My Pictures: informal image collections

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digital photography, consumer, organising

Digital techniques are rapidly becoming popular for the recording of images, but current applications for handling image collections still lag behind the varied and fluent ways of interacting that traditional informal collections offer. Here we report a field study of how home users use traditional ways of storing and organising their private photo collections. We compare this to the possibilities and limitations of current tools for digital image collections. Findings indicate that the interfaces of current digital tools provide excellent support for solution oriented indexing, but limited support for browsing and storytelling. Finally, we present an interface which combines the best of both worlds for interacting with digital images.

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Research report

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ID-StudioLab

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Preface

This is the research report of my graduation project at hp Laboratories Bristol (UK).

I would like to thank the people at hp Laboratories Bristol for giving me the opportunity to work on this project. I would like to thank Janet Bruten and Erik Geelhoed for their excellent supervision.

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Summary

In the world of digital imaging a lot of effort is put in enabling users to store, print and share their pictures whenever and wherever they want. People can choose between an increasing number of solutions. New and improved cameras are being introduced on the market each month. Every new generation has a better performance and lower price than the one before. Most new versions provide a more convenient way to transport image data to other digital devices or directly to the Internet. Online services are now joining with the retailers on the corner of the street so people can keep using their favourite photo or grocery store to order their prints. The computer and the Internet play key roles in the image process chain and therein lies one of the main issues. People are expected to have a certain level of technical computing skill to be able to profit from the advantages the digital process of imaging brings.
The conventional photography market is slowly changing into a digital version where it seems a trade off is made. The new possibilities of the digital technology can be very appealing, but shouldn't the traditional values be taken into account? And how does this relate to the process of organising, the stage between capturing and presenting images, in other words how to manage a collection of images that is stored in a digital format?

The goal of this project is to design a user-interface for personal image collections that is easy to use, capable of managing a large number of images and aims to make organising photos a pleasurable experience. Most people have a lot of experience with recording images by using film cameras and are very much satisfied with the traditional and straightforward way of ordering prints and organising these in for instance shoeboxes or albums. In this project a research is conducted to better understand the key values (and limitations) of organising collections of printed photos (discussed in chapter 3 "User perspective"). In order to be able to come up with innovative solutions the user research was split up in two parts:

1) A research at home consisting of 6 interviews to explore the context. Questions as why, when and where do people organise their pictures are important to investigate. Most solutions for digital image management overlook the importance to understand these conditions.

2) A research at Labs consisting of 8 observations to analyse the techniques people use to sort a collection of several photo wallets. This research gave answers to the basic question of how do people organise their pictures?

The conclusions of the user study were mapped out with the findings of the market review (see chapter 2 "Market perspective") in which the offering of digital solutions is analysed. This match is described in chapter 4 "Match of market and user research findings". Especially the user research generated a broad range of findings and in order to be able to develop a concept that fits in the limited project's timeframe, we choose to first split up the key findings into three areas of interest:

1) Management of digital image collections
   Discusses the mismatch between the user's need to put a personal touch and style in the process of organising and the market offering of digital solutions that tend to frame this process, by imposing a step-by-step method. This reflects on the way people can create personal stories and also on the restricted freedom to label and retrieve images.

2) Using photo collections
   Addresses the loss of the two main key values of the traditional process of organising, namely it's tangible and richly evocative chara cter.

3) Bridging the gap between the digital and physical world
   An extra element of interest was detected during the research. Some people explained, because they started to use a digital camera as well, they experienced a change in their usage behaviour. Most images stored in digital format didn't seem to be used at all. This negative effect didn't correspond with their need to review pictures, especially the ones that were taken a while ago. User study showed that pictures are part of a lifecycle, which fluctuates the need to review over time. Printed photos were more often used for review or album creation, while digital images stored on the computer tend to be kept inactive.

As described in section 4.5 "Conclusion" a selection is made that mainly focuses on the second area of interest – Using photo collections and it's tangible character. All three areas are part of a bigger concept that best can be described as a smart solution. By approaching the issue of organising a set of digital images from a use r perspective, the technology is put in a serving role. One of the first steps in making organising personal image collections a compelling task is to provide a solution that enables a more dynamic and intuitive means of control. A flexible or open solution that addresses the current mismatch between user characteristics (as the desire to put a personal approach in the process of organising) and market offering of formal and framed digital organising solutions. This conclusion leads to the revision of the design objective in: "a tool that helps you create a personal story from a collection of digital images.", thereby bridging the gap between the hierarchically-based image managers and the dedicated album creators (as shown in figure 1).

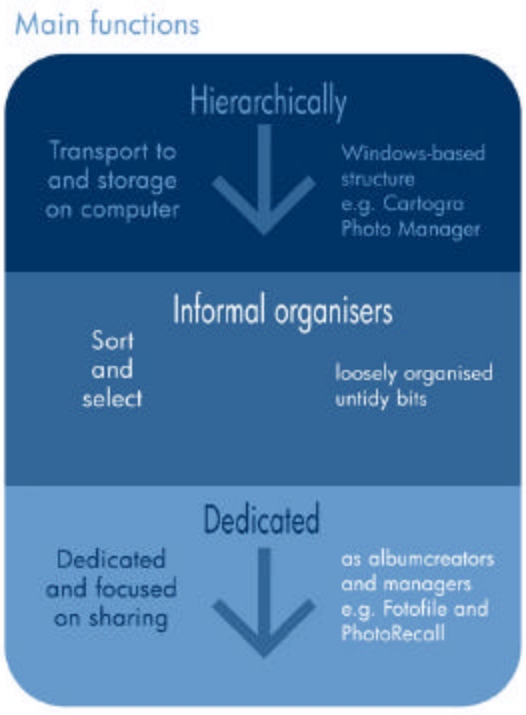


Figure 1 – Diagram to identify gap

A scenario is presented that puts the concept into a context of a family environment, thereby using the insides gained during the user research. Design aspects of the concept are explored by using metaphors as shown in figure 2 – Project scenario.

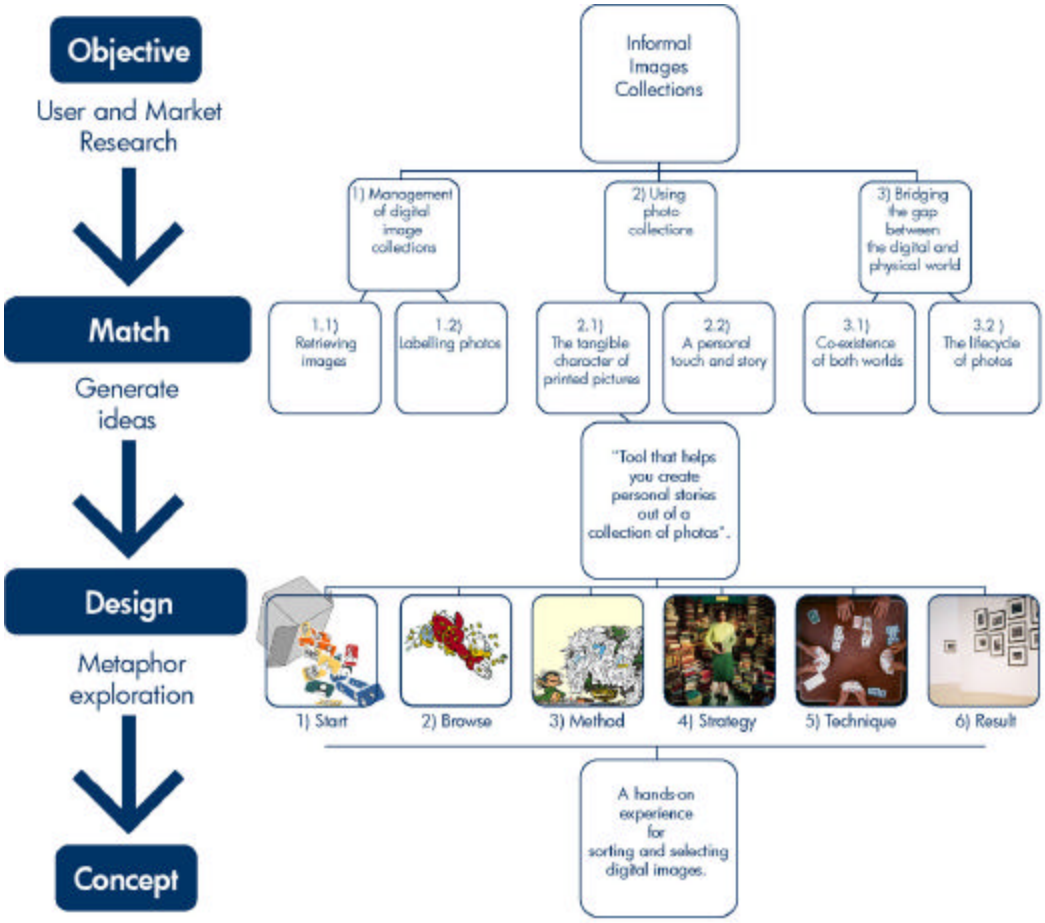


Figure 2 - Project scenario

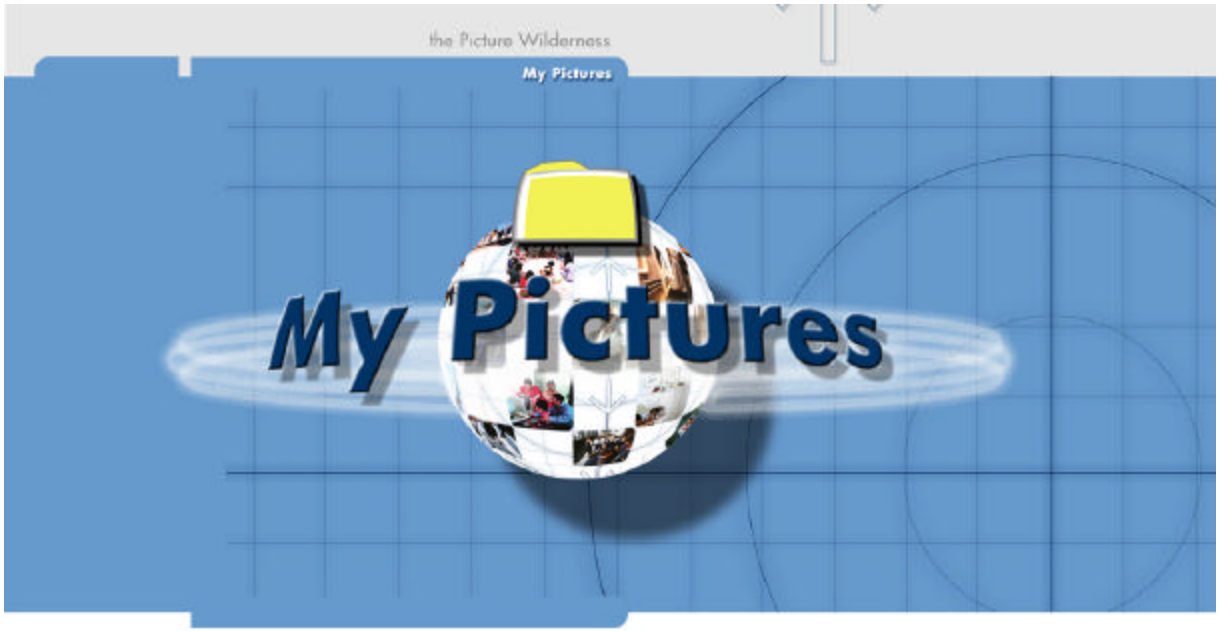
These metaphors are an informal way to find answers to the following two basic questions:

- How to translate the more important values of the analogue process into a digital version?
- Which new values or possibilities can contribute to the functionality and enjoyment factor?

The final concept is described in section 5.4 “interaction model and interface design” and presented in a narrative format, using the scenario as guideline. The use of a touchscreen tablet is suggested to be the best appropriate configuration for the task of organising. Then the focus is put on the most important aspect of the concept: the intuitive control that is provided by the use of gesture driven input. This gesture driven input functions as a set of tools that is designed to enhance the level of interaction between the user and his images. The concept can further be described as an open solution that puts the focus on the images rather than on the underlying

technology. As a result, the GUI (Graphical User Interface) is dominated by the pictures, leaving out the buttons, tool palettes and pop-up menus that normally dominates the screen in standard Windows-based image managers.
The report ends with some suggestions for improving the concept. These suggestions are focused on enhancing the functionality of the solution. Ideas for extended use of indexing, intuitive labelling and support by other programs are described to show the proposed solution not only fills the gap as shown in figure 1 above, but could just as well stream the process of organising collections of digital images.

Contents



Introduction

1. Introduction

1.1 hp

Hewlett-Packard was founded in 1939 and has been a global player in the computing industry for many years. Its strong position in both the business and consumer markets has been established by inventiveness and a reputation for high quality. However, due to vast technology developments and the rapidly evolving environment, the company has had to reinvent its strategy.

The new direction for the future is to focus on capitalizing on the opportunities of the Internet and the proliferation of electronic services, in terms of three vectors: e-services, appliances and infrastructure - visualised in figure 1.1.

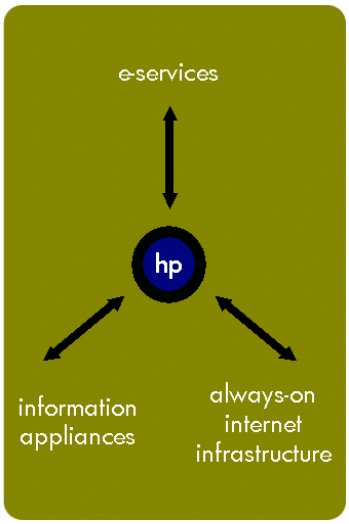


Figure 1.1 - the three vectors

The first-wave opportunities include:

- e-printing;
- e-publishing;
- digital imaging; and
- communications/service providers.

1.2 hp Labs

hp Labs is Hewlett Packard's corporate research laboratory and consists of 6 sites around the world. hp Laboratories Bristol is the second-largest research site, with a main focus on e-services for both individuals and businesses.

It's mission is twofold: to invent "disruptive" technologies that will change markets and create entirely new opportunities and to provide leadership technologies to hp's computing and imaging businesses in infrastructure, services and appliances.

1.3 Digital Imaging

The digital imaging business is one of the key markets where hp will explore new opportunities. hp has already rolled out photo-imaging products and services, including cameras, printers, scanners and a photo-sharing site called HP Photo.com, formally Cartogra. With this strategy hp has gained an important role in the digital imaging market.

Despite the expectation that the traditional film-based process will shift toward a digital one, the old fashion analogue photography market is still expanding. The technology of photography is only about 130 years old and global adoption is high.

The process of buying film, developing and printing has become an established service, about 100 billion pictures are taken each year and this amount is still increasing (see figure 1.2).

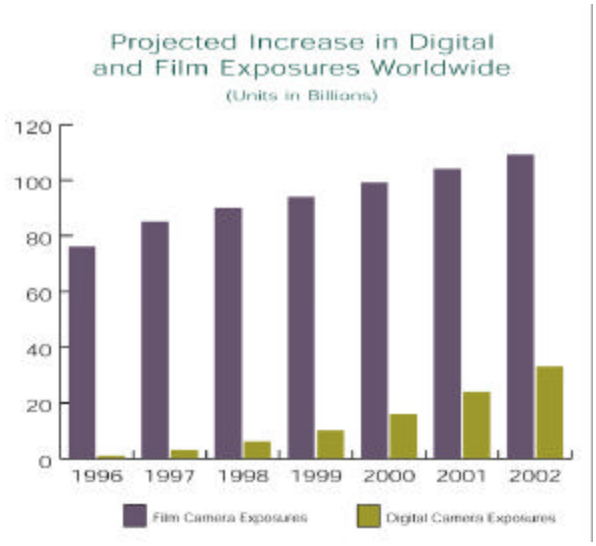


Figure 1.2 - Projected PhotoVolume by Lyra Research

“The end game is to get all the people still using film to go online and then have them eventually migrate over to digital cameras,” said Raj Kapoor, CEO of San Francisco-based Snapfish. [1]

With projections of a multibillion-dollar future, many technology companies are vying to establish a de facto standard for imaging software, creating a new revenue source even if sales of digital cameras don’t seem to follow the expected projections.
“The revenue from prints doesn’t seem to be meeting expectations,” said InfoTrends analyst Lia Schubert. Online photo printing was a 13 million dollars business in 2000, Huske estimated. That’s a mere speck in the overall 40 billion dollars photofinishing industry. [1]

1.4 Project description

1.4.1 Problem definition

Due to technological developments, the photography market is rapidly expanding. The photographing customer can choose between an increasing number of solutions. The bulk of these solutions consist of excessively featured and quickly outdated appliances and applications. While the consumer is looking for a gratifying, affordable and easy to use solution, the market promotes the use of the relatively expensive digital cameras and technology driven applications. As a reaction to this overwhelming digital promotion, customers tend to rely on the proven technology and service of the traditional film processing. User driven innovations in the digital arena can approach the situation from a different angle. In this user-centred project, the pleasure of photography will be taken as a starting point for further user research.
Digital photography is part of a complete process, from capturing a picture to the actual (social) use of these images. To gain acceptance by the mainstream of the market, there are still some shortcomings to be overcome. The main issues are the quality and price of the digital camera, and the ease of use of both camera and all devices related to the process of digital imaging. As Kodak states: "….. the computing industry will have to simplify the process of downloading, manipulating and printing the digital images". [2]

This project will focus on the use of physical photos and digital images by consumers. As the process of taking pictures and preparing them for further use is shifting from an analogue to a digital process, new possibilities come to light. Innovative solutions can change the way pictures are used.

1.4.2 Assignment goal

The aim of this project is: to design a user-interface for personal image collections that is easy to use, capable of managing a large number of images and aims to make organising photos a pleasurable experience.

To put it in a more abstract description: "Provide a mechanism that makes organising personal digital images a more enjoyable and rewarding activity, and one that enables effective sharing of images."

For this to happen we need to take into account the contexts, especially the social interactions, in which people currently use their photo collections, e.g., to exchange experiences and to identify the key advantages that digital technologies can offer in this domain. Finally, we aim to create a rough mock-up that allows evaluation by prospective end users.

This project is focused on the question: How to manage an album, a library or just a "shoebox" filled with photos that cannot be touched physically?
The key issues surrounding the personal image collections are:

- Is it possible to translate the more important values of the analogue process into a digital version?
- Which new values or possibilities can contribute to the functionality and enjoyment factor?

1.4.3 Project Scenario

The assignment will be carried out in line with methods used at the faculty of Industrial Design Engineering of the University of Delft, namely "Creating products for people" where the design is matched to the requirements of a specified target group.

The design space will provide a more usable frame, in which specific insight can contribute to developing a detailed picture of the users, their environment and the role of the product in this given situation. A technologies viewpoint will most probably lead to solutions that make already existing solutions more efficient, rather than looking at the possibilities that could provide a more unique and novel solution, tailored to people. Within this frame an informal model is generated - as shown in figure 1.3 below - to pinpoint the different areas of:

Figure - 1.3 - Collage representing 4 areas of interest

- technology developments (changing environment);
  New digital technologies might change the image landscape and influence user behaviour. A brief analyse will be done to gain a better understanding what kind of developments we can expect.
- the market (transformation);
  A market analyses will provide a snapshot of the current product offering.
- the user;
  Current user behaviour, the techniques and strategies of how traditional prints are organised, will be observed in a research at hp Labs.
- the human relationships (social circle);
  This domain will be explored in a user research at home to better understand the context in which the task of organising is performed.

The dynamic relationship between products and users can best be captured in a scenario. In this project an innovative method will be used for a collaborative design process focused on users. In this phase a user study can contribute to the

exploration of customer needs and technological fulfilment. This project is focused on finding new ways to facilitate organising of personal digital images. Within this process, user research provides the basis for finding these new ways.

The following simplified model (see figure 1.4) is used as starting point for analysing the basic process of capturing a picture to the actual use of the image.

