Collections

Adapting the Display of Personal Objects for Different Audiences

Fernanda Bertini Viégas
B.F.A. Graphic Design and Art History
University of Kansas
May 1997

submitted to the
Program in Media Arts and Sciences,
School of Architecture and Planning,
in partial fulfillment of the requirements for the degree of
Master of Science in Media Arts and Sciences
at the
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Abstract

Although current networked systems and online applications provide new opportunities for displaying and sharing personal information, they do not account for the underlying social contexts that frame such interactions. Existing categorization and management mechanisms for digital content have been designed to focus on the data they handle without much regard for the social circumstances within which their content is shared. As we share large collections of personal information over mediated environments, our tools need to account for the social scenarios that surround our interactions.

This thesis presents Collections: an application for the management of digital pictures according to their intended audiences. The goal is to create a graphical interface that supports the creation of fairly complex privacy decisions concerning the display of digital photographs. Simple graphics are used to enable the collector to create a wide range of audience arrangements for her digital photographs. The system allows users to express their preferences in sharing their personal pictures over a disembodied environment such as the Web. The system also introduces an original approach to the presentation interface of photographic collections on the Web: a viewing application that takes into account the viewing history of the photographs and the integration of text comments to images.

Thesis Supervisor: Judith S. Donath
Title: Assistant Professor of Media Arts And Sciences

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Fernanda Bertini Viégas

The following people served as readers for this thesis:

reader
Brian K. Smith
Assistant Professor of Media Arts And Sciences
MIT Media Arts and Sciences

reader
Rachel Strickland
Researcher, Experimental Cinema
Interval Research Corporation

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Next, the work done in Collections is a team effort and, as such, I am deeply indebted to two great programmers who helped turn Collections into reality: Brian Bower and Matt Lee. Thanks, Brian, for finding the focus, sticking with it and revolutionizing the Collections toolkit in a matter of weeks! Thanks, Matt, for your amazing help with the interface implementation of Collections.

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Love to my sister for being the best sister someone could ask for. Love to my parents for their unconditional support and for believing I could do anything I set my mind to.

I dedicate this thesis to my mother:

Mãe:
Quero um dia ter a mesma força e alegria de viver que você tem.
Com todo o meu amor e admiração,

Fernanda

Table of Contents

1. Introduction

The domestic environment is the primary space where people store and display the things that are most important to them [4][9]. More often than not, such objects are highly invested with sentimental value. Thus, a big part of what defines the meaningful space of the home are the numerous collections of things people have chosen to keep inside its walls. These collections of objects help us define who we are as individuals. They function both as an expression of the self as well as a way of constructing the self [9]. Among other things, we surround ourselves with our books, pictures, paintings, and music collections.

In a world where the objects that surround us are becoming increasingly digital, we have to rethink the concepts of “management” and “display” of articles as important parts of our interaction with the digital world. We are fast approaching a future where, among other things, all of our books will be online, all of our photos will be digital, the music we listen to will be on the network, etc. In this home of the future, it will be crucial to find new ways of relating to and interacting with computational objects.

The advent of the Internet and, later, the World Wide Web (Web) made it possible for people to share computational objects and to display them as they see fit over a network of computers. Therefore, in the past few years we have witnessed the powerful use of public display as a mode of self-expression in such varied spheres as home-page making, newsgroup postings, chat conversations, etc. Nonetheless, the interactive experience in these networked worlds is still a very limited one; essential social cues such as presence and activity are still, for the most part, unresolved [13]. For instance, the establishment and management of identity in these disembodied environments, where information is ephemeral and easily reconfigured, can be problematic [13][54]. Moreover, the administration of privacy is still a rather challenging task [1][59].

The digital environments we have created thus far thrive on their networked structures – the Internet being one example. Because these networks allow people to communicate in ways that were not possible before, the digital world is inherently transformed into an intensely social world: this is an environment that not only connects machines, it connects

people. The irony, however, is that, as it stands right now, this digital world is rather cold seeing how it lacks many of the social cues and subtleties present in the physical world around us.

Taking this far-reaching limitation as a point of departure, this thesis approaches the management of technological objects from a social viewpoint. The project brings forth the notion that collections of digital objects are entities that extend beyond their technical essence and, in so doing, inhabit our social world to become an important part of our socializing processes. For this reason, I regard these collections as part of communicative transactions that we carry on as social beings. Unlike most current information management applications, which deal with digital collections from purely technical perspectives – annotation, filing, and searching systems [19][48][64][65] - Collections addresses the ways in which these collections can be appropriately shared and displayed according to different social contexts. The system presented here supports the owner of the digital collection in articulating appropriate audiences for different sets of digital objects within her collection.

When compared to collections of physical objects, digital collections are, in many ways, more flexible and potentially more dynamic. Digital collections are comprised of computational objects that can keep track of their own interaction history, and they open up the possibility of multiple categorizing dimensions because such objects can be classified under several different groups. These qualities can and should be utilized by managing tools to enhance the social articulation of such collections of data. Yet, it is surprising to see how little attention has been paid to the social utility of meta data – such as usage history and categorization. As we start surrounding ourselves with incarnations of the objects that now inhabit the digital arena, the need to address the social qualities of these objects becomes even more explicitly significant.

Of all digital objects that people transact with, this thesis concentrates on personal collections of digital photography. The reason for this focus lies on the fact that photographs are, in their very essence, highly social objects: people take pictures of moments and events that are meaningful to them and, later, they utilize these images as conversational and reminiscing “props” to share their stories and memories with others. These sharing acts are caused by and occur because of specific social contexts, that is, the sharing situation depends on whom pictures are being shared with. It is the articulation of such varied social contexts and the consequent display of photographic collections that concerns us in this thesis.

The goal is to devise a system that empowers people to use displays to create an expression of identity and to exhibit their computational collections for themselves and others. The key function of these displays is social communication. As with any personal collection, attention needs to be paid to the various levels of public and private display and the way in which these levels are integrated in the networked, digital world.

2. The Collections System:

what it is and how it works

In this chapter I describe the Collections system. I present an overview of the motivations for building the system and I proceed to explain how the user interface was conceptualized and what changes where made along the process of developing the project. I briefly mention some of the theoretical framework involved in the design decisions for the project without, however, giving extensive accounts of these theories; that task is taken up in the next chapter where I expand on the theories that guided the construction of the Collections system.

2.1 Overview

> *When I was a college student in the late 1960s, I spent one three-month summer vacation in Europe. I had a wide range of new and exciting experiences, and when I returned home I began to share these with my family, friends, family, and other people I knew. But I did not give everyone I spoke to exactly the same account of my trip. My parents, for example, heard about the safe and clean hotels in which I stayed and about how the trip had made me less of a picky eater. In contrast, my friends heard an account filled with danger, adventure, and a little romance. My professors heard about the "educational" aspects of my trip: visits to museums, cathedrals, historical sites, and observations of cross-cultural differences in behavior. Each of my many "audiences" heard a different story.*
>
> *The stories of my trip varied not only in content, but also in style. There were varying numbers of slang words, different grammatical constructions, and different pronunciations. The pace of my delivery, body pos-*

ture, facial expressions, and hand gestures were different in each situation. Each description had its own unique mixture of earnestness and flippancy. My friends, for example, heard a speech filled with "sloppy speech" and sarcasm.

Did I "lie" to any of these people? Not really. But I told them different truths. I did what most of us do in everyday interactions: I highlighted certain aspects of my personality and experience and concealed others.

Joshua Meyrowitz

Joshua Meyrowitz's account of his trip to Europe [46] nicely illustrates the notion of how and why audience choice matters in social interaction. We do not interact with every person we know in the same exact way. We are very good at unconsciously changing behaviors from situation to situation and that is part of what makes us highly adaptable social beings. Unfortunately, the same flexibility and ease of adaptation is not present in mediated environments such as the World Wide Web. For the most part, it is not possible for people to dynamically adapt their interaction and self-presentation to different audiences in the virtual scenario of Web sites. Even though people share a lot of personal information in cyberspace, the quality of these interactions is still a far cry from the fluidity and meticulous social tailoring that happens in the real world.

The Collections system addresses the adaptive presentation of digital content in view of its potential audiences. Similarly to what Meyrowitz did by presenting different versions of his trip to different people, the Collections system allows users to articulate which photographs in a personal collection are appropriate to be shown to different audiences. As more people share large collections of pictures on the Web - both on personal home pages and on "family" sites [47][7] - the need to determine the appropriateness of different sections of these collections for different audiences becomes obvious. The system introduces an innovative graphical interface that supports the articulation of varied audience arrangements for the viewing of digital photographs.

Collections also explores an original approach to the presentation interface of photographic collections on the Web. Staying away from too-often-utilized metaphors of physi-

cal albums, the Collections viewing application investigates the display capabilities made possible by the computational nature of digital objects; the application integrates text comments to images and it employs a history of use to create evolving digital albums.

2.2 The System

The Problem: indexing and management of data with no regard for social situations

Categorization tools for digital objects have always focused on the analysis of content. A photographic image, for instance, can be analyzed as a collection of colored pixels that, together, form areas of colors which, in turn, describe the body of a dog. While this is a very useful analysis for indexing and annotating the subject matter of images, it does nothing to account for the fact that this picture is highly cherished by my family as the only photo of a long-gone friend. Such applications do not account for the fact that while it makes a lot of sense for me to share this image with my relatives, most of my friends would not know what to make of this picture. In sum, current categorization mechanisms do not account for the social scenarios inhabited by digital objects.

Social environments are created anywhere people interact with each other [13]. As people share more information over mediated environments such as the Web, management tools need to address the social context in which such sharing acts take place. This thesis sets out to explore an approach for imparting social meta-data to collections of shared pictures on the Web.

Very little has been done in terms of the management of personal photographs from the perspective of audience access. While there has been a considerable amount of work devoted to the organization and retrieval of photographs, the majority of such annotation systems has been developed for very specific purposes such as the automatic analysis of photographic content for searching tasks in business applications [19][48]. Unfortunately, such systems do not incorporate any sort of indexing mechanisms that would be relevant to social situations; the social aspects of digital collections has not been explored yet.

Two main approaches in the indexing of digital content have been keyword-based search and automated content-based search[1]. These technologies have spawned highly powerful applications for the management of and interaction with digital materials

[13][40][54][55][53]. In terms of image annotation, for instance, content-based indexing occurs through the semi-automatic extraction of features such as color, composition, structure or texture. When using applications such as IBM's QBIC system [13], users are able to perform queries that return images that are visually similar to the sample image they provide to the system. One of the great advantages of such systems is the level of automation they feature as opposed to keyword-based annotation systems.

Most annotation systems have been developed for business applications. They work well in situations where users deal with extremely large databases and where the typical task is to specify a query to characterize the items satisfying a requirement [46]. For instance, in the stock photography industry, clients have little, if any, knowledge of the contents of the collection and the indexing system used is either created automatically or by someone other than the end user. A lot of times the main activity performed in such situations is the search for a specific photograph or set of photographs that fit a specific theme or concept.

The approach in this thesis: relating content to potential audiences

Collections is based on the fact that the reasons for creating and keeping personal collections of photographs are usually quite different from those found in industry [36][56]: people build photographic collections to celebrate identity and to share their pictures with others. Kuchinsky et al [36] have noted have noted from their experiments with focus groups that, instead of looking for specific data all the time, people find a lot of value in browsing their own collections of photographs without very specific goals in mind - in marked contrast to the business world. Moreover, these experiments showed that activities that allow for serendipitous discovery were deemed important by users. These are just two examples of how different the goals and considerations can be when we contrast the commercial domain and individual users dealing with the same media. Therefore, the annotation tools geared towards personal data compilations should address these specific characteristics and needs.[2] The Collections system allows collectors to categorize their photographs in terms of their intended audience, consequently imparting on the digital photographs some of the social aspects that they lack in current categorization systems.

