make them easier for children to use. In order of importance, these improvements are:

The music box concept

This is the most significant improvement to *Kid's Music Box*. The *boxes of music* concept was introduced to help children to better understand the underlying structure and the relatively new concept (for children) of digital organizers. The initiative behind this was for the digital organizer to mimic something that children already understand; it is hoped that the analogy will make the digital organizer more appropriate for children. An observation into how children organize their physical items reveals that children often use boxes to store their toys and that smaller boxes contain smaller toys. Hence for *Kid's Music Box*, boxes were used to represent different user accounts and playlists with the analogy that each person has a big box to store all their songs and smaller boxes to put all their songs into.

The visualisation area

Because being able to listen to music is not enough for children – they also want something to do while listening to music. For this, the visualisation area was introduced. The initial evaluation of existing digital music organizers reveals that children love the visualisations that are offered by *Windows Media Player*. Some participants even consider that it is one of the most important features in music organizers, along with games. To accommodate this, the visualisation area in *Kid's Music Box* offers three different features: music visualisation, interactive games, and an image viewer.

The inter-changeable interface (themes)

Even though the *Kid's Music Box* is aimed at children aged six to ten years old, a significant gap exists between the younger and the older group of the target audiences.

The interface is where participants had most conflicting views. One older participant thought that the interface is too “kiddie” while boys think of the same interface being too “girly”. Inter-changeable interfaces were then introduced to resolve this problem.

Send and receive gifts

The gift feature in *Kid's Music Box* allows users to create and open a gift where a gift contains text, a picture and songs. This feature enables children to easily share their favourite songs among friends and family, if they also have a copy of *Kid's Music Box*.

Parental assistance options

The assistance option allows parents to set the music and pictures folder where their child can use within the organizer. Furthermore, it allows the parents to enable filters to filter out songs that are unsuitable.

Other improvements

Additionally, other improvements include the use of pictures and colours. Pictures are used to represent user accounts and playlist and colours are used to enhance the look and feel of the interface. Font styles and sizes are specially chosen to allow children to read text easier. The quick search feature offers users an easy way to look for songs, with minimal input required. The undo feature allows users to undo actions such as delete songs and delete playlist. And finally, extracting music from CDs is made easier with the CD extraction wizard.

Whether the feature are newly added for *Kid's Music Box* or modified features from existing digital music organizers, the benefits of these features are clearly evident in the evaluations. Their roles in *Kid's Music Box* directly addresses problems and shortcomings in currently existing digital music organizers for children and therefore provide a much better foundation for children to organize their music collections.

7.2 Implications for Kid's Music Box and Beyond

Recall that the goal of this thesis was not only to design and implement a digital music organizer for children by improving features from currently existing digital music organizers, but also to explore new approaches and ideas that are more suited for children. It was evident that *Kid's Music Box* accomplished the first half of the goal, but what of the second? What new ideas and approaches have been discovered? Could these new ideas and approaches be beneficial for children?

The first lesson learnt from this thesis was from the background research. It looked at a wide range of fields such as the underlying structure of digital music organizers and child related technologies in order to construct the foundation of this thesis. From this, the motivation of the thesis was clarified. In particular, the *International Children Digital Library* provided a good indication of children's understanding and expectation of information technology. Another important step was recognising the importance of working with children as design partners, and at the same time how to work with children and bridge the intergeneration gap.

The background research laid the foundation for the implementation of *Kid's Music Box*, with the aspirations not only to address the problems from previous systems, but to go beyond and to discover new approaches and new ideas in designing digital music organizers for children based on lessons learnt from background research. To this end, the music box concept was introduced to help children better understand and cope with the digital music organizers. The evaluation phase suffered many obstacles, with most of them coming from the look and feel of the interface.

The remaining lessons learnt were from the evaluation phase, through expert evaluations, empirical usability tests and logging actual use. The *expert evaluations* were valuable in that they provided ideas that supported much improvement to both the interface and the usability of the system. The usability tests reaffirm the design rationale of *Kid's Music Box* and indicate that the shortcomings of previous systems have been overcome. While logging actual use was designed to see how the system works in real world use, it also revealed a major flaw in the evaluation procedure –

participants for the evaluation were chosen based on their computing and academic skills. In retrospect, participants should have been chosen based on another important attribute: the participants' interest in music and organizing music.