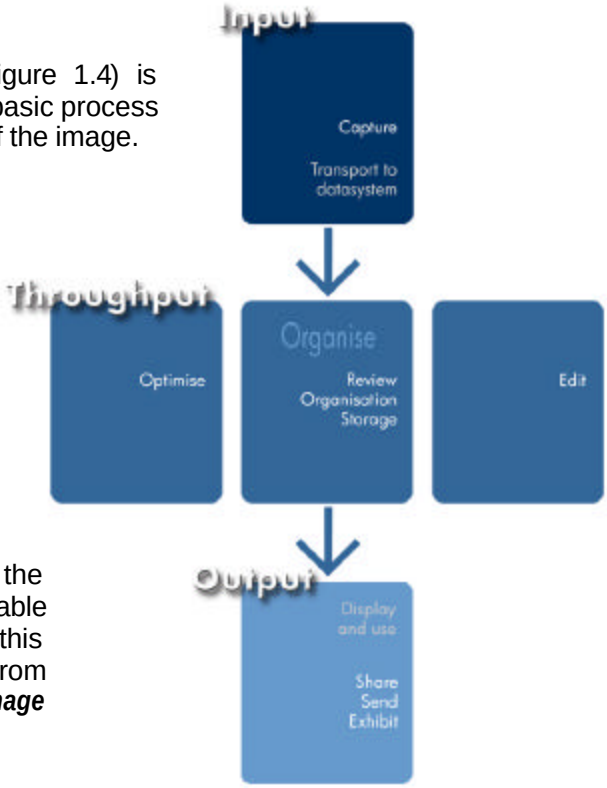


Figure 1.4 - Simplified model of imaging process

1.4.4 Objectives

The principal objective is to develop an innovative solution that promotes and simplifies the use of personal images stored in a digital format. Managing personal image collections can be seen as a fun thing to do. For this to be so, archiving applications should be exciting to use. The hierarchical way people currently have to store and organise their photo files digitally does not provide the flexibility suitable for a dynamic and variable usage of large collections. To change this situation, we will approach the situation from a different angle: organising ***informal image collections***.

1.4.5 Summary

In the next two chapters a research is conducted to gain a better understanding of both market and user perspective. Mapping out the findings and conclusions will lead to identifying the match or mismatch between (unmet) user needs and technological possibilities, described in chapter 4 “Match of market and user research findings”.

Market perspective

2. Market perspective

2.1 Introduction

This section starts with an overview of the tools currently available to support people in organising their digital photographs. In the following paragraph - "technologies on the horizon" – a brief analyses will be presented focusing on how the technology area could develop over the next few years, to better meet user requirements.

Before presenting the market research, two aspects should be taken into account:

1) The temporary nature of the current situation in which only a small segment of the consumer market is using a multi-purpose device to process their images. The exploration of the current assortment of digital solutions will provide a brief overview of how users are expected to process their digital images. Most of the current imaging applications are still focused on and around the home PC. This multimedia configuration is a widespread backbone for digital imaging, connecting peripherals for storage, enabling printing, and supporting image manipulation and organisation. This PC-centric process might change in the future as new devices come to the market and established devices such as the television are being reinvented.

2) A clear distinction is suggested between analogue and digital photography. Traditionally, collections consist mostly of printed photographs, while files stored on digital media, as hard disks and CD-ROMs, represent the digital equivalents. Purely comparing analogue and digital photography will, in this way, not lead to many helpful conclusions, since both worlds are not separable. A more practical approach is needed, one in which both worlds co-exists. In every day life people already have large collections of printed photos, using a digital camera will make this collection grow further. Only now digital image files are produced instead of film. Current market developments show that the transformation from the film to a filmless version is not one that can be analysed with sharp boundaries. Hybrid processes, in which traditional films are scanned and put on the Web or on CD-ROMs, enable traditional photographer to benefit from the best of both worlds. Some online photo services even promote the image digitising by offering free film processing, scanning and online storing. As for the organising part of photography, the transformation to digital techniques will have a great influence on how people store and retrieve their pictures.

2.2 Technology and society

The analyses of current market offerings and new technology improvements provide the context for understanding potential future developments. However, the photography market is a complex market, both driven by technological developments and changes in the society, as the following quote illustrates: “Changes in technology have paralleled changes in the nature of both families and ideas about families in Western culture. Everyone wants pictures of their holiday – and these have been the easiest pictures to take, with bright sunlight, full-length figures and small groups. The coming of built-in flash has meant that snapshots have moved indoors and Christmas and birthday parties are added to the repertoire. Technological change influences the stories we tell ourselves about family life.” [3]

Investigating the tools that are available for organising digital images does not suggest that the traditional way in which people make albums, store photos in shoeboxes and share their pictures will soon be a thing of the past. On the other hand technological developments can change the way people use their pictures. It is expected that in the near future a large percentage of the western population will be using a set of digital devices for home entertainment. The Internet has enabled them to communicate without the barriers of time and distance. The current wave of wireless communication, like WAP and Bluetooth, can provide even more control and convenience. This implies that the future market will be one that is moulded of a mixture of traditional values and new (technology enabled) possibilities.

The focal point for this market review will be the standard configuration of the current home PC. This multimedia machine is already capable of a wide range of tasks. It can store a large number of pictures on hard disk or CD-ROM and provides a door to the vastly expanding Internet. Combined with digital still cameras, Internet photo appliances (IPAs) and peripherals such as printers and scanners it can provide even more functionality than a dark room or photo studio. When looking one step further future personal devices could be capable of:

- Communicating with other devices and services directly or via the Internet;
- Processing and recording media in digital format;
- Displaying visual media on a screen.

These developments will play an important role in the image “workflow”. However it is a technology driven view that leads to wide range of combinations and permutations.

A recent article in Future Image Newsletter quotes predictions for the uptake of these various devices: “IDC's latest projections say digital devices captured a total of 9.1 billion images in 2000 - - and will generate 29.5 billion in 2005. Digital still cameras will account for 17.4 billion digital images captured in 2005, while scanners and Internet photo appliances (IPAs) will account for 10.4 billion and 1.6 billion, respectively, IDC says.” [4]

The organisation of photographs is central to the overall photography process. Operations such as transporting, storing, (re)viewing, sorting, selecting can all be put under the heading of organising. In this review, the organisation of images will be sub-divided into three further sections for analysis, namely:

- View and retrieve;
- Sort and add; and
- Storage and media.

The following sections provide an analysis of the different sorts of organising programs currently available, and finishes with a brief forecast of what might be expected in the foreseeable future.

2.3 View and retrieve

In the evolving digital imaging market there are a large number of tools that offer image collection or album management. These vary as to the Graphical User Interface (GUI), set of features and the range of enhanced automated functions. Rather than reviewing each available product in detail, this section analyses the various types of functionality, offered across the product offerings, illustrating the points with examples. The analysis starts with the basic functions needed for organising pictures, and will finish with the more advanced features.

2.3.1 Preview

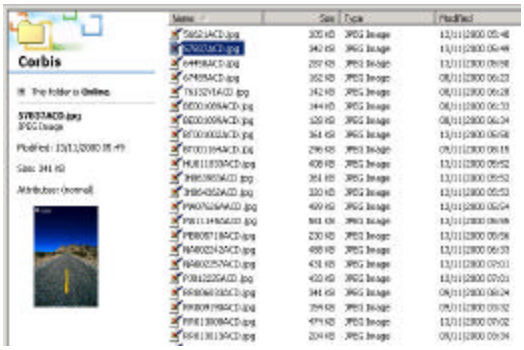


Figure 2.1 - a built-in previewer in Windows Explorer

Digital images are made up of a collection of bits. These bits are stored in files on digital media. In order to know which file represents which picture, the user is offered basic textual information of filename, size, type and date. To enable the user to quickly preview the image, the (Microsoft) operating system explorer function can show a thumbnail. This single image viewing can also be performed by "right-click" products as PicaView from ACD-systems (see figures 2.1 and 2.2).

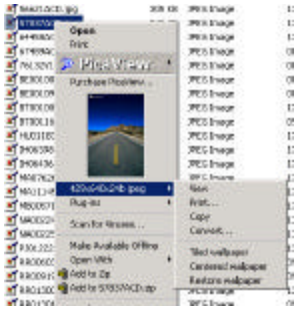


Figure 2.2 - the right-click viewer PicaView

The "right-click menu functions" support extra features such as print, copy and convert, without having to start up a special dedicated program. Although formats such as the compressed JPG, the PhotoShop PSD and universal TIF are most common at the moment, preview enablers generally support a wider variety of extensions. Preview programs have a limited retrieval aided function. When collections get larger, finding a particular picture gets harder and harder, relying on the directory organisation to add contextual information. When the user's aim is to retrieve a specific set of pictures "quick previewers" do not provide a satisfying level of control.

2.3.2 Overview, explore and browse

The textual information provided in the standard Windows viewing mode does not enable quick retrieval of multiple images. However, shifting this viewing mode by selecting "Thumbnails" in the Explorer View menu will change the textual list of files into a set of thumbnails and create a more convenient overview of the folder's content.

This is a built-in solution that resembles with the dedicated standard image managers such as PhotoManager from Cartogra. Cut-down versions of many of these applications are provided on the Internet or come with a digital camera, as part of the service, and are therefore without any charge.

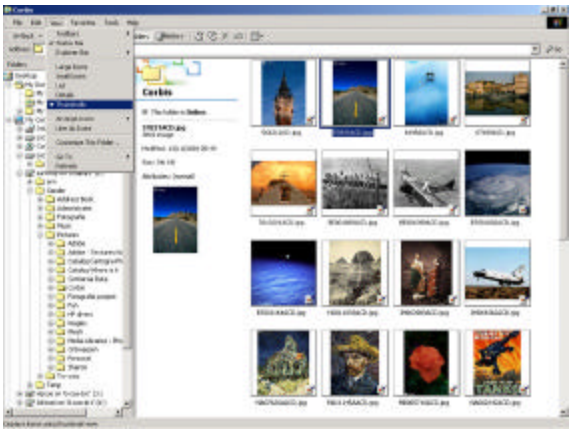


Figure 2.3 - the Thumbnails viewing mode in Windows Explorer

Figure 2.4 – the dedicated PhotoManager from Cartogra

There are a large number of image managers available, most of which look and work similar as the standard Windows Explorer browser, illustrated in figures 2.3 and 2.4 above, and typically contain the following elements:

- Multiple and split frames;
- Banner;
- Menu structure for all commands;
- Standard buttons;
- Explorer for folder structure.

2.3.3 General operation

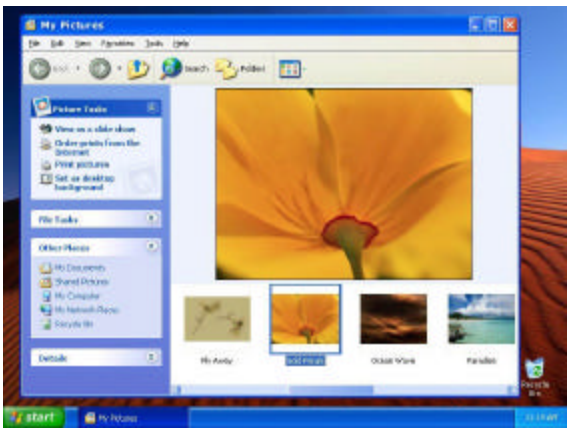
When a directory or folder (sometimes a set of different folders) is selected from the Explorer-style left-hand panel, the program scans all supported image files and creates scaled down thumbnail previews in the right-hand panel. This allows a large number of images to be viewed simultaneously. The selected images can be renamed, copied, moved, deleted or opened for editing. Thanks to drag-and-drop support, this is a method that can be used for opening multiple files in an editing application. Preference (default) settings determine how this thumbnail will operate:

- it can be linked with the original;
- the original can be copied or moved (uploaded) to the central database;
- a thumbnail can have temporary or permanent status.

In the latter case, this thumbnail functions as a fast-loading option but will take up more space in memory. It also allows inclusion of sets of photos from various locations in the collection. Thumbnail and file reference files are created locally in each visited directory or otherwise are stored centrally.

As multimedia content will take an increasingly important role, in the information stream on the PC and the Internet, more and more effort is being put in to make the windows environment a “visually friendly” one. A quick look at the new Windows XP interface shows the growing support of image handling. (see figures 2.5 and 2.6)

The functionality of the Windows operating system will continue to develop, not only due to the efforts of Microsoft - photo-related companies are developing new features which are in turn being bundled with the operating system:



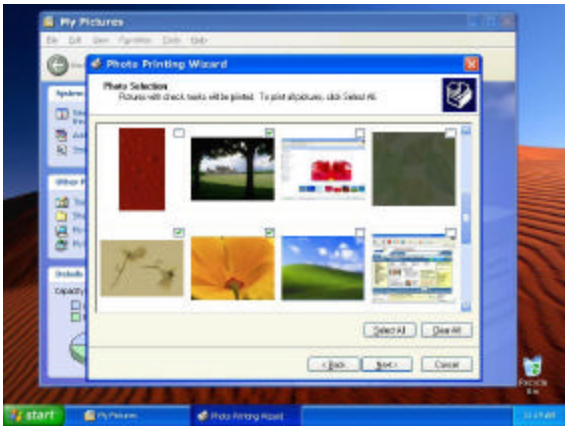


Figure 2.5 and 2.6 - Windows XP GUI and My Pictures support
And Windows XP GUI and My Pictures

“Ofoto says its online photography service is promoted in Microsoft's Windows XP beta 2. The My Pictures folder has an Order Prints feature with a link to Ofoto silver-halide printing services.
This is just one of several imaging-oriented enhancements in XP. Microsoft is clearly moving to build broad-based imaging functionality into Windows, thereby both growing the market, and reshaping the opportunity landscape for competitors and allies alike.” [5]

2.4 Sort and add

The next step in image organisation is the stage of sorting pictures. This can be done to add a new set of pictures to the collection, reconstruct a story or just to bring some order to the complete collection. A process that needs a high level of overview and control, especially since collections will grow over time and can consist of hundreds or even thousands of photos. In a standard Windows environment these photos will be placed into different folders, each representing a different topic. Changing these settings by making copies or aliases will be a complex task.

More dedicated organising programs are needed to enable tasks such as selecting a specific group of photos, labelling photos with keywords and retrieving photos that were taken a few years ago. Programs that support this level of control can be divided into collection managers such as CompuPic, FotoStation and PhotoPhilia and album managers such as PhotoRecall and PhotoBook Publisher.

2.4.1 Collection Managers

Collection managers are programs that support the organising of all images on your computer and CD-ROMs. Standard image managers are normally provided with a new digital camera or are downloadable from the Internet. The Windows-based user interface and the hierarchy within folder structures make these kinds of programs a more technical driven solution.

2.4.1.1 PhotoManager (Cartogra)

PhotoManager is a fast-loading and dedicated viewer. A cut-down program provided as a service of online photo portal hp photo – formally hp's Cartogra. The aim of this application is to facilitate the management of images between camera, PC and the Web. To simplify image transport, a download and upload button make transferring images from camera to PC and from PC to the Web a simple and easy task. Herein lies one of the key issues: storage. People can choose to store their images on a large variety of media. As the difference between the original image file and its duplicate will not be visually detectable, a risk occurs that the overview of the collection is lost. This approach will on the other hand assure the owner of having a backup of many photos.

The following features address this issue:

1) The central storage offers two huge advantages that take an application into the field of image cataloguing. First, once thumbnails from a CD-ROM have been generated and stored (caching of thumbnails, in-memory image cache) they can be viewed and searched even when the CD is no longer present. The second advantage is that central storage makes it possible to expand the information (standard: basic thumbnails and basic file information) without the need to access the original file. Additional information can include any other details that the user desires, as references/links to other related files or more detailed descriptions and even multimedia content as voice annotations.

2) The identification of duplicate images.
PhotoManager informs the user when a duplicate set is found. One of the techniques that makes this possible, content-based image retrieval, can also be used in other situations as shown in the next example (see figure 2.7).

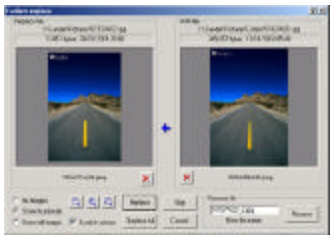


Figure 2.7 - Duplicate image identification in PhotoManager

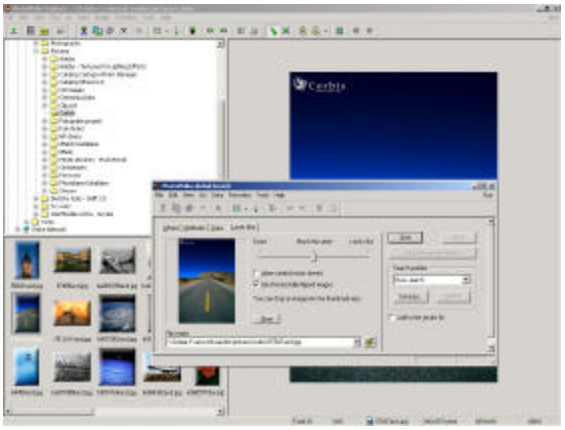


Figure 2.8 - Search by "looks like", from PhotoPhilia

2.4.1.2 PhotoPhilia

In addition to standard search features, PhotoPhilia (see figure 2.8) offers the search by “looks like” criteria. This visual-based search method offers a relatively new way of image retrieval, that most likely will gain value as collections grow in volume over time. As many other image managers PhotoPhilia offers automated HTML pages, wallpaper and slideshow generation, which are in this case richly featured.

2.4.2 Album Managers

Album managers are one step further in the organising process, or practically speaking an extension of the Windows-based folder structure. Stories can be reconstructed as photos from different folders are selected and sorted into albums. These digital albums share the same functionality. Some services facilitate posting on the Web or make the album transportable by E-mail and on portable media or they can be printed in real tangible albums. Alternatives seek a direct comparison with the traditional way how people are used to handle their pictures. The most direct translations are using the book and bookshelf metaphor as illustrated in the next section.

2.4.2.1 PhotoRecall

PhotoRecall Deluxe – from G & A – is an all-in-one digital imaging toolbox. This capture, catalogue and communication suite has taken the traditional image manager one step further. Instead of labelling itself as a digital asset manager or an image manager, it prefers to be known as a photo database and communication suite.
The backbone of PhotoRecall is the Library, which uses the Microsoft Access 97 database engine to create database (.MDB) files. It operates on a single central database, although the user can create as many albums as he wishes.

The user can give each photo a title and append a few notes; the program will create a link to the original file. When opening an album, it (in default settings) builds and displays temporary thumbnails for each image, but it can also make permanent ones.
Albums are a traditional way of organising and presenting a set of photos. These selected sets of photos mostly represents a framed story with topics like holiday or newborn children.

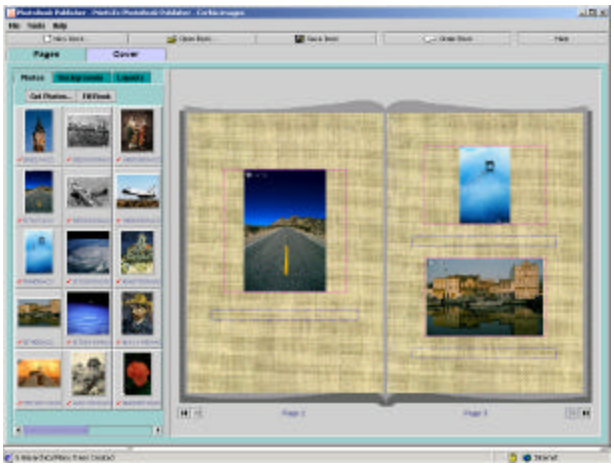


Figure 2.9 - Printlife's album service - currently discontinued its album printing services.

There is a question as to whether people are likely to put time and effort into creating such albums on a computer-based device. Figure 2.9 shows the interface of Printlife's album service. The currently discontinued service was offering its customers the ability to have the digital albums printed.

2.4.2.2 Virtual Album

Virtual Album is a program that enables archiving and retrieving photos in a more detailed way. When collections get larger over time the issue of retrieval becomes more evident.
Virtual Album has a sophisticated feature to archive each photo and album by labelling the content into different categories, as shown in figures 2.10 and 2.11.

Figure 2.10 and 2.11 - VAlbum search and Figure 2.12 - VAlbum zoom

In this way the desired photos can be found including the details of the story the images represent (see figure 2.12). Preserving the story behind the photo has not only direct personal benefits (people may otherwise not remember all the important information over time), other people who might be interested can now reconstruct the story by reading the additional information. One question remains: In order to benefit from these features the user needs to archive his collection in a consistent

and formal way. Manual indexing is a time consuming task and thereby seems only of interest for the enthusiast.

2.4.3 Other presentation styles

The album is one of the traditional ways of presenting a personal image collection. The electronic version, an E-album, is an apparent representation of the physical equivalent. This method can be described as new ways of doing old things. In the digital world more dynamic ways of presenting and sharing collections are developed. The slide show and Web gallery are some that are already part of most image managers. In the following section some new ones are presented.

2.4.3.1 Timetunnel

Timetunnel from Canon offers an alternative organising presentation. A selected set of photos preferable a complete folder with a maximum of 500 images can be put into play. Timetunnel will then, as the name suggests, present these images in a timeline-based constructed story, an easy and interesting way to review and explore a collection, as shown in figure 2.13.