1. When using keyword-based annotations, users benefit from the fact that information about media objects can be expressed in terms that are meaningful to the them; for example, in terms of attributes such as people's identities, events, location, etc. As content gets indexed, a semantic layer is created, that is the building block of many annotation systems. In designing such systems, there is a clear trade-off between flexibility and automation. Keyword-based systems are flexible and contextually more appropriate than content-based systems at the price of being much less automated than the latter.

As social beings, we continuously adapt our social performance to the context around us [26], we constantly make fairly complex decisions about what is appropriate to share with other people at different times. The sharing and enjoyment of personal pictures present a natural extension of this kind of social adaptation we perform so skillfully. Social situations usually emphasize and reify sets of audiences in fairly tangible ways; for instance, when we participate in a Thanksgiving dinner, both the conversations that arise and the possible exchange of pictures that happens are very much tied in to the people present and happen because of them. When, on the other hand, we meet with colleagues in the working environment, a different social situation is created and different topics, behaviors occur. Likewise, there are sets of pictures that one would share with her relatives and there are other pictures that one would rather not share with them. Some pictures are meant for friends whereas others might be shared only with immediate family.

Much of the work done in Collections is devoted to the creation of a system that permits and encourages the construction of multiple photographic albums intended for different individual viewers and different groups of audiences. One of the main research questions is the need to make the different categories of audiences that inhabit our social life explicit. This is a non-trivial task considering that people are not used to articulating such categories explicitly; as Lakoff points out, “most categorization is automatic and unconscious, and if we become aware of it at all it is only in problematic cases.” [38]. The challenge is one of supporting decisions such as what information to reveal, what to conceal, and to whom utilizing an interface that stays away from the onerous processes of current privacy programs. While information privacy mechanisms abound, the user interface to such programs has received scant attention. Collections utilizes a graphical interface that, unlike text-based interfaces, allows for easier and more flexible ways of creating, applying and reviewing privacy policies as they relate to potential sets of audiences.

Photographs in the Collections system get categorized along two dimensions: image con-

2. FotoFile [36] is the first annotation system to come out of research efforts that is guided towards consumers as opposed to an industry audience. It makes use of the aforementioned automated capabilities but taking into account the difference in scale of the database and the fact that users will, most likely, be familiar with the entire collection of pictures. Even though the FotoFile system assumes that people classify their photographs according to narrative content, it still bases the annotation process solely on the contents of the images. Collections, on the other hand, aims at establishing a social self through the annotation of digital collections. We are not only looking at the contents of photographs, we are also looking at how collections of photographs - and other sets of digital objects such as books - fit within the social context around them.

tent and intended audiences. The former allows collectors to group their pictures in thematic groups; it is the personal level of the categorization process as it addresses the themes that make sense for the collector in terms of grouping her pictures. The latter can be understood as the social level of the categorizing procedure: it relates sets of photographs to potential viewers. The personal level articulates the ways in which the collector perceives her pictures in terms of their subject matter, whereas the social level refers to the categorization of photographs in relation to their intended audiences. Finally, the third major task in the Collections system is that of ascertaining that a viewer is a member of a specific audience created by the collector. Since viewers do not know what audience group(s) they are a part of, the system needs to define their membership through the interaction with viewers.

Because sharing personal pictures is a highly social experience, determining viewers' membership should be an equally social activity. Therefore, instead of making use of encryption keys – which is common practice in privacy applications – Collections proposes an alternative way of determining audience membership: the creation of sets of question-answer keys. The goal is to create a more social way of authenticating membership.

Collections is comprised of two distinct parts: the categorization toolkit and the viewing application. The categorization toolkit deals with all issues concerning the contents of the photographic collection and its relationship to different audiences, whereas the viewing application handles the presentation form of the photographic collection to the viewers. The three main topics addressed by the categorization portion of the Collections system are:

A. *Audiences*: defining the audiences for photographs

B. *Collections*: categorizing the content of photographs

C. *Keys*: recognizing audience membership

In addition, the research agenda for the viewing application is comprised of the following issues:

A. exploring the presentation possibilities of albums of digital photographs

B. integrating text comments to the presentation of the collection

2.2.1 The Categorization Toolkit

The categorization toolkit is an application intended to be used exclusively by the owner of the photographic collection, whom, henceforth, I refer to as the collector. It is here that all

decisions concerning the association of specific sets of pictures to specific audiences take place. The access structure created in the categorization program is never made explicit to the viewers of the photographs; instead, they see the results ensued by the categorization structure[3].

One of the main concerns in this portion of the project was to make the interface fairly lightweight - i.e. keeping text entries and forms to a minimum - while allowing the flexibility of collective (coarse-grained) as well as fairly specific (fine-grained) actions to coexist. Another interface challenge was to graphically convey the relationships between the various audiences: from general to specific, as well as encompassing and mutually exclusive audiences.

The categorization application is comprised of four modes: new pictures, audiences, collections and review. Each one of the modes is intended as entry points to collectors' most frequently performed tasks and each one of the modes is interconnected to the others.

A. Collections

Joanne is the mother of two-year-old Maddy. From 10am to 7pm Joanne is also a researcher at a computer laboratory. From 7:30pm to 8:30pm she becomes a runner and, for the rest of the evening, her daughter allowing, Joanne engages in movie critique. The daily activities she carries on and the social roles in which she engages throughout the day make her interests explicit and help shape her identify.

It would not be hard to imagine that, when organizing her personal pictures, Joanne might think about them in terms of fairly straightforward categories that reflect her interests as well as her various roles as a social being; she might think about categories such as 'family', 'lab-related', 'jogging' (or 'hobbies'), and 'cinema'. Within the ‘family’ category, for instance, Joanne might have more specific grouping of pictures such as: ‘Maddy’, ‘relatives’, ‘grandma’, etc.

3. The audience structure created in the categorization toolkit is regarded as something that is private to the collector; moreover, it might not be desirable for viewers to know which audience circles they are a part of or from which audience circles they have been excluded. For instance, visitors to my site need not get informed of whether they are a part of my ‘good-friends’ audience, or a part of my ‘not-so-good-friends’ audience; it would be socially awkward for them to get such information.

In Collections, the ability to categorize pictures according to their content is based on the fact that people's pictures are fairly reflective of their interests [5]. Grouping personal pictures into categories that correspond to personal interests provides an intuitive and fast way of organizing images. It also allows for a vastly varying degree of detail on the collector part: for instance, Joanne can create rather general sets of collections - ‘family’ - as well as fairly specific ones - ‘Maddy’.

These categories then become the equivalent of picture collections in the system. Each image can be part of multiple collections. Take, for example, a picture that shows Joanne jogging while pushing Maddy's trolley; it can be simultaneously classified under 'family' and under 'jogging'. The flexibility collections of digital picture provide in terms of arrangements is one of the obvious benefits they have over physical photographic collections. Moreover, the ability of overlapping categories maps well into the way we perceive our social world: almost never do we find ourselves in situations that are a clear cut in terms of social classification, nor in terms of interests. Usually, social situations are highly fluid and span multiple categories [38].

These daily activities help shape our identity. Likewise, they make areas of interest evident. More often than not, the various objects with which we surround ourselves - be they physical or digital - will relate to these areas of interest. The Collections system takes these areas as the starting points for categorizing digital pictures.

This classifying activity of relating pictures to areas of interests is the first of two categorization procedures that the collector carries out in the system; it is here that the collector organizes her pictures in terms of subject matter. The second categorizing dimension concerns specifying audiences for sets of pictures.

B. Audiences

Joanne sits in her living room looking at the pictures she just got developed. There are some adorable pictures of Maddy. As she goes through the photos, she decides which ones to put on the family album, which ones will go on the mantel so that visitors can see, and which ones she will take to work the next day to share with her colleagues. Some pictures of Maddy came out blurred and a bit over-exposed; nonetheless, the grandparents will love to see them all the same. Another picture - a wonderful close-up of Maddy and Lucy, the seven-year-old boxer - will definitely become the front piece of this year’s holi-

days card for friends and family.

Had Joanne been dealing with digital pictures on the Web, she would not have been able to determine nearly as easily nor with as much flexibility who should see which pictures of her daughter. A process as simple and yet, as essential to the nature of personal pictures, as deciding which photos to share with whom is currently not supported by any of the tools that deal with digital pictures on the Web.

Classifying pictures in term of their intended audiences is the second big part of the categorization activity in the Collections system and the heart of the social interaction model we propose. The audience mode allows the collector to structure different sets of audiences for her pictures in the way that best reflects the social interactions and access levels that she deems appropriate with regard to her collection of digital images.

The way in which we interact with different people affects our perception of them. Moreover, the level of intimacy in social relationships is one of the main factors driving the kinds of interactions that happen between people. As Goffman notes, we adapt our social performances all the time depending on whom we interact with [26]. The Collections system takes those interaction variables into account when looking at the audience for photographs; that is, the display of any information depends on whom it is being displayed to.

Just as in the categorization of pictures into different sets of collections, here too audience levels are defined by the collector herself. The reason being that this is the best way of ensuring that the categories will have the most personal relevance to the user. Audiences can range from people that are very intimate to the collector - and therefore would be allowed to have access to most of the digital content - to groups of people who are not close at all to the collector - therefore having access only to the most public parts of the photographic collection.

The notion of designing a graphical rendition of audience structures built by the owner of the collection is not trivial. As social beings we are so good at adapting our social performance to the audience at hand that this becomes part of routine skills that are taken for granted in social interactions; it is something we do everyday almost automatically. Having to explicitly express these relations can be a fairly complicated task [38][58].

As the explorations of the audience interface progressed, it became clear that certain

models were too limited to deal with notions of privacy and its relationship to audiences; it also became obvious that the system would have to support a variety of actions concerning the structure of audience arrangements. The next step, then, was to make sense of the overriding patterns of audience combinations a collector might want to express when relating her personal photographs to potential viewers. This brought up three main concepts of inter-audience relationships that cover most of the audience-related tasks a collector might want to express: encompassing audiences, discrete audiences, audience exclusion.

In what follows I explain what each one of these inter-audience relationships are and how they are supported by the user interface in Collections.

Encompassing Audiences

The first notion, and the most basic one supported by the system is what I call encompassing audiences: the idea of one audience being “contained” within another one and that this encompassing relationship follows a privacy gradient [see figure 1]. This relationship makes explicit the notion that our interactions with people run along a privacy axis where we decide how much to reveal and how much to censor at any given point.