The evaluations of the system indicate that *Kid's Music Box* is better suited than previous system for children to organize their music collections. Many aspect of the system both in the design and implementation phase could have been done differently. The interface should be more customizable. This means that not only should users be able to choose a pre-defined background colours, they should also be able to specifically choose all the colours they want. The selection process could be made as a game for the interactive area, where the interface of the system is displayed on the interactive area and users can apply their own colours and styles to the interface. Any changes to the interface on the interactive area will then be reflected on the actual interface. In recognising that not everyone will like the games and themes preloaded into *Kid's Music Box*, it would be natural to allow users to design their own themes and download their own games (games must be in *Flash* format, which is widely available free of charge on the Internet) into the system.

Kid's Music Box is a step in the right direction, in providing children with an easier approach to organize their growing digital music collections. It is only a small step – only a small beginning, but it has great potential for growth, to benefit and encourage children to organize their digital music collections into *boxes of music* where it lives up to its name.

Appendix A

Use cases for the *Kid's Music Box*:

- *Opening applications and Loading existing data*
 - *Basic course:*
 1. The executable file is started
 2. The system checks for existing accounts, playlist and songs
 3. The existing accounts then displayed on the *Login Window*
 4. The user clicks on their account to login
 5. The *Main Window* displayed
 6. The existing playlists and songs for the selected account are displayed on the *Main Window*
 - *Alternate course:*
 - 3a. If no existing accounts was found, an account name “*Public*” is then created and displayed
- *Parental control features*
 - *Basic course:*
 1. The parental control window is opened from the *Login Window*
 2. Setup the music folder
 3. Setup the pictures folder
 4. Setup the gift folder
 5. Setup the filters
- *Managing accounts*
 - *Basic course:*
 1. Using the wizard to create an account from the *Login Window*
 2. Remove an account from the *Login Window*
 - *Alternative course:*
 - 1.1 An account is created with an already existing account name
 - 1.2 Account must be re-created.

- *Song playbacks*
 - *Basic course*
 1. Play a song by clicking on the “*Play*” button.
 2. Pause a song by clicking on the “*Pause*” button.
 3. Skip a song by clicking on the “*Next*” button.
 4. Go back to a previous song by clicking on the “*Previous*” button
 - *Alternate course:*
 - 1.1 If no song is selected, the first song from music library is then played

- *Add songs*
 - *Basic course:*
 1. A file open dialog activated by clicking on the *import* button
 2. User select wanted songs from file open dialog
 3. Songs imported into the music library
 4. Songs are also assigned to the selected playlist

- *Remove songs*
 - *Basic course:*
 1. User selects the songs that are to be deleted
 2. The delete button is clicked
 3. The selected songs will be removed from music library
 4. The selected songs will be removed from the playlist

- *Rate songs*
 - *Basic course:*
 1. User selects the song that is to be rated
 2. Clicks on the *stars* column of the song
 3. Select a rating for the song from the drop down box

- *Assign songs to different playlist*
 - *Basic course:*
 1. User selects the song that is to be moved to another playlist
 2. Clicks on the *playlist* column of the song
 3. Select a playlist from the drop down box

- *Creating gift*
 - *Basic course:*
 1. User clicks on the *Create Gift* button
 2. A wizard appears to help users create gift
 3. User required to insert images, text and songs into the gift
 4. The gift is created and place on the predefined location