Figure 2.13 - Canons Timetunnel

2.4.3.2 VoiceLink+

VoiceLink+ from InChorus is a dedicated application to generate transportable multimedia mini-albums, easy to send via E-mail. Single pictures are put in a sequence and then combined with voice annotation to create short movies. A program focused on sharing but the underlying principle is also suitable for creating collections for personal use.

2.5 Storage and media

One way to analyse the various approaches to storing digital images would be based on the technology used, i.e. magnetic (e.g. hard disk), optical (e.g. CD-ROM) and solid-state (e.g. flash memory card). However, by mapping out this space a better understanding can be developed of how the process of capturing, transporting and storing images is related to the users needs and desires. From this perspective the following model is used:

- Personal archival storage -
  as hard disk, CD-ROM and DVD;
- On-the-road storage -
  as the flash memory card for digital cameras and
  portable storage as the Mind@Work's Digital Wallet and the Nixvue's Digital Album;
- On-the-Web storage -
  as personal Web pages and online storage as part of the vastly developing imaging E-services.

Customers can choose the combination of storage and media that is most convenient. Not only will this depend on their personal preferences but also on which type of camera they own and on the digital equipment and services they are using. Since there are a large and still growing number of possibilities to choose from, a clear distinction as in the traditional photo print storage (with the shoebox, album and photo wallet) cannot yet be made.

2.5.1 Personal archival storage

2.5.1.1 Hard disks (Magnetic)

Digital cameras are very much linked to the home (or business) PC. The first place that the image data on the camera most likely to be transferred to is the hard disk on this PC. Although retail services and wireless connections (a built-in feature on some new cameras), make other solutions such as the Web more accessible, it is expected that a computer-based or computer-like device will remain central for the immediate future. Kodak's latest MC3 camera illustrates that both methods can support each other: "In one 'Take everywhere' unit there's a lens, display, microphone, speaker, TV-video output jack, audio output jack for playing music on a home or car stereo or through headphones, and USB for uploading and downloading files from a PC; there's even a tripod mount and a slideshow function for playing still pictures on a television. Kodak showed a planned add-on for the MC3: a snap-on module and PC-connected receiving unit for uploading photos and videos to the PC, and for downloading music files to the MC3. It's based on high-speed radio frequency (RF) technology Kodak is developing in-house, with a 150-foot range. Kodak says it can download a 32MB card's contents over RF in 14 seconds – and that a device using the Bluetooth WPAN specification would take six minutes." [6] As supported by Apple's CEO Steve Jobs vision referred to as the digital Hub: "The PC is evolving into the centre of our digital lifestyles. So, than rather being stand-alone computers, these computers are being used as the centre for a variety of portable digital devices. It's hardware, it's the OS, it's applications and it's portable devices, all combining to create solutions." [7]

The price/capacity rate, accessibility and reliability are the main arguments that make the hard disk a primary source for storing digital image files. As the performance is improving continuously (see figure 2.14 below) – according to Moore's Law - the hard disk becomes an even more attractive solution for storing large image collections.

One of the latest innovations that is improving storage performances is related to the data densities of hard drives. Technically it is called antiferromagnetically coupled (AFC) media and informally referred to as "pixie dust" at IBM. Drives with densities of 100 gigabits per square inch will enable desktop drives to reach 400GB storage levels, notebooks 200GB, and one-inch Microdrives 6GB. [8] The improving price/capacity rate makes this a hard to beat storage solution.

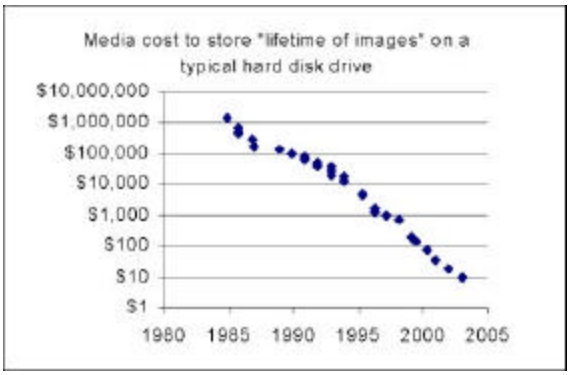


Figure 2.14 - Technology and the future of pictures - Digital Imager – Nov. 2000 issue - www.digitalimager.com

2.5.1.2 a Peer-2-Peer solution

A new service that is entering the market is called Bravo, introducing a P2P solution. The technology used has gained the consumers attention via Napster's music-sharing services. The key essence of this model is that the photographers store their multi-megapixel images themselves; with 40 gigabyte hard drives costing only a few hundred dollars, high-resolution image storage is not a problem on an individual basis. Bravo's own servers host the "cache" of the thumbnail views of "shared" albums for faster access. [9]

The question what people prefer; storing their personal image collection on their computer or "outsourcing" it to a specialised Web-service is arguable. Social and personal preferences play an important role; issues as convenience, accessibility, trust, assurance and properties are very relevant. On technical basis it is an issue of what the balance will turn out to be. Perhaps it comes down to the digital progression and the balance between the increasing memory size and its optimising price/capacity rate, the improving resolution and thereby growing file size of digital images and the forecasts in which a majority of the home imaging market will be using an always-on broadband Internet connection.

"Bravo is gearing up on the assumption that a sizeable chunk of the digital picture-active population will have a Digital Subscriber Line (DSL) or better connections this year, with more high-speed Net users signing on at an ever-growing rate. However, dial-up Net users will be able to view other's shared images, and even download a print-resolution photo - they'll just have to suffer with long connect times. Dial-up users will not be able to easily share their full-res images, however, as that requires an "always-on" connection. The dial-up user will be able to share an album and create a cache of thumbnail views to let others see their images, but they must log on to their Internet Service Provider (ISP) to allow others to access the full-res image for printing." [9]

As many modern appliances, e.g. the mobile phone, that are built around a network connectivity the Law of Plentitude – "more gives more" [10] will play an important role. For the current situation in which most people are using a dial up connection this resolution on demand solution seems to be a suitable option. As the standard PC is a dominant player in the digital image process there is not much extra work needed to make these images available for others to view or even print.

All in all a concluding phrase from K. Krishnan – Bravo President and CEO - illustrates the potential of Bravo's swapping services: "… He knows 15 MegaPixel (MP) cameras are not that far away. When you get digital images that size, Krishnan says, "how do you share and store them?"
"Bravo's answer to that question is you don't centrally share and store high-resolution images – you facilitate the transmission of images from one individual's own storage to another's PC." [9]

2.5.2 On-the-road storage

This type of memory can be used for many different reasons. One of the most obvious is the use for storage in cameras, like the Smartmedia (used by Agfa, Fuji, JVC, Olympus, Ricoh, Toshiba), the Compactflash (used by hp, Kodak, Minolta, Nikon, Canon, Casio, Epson, Fuji, Pentax) and the Memorystick (Sony). The primary functionality of the in-camera-memory can be compared with the traditional filmroll. Only in this case the digital medium can be reused, therefore the card will function only for temporary storage of images. As previously indicated with the hard disk flash memory is also strongly improving in performance as well as optimising its price/capacity rate (see figure 2.15 below).

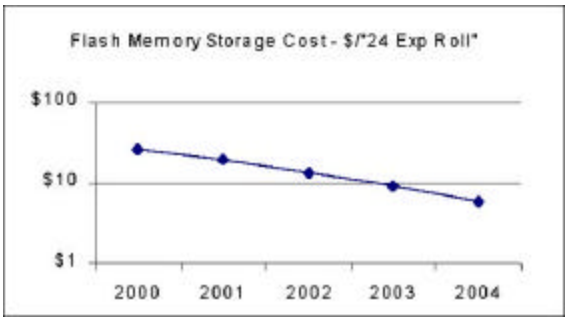


Figure 2.15 - Technology and the future of pictures - Digital Imager – Nov. 2000 issue - www.digitalimager.com

Although some cameras exist that can store on CD (e.g. Sony CD-1000) and floppy disk (e.g. Sony Mavica) or even SuperDisk (e.g. Panasonic PalmCam) most of them will use the flash memory cards. New formats of flash memory will soon be introduced, e.g. the DiskOnChip Flash Disk from M-Systems, MultiMedia Cards from Lexar Media and the IBM's MicroDisk which is one of the interesting candidates for widespread adoption because it's memory capacity, size and performance. Another important value is the support of the format that assures compatibility with other devices.

Other types of on-the-road storage are the CD-ROM and DVD (optical). Both are now available in write-once and rewritable versions. Especially the write-once disks are for both archival as distributional use. A dedicated version of the CD-ROM is the PhotoCD developed by Kodak. Although this format already exists for several years it seems that it is becoming a more attractive solution for both digital as traditional photographers. More and more retailers are offering the option of digitalising the film as a kind of hybrid service. Especially in the US, where many photo stores, photolabs and online services or even retailers offer the service, since they have placed a special PhotoCD module directly into their existing processing and printing system. In this way people who use the conventional film camera can have the advantage of the additional digital possibilities.

The DVD is seen as the next generation optical disc. It is a matter of time till the DVD will come into play in the consumer photography market. This adoptance is not only a question of storage demand, the need for higher storage capacities. The CD-ROM has already a relatively high capacity of around 650 MB and its lifecycle can be extended by the new DDCD format that is agreed by Sony and Philips last July. The new format enlarges the capacity to 1,3 GB and could have the same boosting effect as previously on the floppy disk, by giving it a second life.

Besides the capacity the DVD's potential lies in the supporting aspect, the versatility of the DVD could play an important part in its way to recognition. Game consoles, DVD-players or other home entertainment devices are normally placed in the living room, which is a more attractive place than the study room or even the attic, a common place for most PC's today. Many imaging companies are anticipating on this movement by targeting new solutions on the home entertainment aspect, as the

case with PhotoWorks PhotoDVD service and Iomega's Fotoshow. "PhotoWorks is now offering a PhotoDVD service, letting customers select images from online albums and have the images recorded to a DVD discs, usable on any standard TV-attached DVD player. The cost is $24 for 50 photos, and $ 0.10 per additional photo for a maximum of 200 photos per disc. Users can choose from five visual themes and seven thematic sound tracks to accompany their image slide show. PhotoWorks, as Seattle FilmWorks, offered Pictures On Disk back in 1994 and says its consumer online photo archive currently holds more than 175 million images." [11]

Figure 2.16 - Digital Wallet from Mind@Work

More dedicated on-the-road storage solutions are the Digital Wallet (figure 2.16), the Photo wallet and Fotoshow (figure 2.17), using magnetic storage techniques. The Iomega's Fotoshow makes clear that storage solutions can have a versatile character by not only connecting to the PC and camera but also directly to the television. Fotoshow uses the ZIP cartridge as storage medium, a standard that is supported by more and more multimedia PC's. The ZIP cartridge is especially suitable for temporary storage and typically used where portability is needed. In the case of Fotoshow the ZIP can function as a temporary buffer between camera and final storage as computer's hard disk and CD-ROM.

The renewed effort to bring the viewing of photos back to the television is an interesting development, which didn't seem to succeed with previous attempts by Kodak's Photo-CD player.

Figure 2.17 - Iomega's Fotoshow

2.5.3 On-the-Web storage

Undoubtedly the Internet will play an increasing important role in transporting personal image data. Anticipating on this development the business market has intensively started to offer E-services concentrated around storing, sharing and printing. These services can be labelled as PhotoPortals, aimed to offer a complete end-to-end solution. As the Internet becomes a backbone in transporting digital images a network of partnerships are established to offer the customer a higher level of convenience and accessibility. By Kodak's count, there are 130 dot-com companies pursuing fortunes from the fast-moving convergence of consumer photography with the Internet. [12] The following article (figure 2.18) shows a list of the most popular PhotoPortals of last January.

Rank	Overall Rank	Website	Reach	Unique Users (000)	Page Views (000)	Hours (000)
1	458	photopoint.com	1.9%	1,853	38,014	651
2	671	shutterfly.com	1.4%	1,333	16,336	268
3	1003	zing.com	1.0%	962	12,952	296
4	1169	photoloft.com	0.9%	848	8,276	105
5	1177	kodak.com	0.9%	845	10,631	135
6	1349	photoworks.com	0.8%	748	14,777	216
7	1625	canon.com	0.7%	638	5,620	66
8	1719	snapfish.com	0.6%	608	18,429	211
9	1735	ipix.com	0.6%	604	1,741	25
10	1767	photonet.com	0.6%	595	5,531	133
11	2101	corbis.com	0.5%	505	3,764	73
12	2150	ofoto.com	0.5%	494	7,624	272
13	2741	picturetrail.com	0.4%	386	3,836	69
14	3140	searsportrait.com	0.4%	340	6,944	66
15	4136	photostogo.com	0.3%	263	2,014	14
16	4351	cameraworld.com	0.3%	251	4,640	82
17	4488	ememories.com	0.3%	244	6,084	141
18	4798	clubphoto.com	0.2%	229	1,453	50
19	5309	bhphotovideo.com	0.2%	207	6,356	68
20	5314	olanmills.com	0.2%	207	1,069	12
21	5659	gatherround.com	0.2%	195	1,249	22
22	6322	wolfcamera.com	0.2%	175	1,014	20
23	6426	photo.net	0.2%	171	1,051	18
24	6684	ritzcamera.com	0.2%	165	489	31
25	7385	photochannel.com	0.2%	150	956	11
26	8533	photoisland.com	0.1%	129	1,452	21
27	9617	polaroid.com	0.1%	115	702	16

Figure 2.18 - Source PC Data Online - Jan 2001

Posting digital pictures is already immensely popular. About 15 million people have displayed pictures online, according to InfoTrends, a Boston research firm. Relatively few people though are spending money to have their pictures developed and printed by the Web sites. "The revenue from prints doesn't seems to be meeting expectations," said InfoTrends analyst Lia Schubert. Online photo printing was a 13 million dollars business in 2000, Huske estimated. That's a mere speck in the overall 40 billion dollars photofinishing industry. [13]

Most business models are projected to gain revenue from photofinishing orders; storage is thereby part of their customer service. Over time, when more and more

people will be using digital cameras and each digital image collection will have grown, the company's image database is expected to consume quite a lot of storage space. It is likely that a large part of a personal collection will become inactive over time, thereby significant contributing to the operating costs. To cover this potential problem most PhotoPortals provide a limited storage capacity and charge the costumer when exceeding this amount. Latest news from Future Image illustrates this pressing cost issue, as Zing closed its consumer site: "Zing reportedly paid $100,000 in hosting costs and $100,000 in equipment leases per month for its 18 terabytes of stored digital photos." [14]

"InfoTrends Research Group says more than 8 million people have now posted photos to online Web photo sharing sites, and the images were viewed by 28 million people. However, the firm reports that per-user revenue was low. [No surprise there in light of the changing business plans and outright failures of many formerly top Web photo service sites.] Online photofinishing revenue is forecast to grow at an average annual rate of 57% through 2006, InfoTrends says, "but in the short term, it is not enough to support so many players dependent on self-funded growth." [15]

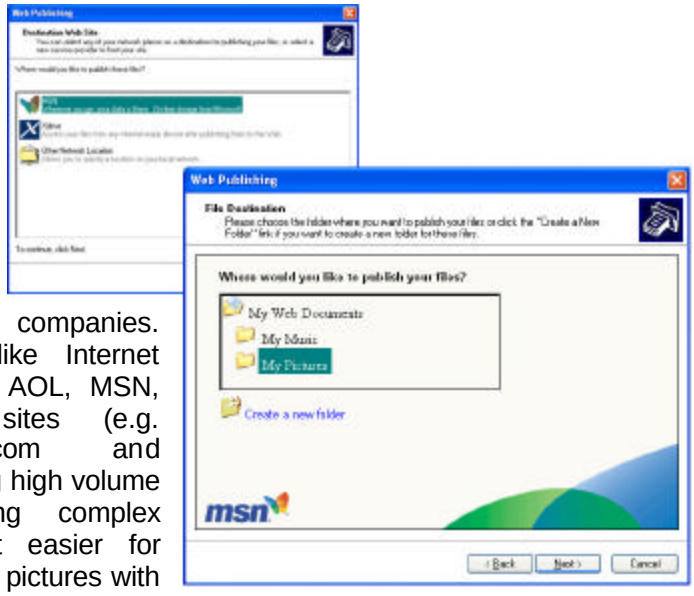


Figure 2.19 and 2.20 - Windows XP - "publish this file to the Internet "

Current developments in the Internet image industry are focussed around partnering with both on and offline companies. Interesting online partners, like Internet Access Providers (as Yahoo, AOL, MSN, Lycos) and Community sites (e.g. CollegeClub.com, MyPets.com and eCircles.com), are all generating high volume or focussed traffic. Building complex supporting networks make it easier for customers to communicate their pictures with others. It also provides them with a more balanced offering of tailored photofinish products and services ranging from standard prints, enlargements and printed albums to photo-personalized mousepads, coffee mugs, cakes and sheets of gift-wrapping paper. Conventional photographers should not be excluded from these possibilities. Not only will companies directly miss their share of the relatively high revenue stream, it might also slow down the transformation to a digital-centred photography market. By letting the customer get a taste of the digital world, they are more likely to be convinced of its possibilities, like for instance the instant results. One of latest initiatives that underlines this development is the hybrid service described in the following article. "Consumers can now try online image sharing for less than $7, as three of the largest mass-market in the US launch new digital initiatives. Wal-Mart is now selling single-use film cameras for a $6.84 price that includes digitisation and online sharing at Walmart.com's Photo Center." [16]

Another way to put images on the Web is the use of personal Web pages. People can choose between building their own site or using the facilities of specialised E-services, also called Web presence providers, making the maintenance task less

complicated. However, the new Windows XP has direct support to update your personal page, thereby providing more control and convenience as shown in figures 2.19 and 2.20 on the right.

Figure 2.21 - the digital fridge homepage

2.5.3.1 the Digital Fridge

An example of alternative metaphors is the Digital Fridge (figure 2.21). This online service, from Kensington - also producing the digital photoframes - has a very young and appealing character. It provides the popular service of online content management and sharing.

This growing business of application service providers is focussed on managing the personal content of customers. Digital Fridge targets on people who like to share their multimedia content ("post photos and videos") with other people. The metaphor of the fridge is a very interesting and creative one.

However, there are still some question marks surrounding this new developing multimedia service model:

- At the moment multimedia content on the Web is dominated by still images. "Still images represent 85-90 % of the media files currently on the Web and in the Visual Search Engines indexes." [17] A large number of special dedicated online photoservices with a tailored customer profile provide attractive alternatives for posting images on the Web.

- "It is expected that in the near future the consumers storage demand will exceed the business demand." [18] The price of bits is decreasing rapidly and people can choose between a variety of options when it comes to storing their personal collection. The question is therefore: are they willing (to store and) pay for storing their digital content on distant servers? In other words: how will these services gain enough revenue?

2.6 Technologies on the horizon

The photography market is changing rapidly as the supporting technology is improving. The transforming image landscape should provide the consumer with more possibilities. The heart of this will be the image camera. A wide variety of digital devices will be able to support standard image recording functions combined with viewing capabilities. Besides the dedicated still image camera there are new devices introduced to the market that facilitate still image capture features. For the digital video camera it is more like a secondary function, whereas a PDA can host image capturing with the “click-on digital eyes”. The trend of convergence will create multimedia recorders that can capture sound, still image and movies.

Even hybrid solutions are being introduced. One of them is the digital film roll that can be used in conventional cameras. Another hybrid solution captures both digital and film format as in the ViviCam illustrated in the following news article. “Vivitar is releasing a line of entry-level digital cameras, that includes an unusual offering: a hybrid unit that combines sub-VGA resolution digital capture with 35mm film. The DIGI 35mm has a 320 x 240 CMOS sensor. Unlike Kodak's film/digital hybrid, the Advantix Preview, this unit stores the digital files (the Advantix Preview only holds the most recent shot). It's reminiscent of Polaroid's I-Zone Combo film/digital package where the digital and film components each have their own lens, but in this case they face the same direction so the user can quickly snap both a film and digital exposure. The combo is $119, and should ship this month. The ViviCam 2795 features MP3 playback and video and audio clip recording; otherwise it's a standard VGA unit with a fixed focus, fixed-focal length lens, CMOS image sensor and CompactFlash.” [19]

A new solution, the real-time digitisation of the film, is expected to be released by the end of this year. It uses a dry film process technology, developed by Applied Science Fiction. The Digital PIC (Process & Image Capture) digital dry film process is environmentally friendly, the company says, and provides real-time digitisation of exposed [but undeveloped] 35mm film directly into an RGB digital format in under seven minutes. The process uses "micro-amounts" of a proprietary developing agent. The color data and exposure settings are established on a pixel-by-pixel basis, ASF says, and recorded on an "Extended Range Digital Negative" CD. The Austin, TX company says Digital PIC technology will work on photo kiosks, microlabs, backoffice workstations, backlabs, and quick print stations. No word yet on how the company and its partners plan to address the customer objections expected to be raised by the fact that Digital PIC destroys the film negative. [20]

Figure 2.22 - the EXIF property information in Windows XP

The next step in the process is related to transporting digital image information. An infrastructure network is being developed to support the transporting of digital image information throughout the whole process. In other words: imaging-capable communication.