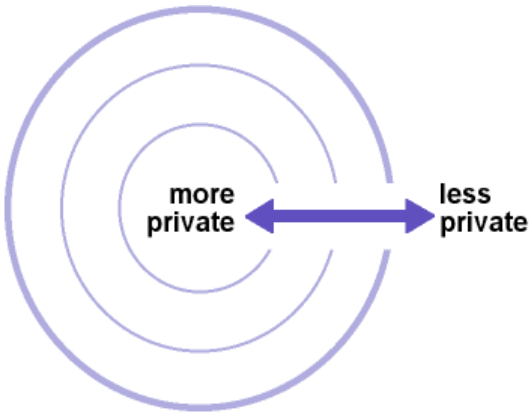

Figure1: privacy axis with regard to audience circles

For instance, let us imagine that a collector has created two audiences called 'acquaintances' and 'friends'. An encompassing relationship would mean that the 'friends' audience encompasses the 'acquaintances' audience in the sense that it has access to everything that 'acquaintances' has access to in addition to having access to more things - i.e. it has more access privileges than 'acquaintances'[see figure 2]

Figure2: encompassing audience circles

This encompassing relationship is made explicit on the user interface by the placement of one audience circle inside another one. The interface solution for showing encompassing audiences works very much in the manner that contour lines in topography work; the difference being that here we show levels of access instead of points of elevation. For instance, in the same way that the slope of a mountain is represented by consecutive contour lines for higher elevation, so are “higher-access-level” audiences represented as consecutive circles contained by previous ones. In addition, every access level is color-coded: darker colors are used for lower access levels and lighter colors are used for higher access levels. [see figure 3]

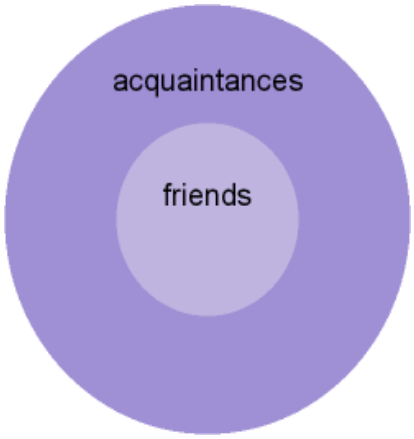

Figure3: color-coded access levels within encompassing audiences

The encompassing notion is an effective way of thinking about inter-audience relationships that map well onto a privacy continuum. Nevertheless, it is a limited model in the sense that it accounts exclusively for one kind of audience arrangement; the one where all audiences share significant parts of the same content and where access is merely a matter of degree.

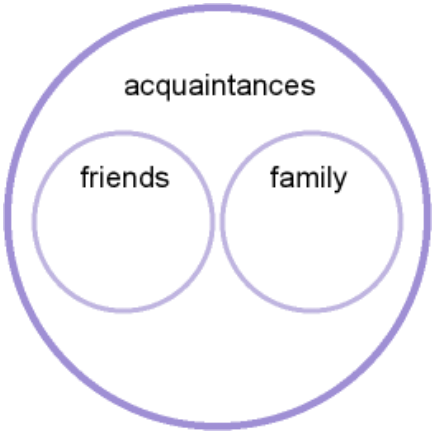

Figure4: discrete audience circles

Discrete Audiences

Discrete audiences, the second inter-audience relationship supported by the Collections system, addresses scenarios where multiple audiences do not share significant portions of the content at hand; instead, they exist as distinct audiences within the same access level. This kind of interaction mechanism is rather common in the real world and happens every time that, for instance, we give people an account of an event and, depending on whom we are talking to, we highlight and suppress different parts of the story for the sake of appropriateness [46].

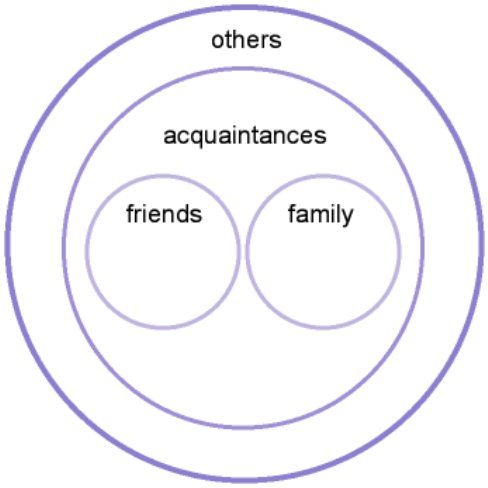

Figure5: new encompassing circle

To illustrate this case, let us turn back to the previous example, where a collector has created an audience structure with two encompassing circles - 'acquaintances' and 'friends.' Imagine that the collector decides to create a new audience circle called 'family.' She

decides that 'family' should have greater access than the 'acquaintances' level does (an encompassing relationship). Nevertheless, she also realizes that the 'family' audience should have access to some sets of photographs that are different from those that the 'friends' audience has access to, and vice-versa. This creates a situation where two audiences ('family' and 'friends') require an encompassing relationship to the same lower-access audience ('acquaintances') while keeping additional access to distinct parts of the collection. This is what I call discrete audiences.

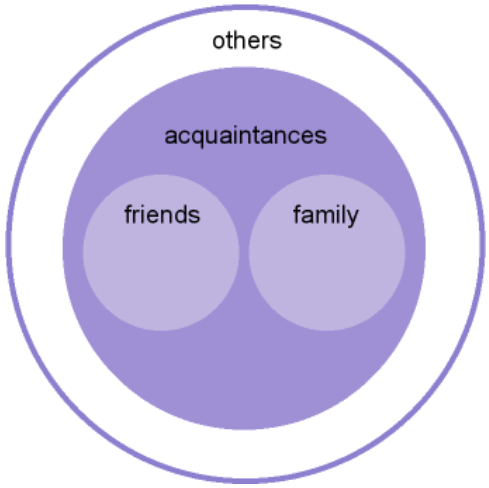

Figure6: automatic/implicit audience exclusion

Discrete audiences are represented in the graphical interface as multiple circles that inhabit the same access level of the encompassing audiences [see figure 4]. Another way of visually understanding them is through their representation as contour lines; discrete audiences share the same access level and, therefore, are represented by the same color.

Unlike the encompassing audiences, which reflected a simple varying degree of privacy, discrete audiences deal with varying content.

Because discrete audiences exist within the same framework of encompassing audiences, the Collections system takes advantage of that association and makes the task of assigning content to many audiences less laborious. Let us imagine, for instance, that the collector of the previous example relates a photograph to the 'acquaintances' level of her audience. Because both 'friends' and 'family' have higher-access privileges than 'acquaintances', both of these audiences get automatic access to the new picture.

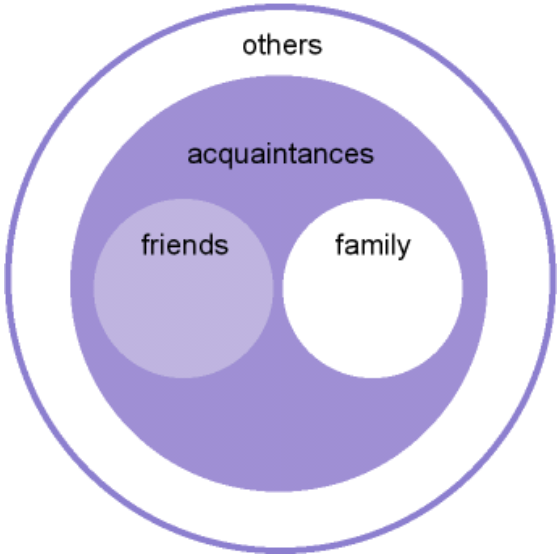

Figure7: taking advantage of the toggling mechanism in Collections to specify audience arrangements

This feature allows collectors to make fairly straightforward decisions that are associated to groupings of audiences. Nevertheless, it is still somewhat limited in its ability to allow for fine tuning of audience arrangements. One crucial aspect of social situation management that it lacks is what I call audience exclusion.

Audience Exclusion

Social situations are defined as much by who is inside them as well as who is out of them [46]. Therefore, the Collections system supports manual audience exclusion, allowing for a fairly fine-grained treatment of audience arrangements.

In the example above, whenever the collector associates a picture to a low-access audience (acquaintances), all high-access audiences (family, friends) become automatically associated with that picture as well. The only mode of audience exclusion is implicit and automatic. As an illustration, let us imagine that the collector creates yet another audience called 'others' and that this becomes the lowest-access audience in her structure, being encompassed by all others [see figure 5]. Now let us suppose that she decides to associate a picture to the 'acquaintances' level. This means that, automatically, 'friends' and 'family' get access to the picture whereas 'others', automatically does not - this is an implicit form of audience exclusion [see figure 6].

There are situations, however, when one needs more control over audience arrangements. For that reason, Collections has a toggling mechanism that allows collectors to deliberately exclude portions of the audience arrangement as they see fit. For instance, let us suppose that the collector above decides she wants a picture to be related to 'acquaintances' and 'friends' but - not to 'family'; she can toggle the 'family' circle off, disabling its association with the picture [see figure 7].

Similarly, in complex audience structures, collectors might find that utilizing the toggling mechanism is fairly helpful in including disparate parts of the audience in new arrangements.

Finally, the combination of mechanisms that allows for encompassing audiences, discrete audiences and audience exclusion in the Collections system creates a highly flexible system for arranging and fine-tuning sets of audiences while still using a fairly simple graphical interface.

In fact, one of the interesting interface questions that arose during the progress of the project is related to the representation of discrete audiences that share some of the same content but not all of it, where this content is only available to them, not to the lower-access audiences they encompass. The first, and most obvious, solution was to represent such a scenario through the overlapping of the discrete audience circles; actually mapping the overlapping of content to the overlapping of the circles on the screen. One problem with that approach, however, is that it does not scale well. Let us suppose a situation where eight discrete audience circles have some content in common and that some of these circles are themselves located in distinct audience circles; it would be impossible to represent sharing of content via overlapping of the circles because of the disparate location of all the circles involved. The solution for this limitation was found in the use of the toggling mechanism - without overlapping - which allows collectors to pick and choose whichever combination of audience circles makes the most sense in any particular situation, independently from the location of each circle [see figure 8]. Also, because of its straightforward representation on the screen - as highlighted and unhighlighted areas - the toggling allows collectors to focus attention on each circle as an independent entity; a characteristic that provides a simpler way of organizing and visualizing various audience arrangements.

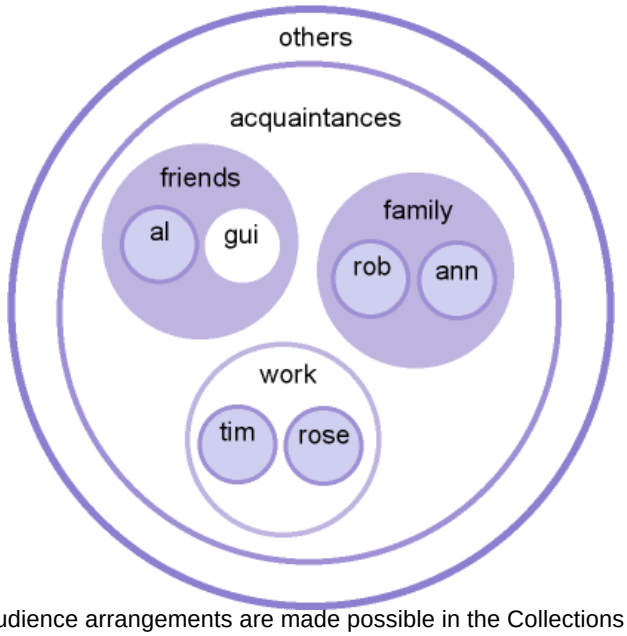

Figure8: complex audience arrangements are made possible in the Collections system because of audience exclusion and the encompassing relationships between audience circles

C. Keys

Because Collections is designed to support interactions over mediated environments such as the Web, where the owner of the pictures is not present or in direct contact with the audience, there is the need to create a proxy that will make use of the collector's categorization decisions in ascertaining who is visiting her site and, consequently, what content should be shown at that point. The creation of keys in Collections functions as the link between all of the decisions made by the collector in the categorization toolkit and the viewing application. It is through the use of these keys that viewers gain access to the content assigned to them in the photographic collection.