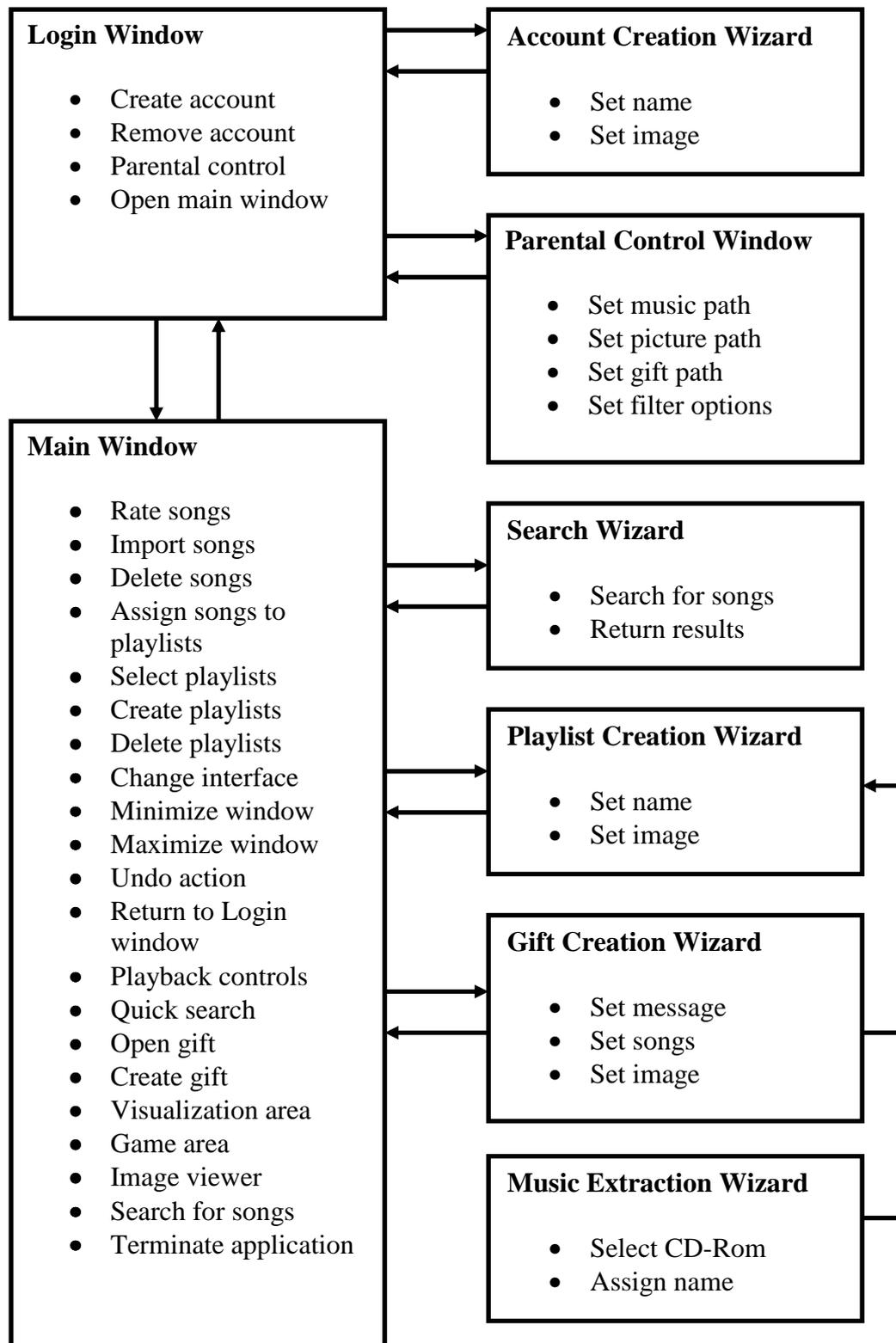
- *Open gift*
 - *Basic course:*
 1. User clicks on the *Open Gift* button
 2. A file open dialog will appear
 3. User selected the gift
 4. The gift added to the playlist
 5. Songs are added to the music library

- *Delete gift*
 - *Basic course:*
 1. User selects the gift from the playlist manager
 2. Clicks on the delete button
 3. The image, text and songs will be removed
 4. The gift will be removed from the playlist manager

- *Add a playlist*
 - *Basic course:*
 1. User clicks on the *New Playlist* button
 2. A wizard will appear
 3. User required to enter the name and select a picture

4. The newly added playlist is represented by the selected image
- *Remove a playlist*
 - *Basic course:*
 1. User selects the playlist that is to be deleted
 2. User clicks on the *Remove playlist* button
 3. Songs belongs to the playlist is first removed
 4. The playlist is then removed from the playlist manager
 - *Managing the Multi-display area*
 - *Basic course:*
 1. Displaying the games area
 2. Displaying the visualisation area
 3. Displaying the image viewer
 - *Searching for songs*
 - *Basic course:*
 1. Songs can be searched with the quick search feature
 2. Songs can be searched with normal search feature
 3. A wizard is included to help users performing search
 4. Results from search can be saved as a playlist
 - *Quitting application and saving*
 - *Basic course:*
 1. The close button is clicked to terminate the program
 2. Song attributes such as the playlist it belongs to and its rating is saved to the database
 3. Playlists are saved to the database

Appendix B



Appendix C

List of Questions asked.

- What are you trying to do?
 - Add or Remove songs from music box.
 - Rearrange songs in music boxes.
 - Listen to music.
 - Play games.
 - Rate songs.
 - Create or Open gifts.
 - Get music from CD.

- Are you using Kid's Music Box with:
 - Alone
 - Friends
 - Family

- Was Kid's Music Box fun to use?
 - Yes
 - OK
 - No

- Was Kid's Music Box easy to use?
 - Yes
 - OK
 - No

- Was Kid's Music Box useful?
 - Yes
 - OK
 - No

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