The Internet Imaging Protocol (IIP) is prescribing important standards making it possible for imaging, computing and communication related companies to jointly build parts of the network. A forecast for picture-taking communication devices was recently made by Daniel Carp, president and CEO of Eastman Kodak Co., Rochester, N.Y., who commented the next revolution in imaging would be 24-hours-a-day, seven-days-a-week access to pictures for everyday communication. "The camera will become part of other devices people will have with them all the time, giving them the ability to digitally transmit images from anywhere." [21] As this article indicates the Internet itself may become the backbone of image data transport, making it possible for consumers to connect with their favourite shop, friends and family.

Another important ingredient in this process is the support of metadata. One of the most popular image formats is the JPEG, which already supports embedding essential metadata in the EXIF header (see figure 2.22). The following article about a new print image-matching standard illustrates the use of metadata in this case to improve the printed image quality. "Now Epson is leading a movement to improve image and print quality, and has signed Casio, Konica, Kyocera, Minolta, Olympus, Ricoh, Sony, and Toshiba to utilize its new format. The new system embeds additional image information into the EXIF header of a standard JPEG file -- information the printer uses to boost print image quality. The digital camera manufacturer sets image-specific parameters including gamma level, color space, contrast, sharpness, brightness, saturation, shadow point, highlight point and color balance. [22] Metadata cannot only improve the print quality and consistency it could also be applied for archival use. Metadata will play an increasingly important role in the digital imaging industry. " …Image metadata can lend digital pictures the same standardization and the same predictability that film offers. The game really start to get interesting when you use this technology to attach the five W's to your pictures: The who, what, where, when, and why. In other words, all pictures could be embedded with a permanent record of the names of the people in the shot, their e-mail addresses, the name of the photographer, where and when the picture was taken. And even a sound file or a Java applet to enhance the viewing experience." [22]

A more advanced archiving system can combine information gathered from metadata tags and content-based image retrieval. The technology of content-based image retrieval can have an additional effect on the users digital imaging behaviour. Features such as auto-indexing by face recognition lie within the capabilities of this technology. However, in order to work properly a certain success rate in recognition is needed, in turn requiring a certain level of quality in the images. This will limit its application in many social settings as photos taken in a family and friends context are normally not characterised by high technical quality. Photos represent an emotional value and the question as to whether an image is "good" could be rephrased as: does the photo capture the moment?

2.7 Findings

The market of digital imaging currently provides a large number of organising solutions. Looking at the basics of current organising programs, a list of common features can be drawn up:

- Previewing capabilities;
- Storage of multimedia files;
- Recognition of different image formats;
- Conversion of existing image and database formats;
- Network support for databases;
- Multi user configuration;
- XML-based indexing;
- Content-based image retrieval;
- Search on synonyms;
- Thumbnail handling;
- Offline access; and
- Property-based control.

A program that supports all these characteristics will have a better overall performance. If it also automates most user resistant tasks, such as textual data entry, by using techniques such as content-based indexing and retrieval, the program will simplify the process of storing, sorting and retrieving. Putting this technology driven viewpoint into practice makes the future rather predictable. In real life, it is more complicated. People indeed seem to be influenced by the new possibilities technology brings. New ways of interaction and communication can be explored. The meaning of these new opportunities is given by the actual use and peoples' perception. The way that image companies might approach the roll of technology developments is expressed by the following line: 'By putting pictures before more eyes and making reordering simple, Kodak and others believe they can get consumers to spend more on photography than ever before." [12]

The changing consumer behaviour due to the introduction of innovative image solutions is described in more detail by the following 2000 Digital Camera End User Study findings: "Digital photographers are not sufficiently satisfied with the image quality produced by their digital camera to retire their film camera. However, digital photographers are transitioning more of their image capture to the digital camera, because they enjoy the unique benefits of digital capture: convenience, instant feedback, emailing, printing photos at home, and the ability to print only the images that are the best shots," says Michelle Lampmann, market research analyst for InfoTrends Research Group. "As a result, digital photographers capture and print more images than they did with their film camera." The 2000 Digital Camera End User Study shows that, on average, using a digital camera increases the number of

pictures used in electronic and printed documents by 86%. In addition to printing more photos, digital photographers are actively using the Internet with their images. Emailing photos has become the most popular way to share snapshots with friends and family, followed by sharing prints. The study shows that users email a median of four images per week. Another growth area is online photo albums. The study shows that 50% expect to post images on personal Web sites in the future, and 31% expect to create photo albums on a commercial Web photo site in the future. [23]

The current offering of organising solutions operating on the computer show a widespread number of possibilities. Most of these solutions are based on operating systems like Windows. This OS environment can limit the freedom to put in a personal approach, thereby locking the user in the limited frame of the application. The main part of the offering is richly featured with special and dedicated functions. The user is expected to find these facilities behind the many popup menus and tool palettes. Putting a personal touch to the collection or presentation will, if possible, not be an intuitive process; the user should at least understand how to adjust the default settings. The many options, features and parameters of image managers do not make the operation an easy task. Especially for non-techie users it does not seem to provide the necessary convenience and flexibility. Most programs will produce a result that is quite framed and formal, the user is restricted and limited to the way the program describes them to work. In reality people like to apply their own organising strategy, which develops and changes over the years – see next chapter "User perspective". These various systems of organising are partly a way to express personal taste and creativity. In other words by using existing products the process is reversed from one where the user is free to use his own approach and style to one where the user needs to understand how he is to operate the program, or is expected to read the tutorial.

Most programs are based on technical possibilities. One of the characteristics of computers is their capability to store data. This also seems to be of influence at the basis of organising digital images. To retrieve image data the programs need to get informed by textual data such as title, date and other keywords, also called metadata (data about data), which preferably is provided during the input of the images. Instead of "prescribing" how people should index and store their pictures in order for them to retrieve these images, looking at how they would like to use pictures could provide a different angle to meeting consumers' needs. Or what other kind of information, than the keywords that describe the content of an image, can automatically be generated to build the semantics in form of metadata? Resulting in the quote of Kodak's CEO D. Carp: "What consumers need are better ways to organise, better ways to access their pictures." [24] When using the labelling features and functions that current products offer, organising will become a manual time-consuming and technically complex craft. Some features such as recognition and indexing will become more sophisticated as the underlying technology progresses. Automating user resistant tasks as labelling and possibly searching can provide more convenience. Technological advancement as auto indexing, visual information retrieval, etc. could on the long run make the time-consuming and craft-like task of manual indexing and archiving obsolete. And finally, handling digital images depends on the retrievable and this not only relates to a single but also to sets of photos (sequence) from the great mass of stored data/content.

2.8 Summary

In the following section a summary is presented containing the four main findings of the market review and future perspective:

1) Programs based on operating systems such as Windows tend to limit the freedom of bringing personal style into play.

2) The market analyses showed a future perspective of smart images (metadata and resolution-on-demand) and a large variety of transport, information and communication possibilities.

3) Questions surrounding the storage issue need to be taken into account (see figure 2.23). If photos are fragmented across different media and different locations, how will people be able to find and retrieve all these images?

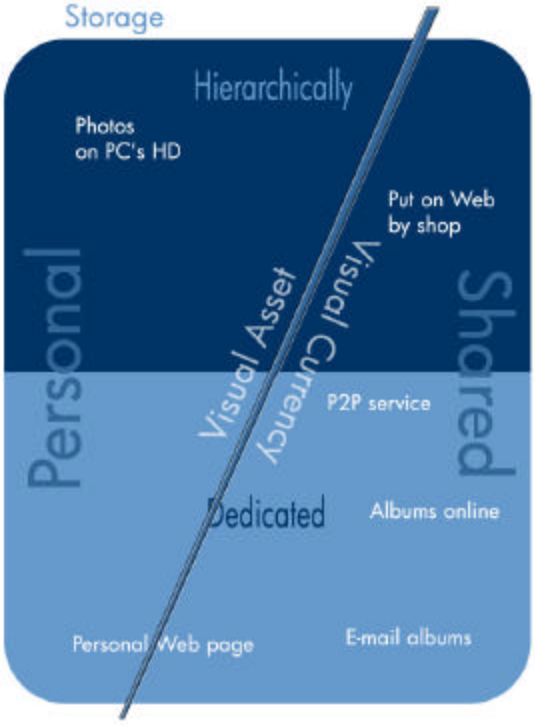


Figure 2.23 - Storage solutions mapped out in organising model

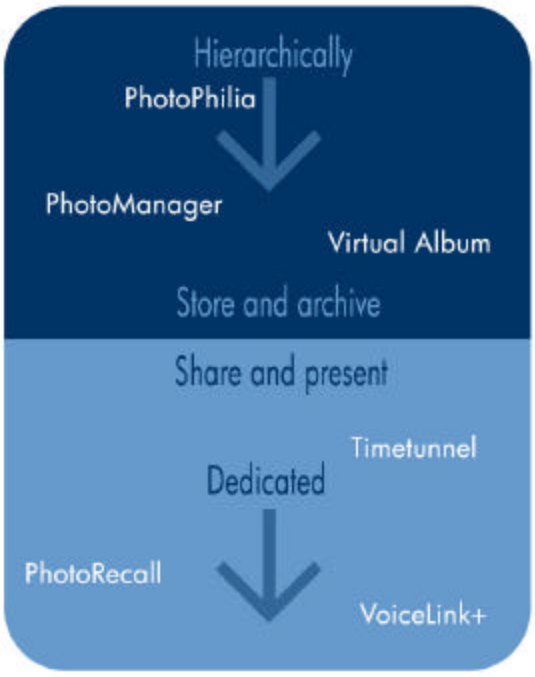


Figure 2.24 - Assortment mapped out in organising model

4) An interesting part of the current organising assortment concentrates on labelling or tagging the photos with keywords and other information regarding the content of that certain photo (see figure 2.24). This field of interest can play an increasingly important role as the underlying technology is rapidly developing. The product assortment can roughly be divided in two categories: one is concentrating on storage and archiving issue while the other is facilitating the communicational aspects as sharing (, exhibiting) and presenting. This type of organising solution can reflect on the way it handles the issue of indexing/labelling.

User perspective

3. User perspective

3.1 Introduction

The synergy between technological possibilities and human needs are important for new solutions to be valuable. In order to find innovative solutions the traditional values of tangible photos should be further explored. The domestic environment where people are used to handling photos will be taken as starting point for analysis. In this chapter the findings of a user study will shed more light on the user perspective. The objective is to find new solutions that make the organising challenge a more enjoyable task.

Digital Imaging is a growing and fast developing market. It is expected that in the future the majority of the family photography market will be using the digital process to capture, transport, organise and communicate personal images. With this notion in mind there are, at this moment, still a lot of advantages to the traditional way of making and handling pictures.

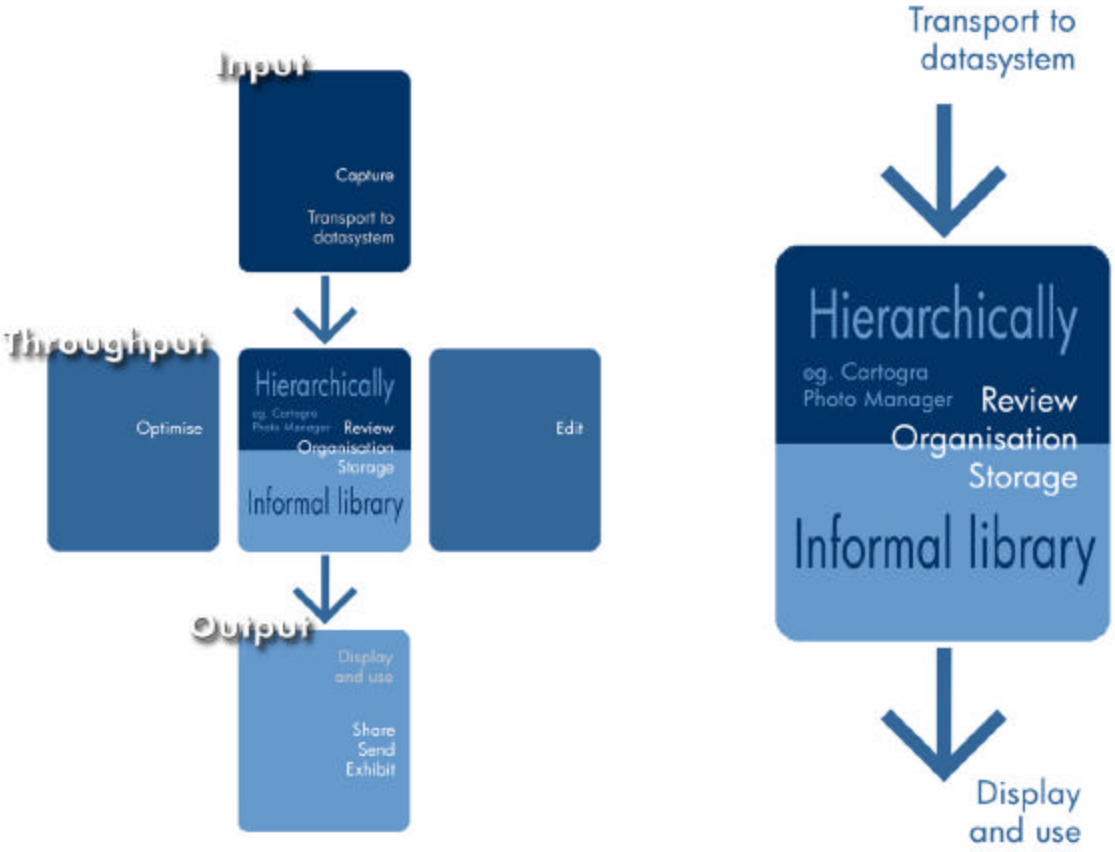


Figure 3.1 and 3.2 - the Photo workflow

This project is focussed on the middle part of the complete photo process, in which the pictures are organised. The figures above visualises the approach; in the figure 3.1 (left, above) a model is presented with the stage of organising as part of a

complete image process and figure 3.2 (right, above) with a focus on the organising itself.

In order to retrieve pictures for solo viewing or sharing, photos need to be organised and collections kept up to date. This stage in the process seems to be both the most time consuming and least popular. For instance: research from Kodak has pointed out that from all pictures taken only 2 % are actually being used. The other 98 % ends up in an album, a drawer or a shoebox. In the U.S. there are an estimated 150 billion prints stored in "shoeboxes".

The digital format will replace the film over time; bringing new possibilities and changes in the way people handle and use their pictures. Looking at the stage of organising, it can be expected that the increasing volume of digital images stored on electronic media, such as hard disks and compact discs, will become an important stage in the image lifecycle. Or from a users point of view:
"…… the process of locating a desired image in a large and varied collection can be a source of considerable frustration." [25]

The current trend of digitisation of the complete photo process makes topics such as organising and retrieving desired images an interesting subject for research. "The process of digitisation does not in itself make image collections easier to manage. Some form of cataloguing and indexing is still necessary – the only difference being that much of the required information can now potentially be derived automatically from the images themselves." [26]

With most of the current programs, it is only possible to archive images in the Windows-oriented folder structure, relying largely on text descriptors or classification codes. These technology-driven solutions do not provide much flexibility, are not fun to use and almost certainly do not meet the ease-of-use requirements of the non-computer literate consumer.

A better understanding of the user and his current photo organising behaviour will provide more insight in the underlying needs, desires and values. To describe the users that are subjected to this analysis a first description of the context is needed.
A large part of the consumer photography is build around the capturing of important moments in family life. Ranging from family history as growing up of children, weddings, and family reunions to recreational use as going on holiday and visiting friends. As stated by J. Eakings, this is probably the most common single reason for storing, transmitting and displaying images, though this category includes a wide variety of different attitudes and interaction styles: "… Most individuals interact with images in different ways at different times, perhaps spending an hour in an art gallery one day, and watching a sports video the next. Trying to categorize such behaviour by user type does not seem very useful." [25] A useful answer is found in prof. J. Donath's approach: "As we share large collections of personal information over mediated environments, our tools need to account for the social scenarios that surround our interactions." [27] During the user research a social scenario, set in a family environment, will be developed by using the study findings and market research information.

The family photographers range from hobbyists to happy snappers, representing the largest part of the image consumer population as shown in figure 3.3. Happy snappers are people who do not seek the highest level of technical quality or organisation of their collection. Their aim is to be able to use the images to experience the enjoyment that this gives. “A good photograph must have some reasonable technical quality but is mostly valued for its content and the memory it refers to. The closer the photograph is to the memory the higher the value.” [28]

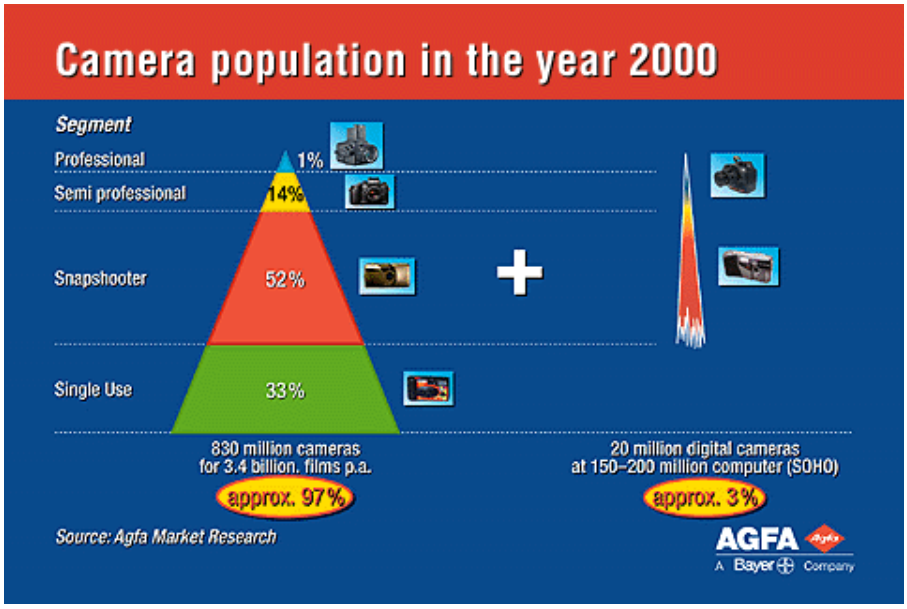


Figure 3.3 - Camera population in the year 200 – Agfa-photo

“The social value of pictures is underlined both while capturing precious moments of the occasion as during the usage stage of sharing and reviewing this occasion. For both happy snappers and hobbyists holidays and trips along with social events with friends and family were the most likely times for picture-taking.” [28] This is further specified in a recent market study: [29]

- Vacations Snap - still most popular - 71%
- followed by children - 54%
- family - 54%
- nature - 48%
- Christmas - 34%

Photographs can be a means of communication, enabling the reliving of precious moments both individually and with others. “Both happy snappers and hobbyists alike described the viewing of photos as taking place in a social context, either when people like friends and family visit, or during conversations. This also seems to occur around events such as holidays and other festivities.” [28]

Capturing and finally using pictures by creating and presenting albums or by using the prints as conversational props are both popular things to do. However, in order

to ensure that pictures are available for use they need to be easily retrievable. Organising is a crucial factor in this process. The time needed, to create collections and keep them up to date, makes organising photos one of those things that gets put off until “some other time”.

Within this context the scope of the project is narrowed down by focusing on the user group that understands the value of preserving the family history and therefore plays an active role either by capturing the precious moments or by maintaining and guardian the photo collections. In an every day household the father and mother typically fulfil these tasks. This statement is also supported by research and marketing reports. An even wider group is specified where both parents and grandparents show great interest in maintaining personal image collection. This rough specified group is representative for the research objectives and is also an attractive target market. During the user research more inside is developed that will allow us to further specify the target group.