The creation of such access keys, however, needs to follow the social nature of the content with which the application deals: personal photographs. Photographic collections are highly cherished by their owners for their ability to help construct and express identity and memories [9]. People are usually very fond of sharing their personal pictures with the "right" kinds of audiences – i.e., audiences that know how to interpret the photographs, those that "know what's going on" [5]. For these reasons, the viewing application should be able to negotiate with the visitor who they are and what their relationship with the owner of the site is – i.e. to which audience set they belong. Thus, regular solutions for keeping data securely guarded – such as username/password combination, and sets of encryption keys – are not always the best answer for applications like Collections. Such

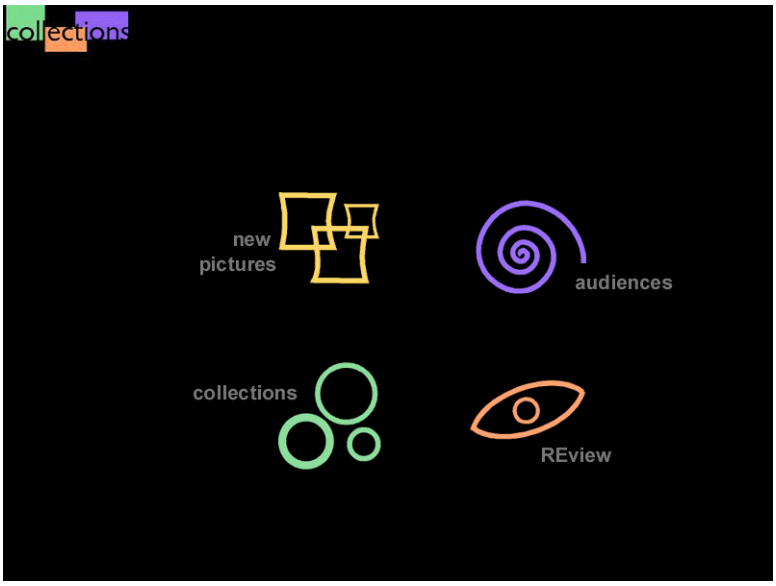

Figure9: opening screen of the categorization application

mechanisms are, for the most part, overly heavy handed for the privacy task in Collections; instead, there is a need to use more transparent and socially appropriate means of carrying out the negotiation between visitors and the content to which they have access.

Because of the flexibility and consequent breadth of privacy scenarios made possible by different audience arrangements in Collections, the access solution proposed by the system is two fold; it differentiates between general sets of audience and more specific audiences. This distinction is translated into two different kinds of keys: question/answer combinations and username/password combinations.

As an example of a question/answer key, let us suppose that the collector would like to generate a key for the 'friends' audience – an audience circle in her framework that is fairly general and that contains many members. She may decide that an appropriate question to ask might be: *what is my son's name?* This is the kind of information that, supposedly, her friends would know about her. The interaction model in this case is one where the viewer gets asked the most general question first and, supposing he answers that question correctly, he gets the option of viewing the pictures available at that access level or answering yet another question that will take him to a higher access level. In the case where the viewer fails to answer the question correctly, he gets access to the last level he achieved; if he fails to answer the very first question key, he only gets access to the totally public images within the site.

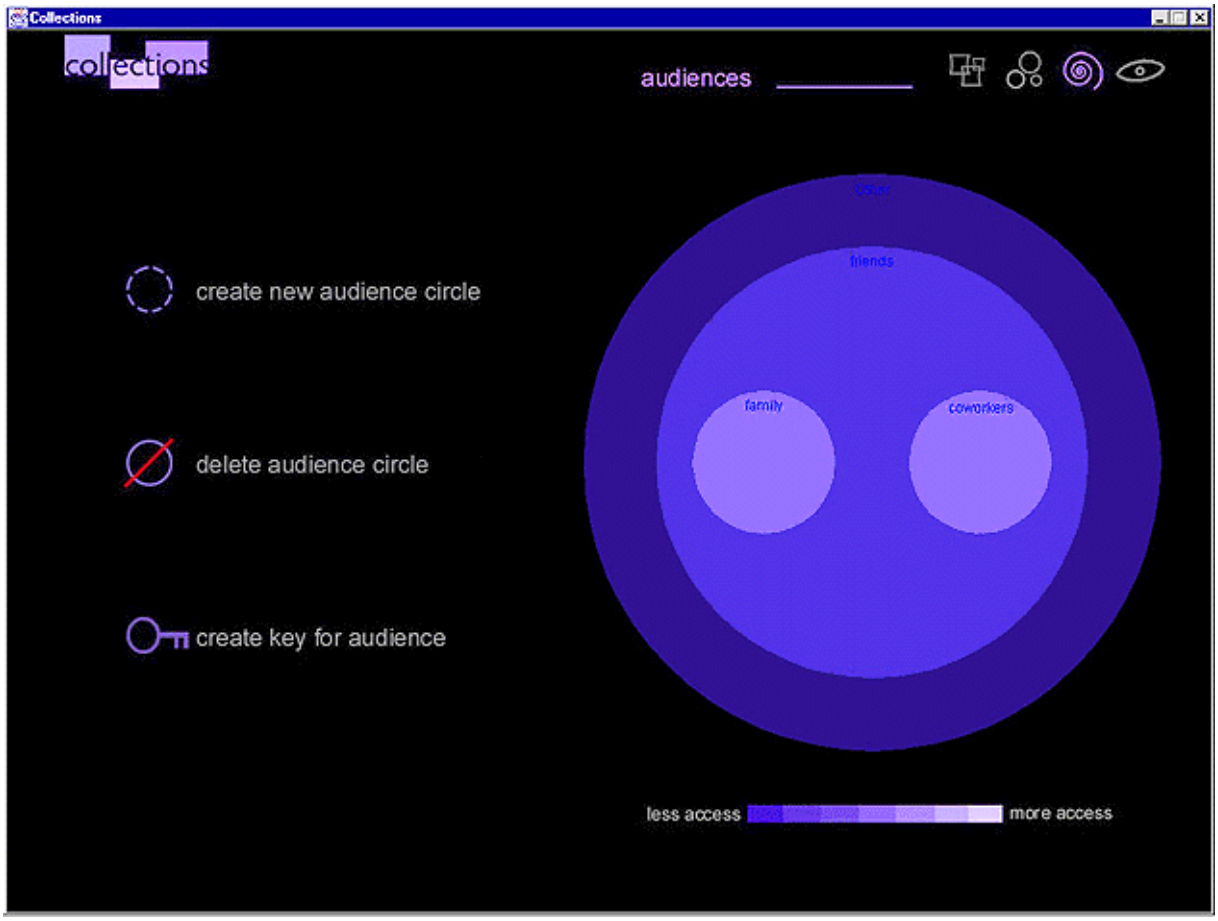

Figure10: audience mode screen

Question keys are meant for general audiences, where one does not want to list down all of the members' names and create passwords for all of them. This use of information is a good application of the notion that social interaction functions as a kind of mutual self-disclosure - "*tell me what you know about me and I'll share more content with you*". Furthermore, it is highly evocative of the nature of privacy supported by the Collections system because it allows for a social use of information and it acknowledges the existence of fuzzy boundaries with regard to audience settings.

The other kind of audience key - username/password combination - works well for very specific audiences such as those comprised of a single person. The fact that the collector has created an audience category of a single person is a good indicator of that person's special status. It probably means that the collector has fairly specific photographs in mind that she would like to share with this individual and that, possibly, this person will be coming back to view pictures on a regular basis. The fine granularity of such audiences

Figure11: collections mode; creation and deletion of collection sets

demands a different kind of keying approach. One problem of using question keys in this case is that the more one-person audiences a collector has the harder it becomes to pin down questions which only one person would know how to answer. For that reason, Collections also supports the traditional kind of access key: username/password.

The issue of creating authentication mechanisms that are more social and more personal in nature than current ones is an important topic in designing privacy applications that try to create socially richer digital environments. Collections proposes an alternative to the currently standard username/password combination; the use of question/answer access keys. This type of key is more socially appropriate for applications that deal with semi-public content – information that is personal but which people would want to share with the right kinds of audiences. Even though this solution has some advantages over current approaches - such as the support of fuzzy boundaries and a more flexible authentication mechanism - there is still a lot to be done in this field which lies beyond the scope of this thesis.

Figure12: collections mode: relating collections to audiences

D. The Categorization Experience

Stepping through the categorization process will help illustrate Collection's interaction model. In what follows I introduce all elements of the categorization user interface.

The opening screen presents the collector with four choices: audiences, collections, new pictures, and review. These are the main action modes within the categorization application. [see figure 9]

Audience Mode

In the audience mode, the collector defines the various sets of audiences with which she will be associating her pictures [see figure 10]. By selecting an action item (on the left) and locating its placement within the audience structure (on the right), the collector builds up her audience structure. At this point, all encompassing relationships and discrete audi-

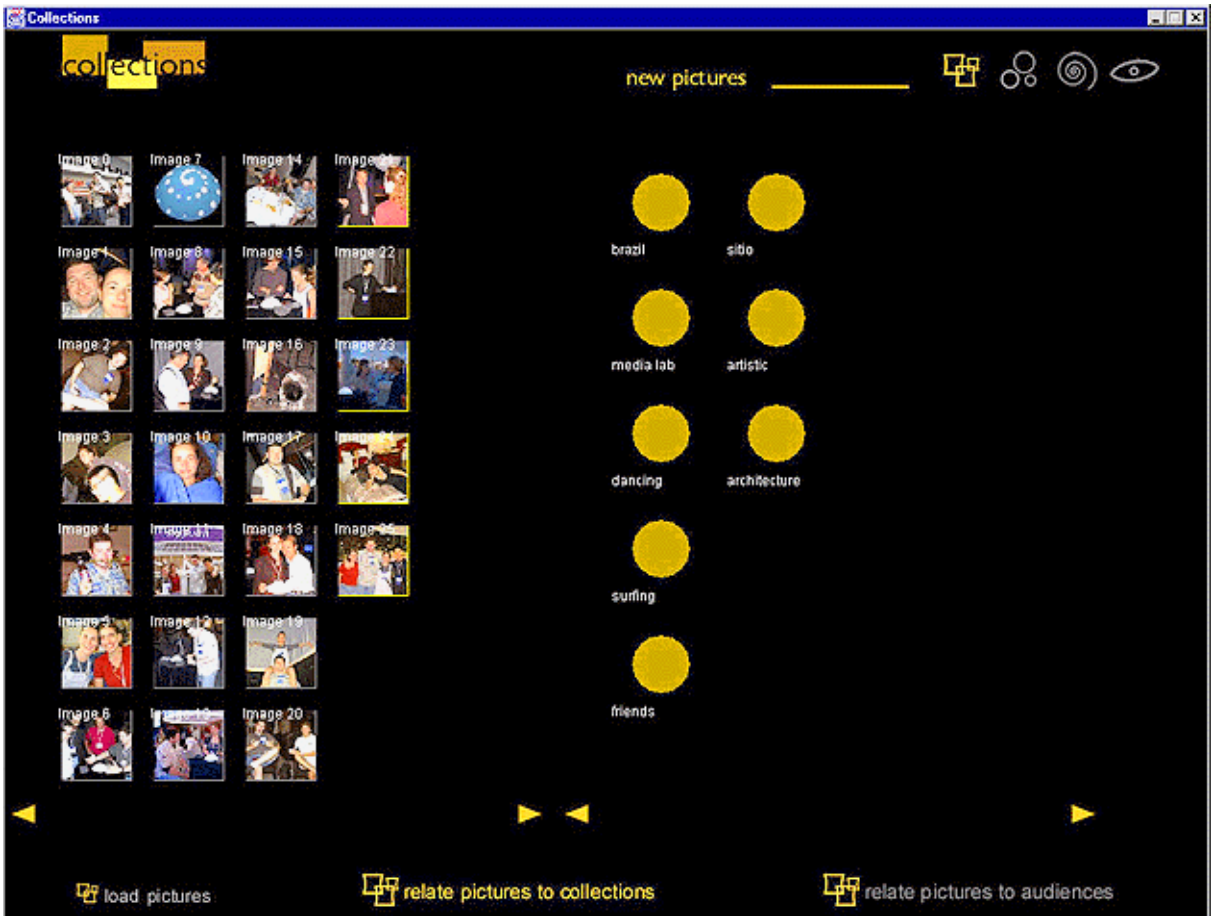

Figure13: new pictures mode: relating pictures to collections

ence circles are created. The resulting circle arrangement (on the right portion of the screen) is the one that will be referred to on the other modes of the categorization toolkit.

It is also in the audience mode that the collector creates *keys* for each audience within her framework. It is here that the collector chooses which one of the two kinds of keys to attach to each audience arrangement: question/answer key, or username/password key.

Collections Mode

The collections mode allows the collector to define various sets of photos according to the content of the images [see figure 11]. Similarly to the audience mode, here too the collector selects action items on the left to create her collection structure. These new collections function as “empty containers” at the time of their creation and will be filled up with pictures as the collector re-arranges the photos contained within other pre-existing collections or uploads new pictures to the system.

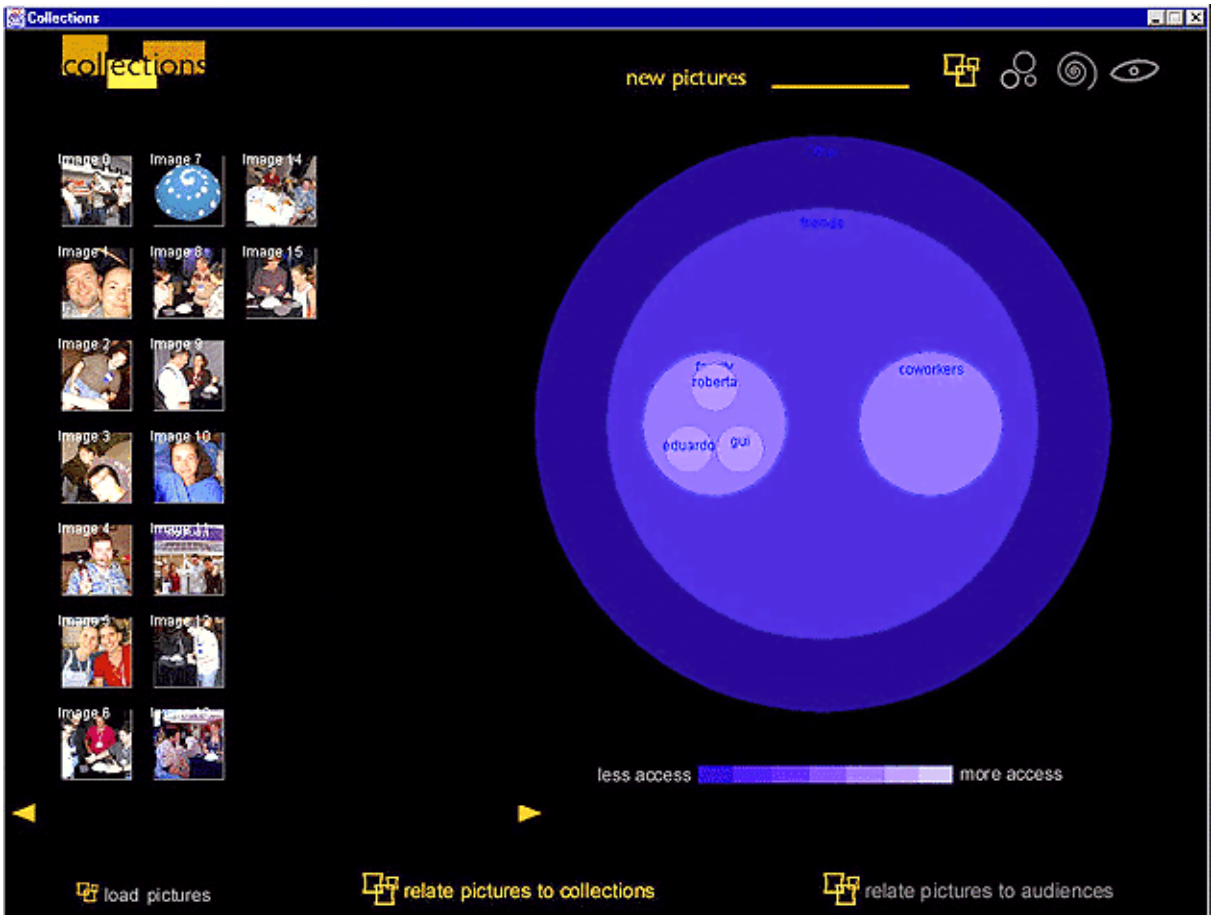

Figure14: new pictures mode: relating pictures to audiences

In addition, this mode also allows the association between collections of photographs and audience arrangements [see figure 12]. The intersection between collections and audiences is what generates actual “photo albums” within the Collections system - it defines the content that will actually be accessible to viewers later on.

New Pictures Mode

In the new pictures mode, the collector is able to upload new images into the Collections system. These get uploaded as a new “collection”; a collection which has not been attached to any audience arrangement. The collector then chooses whether to associate the entire new collection or specific pictures within it to audience arrangements. She may also choose to associate specific pictures with pre-existing collections in the system. In so doing, she sees her thumbnails on the left of the screen and her different sets of collections on the right of the screen [see figure 13]. Association occurs whenever the collector selects a thumbnail - or a set of thumbnails - and drags that selection to one of the collections on the right.

Figure15: review mode: the collector is able to select specific audience arrangements (shown on the lower left) and see both the thumbnails related to her selection (on the right) as well as the graphical representation of her audience arrangements (on the top left portion of the screen)

Association of new pictures with audience ranges works very much in the same way. Thumbnails are seen on the left of the screen and audience circles are seen on the right [see figure 14]. The collector selects the desired thumbnails and drags her selection to the audience circles. The affected audience circles automatically get highlighted so as to give feedback about the performed action. Another interaction possibility is for the collector to select the audience prior to associating any thumbnails. This allows her to fine-tune whichever audience arrangement she sees fit for the new pictures on the left; she can then proceed to select the thumbnails and drag them into the selected audience arrangement.

Review Mode

The review mode is where the collector is able to evaluate all decisions made concerning the association of pictures with sets of audiences and collections. This is where she finally sees what “photo albums” she has created after her categorizing activities [see figure 15].

A list of all audience arrangements is displayed on the lower-left portion of the screen. The collector then highlights any entry on the list and that causes the corresponding audience circles to be highlighted (top left); the pictures that are associated with the particular audience arrangement get displayed on the right half of the screen. This interface allows for a quick and easy way to monitor the results from the categorization decisions made in the system.

2.3 The Viewing Application

The viewing application is the second part of the Collections system; it is an independent application from the categorization toolkit. Unlike what happens in the categorization application, which was designed specifically for the collector to use, the idea here is that others will interact with the application and will view the pictures. It is here that the results from all the decisions made in the categorization toolkit get displayed to the viewers. This part of the Collections project focuses on the interface and navigation possibilities for the display of digital pictures. The research interest lies on the aesthetic and expressive qualities of the viewing experience.

Most current applications for displaying digital photos reproduce, almost completely, the format and interaction model of physical photographic albums. Some applications go as far as to simulate the bindings and page-turning aspects of regular albums [see figure 16]. While such interfaces rely on the familiarity we all have with photo albums, they fail to explore the many possibilities of the digital medium they inhabit. As we turn more to the use of digital cameras, it is important that viewing applications start to investigate the aesthetics and expressiveness of the display of digital photography in its own terms, highlighting its intrinsic characteristics instead of continuously trying to emulate the attributes of regular photographs and albums. There is a lot to be gained from delving deeper into the richness of the medium inhabited by digital photos; both in terms of investigating presentation forms that are more engaging as well as creating more meaningful ways of displaying photographs. Yet, it is surprising how little has been done to provide people with alternative ways of displaying their photographic collections.

The viewing application in Collections is an attempt at exploring some of the presentation options made possible by the digital world. The application takes advantage of the fluidity of the digital medium to create a lively presentation of the photographs in the collection; a

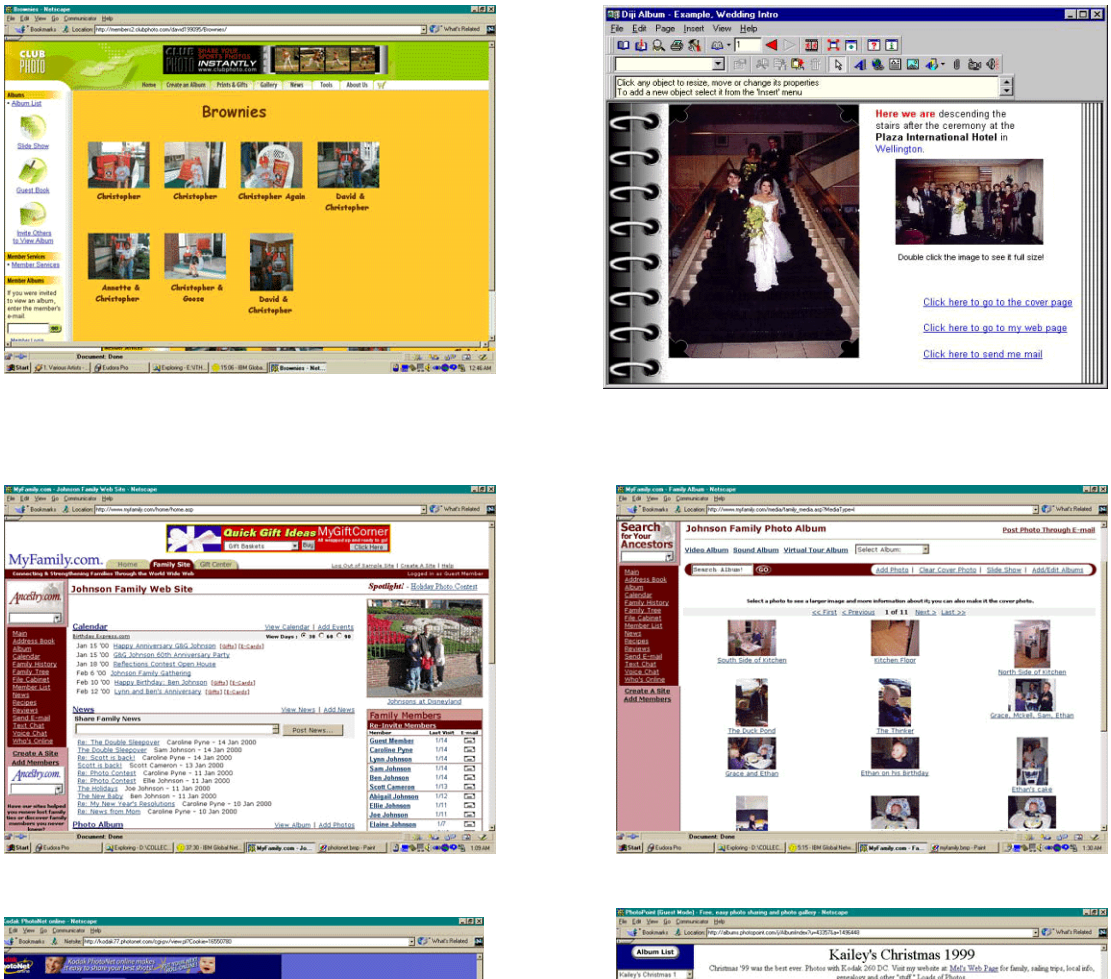

Figure16: Examples of current display interfaces for digital pictures on the World Wide Web. Top left (clock-wise): ClubPhoto [7], DigiAlbum [12], MyFamily Album [47], PhotoPoint [52], PhotoNet (Kodak) [51], MyFamily [47].

presentation that strives to keep the flow of images, text and the overview of the photo-graphic collection as unified elements of a continuum; a continuum that expands from indi-vidual elements to a meaningful ensemble of items. Such an interaction model is aimed at enhancing the viewer's understanding of and engagement with the photographic collection.