3.2 Assumptions

An unorganised set of pictures, a shoebox full of photos for example, functions as a rich source of memories, but retrieving the desired picture will become more difficult as the volume of un-organised pictures increases. On the other hand, an album will mostly serve for a well framed and structured reviewing event, with limited room for the unexpected. Any organising method or strategy serves a specific purpose. As an indication, the following market research findings by the Photo Marketing Association illustrates (figure 3.4) the currently used organising and presenting methods. This graph shows the dominance of the use of albums and frames to present photos. It also underlines the importance of photos as communicational props and the corresponding user behaviour, where photos are kept loosely around the house (in boxes, on refrigerator doors, as decorations in the house, etc.):

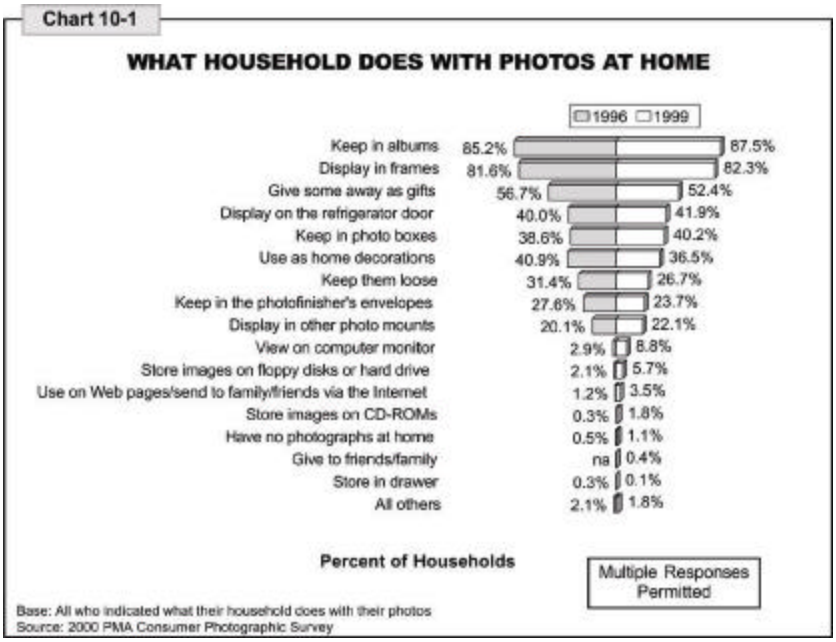


Figure 3.4 – What household does with photos at home -
Source: P. 136 - Chapter 10 - Photo Storage and Display – PMA U.S. Consumer

Increasing the degree of organisation of image collections and making the process of organising them a less time consuming task will not be the primal aim of this project. Instead, it can be described as seeking to help people gain control over the chaos rather than bring complete order to it.

The domestic environment where people are used to handling photos is closely related to the nostalgic and emotional values related with photos. The objective is to find new solutions that make the organising challenge a more enjoyable task. This leads to the assumption that the family photographers have a need for a more informal solution, which provides them with a fun-to-use tool as described in the following article of Maypole: "Informal communication – sharing a joke, teasing each other, talking about what kind of day you have had – is an important part of family life. The family can be an interesting context for innovative future communication technology. In exploring this vast communication domain, Maypole researchers discovered that communication with pictures can lead to unexpected new forms of socialization." [30] Rather than purely concentrating the research on how the technology might change how people use and share photographs, it is more interesting to go back to one of the basic functions of photography – communicating with conserved and precious memories.

A starting point for user research is found by asking questions. One of the main values of having pictures is the use of them as communicational props. In order to be able to use them as such, the images need to be retrievable. Question is how can people easily retrieve a picture that is part of a digital collection? As the volume of digital collections increases over time the need for solutions that enable convenient retrievability will become more important. Digital imaging technology could change customs and values, for example:

- Making images more immediately accessible;
- Giving people the ability to remotely, asynchronously and collectively create and share albums or sets of photos;
- Being able to communicate these pictures anytime, anywhere and with a wide variety of tools;
- Increasing the flexibility of how photos are organised
  - the same picture can now more easily be used with different output devices/formats- one digital picture doesn't have to be put in just one digital album.

These capabilities were further investigated in a user-centred perspective. The following two assumptions were made:

1) People would like to share the task of organising;
2) People have problems in sorting their pictures, especially when it comes to the commitment of assigning one picture to only one set.

3.3 Research questions

When taking the development of digital technologies into account is it quite clear the landscape of family photography is on the verge of reinvention. Questions arise around how technology will influence the behaviour of and attitude towards photography. To gain a better understanding of this process of change, we went back to the nature of organising photos. User research was conducted to map out the different values and basic characteristics. The basic research questions stated below will help to find answer to the two previously presented assumptions:

- What do photos represent?
- What do people do when they organise their photos?
- Why do people organise their pictures?
- When and where do people organise their pictures?
- How do people organise their pictures?

3.4 Findings

3.4.1 General process of organising

In the following section a representative process is described of how photos are organised. The objective is to shed some light on how photos end up as part of a collection.

The first step in organising starts when photos are collected at the shop. Both prints and negatives are stored in photo wallets, each roll representing a batch of photos. These batches become part of the complete collection (a continuous story) but will also function as stories on their own. When photos are first viewed the unsatisfying ones are, in many cases, instantly rejected. After this first rough selection the photos are sometimes directly shared with others, or first put in flip files. In some cases photos are redirected into different groups but most of the time kept in the photo wallets and then stored in a drawer or box as part of a larger collection. Photos kept in photo wallets have the advantage of leaving the original configuration unchanged; a secure station where the basic relationship with prints and negatives are kept in contact. Index prints can adopt this value of having a snapshot of the original settings. Some people recognised the advantage of having index prints (e.g. sometimes automatically included as part of the service) but certainly not in all cases. Several people kept the index prints stored with the negative and used them to identify the negatives when photos were already taken out of wallet. Most people however didn't have the need to preserve the link, because reprints are ordered almost instantly after purchasing the first prints. They rarely felt they needed the negative for reprints in later stages.

A next step in the organising process might be the use of flipalbums. When moving photos from the photo wallet to the flipalbum the original chronological order is normally preserved. A rough preselection will divide the presentable photos from the unsatisfying or duplicates. When there is a need and time to go beyond the flipalbum people choose to create albums. This way of organising and presenting is more open for personal preferences. Although a lot of people felt the need to build albums and even had quite detailed ideas on how they would have them created, most of them didn't get around to it. It was one of those things that was on their wishlist but put off until "some other time".

Most people were satisfied with preserving the original photo wallet, as illustrated by figure 3.5. Reordering and thereby changing the original setting was something they preferred doing at a time that was more convenient. They realised that reconstructing stories becomes more difficult when the time past between capture and organising is increasing, but sometimes experience had learned them that photo wallets are the easiest way to store their photos. It doesn't take much time and the original format is kept. Some basic archiving as putting date and label on each wallet would make it easier to, in time, remember the corresponding moment/period and place.

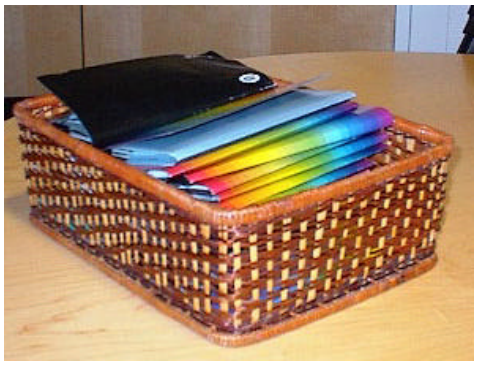


Figure 3.5 - a photo-wallet-basket

3.4.2 What do photos represent? And what do people do when they organise their photos?

Photos represent an important part of people's life, ranging from family reunions, shared moments to personal achievements, milestones or even the most basic and seemingly ordinary moments in life. People are using photos to preserve and communicate their stages in life. Photos trigger their memory, remembering the corresponding event. Capturing the events is as preserving the moments. In some cases people even described taking pictures as something done by instinct. The captured moments represent an emotional value, a kind of visual asset. Managing, sorting and archiving photos therefore is a personal process with a great nostalgic character. Photo wallets, shoeboxes and albums are the most commonly used tools for storage and sorting, and also have a historical and emotional value.

3.4.3 Why do people organise their pictures?

In literature a very basic explanation is provided: "… in the act of collection and handling, a sense of historical movement is produced. The principles of selection and arrangement are exercised to tell a story of progress or decline, to construct a sense of period and to hint at major historical shifts." [3] This can be a direct personal aim (of reviewing), a social (of sharing and communicating) or even one for archiving use (to store and conserve valuable and essential family history). The distinction between long time aims and one of direct benefits is interesting and most probably will play an important role in people's personal organising strategy. Direct benefits are mostly the main motives to start the action of organising. From this point of view, a forthcoming family reunion might be the actual reason to finish a photo album. Examples like these show that there can be a significant amount of time between capturing and organising. This delay in organising is described in this report as a kind of post-organising.

3.4.4 When do people organise their photos?

Some people might have a more structured and disciplined method of instant organising. Or even in stages, starting with a shoebox collection. A first selection is stored in a temporary album that later will be upgraded to a complete album, where photos are supplemented with textual information and requisites like tickets, postcards and drawings. It is also imaginable that people are satisfied with storing shoeboxes filled with a random collection of personal images mixed with other elements. Exploring these strategies was a productive way to understand the motives that determine why or why not people organise their photo collection.

3.4.5 Where do people organise their photos?

Organising photos is a typical domestic task. Although in some cases a rough preselection is made directly after purchasing the prints in the shop or on the way home, most work is done in the house. The most favourable places are the kitchen and the living room, since in both rooms relatively large tables are available satisfying the need for space (examples given in figures 3.6 to 3.8). Space is a basic requirement, especially when a stock representing several years of ones life is to be organised.



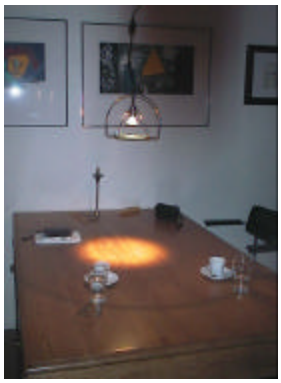


Figure 3.6, 3.7 and 3.8 - Examples of environments where organising takes places

The other requirement is time. People need a significant amount of time to complete the process of ordering and selecting. The objective is to finish the process to a certain stage, which could be creating an album or just reordering a part of the collection. The time and space-consuming method of organising photos can be described as a creative but intensive task. Once started it becomes almost impossible to stop before finishing, and in order to start people feel they need to reserve time and space in advance.

3.4.6 How do people organise their photos?

General

During the process of organising, the user is free to build his own sequence by selecting the pictures he thinks are best suitable for (re)constructing the desired story. Herein lies the inconsistency; stories are based on personal perceptions and preferences. It is thus not surprising a large variety in organising approaches can be detected, varying between people but also varying in time.

Time and occasion are the most dominant factors that prevent people from organising photos with a high level of consistency. However, a general line can be detected that matches with both the goal that is set and the personal strategy that should lead to this goal. The following example illustrates this relationship: People like to preserve firsttimers and onetimers (as moving to another house, weddings of friends or family members, holidays to a tropical destination and the birth of their first child) for personal and social use. Firsttimers and onetimers are therefore not surprisingly the most likely events to be captured in albums.

When unsorted collections are being organised the chronological order will in general be the first element to sort by. This task gets more complicated when photos are captured by more than one person and with more than one camera. Another factor, that influences the difficulty of the task, is the time that has past before the

actual organising takes place. Index prints, labelled photos (see figure 3.9), archived photo wallets (with added date and label) are helpful tools. Shoeboxes, however rich of impressions, are the worst-case scenario, because different sets of pictures can easily be mixed over time. The order in the pile is a result of both reviewing and adding of recent photos. While recent photos are mostly on top, shuffling through the photos often leaves them disorganised.

In some cases photos are filed in flip albums. Flip albums sometimes function as temporary albums. The chronological order is better preserved and secured than would be the case with shoeboxes. Although one participant did put in an effort to order his 'shoebox' as shown in the following figure 3.10.

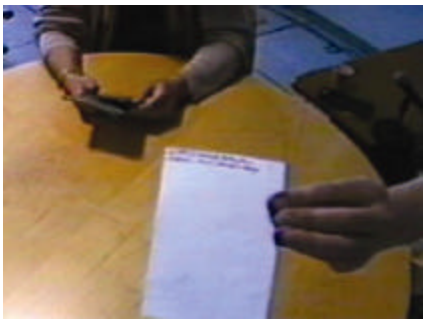


Figure 3.9 - labelling on the back of photo

Figure 3.10 - A chronologically ordered 'shoebox'

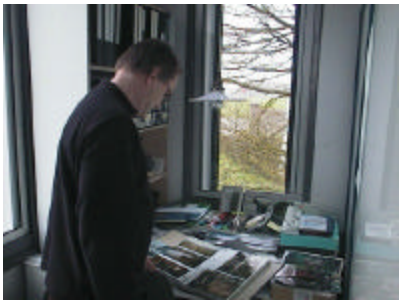
Technique

In this chapter the process of and the techniques used for organising photos are described, using the findings of the semi-structured observation research, conducted at hp Labs.

In general pictures can be organised in a variety of different ways and methods. The objective varies from labelling sets of photo wallets (e.g. stored in drawers) to creating albums (e.g. to share with other). Albums are in general seen as a better use of photos. In some cases people preferred to enhance their albums with text annotations or other visual material, as holiday souvenirs like tickets and maps.

Organising photos is a typical task that not all people get around to, resulting in a feeling ranging from discomfort to guilt. However, in cases where photos were organising, the user objective could in abstract sense be described as the aim to reconstruct stories. These stories can range from continuous stories (of for instance shared life experiences) to themed stories with a beginning and an end (like holidays and birthday celebrations). The kind of organising strategy people choose depends on the nature of the story and on the final objective of the owner. People have the freedom and flexibility to choose the method that suits best with their personal preference. Creating albums is not always the users objective, either they find albums too formalizing or they just don't feel the need to create albums. As a

result most user study participants have a rich mixture of shoeboxes, flip albums and albums – shown in figure 3.11 and 3.12.



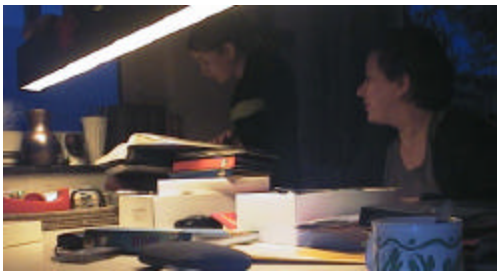


Figure 3.11 and 3.12 - A rich mixture of shoeboxes, flip files and albums

In general albums are seen as a final stage of organising and photo wallets as the starting point, the process where photos are selected from different wallets and reconstructed in a story and album is taken as the point of focus for further analyses. The nature of this process is described in the next sections.

The process from photo wallets to albums

This process can be divided in the following three main stages, also visualised in figure 3.13:

1) Preselection
2) Group and pile
3) Select and construct

Figure 3.13 - process of organising

1) Preselection - Selection of participating photos or wallets

A set of photos stored in a wallet represents an original undisrupted batch. For reconstructing stories, these sets need to be reordered into different piles. The number of photo wallets that is brought into use depends on the story's timeframe and will increase when a significant period is covered, thereby making the task of reordering more complex, time consuming and space demanding. In most cases photos were organising on the flat surface of the kitchen or living room table, but in some situations these common options didn't provide enough space and therefore some people even used the floor to spread out their collection. This underlines the need to choose or develop a personal system; a strategy or method that best suits the task of organising. One of the requirements for organising photos is the need to have an overview during the process.

2) Group and pile - Regroup pictures in new piles

Rearranging collections by date is generally the first thing to do. Breaking them up in subjects, as events, would be the next step especially when collections are mixed up and thereby consisting of a large variety of topics (time span and number of images).

In general, pictures are put in separate group each representing a specific topic. Typical labels for groups of photos are based on the nature of the image:

- Family photos – family parties as birthdays are typical occasions that are recorded for family history use. In many cases these pictures end up as part of separate covering stories or as part of the ongoing process of chronicle records, consisting of a mixture of old and new pictures;
- Kids – parents are valuing the photo collections of their kids very highly. Collections should reflect the process of growing up and therefore each stage and milestone in their children's life should be recorded on camera. During the research it was typical to see that several parents said they only managed to create albums for their first child. Somehow it became more difficult to do the same for the other kids. Time was brought up as the main reason for this inconsistency.
- Special events – happy memories of holidays and special weekend activities typically produce photos that are often put in albums. One of the reasons might be that these occasions represent stories of their own, having the four most suitable characteristics for creating albums: a beginning, a shared theme, an end and all within a limited timeframe;
- Technical pictures – in which people like to put their creativity and technical skills. Examples like panorama photos of buildings and landscapes like sunsets, were in many cases used as illustrative pictures to be put in the beginning or end of an album, summarising the settings or atmosphere of the story.

Once the selected photos were put on the table the user has a strong need to "stay in control". To maintain an overview people use some basic, simple and direct gestures that enable them to quickly view and manoeuvre their photos around. Starting with a photo wallet one by one each picture is viewed and dedicated to a certain group. Riffling through the set will give a quick impression of the general content of the picture (see figure 3.14) Small sets are kept spread so each photo is revealed, whereas bigger sets are piled and representatives are put on top. There is

at first no need to keep it need and tidy; underlying photos that reveal a small part of the image can provide the user with enough clues to identify the picture. Another remarkable aspect was the fact that people preferred to keep empty spaces between the different sets. Two reasons can be brought up:

a) A way to reserve space in case new configurations or sets are developing;

b) These visible boundaries keep sets apart from each other.

Figure 3.14 - Riffling through a set

The stage of selecting and sorting photos one by one into new sets is characterised by its richness of interaction and memories. During the process many ideas come to life varying from impulses of how the images can be used in albums, frames, etc. and how they can be communicated and shared with others. Each photo is reflecting a story on its own and the decision in which set it should take part of is a repetitive process. This process is build around classifying each image. Sometimes pictures were rejected for aesthetic reasons or because the available duplicates were of a better quality. These pictures were then filed away, returned in the wallets or turned up side down, shown in figure 3.15. The second research assumption: "People have problems in sorting their pictures, especially when it comes to the commitment of assigning one picture to only one set." didn't seem to be a very big issue, at least when seen as a possible direction for innovation. Sometimes it is a hard decision but in most cases people were able to quickly determine if a single picture says sometime that matches one of the stories of a pile.

Figure 3.15 - Filed away by turning pictures up side down

Another interesting question is related to the overview. How did people know where to put and find a specific picture when the table is covered with a large number of photos? After sorting a small number of photos, a mental map is being build, getting systematically clearer how every set is representing a substory on its own. The areas of the different sets are remembered by place and label/keyword. The person who is organising then remembers each area and their position, making it easier to navigate through his collection.

3) Select and construct

The last stage in which a story is reconstructed normally starts when the different piles are moved to one side of the table, thereby creating an empty space to work on the story. While reconstructing a story people selected images from the different piles and moved these to the working area. A pile can represent a substory on its own and in these cases the complete pile can be directly inserted into the final story. Selecting and putting the photos in the right order is a matter of visualising the story that people already seem to have sketchily in their mind.
Again an overview is needed, so people have a rough idea of what sets and pictures are available. By using the mental map that is being built during the process people can navigate through their collection quite easily. An extra set of clues can be

provided by each top picture that covers a pile, especially in cases where the collection consists of a large number of images. In situations where there are not that many pictures available people can choose to spread out each pile to a certain extend. This way they can have a quick peak at the underlying images.
The task of constructing a story by using a collection of photos can be compared with the job of an editor's, who is dealing with the question how to cover the story best by quickly deciding what is in put and what is left out and.

3.4.7 Additional

Some participants noted that, because they were the ones who normally took pictures, reviewing the photos not only remembered them the occasion but also that precise moment. The memory was triggered and they could even relive details, as the exact spot where they were standing, the position of the sun, settings of the camera and so on. One participant therefore emphasized he thought he was the best person to organise the photos while another said he didn't feel the need to organise the pictures in an album since he already remembers each story just by looking at the picture (independent on its location in a set of pictures). This emphasizes the importance of user perception in valuing a picture. Another interesting aspect relates to the traditional role-play where the husband normally takes the pictures and the wife organises them, as guardian of family history. This statement was not supported that distinctive by the findings of this research. The user study consisted of 14 participants and therefore more detailed statements cannot be supported.

3.5 Summary

In the following section a summary is presented containing the main findings of:

- Research at home - consisting of 6 semi-structured interviews - reviewing the task of organising in relationship with the complete process and understanding the (family environment) context. Questions as why, when and where do people organise their pictures are important to investigate. Most solutions for digital image management overlook the importance to understand these conditions.
- Research at Labs - consisting of 8 semi-structured observations - with a focus on organising to analyse the techniques people use to sort a collection of several photo wallets. This research gave answers to the basic question of how do people organise their pictures?