Because narratives and stories are an intrinsic part of how people share personal pictures [5], viewing applications for digital pictures need to address the integration of commentary and images. Such verbal commentary can take the form of text, voice, or both concurrently and each one of these possibilities opens up a range of options in terms of the presentation interface. In Collections, verbal comments assume the form of text; these comments are an essential part of the interaction experience as they enhance both the content and the aesthetic aspects of the photographic albums.

2.3.1 Montage

> *Eisenstein's original concept of montage was that meaning was not inherent in any filmed object but was created by the collision of two signifying elements, one coming after the other and, through the juxtaposition, defining the sense to be given to the whole. Montage, then, exists not only in one shot but in time, not only in one object but in the perception of a sequence of meanings.*
>
> *Naum Kleiman*

In the viewing application in Collections, images are shown in clusters according to time and to topic – the topics being the different collections created in the categorization toolkit. This kind of display borrows its meaning from the concept of montage [17]. The spatial organization of several pictures based on these two dimensions gives viewers a greater sense of the ensemble created by the photographs. Furthermore, specific pictures and the comments attached to them gain new significance because of the clusters in which they are embedded. Unlike what happens in physical albums, where the standard organization of pictures is not necessarily expressive of any sort of association between the photographs, the computation aspect of digital photographs allows us to explore visual proximity in the presentation in terms of the time stamp on each picture - consequently imparting meaning to the proximity of one picture to the next.

Photographic collections are complex arrangement of moments that celebrate people's identities and, therefore, it is important to be able to have a holistic view of the entire collection as well as to view specific instances in detail. Collections of photos, then, can be seen as montages in their very essence: entities whose true nature and significance can

Figure17: Time sequence of the opening of an album for viewing; the more a viewer drags the initial square in a diagonal direction, the more pictures are displayed on the screen. The pictures are arranged by time.

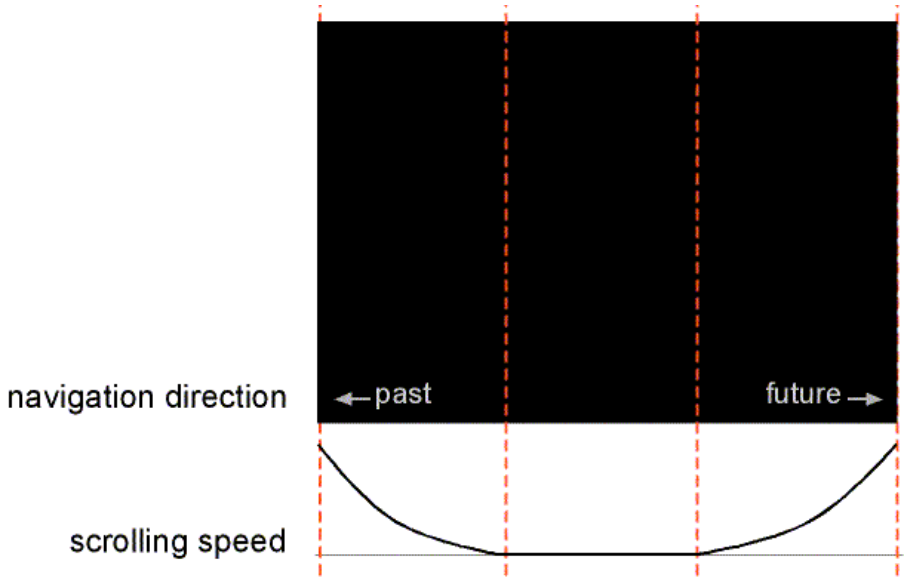

Figure18: Diagram of the navigation sections on the interface of the viewing application. Whenever the cursor is placed on the center section of the screen, no scrolling occurs. Underneath the diagram, the varying scrolling speed is shown.

only be grasped in their ensemble. It is through the viewing of many pictures that one gets a better sense of the flow of the collection and the meaning of each picture within the greater scheme of the collection structure. For that reason, photographic collections readily lend themselves to the concept of montage for presentation and display.

2.3.2 The Viewing Experience

When a visitor accesses the viewing application, he sees a group of different albums available for browsing. These albums are a subgroup of the actual set of collections created by the collector in the categorization toolkit – this subgroup represents the portion of the photographic collections to which this particular visitor has access. Let us suppose, for example, that the owner of the photographic collection had set up the following set of collections: ‘boston’, ‘home’, ‘artistic’, ‘architecture’, ‘family’, ‘vacations’, and ‘dancing.’ Out of these collections, the present visitor – an acquaintance of the collector - has access only to the following items: ‘boston’, ‘artistic’, and ‘vacations’; consequently, these are the collections he sees as he enters the viewing application.

This does not mean, however, that the visitor has access to every picture within those collections; there is the possibility that, for instance, the collector might have tagged some of the pictures within “vacations” as viewable only by relatives. Consequently, these pictures

Figure19: Pictures that have comments attached to them are displayed with a yellow border. These images can be dragged diagonally so that the comments can be read. Pictures can also be viewed at full size on the viewing application.

are not accessible by this viewer. The set of pictures to which a visitor has access in any collection comprises a subgroup of pictures from that collection. As mentioned above, the same thing is true of the set of albums to which a visitor has access: they are a subgroup of the entire group of albums in the categorization toolkit. This “filtering” mechanism is the result of the privacy decisions made in the categorization toolkit.

To open up an album, the viewer clicks on the square that represents that album and drags it diagonally. This action causes thumbnails of the pictures inside that album to gradually “come out” of it and be displayed on the screen. The more the viewer drags the album square, the more thumbnails come out of it [see figure 17]. The visitor then sees several clusters of thumbnails, spatially organized by time; the leftmost cluster being the oldest set of pictures in the album.

The viewing screen is horizontally divided into three navigation sections. These sections are not visually evident to the viewer but their purpose becomes clear through the interaction with the photographs. Whenever the viewer moves the cursor horizontally, he causes the clusters of thumbnails on the screen to scroll, allowing him to view more pictures in the album [see figure 18]. Each side of the screen causes the scrolling action to happen in a different direction: placing the cursor on the left side of the screen causes the album to go back in time, whereas placing the cursor on the right side of the screen has the opposite effect. The viewer can also control the speed with which he desires to browse the photographs: by placing the cursor closer to either left or right edges of the screen he causes the scrolling speed to increase. Leaving the cursor around the center part of the screen causes the scrolling to stop, allowing photographic clusters to be viewed in more detail. Finally, the viewer may also look at any picture in its original size by double clicking on any thumbnail; this causes the actual-size picture to be displayed on the screen for a few seconds before going back to its representation as a thumbnail.

Similarly, whenever the viewer wishes to access the comments attached to a photograph, he clicks on that picture and diagonally drags it to find the comments being gradually displayed on the screen. The display of comments follows the reverse order in which they were attached to the picture: the most recent comments are shown first [see figure 19]. The action of “opening up” comments attached to a picture closely follows the interaction model of opening up an album. Because not all pictures have comments attached to them, the ones that do are displayed with a yellow border around them that signals their special status. Diagonally dragging pictures without borders is not possible.

The navigation model on the viewing application - without buttons nor menus, only minimal graphics - aims at conveying a sense of continuity and flow, which is very much in accordance with the flow of moments and memories that comprises a photographic collection. There is no concept of “turning pages”, scrolling down for comments that are located far away from pictures, nor going to a different page to view a picture in actual size. The display and interaction model was designed specifically as a way to maintain flow and cohesiveness. The viewing interface is structured so that every element, be it image or text, becomes part of a continuum rather than discrete, individual elements. Both the way in which a viewer opens up an album and the way in which he looks at comments attached to pictures function as exploratory means of interacting with the photographic collection.

The viewer also has the option of adding his own comments to a picture and, in so doing, personally contributing to discussions about any of the pictures available to him. The viewer right clicks on the picture and a dialog box pops up; this dialog box allows him to type his comment and, when he is done, it automatically adds the comment to the selected picture.

The viewing application of Collections also keeps track of the interaction history of the pictures it displays. The purpose in keeping track of how viewers interact with the pictures is so that the usage of the collection can be reflected back to viewers next time they open up the photographic albums. This record of interaction history happens in three different ways: first, each time a viewer stops the scrolling action, the viewing application records the time during which the viewable thumbnails stay displayed on the screen. Second, whenever the viewer opens up the comments related to a particular picture, that action is also recorded. Third, the application keeps track of every time a viewer double clicks on a thumbnail in order to see a picture in its actual size.

Any one of these three actions causes the specific thumbnails to be displayed slightly bigger next time the album is opened, creating a montage of thumbnails that vary in size and where physical dimension is associated to popularity. By showing the most cherished and popular photos at a larger scale, the viewing application plays with the concept of aesthetic emphasis and, thus, creates a visually dynamic presentation of the photographs. It also succeeds in creating an evolving album; one that reflects not only the decisions made by the owner of the collection but one that is constantly changing according to the usage of its viewers.

3. Theoretical Framework

In this chapter I outline the various fields of studies and related theories that have guided much of the work done in Collections. Their influences on the project range from general considerations to specific and practical aspects of Collections. All of the studies and theories outlined in this section deal, to a greater or lesser extent, with concepts of communication and information flow.

In what follows, I briefly discuss each one of the relevant theories and approaches to social interaction as communicative acts. I then proceed to explain how these approaches relate to the work done in Collections.

3.1 Why Photographs?

The notion of sharing information over mediated environments such as the Web is at the core of the Collections project. Photographs, in particular, provide us with an excellent example of information content that is remarkably social in nature. Sharing digital pictures have become one of the most popular uses of home pages as well as of email. This popularity dwells in the power that photographs have of bringing people together, allowing them to keep in touch with loved ones, and providing a means of updating friends on the latest events in one's life; in so doing, photography satisfies obvious individual and social needs. Csikszentmihalyi has pointed out that photographs are the prime vehicle for preserving the memory of one’s close relations and, for this reason, they are often described as being “irreplaceable” [9]. In a study carried out by Csikszentmihalyi and others [9], physical photographs were found to be the third most cherished objects in people’s houses, being placed immediately after furniture and visual art.

The act of sharing personal pictures is as popular and as old as the invention of photography itself. Photography is intimately bound up with domesticity and the private world, and

has been so since its inception. This bond is evident in family photographs – portraits and snapshots, images of familial rites of passage such as weddings – in which the seemingly existential relation between photographs and memory folds individual and collective identities into familial narrative time [61].

The evolving connection between the technological innovations in photography and the home has progressed in fairly significant ways from the Victorian era – with the invention of the stereoscope and the visiting card – all the way to our times – with the advent of digital photography. Because of its popular nature, every technological innovation in photography had to come to terms with questions of its social use and adaptation; every change meant new ways in which to picture oneself, to be perceived in and, finally, new ways in which to share one's pictures. Presently, as we stand before the latest set of technological innovations that affect the world of domestic photography – the advent of digital photographs and the reality of the Internet – we are, once again, grappling with issues of social acceptance, social adaptation and, most importantly, we are looking for ways to improve these technologies based on their social uses. In sum, what is important in the current development of domestic photography is not so much the digitization of photographic processes per se, but rather the potential flows and convergences of images and consequent social meanings as they are structured by the innovations in the communication media they inhabit.

One primary characteristic of domestic imagery is its selection of an audience. Snapshots, home movies, and home videotapes are personal documents, and, as such, are meaningful to limited groups of people who generally "know what's going on" [5]. These are people that know enough about the context of the images to know how to interpret them. The existence of such an "expert" audience causes people to take great pleasure in sharing their personal pictures. For that reason, audience selection is at the core of the Collections project. Because sharing personal photos is such a socially charged experience, there is a great need to provide people with tools that allow them to express their preferences when displaying their digital photographic collections to others. Audience arrangement is one of two main dimensions along which photographs are categorized in the Collections system.

In addition, domestic photography is not about technical excellence or virtuosity; rather, it is about the subject matter in the pictures. As Wilson Hicks pointed out, "Even though little Alice's face is chalked out by the sun, or half lost in shadow, it is still little Alice. The viewer, knowing her so well, by a trick of the imagination sees the real little Alice whenever

he looks at her image, which he deludes himself into believing is much better than it actually is" [73]. The significance of subject matter within compilations of personal photographs, so well illustrated by Hicks, represents the second dimension along which photographs are categorized in Collections. Remembering clusters of pictures within one's own collection is, cognitively, a much easier task when they are arranged as content-based groups of images.

Historically speaking, photographic images have never been met in isolation; instead, they have always become meaningful through the social context in which they are embedded and through their close relationship to the spoken word and casual, oral culture [42]. The link between personal pictures and verbal channels of communication is a major element of the interaction model triggered by personal pictures. During exhibition events, people show their pictures to others as part of face-to-face interaction, while delivering verbal, ongoing commentary of the stories that are associated with the pictures. Storytelling and related comments may, in turn, stimulate additional activities: more dialogue, or more picture taking, or searches for old photographs [5]. Unfortunately, though, the same richness of interaction is not present in mediated environments such as the Web. There, the activity of sharing pictures is still rather contrived as current tools lack the ability to provide users with flexible ways of managing and sharing their photographic collections. This limitation results in a conspicuous paucity of social situations within which photos are viewed as opposed to the social richness that the sharing of personal photographs sustains in the physical world.

In the case of Collections, where all of the photographic content is posted on the Web, text comments gain the importance of the spoken commentaries that accompany picture sharing in the physical world. The viewing application in Collections weaves textual commentary to the display of pictures with high regard for the presentation of both images and text so that they create a cohesive whole. The necessity to complement pictures with the accompanying commentary and the ability to display that combination in an appropriate manner are two of the research goals of the Collections system.

As a conclusion, domestic digital photography should be viewed as a cultural instead of a merely technical phenomenon; it is crucial to understand its power as a communicative element embedded in a social context. Questions about how digital photographs are used, shared, and managed can be viewed as questions about social communication. For that reason, applications dealing with digital photographs should support the kinds of social

interactions inherent in the act of producing, managing, and sharing photographs. The space of established uses, values, and meanings of domestic photographic images is the one in which the new image technology of digitization will have to negotiate for attention.

In Collections, we explore how people use the medium of digital photography as both producers of messages and audience members. The key research motivation springs from the need to provide people with a richer social environment in which to share their collections of personal pictures. To that end the categorization system allows people to manage their photographic collection in detail with regard to what content is appropriate to be displayed to what audience. In the viewing application, on the other hand, people are able to engage in verbal interaction while browsing a photographic presentation that has been tailored for them personally.

3.2 Why Audiences?

The previous chapter started with an extensive quote by Joshua Meyrowitz where he narrates how he tailored his account of a summer trip to different audiences. The passage nicely highlights the importance of adapting people’s self-presentation to varying audiences in social situations. Goffman refers to this adaptive behavior as the various social roles and dramas in which we engage as social beings [26].

It is important to note that the role-playing activity to which he refers is not the exceptional case where people who are dishonest - or not in touch with their real selves - pretend to be someone else. Rather, he speaks of the kind of role-playing that functions as a crucial interaction mechanism found in every society. The general picture is one of people actively involved in many different dramas. He alludes to the fact that people are constantly changing roles, learning and adhering to a complex system of conventional behavior. Goffman's scenario provides us with a fairly dynamic picture of self presentation in social interactions.

One can rethink this approach the other way around to understand the importance of audiences in the presentation of self: whenever audiences change, so do the social performances of actors.

Meyrowitz' account, in the beginning of chapter 2, begs the question of what would have happened with the various accounts of his European vacation if, on his return, his parents had decided to throw a surprise homecoming party to which they invited all of his friends, relatives, professors, and neighbors. What would have happened to his description of his trip if he could not have separated his audiences? What would have happened if he were put on the spot to give a brief talk on his trip to all people present?

One possibility would have been for him to have begun with the “safe” description that he would have given his parents risking boring his friends to no end. Had he reported on his dangerous or romantic adventures, his parents and neighbors might have felt uncomfortable. The conclusion, obviously, is that almost any account designed to a specific audience would have either bored or offended parts of the combined audience. One clear possibility would have been for him to devise a new, synthesized account that said a little bit to each segment of the audience but that was bland enough not to offend anyone present. No matter what he said, the situation would have been profoundly different from the interactions he had with isolated audiences.

The key words here are: bland and offensive. It seems that every time we need to adapt to a big audience formed by people with whom we have very distinct relationships, we are given two options: sticking to one of our many social roles/personas and, by doing so, offending parts of the audience or, trying to combine all of our personas into one general and “safe” new role.

When reflecting upon the current state of affairs on the Web, we quickly realize that there is nearly no isolation of audiences. I post a home page knowing that just about anyone can get to it. I have no idea about who comprises my audience and, consequently, I have no control over how to present myself more appropriately to any specific viewer or group of viewers. This results in a serious limitation to social interaction.

3.3 Disembodiment and Dissociation

When I sit down with my relatives after a Thanksgiving dinner and start sharing pictures of my last vacation trip, I know every person in the room and I know how to tailor my stories to the audience in front of me. I become deeply engaged in the experience because I have

the ability to decide how to share my pictures and stories; I decide what to reveal and what to omit. In sum, I have control over my presentation.

The ability to effectively adapt one's performance to different social contexts is one of our most important skills as social beings [25]. Technologically mediated spaces, however, are still conspicuously limited in providing ways for people to monitor and control their self-presentation. This inability causes two phenomena which have been described by some authors as: *disembodiment* and *dissociation* [3][24]. These phenomena interfere directly with the control of inflow and outflow of information [3], both of which are crucial to the projection of an appropriate self-representation within technological systems.

This sense of control is crucial in order to engage people as active agents in social situations of self-presentation. Disembodiment occurs whenever there is a loss of control over one's self-presentation; it occurs in mediated environments whenever people are not able to represent themselves as effectively and as flexibly as they would in face-to-face situations. Disembodiment, thus, results from the lack of crucial social cues on which we rely in real-world settings.

The ability to fluidly tailor one's self-presentation is an essential part of how we negotiate the image we project of ourselves to the world and this ability is still in its very primitive stage in the digital world. The categorization capability in Collections directly affects the level of control one has over one's own presentation to viewers on the Web, therefore decreasing the side effects of disembodiment in the resulting mediated interactions.

3.4 Audiences and the Boundaries of Social Situations

Erving Goffman [25] argues that personal identity is not a static collection of attributes but a dynamic, relational process. People construct their identities, he suggested, through a negotiation of boundaries in which the parties reveal personal information selectively according to a tacit moral code that he called the "right and duty of partial display". Goffman developed this theory in settings (e.g. public places) where the participants could see one another face to face, but it has obvious implications for technology-mediated interac-

tions. In particular, to the extent that a technology shapes individual's abilities to negotiate their identities, Goffman's theories have implications for that technology's design.

In situational literature, situation boundaries are usually defined in terms of the physical environment and location in general. Nevertheless, that definition does hold when we think about electronic media in general and interactive media in particular. In the mediated scenario place is not the real issue; information access is. Thus, the definition I will use here will be based on “barriers of perception” [27] instead of location, because the implicit issue is one of understanding which types of behavior are available for other people's scrutiny.

By using the term “information” I am referring to its specific meaning as social information: all that people are capable of knowing about the behavior and actions of themselves and others [46]. The term refers to that amalgamation of things we learn about each other in acts of communication. Put simply, the information of concern here deals with social behavior - our access to each other's performance.

Unfortunately, social performance in terms of interaction roles is severely limited in cyberspace, particularly as it concerns the control of content on home pages. The content I post on my home page is static; it remains the same no matter who looks at it. This limitation renders the content on my home page factual rather than social. Whenever I post things about myself on my home page, those things act as factual information: you learn them if you did not know them before. There is no social interaction per se based on the information; there is no mutual self-disclosure.

Clearly, one could argue that, despite being static, home pages still provide some sort of social interaction in the sense that they exist to be viewed by others and, in others viewing them, acts of communication occur. That is indeed true. Nevertheless, this is a one-way act of communication, which makes it un-situational. What the viewer gains is “knowledge” about another person without any sort of social experience.

If we want to experience rich social interaction over mediated environments, then we need to develop appropriate tools that allow for the social dramas to be enacted.

Situation boundaries are highly variable rather than static aspects of an individual's existence, and there are potential infinite degrees and patterns of situation overlap [46]. While

we usually think about situations in terms of who is included in them, situations are also defined by who is excluded from them.

This is an important aspect of the design of the Collections categorization program: the ability to manually exclude people from a specific audience. This capability makes the interface a lot more flexible in terms of tweaking audiences.

The nature of situations and audiences is such that the combination of previously segregated audiences does not result in a “union” or “addition” of the situations formerly present. Instead, there is always the creation of a new, unprecedented situation. Let us, once again, turn to Meyrowitz' hypothetical exercise on the account of his European vacations as a setting where there were isolated audiences that came together. We quickly realize that the resultant social situation is not one where he plays the “good”, well-behaved son and, in addition, he plays the adventurous, romantic young man. Instead, he adapts to the merged audience by playing an entirely new role.

It should also be noted that the permanence or evanescence of “audience grouping” deeply affects the resulting quality of interactions. There is a big difference between the effects of long-term and short-term mergers of audiences. The combination of different audiences is a rare occurrence in face-to-face interaction, and even when it occurs (at a weeding, for example) people can usually expect the speedy resumption of isolated interactions [46]. The same is not true of the virtual world. Combined audiences are rather inescapable in cyberspace and, therefore, have a much greater effect on social behavior.

The limitations of self representation on the Web radically limit the sets of social situations we encounter. Electronic media affect us, then, not primarily through their content - which can be the same as that of other media - but by changing the “situational geography” of social life [3]. The same is true of what happens on the Web, where audiences are composed of virtually everyone and anyone.

3.5 Privacy

> *The capability to explicitly or implicitly negotiate boundary conditions of social relations. Privacy is situational and relation-specific. In some contexts, a person will voluntarily yield highly personal information and will not consider that release, by itself, a diminution of privacy. In other contexts, the most mundane information will be guarded with great care.*
>
> *Rohan Samarajiva*

The categorization application in the Collections system touches upon critical issues of privacy on the Internet. Personal photographs are the kind of objects that are highly invested with personal meaning and therefore constitute rather important content for their owners. Nevertheless, heavy-handed privacy solutions such as multiple sets of encryption keys can be hardly thought of as appropriate answers for the problem. It is crucial to design alternative solutions for different kinds of private, social content. For that to happen, there needs to exist a broader understanding of what privacy is and how it changes depending on different contexts.

Commonly held legal and philosophical views on privacy focus on the restriction of access others have to particular areas of one's life. Even though such separation-based notions of privacy might seem inevitable at first, there is an alternative interpretation that articulates aspects beyond normative definitions of privacy: the concept that a person's privacy is inherently linked to the control she has over aspects of her life [33]. This view is especially appealing for thinking about information systems as part of a social context because it helps explain why people would wish to control personal information at many different levels. Consequently, instead of being viewed as a synonym to seclusion and secrecy, the nature of privacy can be defined as a variety of freedom [33], a freedom that functions by granting the individual control over the division between the public and the private with respect to certain aspects of her life.