3.5.1 What do photos represent – and What do people organise when they organise their photos?

1) Photos represent a moment in life, reflecting both personal and social values. A set of photos represents a history record, and when photos are organised people, in abstract sense, build or reconstruct a personal story.

2) Photos are part of a lifecycle, which changes or fluctuates the value of photos over time and the need and ability to review, relive and organise these images. The value of photos relates to its content, its age, and viewer's perspective: the relationship viewer and photographer and phase of their lifes. In other words; photos represent a visual currency that fluctuates over time. The content of photos is referring to the when and why an image was captured. In this report also called "photomotives" and the following list of different "photomotive" labels was drawn up: firsttimers, onetimers, personal achievements, special moments, shared moments, life experiences, treasured occasions, family reunions, milestones, and simple pleasures.

3.5.2 Why do people organise their photos?

3) People organise their photos to reconstruct and preserve a story, preferably through their own perspective, even when the objective is to present or give them to others. In other words, they would like to tell their version of the story.

3.5.3 When do people organise their photos?

4) In order to organise their photos, people feel they need to plan ahead, because organising a collection requires time and space. They cannot stop in the middle of the process and walk away.

5) For others, for instance as a surprise or gift.
When there is an immediate need, people seem to be more motivated to organise their pictures. A kind of "post-organising"; in order to reconstruct a story there is a need to have an overview of their current collection. One typical example was the occasion where a husband created a photo collage to give to his wife on her 40th birthday.

6) For personal use, for instance to update a chronicle-based yearbook.
"Firsttimers" and "onetimers" are the most favourable motives to create a story that is put into an album. By doing this people reconstruct a period in their life. These kinds of stories are characterised by a beginning and an end. Continuous stories are most difficult to organise and reconstruct, because it is an ongoing process and needs a certain level of consistency, which is not typical for most user's organising behaviour. In some stages of people's life the desire to reconstruct continuous stories is more prominent.

7) Solitary
The task of organising is mostly not shared. One of the main reasons might be that people like to use their own strategy and put in their own style and approach. Reviewing it solitary gives you the freedom to relive and reconstruct the story in your own way, as well as a moment/time of reflection.

3.5.4 Where do people organise their photos?

8) Domestic environment
Locations like living room or kitchen where the surface of a large table can be used or even the floor. A certain amount of space is required.

And at the end it will end up as being part of this environment (e.g. albums in cupboards, frames on the wall). This context seems to explain the need to use a personal approach and put in a personal touch.



Figure 3.14, 3.15 and 3.16 - Examples of storage

9) Fragmented storage
People keep their photos fragmented around the house (see figures 3.14 – 3.16). Common places to store photos (and films) are:

a) in flip files in the cupboard in the living room;

b) in albums on shelves in the attic;

c) in photo wallets in filing cabinets in the study room;

d) in shoeboxes under the bed in the bedchamber.

3.5.5 How do people organise their photos?

General

10) People have a lot of ideas and plans for how they would like to use their photos, especially during (re)viewing, due to its evocative character. They have a feeling ranging from discomfort to guilt when photos are not being used.

11) Everyone has their own personal presenting and organising style or strategy, leading to a rich mixture of storing and presenting styles. The results can be clustered in groups as photo wallets, flip files, shoeboxes and albums.

12) In many cases photos remain in the photo wallet. Two of the big advantages of keeping photo wallets unchanged:

a) Preserving of the original chronological order;
Photo wallets present a separate batch and can either contain a story on its own, a substory or be part of bigger story.

The time-based order can also be found in cases where an album is created. During the process of organising all photos were mostly (re)ordered into a chronological set, which becomes more of a project as collections grow in volume over time and the time of the last update has been quite a while ago. This time-based order is a suitable representation for the next stage of creating a photo album: selecting the photos to use in final story.

b) Keeping the link between print and film intact.

Miscellaneous:
Index prints are becoming a standard service provided by the shop and these overviews have an extra value, although not recognised by all participants. When photos are placed in albums the index print can preserve the link between photo and film.

Technique

13) Printed photos have a tangible character, which is expressed in the way people organise and share their pictures (in other words: interact with their images).

14) Sorting photos into sets is done quite easily and people have a limited number of (around 4 to 6) different main categories, like themes or topics in mind.

Match

4. Match of market and user research findings

4.1 Introduction

The findings and assumptions outlined so far still address a wide field of interest. We first will review the assumptions to determine if the predefined direction for innovation is supported by the user research findings. In case at least one of the two assumptions is confirmed there will be a direct motive or design frame for product development.

4.1.1 Reviewing the assumptions:

- Did or would people actually like to share the task of organising?
  No, not necessarily. People like to communicate the results in form of personal stories. Organising seems to be a more personal issue. One where the user is free to put in his own perception and preference (see user research findings 4 to 7).
- Did people actually have problems with sorting their pictures, especially when it comes to the commitment of assigning one picture to only one set?
  No, and sometimes they can even clearly motivate why one picture although matching several criteria, is put in just one specific set or group (see user research findings 14).

The rejection of both assumptions does indicate that current user behaviour, where photo prints are selected and sorted in an informal and tangible way, is a very personal and emotional process. Although some limitations or discomforts might be addressed, people have become accustomed to organising their pictures the way they do now. In this light, digital solutions should not primarily focus on providing technological-based solutions that tend to professionalise the process of organising. Most people don't seem to like handling their collections to the level of librarians; managing an archive that consists of a personal image collection will therefore probably only suit a small group of people.
Current offering of digital solutions requires people to adjust their way of organising to the process that is described by the program. Thereby not providing an appealing alternative for the traditional organising of printed photos.
The basic motive for innovating in this area should address the issue of locked-in organising solutions and their professional nature.

As both assumptions are not confirmed by the findings of the user research we will first go back to the main findings of both market and user study to redefine new directions for innovation. Further focussing is necessary to highlight the key findings and define the match between market and user findings.
As previously stated in the report, the adoption of digital technology by the photography market could have a great impact on the user's behaviour. Market changes will enable new possibilities. The challenge is therefore to relate traditional values and limitations of organising photo collections to current product offerings and the opportunities presented by new technologies (in this report also referred to

as: technology enablers and simplifiers). In the following section these two viewpoints are mapped out by starting with clustering the fields of interest.
Three domains are identified, each containing two subtopics. Each domain is first presented as separate design spaces. The market review findings are used as a framework to reflect technological possibilities and limitations whereas the user research findings will function as a panorama view, reflecting the (unmet) user needs and limitations. References are made to the list of key findings to be found in chapter 2.8 – Market review findings and chapter 3.5 – User perspective summary.

4.2 Management of digital image collections

Identifying the domain

Current product offering for digital imaging do not support the flexibility users require (see market review finding 1). People use a wide variety of approaches to organise their printed photo collection, depending on the particular circumstances (see user research findings 6, 7 and 11).

When people feel the need to review images it is mostly because they would like to recreate stories by browsing through parts of their collection as indicated in the following quote: “Consumers are not interested in single images but in collections of images that narrate stories. Story-telling is one of the oldest human skills, yet in these times an individual can no longer afford the time to patiently organise and annotate images.” [31] Current offering seems to put the emphasis on the method rather than the process of retrieving. Hence in order to be able to retrieve digital images at a later date, the user is expected to first label each picture.

Direction for innovation

The process of sorting and selecting printed photos is a process richly evocative of both emotions and ideas. The valuable ideas and memories that pop up could be captured in an informal way so that it doesn’t interfere with the ongoing process of organising. This information can be used for bringing in a more personal touch during the creation of multimedia albums. Another use can be to label images or sets of images with more personalised information.

In this section the emphasis is put on labelling images since current market offering seems to approach this issue from a technical viewpoint. Rather than supplying standard forms in which each field needs to be filled in manually, we first should go back to the basics and look at what kind of information people would like to attach to a digital image. Then solutions can be found by looking at which moments during the process of organising, people are most interested in recording index information and in what situations is there a need to obtain this information. Starting with the last: the need to retrieve information:

1) Retrieving images
   Three issues make this an interesting area of research:

   a) The fragmented way people tend to store their printed photo collection around the house is, to a degree, supported in the digital world (see user research finding 9 and market review finding 3). People can choose between a large variety of solutions ranging from hard disk and CD-ROM to the Web as shown in figure 4.1.

      This model shows an informal mapping of different storage solutions divided into a personal and shared nature. Personal

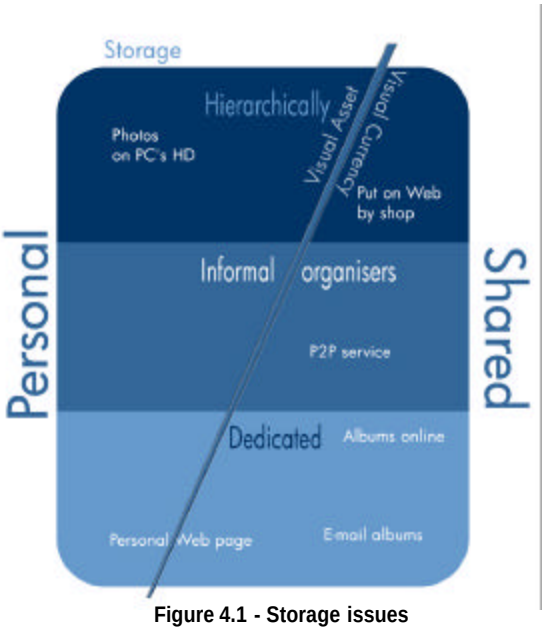


Figure 4.1 - Storage issues mapped into revised model

storage is in this case also referred to as a visual asset whereas shared collections have a more exchangeable nature and is thereby translated as a kind of visual currency.
As collections grow over time it will become more difficult to retrieve images, especially the ones that were taken a long time ago. One of the main reasons to retrieve images is to reconstruct stories and this might become a complex task as these stories can cover long time periods (see user research findings 1 and 3).

b) Facilities to select images one by one in a Windows-based environment, as shown in the interface below (figure 4.3), are quite common. Compared to selecting printed photos out of a traditional collection (see figure 4.2), this is a far less enjoyable task (see user research finding 13 and market review finding 1).

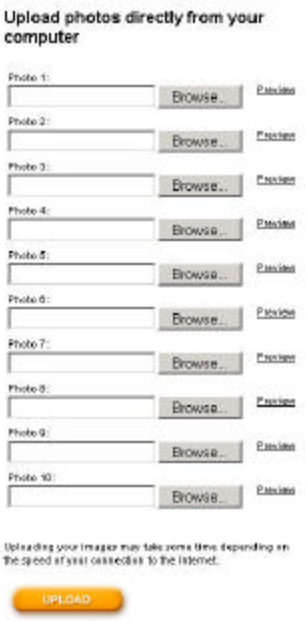


Figure 4.3 - upload page - Fotango

Figure 4.2 selecting photos

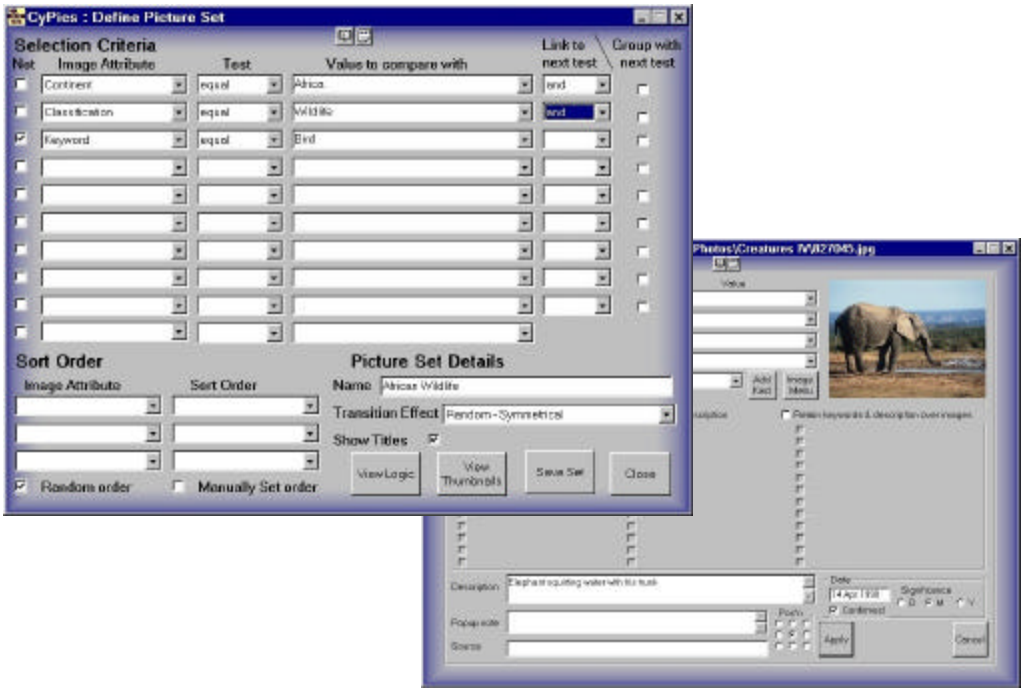
c) The value of having photo wallets, see user research finding 12, and the resemblance with one of the functions of folders (illustrated in figures 4.4 and 4.5). Keeping your photos in wallets can be seen as a basic level of storage. The original batch of photos is kept intact as well as the link to the original – in most cases the negative film. In a digital environment the folder can have the same functionality; the original file - format (mostly the jpg-extention), size and color settings - is kept unchanged. Understanding the value of having and keeping the original batch(es) is one of the key findings addressed in the user study.
Labelling wallets and printed photos needs a more manual input. Some basic labelling can be found, in many cases people were likely to write down key information as time and place on the wallet or on the back of a photo. One of the advantages of organising digital images is that each image file and folder is automatically added with some basic labels as title, date and size. Searching images is made relatively easy since all images can be ordered by title, date and size simply by clicking on a button.

Figure 4.4 – a collection of photo wallets

Figure 4.5 - the folder as digital version of the wallet

2) Labelling photos

The process of labelling photos is still mainly a manual and thereby a time-consuming task, in both digital and conventional photography. Interfaces with property menus as shown in figures 4.6 and 4.7 below are quite common tools for labelling images. On the one hand, this approach of forcing the user to label each photos as they add it to their digital collection is tedious and time-consuming. On the other hand, the labels make it easier to keep track of all images (see market review findings 2 and 4).



Figures 4.6 and 4.7 - CyPics label facilities

In order to be really effective, this type of organising demands a relatively high level of consistency in labelling, which is not typical of most consumers in the home imaging market (see user research finding 2). When it comes to the more frequently executed task of constructing personal stories with a special topic people are likely to browse through their collection, using a kind of visual search method. More detailed and dedicated textual search queries will be possible with programs like Virtual Album. This seems to be most suitable for retrieving single pictures rather than complete sets, in this case the “hard-to-find” ones. The final question is whether people have a need to archive each picture to such a detailed level?

4.3 Using photo collections

Identifying the domain

Digital images on a screen are easy to share with others. It could be stated that the Internet has been a technology enabler or simplifier by making the sharing of images with distant family just as easy as was already the case for sharing photos with neighbours or nearby relatives. Digital imaging has more to offer; direct access and instant results are marketed as the key values. These two characteristics do seem to match with the user's feeling of discomfort when pictures are not being used (see user research finding 10). Digital technology might make it more convenient for people to put ideas into practice. Digital solutions addressing this issue should not overlook the values of the traditional process. The process of sorting and selecting printed photos is a process richly evocative of both emotions and ideas (see user research finding 10). Current product offerings seem to overlook the value of this process. They focus on providing direct and almost single-step solutions in a formal and very structured way and thereby tend to overlook the more encouraging aspects that can be detected in the process of organising of printed photos (see market review finding 1).

Direction for innovation

Combining this with the technical possibilities of the digital process where digital images are easy to share and communicate, would lead to the creation of a rewarding and enjoyable tool that understands the richness in the process of organising and the need or desire to use personal images. In this light the design challenge can be described as to find supporting tools that both enrich the experience and make organising digital images a more rewarding task by using the two key values of the traditional process:

1) The tangible character of printed pictures
   Current product offering where files are stored in folders and where multiple images are selected by clicking on the filename or thumbnail do not seem to encourage much interaction. The "touch and feel" nature of the traditional way of organising offers a convenient way of interaction as well as a rich experience (see user research finding 13). This relationship might also be expressed as a hands-on experience. The gesture-based interaction and its intuitive character are values that might enhance current digital solutions.

2) A personal touch and story
   People like to choose their own way of organising photos and adding their own personal touch, dependent on variables such as individual style, stage in their life and the main objective (e.g. sharing an album, creating a personal year book). This results in a wide variety of strategies, each suited to particular situations (see user research findings 2, 3, 8 and 11). Most of the digital solutions are restricting these personal approaches to pre-programmed facilities with a prescribed process.

4.4 Bridging the gap between the digital and physical world

Identifying the domain

During the project it became more and more evident that the co-existence of the two worlds of the physical and digital environments need to be improved. The use of the image in general might gain value when strengths of both formats are combined.

Direction for innovation

For this to happen a more dynamic and interchangeable relationship is needed. Current developments of hybrid solutions underpin the essence of co-existence. This can also be seen as a growing need, since it can be expected that in the future most people will have a photo collection that is partially digital and partially conventional.

1) Co-existence of both worlds
   During the project it became more and more obvious that due to the change in technology used for capturing and processing images people will end up having a collection of photos that is partially film-based and partially digital in origin. Reconstructing personal stories will be a difficult task when prints of both formats might end up in one collection. Current developments where hybrid services are providing digitisation of films might make it an even more complex world.

2) The lifecycle of photos
   Although it seems that the lifecycle of photos is not directly related to the co-existence of the digital and physical worlds, there might be a growing connection between them. As stated in the user research findings, photos represent a visual value that fluctuates over time (see user research finding 2). This changing value influences the need and ability to review and organise these images. As people become able to choose between a growing number of alternatives to respond to these needs, it will be a matter of convenience when images can be retrieved and used independent on it's format. For instance, if after a long period of time a person remembers a certain event and wishes to retrieve the corresponding set of pictures he will face the challenge to find them. If he would like to share them directly and synchronous with distant relatives but manages only to find the printed versions he is limited when there is no digital equivalent. Market reports indicate changes in user behaviour due to the adoption of digital imaging. As people begin to want to bring old pictures back into play, the importance of supporting the ability to retrieve and reuse photos will increase.

4.5 Conclusion

All three areas of interest are part of a bigger picture focussed on making the organising a collection of personal digital images a more enjoyable and rewarding task. In this framework we will have to take a step back. Evaluating the ideas separately and choosing the most compelling idea is not the primary goal in this project. Both market and user research were done in a more open context, so at the end a better understanding would be achieved, in which the user was placed in a central spot and technology dedicated to a more serving roll. This approach led to the development of a bigger picture in which people are able to control th eir digital images in a more dynamic and intuitive way. One in which digital solutions support a user friendly way of labelling and communicating pictures, where people are more open to respond to their ideas and impulses not limited by technical boundarie s. The link between digital and physical photos would make it unnecessary to organise both collections. In this light the right thing to do is determine what step needs to be taken first to get there.

One of the first steps in making organising personal image collections a more compelling task is to provide a solution that enables a more dynamic and intuitive means of control. A flexible solution that addresses the current mismatch between user characteristics (as the desire to put a personal approach in the process of organising) and market offering of formal and framed digital organising solutions.
This mismatch can also be explained as a gap that gets most prominent during the process of reconstructing stories from collections of photos (see figure 4.8).

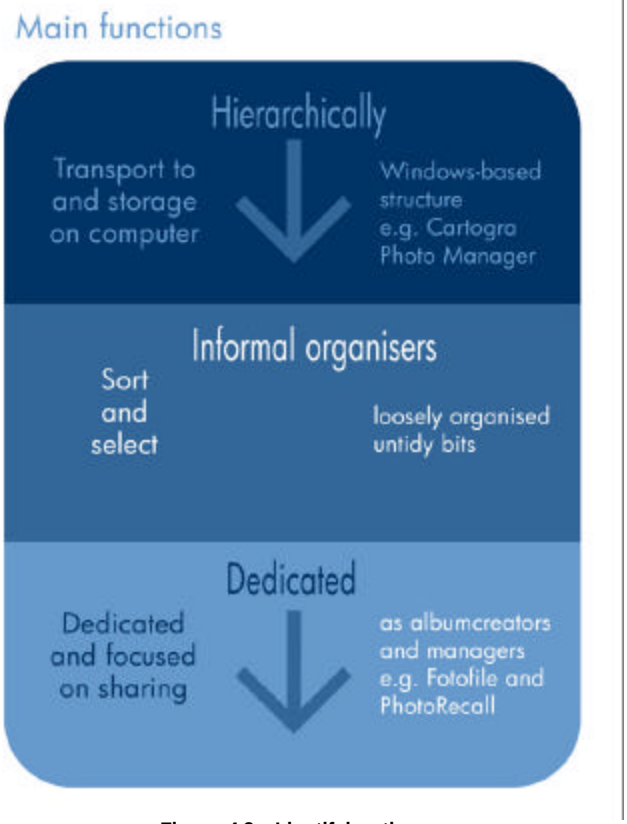


Figure 4.8 - Identifying the gap

In the traditional process of organising collections of printed photos people showed a very personalised way of interacting with their pictures. Selecting and sorting printed photos is a typical hands-on experience and the lack of this type of interaction in a digital environment can be addressed as a gap (between mainly two kinds of organising solutions). On the one hand, there are the image managers; dedicated to manage transport and storage of images. Almost all of these solutions operate within a Windows-based environment. On the other hand, there are the album creators; solutions that focus on presenting sets of images.

The primary design challenge is to bridge this gap by developing a solution that makes organising a collection of personal digital images a more enjoyable and rewarding task. As earlier mentioned, this gap is most prominent during the process of reconstructing stories and therefore the project objective can be narrowed down by further refinement of the design description into: “a tool that helps you create personal stories out of a collection of photos”. Other elements that were discussed in the idea creation will thereby fall out of scope of this project but will remain being part of the bigger concept. Each field of interest is part of a coherent view of what the consumer-imaging world might look like in future times. Developing just one idea in one area would not be possible if the relationship with others is neglected.

4.6 A Scenario - A bit in the Future

Before the concept can be presented a framework is needed to better understand the context in which the solution is plausible to be used. A scenario will be presented, describing an interesting and realistic case where one person will take the initiative to organise the pictures taken during a special occasion. In this way a story helps to describe the match between user behaviour and how technology can fulfil their (unmet) needs and desires. In the near future it is expected that most people will be used to capture their images with digital cameras. Sharing and ordering prints over the Internet will be just as common as showing your photos to the neighbours or collecting the reprints at your local grocery shop. The home PC is not the only device being used; a television, a game console, a cell phone or a digital camera will do as well. In this digital inspired environment the imaging landscape may look very different from today's film-based version with its shoeboxes and drawers filled with photo wallets.

4.6.1 **Storyline and characters**

The context of a family environment is quite representative for most common consumer image behaviour. A lot of pictures are taken within the limits of the family environment or otherwise part of an extended family environment, one in which friends are also included (in section 1.4.3 "Project scenario" also referred to as social circle). In this domestic environment parents and grandparents are most likely the persons who normally organise the photo collection.

Within the household environment mostly women seem to feel more responsible for the maintenance task of keeping track of the complete collection, whereas men like to use their technical skills while capturing the image. This traditional role-play might not be that narrowed down in reality but within this project it is a useful characteristic since the objective is to develop a solution that is both rewarding and easy to use. While organising pictures in an informal setting is more an emotional-based process, current market offering seems to demand more technical skills, thereby overlooking the importance of the ease of use and enjoyment aspects. As a result the current organising solutions might attract a focussed target group of the more techy skilled.

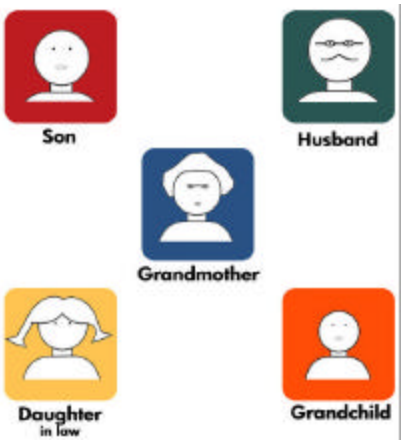


Figure 4.9 - Family context

During the user study it was interesting to notice that in the two families that started to use digital cameras the normal organising routine had changed. While normally both wives took the initiative to organise the images and create albums, now most images ended up on the hard disk of the computer. Not many images were printed so in order to organise their collection, they would need to sit behind the computer in the study room and start using the current organising solutions. None of the user research participants felt the need to do this and as a result most of the digital images ended up being unused. Especially both wives explained they weren't satisfied with the idea that the biggest part of the digital image collection wasn't being used. The men explained that they were comfortable with the fact that they knew the collection was stored safely

on the computer. Retrieving these images was for them a case of selecting the right folder. As this example illustrates, the digital way of organising will in a sense compete with the traditional way of organising printed photos.
In the presented scenario, a family setting is chosen in which the grandfather is taking most of the pictures by using his new digital camera with docking station and the grandmother is organising them by using a touchscreen tablet. In this example a story is presented in which both grandparents are going out for the weekend to visit their son, daughter-in-law and grandchild (see figure 4.9).

During this weekend they will celebrate the fifth birthday of their grandchild. This special occasion is taking place in the holiday cottage in mountain district. The grandchild receives a football as a present of his grandparents and since he enjoys playing football, he will convince his father and grandfather to play a match every day. On the last day they will go out and enjoy the mountain scenery. Not only the grandparents have taken their camera with them. So at the end the grandfather and

Figure 4.10 - original photo collection

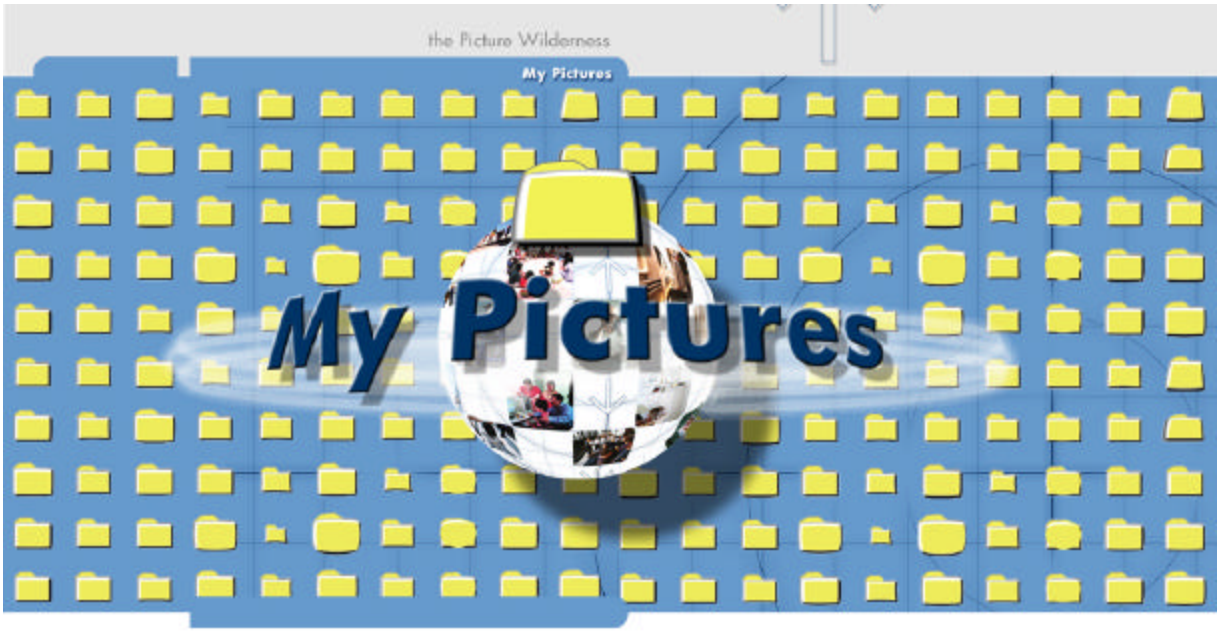
daughter-in-law take most pictures, but also grandmother will have used the new camera, only in a few occasions. As both cameras can communicate with each other the son has sent some of his pictures over to the grandparent's camera (photo collection is shown in figure 4.10).

As they go each their own way the grandmother takes the initiative to start reconstructing a personal story. Focus is put on the grandmother who is very interested in maintaining the family history. The idea is to create an album to share with the family. By doing this she reflects her personal view on the event with her grandchild as main topic. She does this in an informal setting - sitting on the couch in the living room (as shown in figure 4.11). After a while she takes a break but sends her work in progress to a small and

Figure 4.11 - Home environment setting

selected group - in this case the persons that were present during the birthday party. When she comes back she sees that the others have responded to her initiative. Their reactions are put in the story making it a mixed album with a more shared nature. In this way a personal story is created around one specific topic, captured in an album. Other results could include:

- An ongoing communication and a better understanding of the others experiences of that same occasion;
- A reprogrammed and updated show to use for example on her digital photoframe;
- An informal organised collection that reflects her personal preferences.



Design Phase

5. Design Phase

5.1 Introduction

In this chapter the concept is presented starting by exploring the space between the refined design description: “a tool that helps you create personal stories out of a collection of photos” and the user context of the family environment, described in the previous sections.

5.2 Metaphors exploration

Both functional and informal aspects of the concept are explored by using metaphors. In this way a representative visual example can underpin some basic functionality and experience issues. As stated in the chapter 1.4.2 - “Assignment goal”, this project aims to identify the key advantages that digital technologies can offer in the consumer imaging domain by focused on the question: How to manage an album, a library or just a “shoebox” filled with photos that cannot be touched physically? The key issues surrounding the personal image collections are:

- Is it possible to translate the more important values of the analogue process into a digital version?
- Which new values or possibilities can contribute to the functionality and enjoyment factor?

A research is conducted to map out these key values and limitations. One of the design challenges is to translate these issues into design implications. In this project, we chose for a metaphor exploration, which will produce informal requirements to be implemented in the final concept. The generated ideas in the following metaphors will in the remaining sections be illustrated in the context of a concrete example. Each metaphor represents a certain aspect in the process of organising. To make the link between metaphor exploration and design of the concept more clear a chronological classification is made as follows:

1) How to start organising?
2) What kind of experience is aimed at?
3) Which methods do people use?
4) What kind of strategic aspects are important?
5) Which techniques do people use to organise their image collection?
6) What kind of results do people aim at?

5.2.1 Metaphor 1 – How to start organising?

Just flip the box.

One of the boundaries of creating albums is the problem of disrupting the original set stored in photo wallets. Informal collections should address the two values of on the one hand having the original collections stored as separate batches in folders and the value of having albums for personal use and as a means of communication.

- How to use the space
- Just start by inverting the box
- Turn the box up side down
- Feel free and throw your photos on the table

One of the advantages of organising digital images is that the original set stored in folders, which functionality is comparable with wallets, can be maintained. Reconstructing stories by selecting and ordering copies of the images will thereby keep the original configuration in unchanged.

An overlay structure could be used by either making copies of the originals or either saving the links to the images that are for instance part of a new album. Both solutions are useful and a default setting might be to first save all links. In situations where albums are to be printed outdoors or when there is a need to take your personal album on the road to show to friends the program can generate an album with the images embedded in the document.

5.2.2 Metaphor 2 – What kind of experience is aimed at?

Visual browsing - Dive into your collection.

A collection of printed photos is a valuable asset. Reviewing them will evoke many memories. One of the design challenges is to make organising a digital set of images just as pleasurable as currently is the case with printed photos. Aspects as retrievability, control and interaction are important factors to achieve this goal. A rich experience is only possible when people are able to directly interact with the images rather than knowing when and which button to push. A solution that enables the user to:

- Visual asset
- A journey or adventure
- A layered or 3D experience
- Explore, relive and

- quickly and easily select a set or sets of memories;
- explore them in an informal way – not one where pictures are displayed neatly and tightly on the screen but one where the images can be moved around, rotated and displayed in a layered structure.

This layered and loosely structured collection has been also detected in the physical environment (see example in figure 5.1). Mixed collections stored in drawers and shoeboxes represent a visual asset that, when reviewed, can produce many unexpected and pleasant surprises. The informal method is also found in the process of organising. Starting point of each organising process is a set of photos that is spread on the table surface. This way of handling images is in this project described as seeking to help people gain control over the chaos rather than bring complete order to it.

Figure 5.1 - a rich mixture of loosely organised collections

The previous brief exploration leads to the following design implementation:
A user interface is to be designed that is dominated by the photos that were retrieved. The absence of buttons etc. will produce a visually appealing design where photos can be viewed in an informal setting – layered and disordered.

5.2.3 Metaphor 3 – Which methods do people use?

Control over “chaos” rather than bringing order into it.

Most people do not have the desire to organise their images to a level that best can be compared with the task of librarians. Having large collections of photos is seen as a valuable asset but the primary objective is to use them to review or share and not so much to have them neatly organised and labelled in one central location.

In reality people have stored their images fragmented in their house. Some pictures are for instance kept in envelopes and stored in the file cabinet in the study room, others are presented in album and stored on shelves in the living room. This situation can be compared with the storage of digital images where collections can be kept fragmented on for instance CD-ROMs, hard disks and the Web. For the user it is important to have direct control over his complete collection.

In the digital environment access to these sets of images is mainly provided by browsing through folders. This 2-D representation of the office file/folder equivalent seems to limit the freedom of bringing in a more personalised system. A metaphor is therefore used in which people can build a mental map to navigate through a single set of images as well as through their bigger collection in a more spatial way.

- Build a mental map
- Storage location and pile system
- Walk through
- Roadmap

5.2.4 Metaphor 4 – What kind of strategic aspects are important?

Maintain your personal strategy (style, approach and system).

As in most current digital organising solutions the user is limited in using his personal style. Rather than expecting the user to adapt to the program, the program should open up to the user's request of putting in his own style. In the conventional method of organising people have shown a high level of creativity in developing methods that suits them best - dependant on time, the objective and personal preferences. An open solution that lets the user choose his personal way to go through the process and his own presenting style will probably be most rewarding. Especially when the program learns from the user behaviour and preferences the application can be tailored to the users system. A smart solution that stores valuable information in his history log. This information can relate to the different links between pictures, such as when they were last being used, and in what the previous relationships between these pictures were.

- Personal style and expression
- A helping hand from the professional
- Take a break

A next step therefore could be that the program helps out whenever the user needs some suggestions or advice. This would open up new possibilities for a dynamic interaction model where both user and program can play an active roll as well as the roll of adviser.

5.2.5 Metaphor 5 – Which techniques do people use to organise their image collection?

A hands-on experience to sort, select and exchange your pictures with pleasure.

The act of playing cards is a useful metaphor to express the value of the tangible character of pictures. During the user research at labs, where people showed how they sorted and selected their photos, it became clear that the feel and touch aspect of moving pictures on a table is a richly evocative process. By using just some basic gestures people are able to not only (re)organise their images in sets and albums but also communicate personal stories with each other. For developing a digital solution the “card playing” metaphor will be used where key interaction and input gestures from the 3-D environment will be translated into a 2-D representation.

- Exchange your experiences
- Visual currency
- Conversational props
- Tangible character of sorting and selecting
- Pile your favourites
- Freedom and use of space
- A hands-on experience:
  - Hand in - see
  - Hand on - pass on
  - Hand over – deliver
  - Hand down - transmit
  - Hand out - hand around

The previous brief exploration leads to the following design implementation:
An interaction model is to be designed using the intuitive gestures people normally use to organise printed images, comparable with the hand movements during a playing card game.

5.2.6 Metaphor 6 - What kind of results do people aim at?

Show, share and exhibit - Bring your favourites into play.

One of the key findings that came out of the user research was the feeling ranging from discomfort to guilt when photos are not being used. People do have the desire to use their pictures but in a lot of situations they didn't come around to even start taking the first step of organising. Digital technology can enable or simplify the process of keeping (even older) pictures into play. As an inactive collection is seen as a waste, digital solutions can suggest the user for instance to update their online family album. When the user aims to maintain a set of different topic albums or desires to have an ongoing communication with distant family, to keep them updated, it would be technical feasible to suggest or even automate the necessary updates.

- Active use - show, share and exhibit
- Ubiquitous digital images
- Plan and program you show
- Keep your show up to date
- Order and show your favourites
- Relive - Walk through your collection in a gallery style

The previous brief exploration, combined with the ideas of Metaphor 4 (section 5.2.3), leads to the following design implementation:
During the process of reviewing and organising the user should be able to express his desires to label a specific picture as favourite (or representative of a pile). The process of organising can be even more rewarding when, at the end, the user is free to use his pictures in any desired output format. A dedicated organising program, focussed on presenting stories in a certain format, can use the "user specified configuration" in which a story is build by putting the selected images in specific sequence.

5.3 Hardware tool

Before presenting the informal organising solution there is a need to choose a hardware configuration that best suits the task. As mentioned in chapter - market perspective, the standard PC is at the moment the most used tool to organise digital images. During the market research it became quite clear that the image companies recognised the limitations of the PC as an image home entertainment device. Although the PC is a multi-functional device, there is a need for an easier to use tool that should be part of the living room setting. A lot of effort is put in developing and introducing such new solutions and not surprisingly the television is in most cases seen as the best suitable device. Not only do most modern households already own a television, it is expected that in the near future an interactive version will be introduced widespread. One that has an always-on Internet connection and can be used to share and store pictures or even order prints at your local store. New solutions are introduced ranging from camera and storage devices that can be directly connected to the television, or even game consoles like the PlayStation II that lets the user manage his image collection. After Kodak's previous attempts with for instance the PhotoCD-player this new development seems to be one with a lot of potential.

In this project a solution is developed that makes the task of organising a collection of digital images more convenient and enjoyable. And within this frame a television doesn't seem to be the most appropriate tool for the job. One of the key values of organising images in general is the element of direct interaction as a hands-on experience. A television would increase the distance between the user and his image collection and would thereby only allow a more indirect interaction as normally the case with remote control. To put in a personal touch-and-feel it is more likely that people prefer a tool that is within close range. A tablet would in this case be a welcome alternative as it is a mobile device and provides a direct interaction. A touchscreen tablet can be used in and around the house, has the capability of a direct and intuitive control and when positioned horizontally or nearly horizontally on your lap or on the table surface it resembles the situation of traditional photo organising.

Current offering of tablets are more or less split up between the conventional graphic tablets from Wacom and the webterminals for business and consumer use like the Frontpath's ProGear (see figure 5.2) and Viewsonic's ViewPad. Especially the last segment, focussed on consumer use, is interesting to analyse since these tablets are Web-enabled and targeted at the ease of use in and around the house. These terminals fit the profile of being a mobile tool that can be used while sitting on the couch in the living room. Their current technical specifications are not yet sufficient to match the requirements needed for the informal image tool. Screensize and dynamic touchscreen control are the two main lacking characteristics. However, two remarks can be made:

Figure 5.2 - Frontpath's ProGear tablet

1) Current developments show that a production-level LCD monitor can be produced up to a size of 20.8 inch and with a resolution of 2048x1536. [32]

2) A touchscreen with multi-touch and multi-pressure sensing are needed to enable all basic gesture-based interaction. Current tablets on the market do not yet support this mode of interaction. However, research is done in this field and reference can be made to the work done by for instance W. Buxton and his report “Issues and techniques in touch-sensitive tablet input.” [33]

5.4 Interaction model and interface design

Given the multi-touch and multi-pressure sensing tablet, it is now time to present the concept by first exploring the basic gestures with which the user can control his image collection. By observing the tapes recorded during the user study, we found out that people used some basic and almost universal gestures to manage their images. The gesture driven input can be divided in two sets:

- pointing at and touching single photos to select and move;
- activating and moving the position or orientation of a set of images.

As previously mentioned in the metaphor exploration, these gestures are used in a 3-D environment. Their translation into a 2-D format will therefore be a significant part of the design challenge.

The results will be presented in a narrative format by going through a process of organising, illustrated in the context of the scenario described in chapter 4.6 “A scenario” and using the findings of the user study. The proposed solutions are both informed in the current uses and a good understanding of the direction in which technology developments and social adoption might change users behaviour.

It is Wednesday afternoon and grandmother is sitting on the couch. After some busy weeks of family obligations and other formalities she has finally found some time to sort out the pictures taken two and a half week ago (see figure 5.3).

Figure 5.3 - original batch

Next week they will see their grandchild again and for that occasion she would like to have an album to present. Her husband has already offloaded the images from the camera to their main storage disk. The next hour she likes to spend on a first attempt of creating an album. Later that day they will both go to an information gathering about new cruise trips to the Caribbean.

The tablet is set on her lap and before making a head start she will select the folder with all the pictures of the weekend to their cottage house. Her husband has conveniently labelled the batch with "grandchild birthday July 2001". The organising program she uses automatically puts all the pictures on the screen as shown in figure 5.4. As the selected photos all come out of just one relatively small batch she prefers to have all photos spread out and displayed in a chronological view. Therefore she pushes the button to have them reordered (see figure 5.5).

Figure 5.4 - selected image are put on desktop

Figure 5.5 - in chronological order

Before continuing with the story the different stages of the process of organising a collection of printed photos are reviewed. This will underline the motives used for developing the concept. Aspects as how the available space was brought into play and which gestures the user study participants used will reflect on the graphical user interface and the set of gesture driven tools.

A set of 17 photos is displayed on the screen as shown in figure 5.5. This number is chosen as a reasonable compromise between the following aspects:

- a trade off between screensize, thumbnail size and number of photos displayed on the screen;
- this amount is approximately the number of photos that can be found in E-albums;
- one of the changes in user behaviour is the fact that people can instantly preview the pictures they have taken. Unsatisfying ones – due to a lack of composition or for instance sharpness - can be deleted directly from the camera;
- to present the concept it is important not to put to much information in the example given.

In cases where people would like to organise collections that significantly exceed this number the task of organising can get very complex, as shown in figure 5.6. They can choose between two options:

1) Decrease the displayed size of each photo.
   This will have a negative impact on the experience level. When pictures are displayed in a relatively small thumbnail size, the proposed solution will tend to function as a standard Windows-based image manager, thereby overlooking the importance of having a more detailed view over sets of pictures rather than single pictures; or

Figure 5.6 - the complex task of organising a large collection of images simultaneously

Figure 5.7 and 5.8 - going through a set of photo wallets one by one

2) Repeat the process of selecting a number of photos and add them to the collection. This resembles the methods most people used during the user study. When simultaneously ordering a collection of photos (that consists of several photo wallets) the overview is lost. Most people therefore preferred to go through their selected photo wallets one by one as shown in figure 5.7 and 5.8.

Right from the start the table seemed to be divided into two main parts. One part, the table surface closest to the user, functioned as the working space where photos are selected and stories are built. The other part was reserved as storage space: a place where the different piles will temporary be put. Figure 5.9 illustrates this physical separation: piles are kept further away but still remain within reach, whereas photo wallets and separate photos that need to be sorted were kept within comfortable distance.

Figure 5.9 - a working and a storage space

Since all the preselected photos are all displayed in chronological order, there is a comfortable overview to start reconstructing the overall storyline. A first need is to put all related photos into piles that represent a shared label. As shown in the previous section these piles are placed outside the virtual working area. With the top of her finger a photo is selected and moved to a different place. Dependent on the position where the finger touches the image, the picture will rotate or stay in the same orientation, making the place of contact function as the central point of the picture. Pictures are then moved to different piles. (an

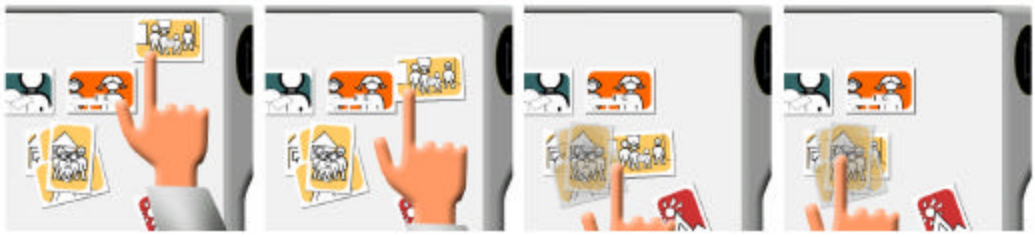


Figure 5.10 - moving pictures to a pile

example is presented in figure 5.10)

Another aspect of the intuitive control is the combination of contact position and direction of movement. As piles are built of different layers, each represented by a single picture, the user must be able to have control over the place where a new picture will end up. An important aspect is to have representative photos put on top of a pile thereby making it easier to recognise the content of each pile. This example (see figure 5.11) illustrates the need to have control over the configuration of each pile. From a designer's point of view the ability to build piles in user defined order is one of the set of tools an informal image manager should supply.

Figure 5.11 - putting favourites on top of pile

For one pile, consisting of all pictures related to the weekend off, the grandmother likes to have a certain picture on top. This will make it more convenient to keep an overview during the complete process. The pile is on the upper right corner of the screen while the desired picture is on the left. She puts her finger on the left part of the photo and then moves it right towards the pile. By placing her finger on the left side of the picture the other side will virtually lift up. This will make the picture go on top of the others on the pile. The example is illustrated in figure 5.12.

Figure 5.12 - placing a picture on top of pile

The next picture will be put somewhere beneath the pile, but grandmother likes to still see a little bit of the picture. The photo is touched on the upper left corner and with a quick movement she rotates and places the image underneath the same set. The position of contact and speed and direction of movement will determine how much and how quickly a single picture will rotate and which position it will have in a

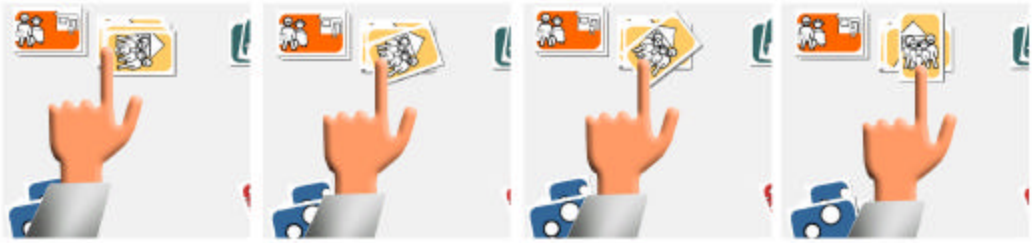
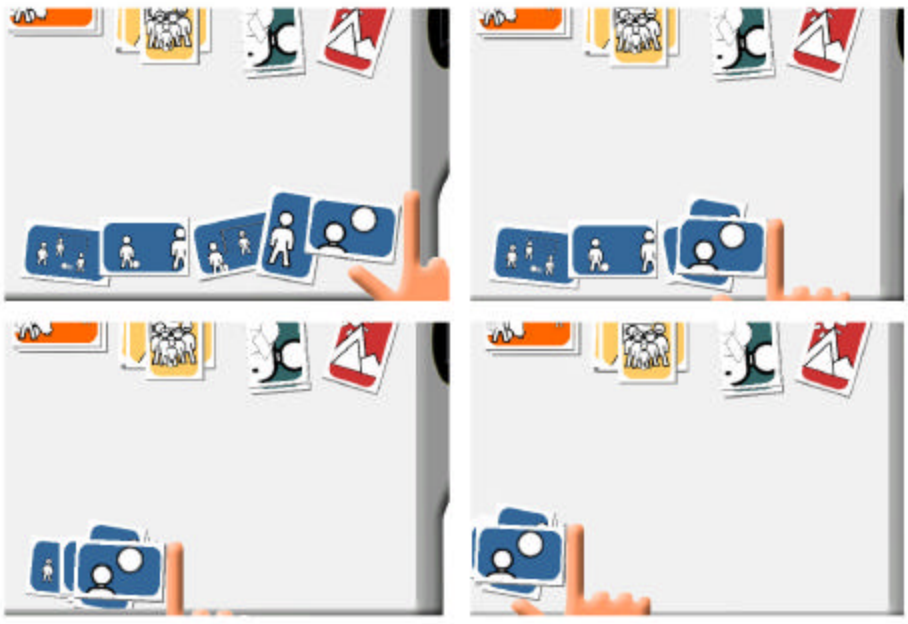


Figure 5.13 - rotating a picture

pile (see figure 5.13).
As most pictures are already put in the different piles a clear view is developed how the final story should be built up. Six piles are set on the table each representing a specific label. These photos will end up in a complete coverage of the weekend but in later stages they just as well might be put in other albums. Grandmother is maintaining a special album dedicated to her grandchild and one day, when he is a grownup, she will give it as a present. Although the main objective is to create a specific album that cover the weekend it seems to be a good moment to label each pile. In that way the important links are created and after a longer period of time it might be very valuable to have a structured archive of different collections. Some pictures that are put in this new album might then just as well end up in the grandchild's photo album.
Now it is time to clean up the table, making some room to reconstruct a story. The different piles are moved towards the upper part of the screen. A hand movement that starts by placing the thumb and index finger next to a pile will redirect the pile to the other part of the screen following the movement of the hand. The photos in a pile will automatically be brought



closer together due to the movement of the hand, as shown in figure 5.14.

Before starting to reconstruct the complete story a substory is put together describing the exciting moments of the weekend where her grandchild for the first time played football with both his father and grandfather. Although this event was actually represented by two different occasions, grandmother decides that for history value it is more suitable to mould them together in one story. In this way the substory will look very nice in the album. In figure 5.15 the process to create such a

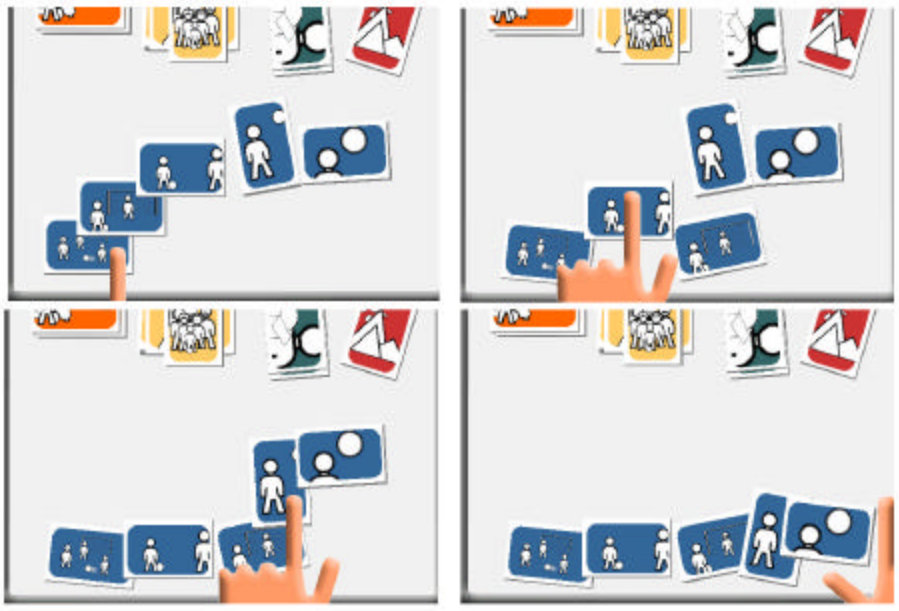


Figure 5.15 - creating a substory

story is illustrated with an example.

This short story is being built-up starting with a panorama-like picture showing all three football-enthusiastic members of the family. The zoom-factor of each picture is used to bring a storyline in the set, starting with an overall picture and followed by zooming in on the main character – the grandchild, who is learning to play football.

Now that all pictures are all dedicated to one of the six piles it is time to reconstruct a story. As mentioned in the last section of the scenario it would be a valuable tool to have an intuitive-based labelling facility build-in. The index information based on the labels that can be given to each pile or set of pictures can over the years be a great help as retrieving and browsing tool.

The proposed solution works in the same way. The basic storage level where images are put in different folders is kept unchanged. An album is built-up from low-resolution copies of the original images and links to these original image files and each original image file is labelled with reference information regarding the albums in which the picture takes part. In the current situation where for instance albums are created from printed photos, people do not have the same option to keep the conventional photo wallets or shoeboxes undisrupted.

Additional information as the labels of piles can be preserved and thereby function as two-ways links. This would enable organising solutions helping people to browse through folders in a more guided or structured format. People can be redirected from one folder to the other thereby showing for instance the progress of a grandchild growing up. As photos in folders can be linked to related albums, thereby showing when and where pictures have been used, it could be just as well possible to review an album and then for each picture go back to the original batch. For this to happen an organising solution should at least have two characteristics:

1) Present an overlay structure - when recreating a story by selecting different photos the original batch stored in a hierarchical folder structure is kept unchanged;

2) Intuitive labelling facilities – that lets the user decide when in the process he/she wants to add index information to his photos.

The concept presented enables a more dynamic way of visual browsing. Especially as digital collections grow over time and tend to be stored fragmented on for instance CD-ROMs, Hard Disks and on the Internet the need for smart solutions might grow. Current offerings seems to concentrate more on the ability to search for a single picture by typing in keywords. People might have a growing need to retrieve sets of pictures based on their links. Links that develop over time and hence not only refer to the actual moments of recording. In the given example the grandmother might after a while, when reviewing the album she made for her grandchild, be interested to go back to the original batch of that specific photo. Using the preserved links would redirect her to this corresponding folder. When browsing through the folder labelled "grandchild birthday July 2001" she might then be interested in finding out where else the image has been used. The organising solution would forward her to the story captured in the album as shown in the scenario used in this project. In other situations she might be more interested in reviewing the related photos that were part of the same pile. This method of visual browsing meets the user's unmet need to better use his images according to his personal preferences and stimulates the ideas that pop up during the process of reviewing images. Labelling functionality presented in this concept should use the advanced technology used in for instance the FlashPix-format. This format is still under development, but reports from the DIG (as Digital Imaging Group's whitepaper protocols and standards), supported by e.g. Kodak, Hewlett-Packard and MicroSoft, show that this format is more and more supported by the imaging market. The introduction of JPG-2000, mentioned in chapter 2.6 "Technologies on the horizon", shows the direction in which the imaging market is heading. This format is been developed in cooperation with DIG and a first attempt is made to embed some basic XML-based metadata support and multi-resolution layer structure.

On the "desktop table" all six piles are moved to the upper part of the screen. This is a good starting point to begin reconstructing the story. The top photos of each pile give a rough indication of what types of pictures lie underneath. Grandmother prefers to have some piles spread out since this will enable her to directly select the underlying photos. And since the screen is big enough to have some piles spread out she decides to do so. The gesture that supports this action is a simple and single touch movement; the fingertip is put on top of a pile and, while exercising some pressure, the finger movement will have the pile spread out. (see figure 5.16)

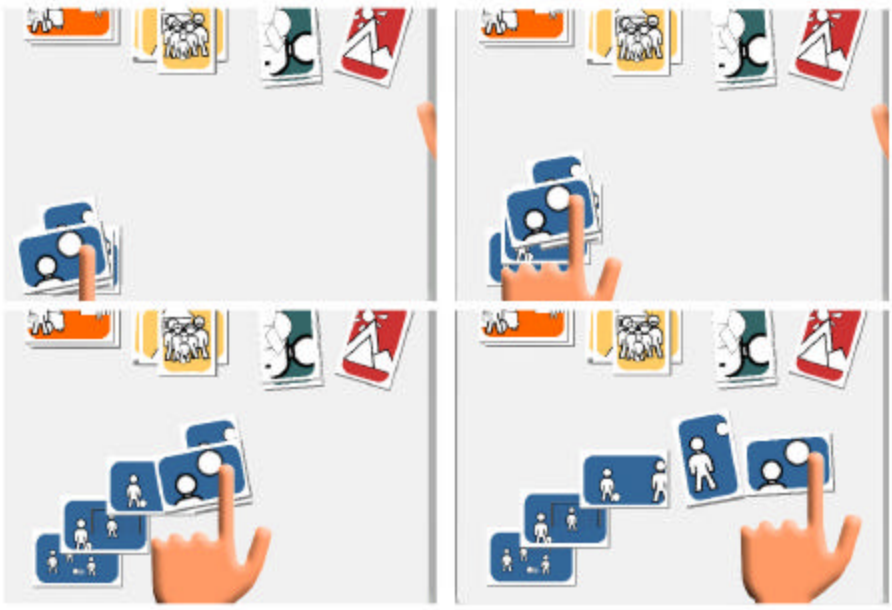


Figure 5.16 - spread out pile

The speed and pressure level will determine how far the pictures will be spread. A reverse movement where the point of contact is right next to the images would bring back the pile.

The story above shows that the piles are separated by the visual white spaces in between them. User study observations showed that this was done to maintain a clear overview. In the digital version of organising images it becomes more important to keep these basic borders intact. The alternative of completely filling the screen with images would have decreased the visibility. It would have been difficult to keep a quick overview and the 2-D projection of a screen doesn't allow the user to pick up his photos very easily. The degree in which a pile will be spread is therefore limited by the available space.
Another aspect that relates to these open spaces is the movement of a single picture to another place on the screen. When an overlap occurs, between the picture that is moved and other pictures on the screen, the application will display the photos on top in a semi-transparent view. This will support the movement of the picture; the user doesn't get confused. As he is concentrating on a specific picture, this image needs to be visible during the whole time. The semi-transparency will also have the function of feed forward. The user will know where in the pile the specific picture is put before deciding to release the pressure to place the image in the pile (see figure 5.17).

Figure 5.17 - transparency of photos

> Next, a story is reconstructing by selecting pictures to be put in a specific sequence. The images are added one by one. In this last stage of the process the application records the sequence of the pictures. The first picture is put on the lower left corner of the screen and each following picture is put next to it. At the end the grandmother puts all the pictures in a pile. An album is selected and the pile is dragged over the album. The picture underneath is recognised as the first picture of the story followed the images on top.

In this example, an album is chosen as the end result. Other output options as a slide show or a personal homepage might be possible as well. However, the presented concept aims to bridge the gap between the Windows-based image managers and the dedicated organisers. A story is built, starting from selecting images stored in folders to the creation of a user defined sequence of pictures. For further use of this set of images the application should communicate the results with dedicated organisers that have enhanced functionalities to create the output options as mentioned above. This brings us to the final section – "Evaluation" - in which an evaluation is presented including recommendations of how this communication could work most efficiently. For the presentation of the concept a focus is put on explaining the intuitive gesture-based control and the design of the graphical user interface, built up of images themselves. And for these aspects a strategy was chosen that can be described as: "Design the simplest tools that fits the task". As a result an application is created that lets the user concentrate on the pictures. Buttons and pop-up menus were left out as much as possible in order to enable the user to focus on the hands-on experience. The gestures that were developed were based on the observations of the user research tapes, later translated in the metaphor of the playing cards. Although the concept wasn't developed to a level that allows a thorough research test, I assume a user tutorial can be limited to a self-explaining movie that shows the set of gesture-based input.

5.5 Evaluation

The concept presented in this design chapter focuses on the interaction between the user and his personal images. The interaction is mediated by a digital tool, in this case suggested to be a touchscreen tablet. The innovative part aims to provide an informal and intuitive control by using a gesture -based input. However, a complete solution for an informal image manager should also provide additional functionality and suggestions for this aspect will be discussed in the next section – "directions for future developments".

Comparing the current offering of image managers doesn't help to understand the function of the presented concept. As described in the scenario, the image managers based on the hierarchical folder structure still has it's own specific function. This function can be described as a way of preserving the original batches, and thereby can be compared with the storage of printed photos in wallets in e.g. drawers and shoeboxes. In this light these image managers can be seen as a first step in which images are offloaded from camera to a storage solution. In later stages, when there is a need to reconstruct stories, these managers limit the user's freedom to put in a personal touch. The informal-based solution as presented in this report does provide the right tool to perform this relatively complex task of selecting and reordering the images. The overlay structure enables the user to select images from different folders and at the same time helps to keep the valuable original batches in tact. From this point of view organising digital images can have a specific advantage over the equivalent of organising a set of printed photos. In the latter case the original batch is lost; a printed photo can be either in the wallet or in the album.

Especially in this stage, where there is a need to put together a story out of a collection of images to share and present to others, the current offering is limited. It is not surprising that the user research at home indicated that digital images stored on the computer's hard disk tend to stay untouched. The presented concept provides a compelling tool to just start organising a collection of images. Thereby using the key value described as the evocativeness of handling collections of personal images and the desire to have a result at the end of the process, in many cases an album to present to others. The presented concept can be even more rewarding when during the process of organising some essential labelling information is recorded. This will be described in the next section.

5.5.1 Directions for future development

A next step, in making organising collections of digital images a more rewarding process, is the introduction of new ways of labelling. Although during the project the decision was made to limit the design space to the interaction part of the organising solution, a statement can be made to show how the proposed solution fits in a bigger picture.

During the process of organising, presented in the previous sections, there were some moments in which labelling can be very rewarding. Facilities that enable a personalised and intuitive way of indexing should not interfere with the ongoing process of organising. In the example, where at a certain moment piles were reconstructed, the task of labelling could be embedded in the process. This would lead to a more sophisticated solution that enables to create a complex level of linking between pictures that are not part of one specific folder. User valued information can be stored as index information (in technical terms: metadata stored

in the header of the image file) but the links between different pictures may just as well be preserved.

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