Also of significance is the notion of the digital persona proposed by Roger Clarke [1], which views digital information as an increasing part of an individual's social identity in the world. As a result, control over personal information is control over an aspect of the identity one projects to the world. When we expand this scenario to the mediated reality of the

Web, this control over information exposure to others becomes an even more crucial element in defining one's identity, seeing how one's entire “virtual” identity is rooted on the information made available to people. Nevertheless, current control mechanisms are still very basic and coarse-grained, and information access tends to be binary instead of multi-layered.

Community Web sites are a case in point. These are fairly popular sites - hosted by almost every Web portal (ref sites) [see figure 20] - where groups of people get together to share photos, contribute to message boards, share calendar events, post update notes and chat live. In such social settings, where multiple people share various forms of digital content, the prevailing mode of information access is based on a person's membership to the group's site. This access model creates a binary condition: a person either has access to everything on the site or has no access at all. The resulting social scenario is one that severely limits the kinds of interactions people might feel comfortable performing. Social interaction in community sites is constrained by the permanent merging of isolated audiences and by the inability of participants to negotiate interaction boundaries. Interactions among groups of people are highly dynamic and multi-layered but, unfortunately, current community sites do not offer the proper support for the flow of more natural exchanges. There is a need for differentiating social situations within community environments; one step in that direction would be to create tools that support personal disclosure of information at various levels, with the ability to negotiate audience boundaries and, consequently, create more focused interactions.

Collections is an attempt at creating conditions under which individuals can exert control and receive feedback over the release of personal information. One of the main goals in the system is to provide fine-grained control over information that is involved whenever one needs to negotiate audience boundaries. Unlike the typically static, coarse-grained access we know from law-enforced and contract-bound privacy rules - usually binary in nature [1] - personal boundary negotiation means a myriad of evolving choices that are based on the reciprocity between the parties involved. For that reason, the categorization portion of Collections strives to give collectors enough flexibility to express their interaction preferences with regard to the digital content that they would enjoy sharing with others.

Finally, it has been pointed out by various authors [3][14][23][24] that a major shortcoming of many privacy-related applications lies in their inability to support means for inspecting, modifying and monitoring policies. A lot of times it is difficult for users of information man-

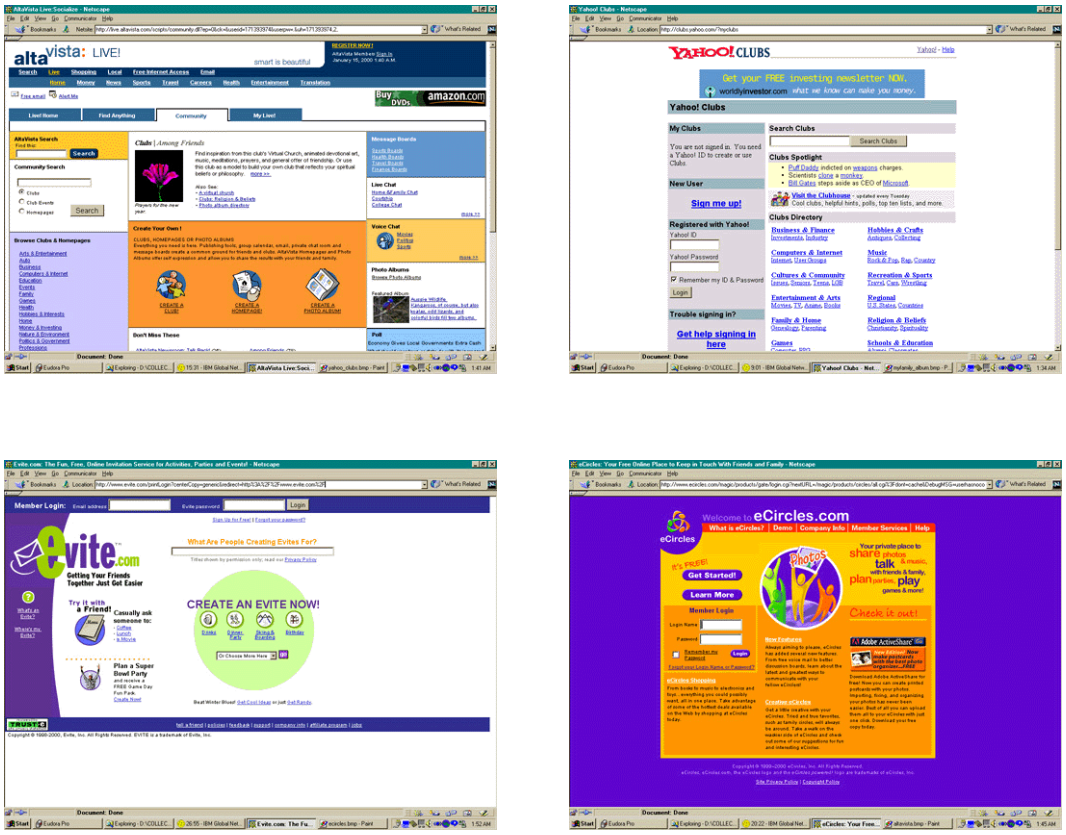

Figure20: Examples of community sites on the World Wide Web. Top left (clock-wise): AltaVista Communities, Yahoo Clubs, eCircles, Evite.

agement software to keep track of all their decisions and policies regarding information access. Moreover, many systems fail to give adequate feedback on what personal content is being broadcast. It has been shown that these limitations deeply affect users' sense of trust, which is a crucial element for the management of personal information in privacy applications [23][70].

The Collections system is based upon the premise that the aforementioned shortcomings can be addressed through the creation of a user interface that is a lot more expressive of users' intentions. In addition, while mostly all privacy-related programs are text based, Collections heavily relies on the use of graphics for the visualization of policies and their resulting outcome with regard to the content. The review mode of the categorization portion of Collections was designed to fully address both the need for monitoring policy results as well as modifying incidental mistakes made during the categorizing activities. The vision, then, is one of creating a graphical interface that supports the creation of fairly complex privacy decisions while keeping away from the currently onerous, abstract interfaces so often found in privacy-related applications.

3.6 Social Concepts and the Collections System

> *Categorization is not a matter to be taken lightly. There is nothing more basic than categorization in our thought, perception, action, and speech. [...] Without the ability to categorize, we could not function at all, either in the physical world or in our social and intellectual lives. An understanding of how we categorize is central to any understanding of how we think and how we function, and therefore central to an understanding of what makes us human.*
>
> *George Lakoff*

By asking collectors to build an audience structure, the Collections system encourages users to articulate some of the various categories of social relationships they are a part of. Audience circles such as ‘friends’, ‘family’, ‘coworkers’, and ‘best friends’ make social bonds explicit. Articulating such relationships is not always an easy task as most of our categorization processes are automatic and unconscious [38][58]. For that reason, the Collections interface was designed to facilitate the categorization activities involved in relating sets of pictures to potential viewers. Various premises present in the Collections graphical interface and interaction model are based on concepts taken from the field of social cognition, particularly those related to the notion of categorization. The following are the key ideas that were taken into consideration when designing both the structure of the system as well as the user interface:

- membership
- prototype and exemplar views
- basic-level categories

It is known from the classical view of concept formation, that we do not consider all members of a category to be equally representative of it [58]. Membership in a category is a matter of degree instead of a binary decision. A simple example is the fact that most people will think first of an apple as being representative of the 'fruit' concept rather than an olive as being a member of the same category when, in truth, both are fruits. This notion of degree works especially well when we deal with social categories because it allows for a more flexible structure of categorization that does not focus so much on boundaries but,

instead, tolerates the “fuzzy” and ill defined quality of social interactions. In Collections the degree of membership is translated into the ability users have of defining multiple, overlapping categories to objects. Things do not have to fit within a single concept, they can span various classifications.

Social psychologists have also enquired on the nature of the features we use to define categories. There is a consensus that the soundest model is one that combines prototype and exemplar views. Briefly speaking, the prototype [58] view holds that people posses summary representations of categories, thus termed prototypes. The exemplar [37] view holds that instead of carrying abstract models of categories with us, we define categories based on sets of exemplars, that is, based on specific instances of that classification. The Collections system deals with both levels of definitions: the abstract nature of prototypes and the illustrative quality of instances - i.e. exemplars. The categorization interface encompasses visualizations of both the hierarchical structure of classification as well as the actual sets of members of specific categories. This approach allows users to organize and browse their collections using whichever model seems more intuitive for them depending on the task at hand.

Finally, a third conceptual bearing taken from social cognition research and which has informed the design of the Collections system, deals with the way in which we organize sets of concepts - interconcept organization. Whenever we organize hierarchies of concepts, we realize that each different level brings to mind different attributes [58]. For instance, “food” may bring to mind 'to be eaten'; “fruit” may bring to mind 'apple'; finally “strawberry” may bring to mind 'red, sweet and refreshing.' Because of the different associations that different levels bring, it becomes important to know which level of abstraction to choose. It turns out that in many hierarchies, one of the levels has special status and is called basic level. This is the level at which we will most intuitively name objects. It is interesting, however, to note that different people might choose different levels of abstraction as their basic level. This might happens either because of distinct goals or because of a different level of familiarity with the subject at hand. In the case of social concepts, however, the level that we consider basic seems far more likely to be flexible and to vary from one context to another, and more likely to depend on our goals than is the case with non-social concepts.

Because of the particularly flexible nature of social constructs, the design of Collections had to be adaptable enough in order to properly reflect the fluidity of the models we build.

Therefore, the assignment of categories in Collections is user based. Moreover, collectors are allowed to traverse the different levels of social hierarchies, overlapping more specific and more general categories, in order to better represent the multiple ways in which they think about the display of their digital collections.

3.7 Interaction and the Construction of Meaning

> *The meaning of cherished possessions is realized in the transaction between person and object; transactions are psychic activities (or communicative sign processes) and not simply physical behaviors per se, although they involve physical behaviors. […]*
>
> *What is important is that the object of interaction has some influence on the experiencer's interpretation because of its own intrinsic qualities. The nth listening to a favorite piece of music, the re-viewing of a painting or a sunset – or any activity – can and should involve novel elements that make the experience unique and complete.*
>
> *Mihaly Csikszentmihalyi*

As Csikszentmihalyi points out, the act of interacting with cherished objects can, in itself, become a way of constructing the meaning of these objects. When dealing with purely digital objects, the graphical interface becomes the portal for the transaction and, consequently, the repository of any possible extraction of meaning. Therefore, it is crucial that attention be paid to the pervasive qualities of the interface in such situations. In the specific case of collections of digital objects, a further challenge arises: the need to address both individual objects as well as the cohesiveness of the collection as a whole. The transactions that occur in such cases span from the collective to the individual and, as such, need to be considered as elements of a continuum.

The meaning constructs that emerge from people's transactions with objects are an important feature of how we function in the world. Nevertheless, in the digital world, over-

enthusiasm for automation has lead a great part of all computational applications to disregard transactions between people and digital objects as meaningful activities favoring, instead, scenarios where the interaction between these two parties is kept to a minimum. A lot of times, automation is viewed by the computer industry as one of the most desirable characteristics of computer programs, choosing what is technically possible over what is socially or cognitively desirable.

Contrary to what most computational tools involving the management of photographic collections might lead one to believe, the human process of categorizing collections of photographs is not a flaw, it is actually one of the main ways in which people interact with and enjoy their photographic memories and moments [56][5]. The Collections system subscribes to the belief that it is not desirable to turn this process into a fully automated procedure, but rather that mechanisms need to be created so that the categorization process is enjoyable and supportive of people's constructive interactions with their collections. The system addresses the need to manage the highly personal and yet, non-articulated decisions that people make when choosing how to share their personal photographs. In this sense, the system's graphical interface is highly helpful because it provides users with a lightweight means of expressing these complex decisions.

The interface in Collections allows one to think about each photograph without having to articulate a pre-established, complex social scenario for it; the collector looks at the picture, looks at her sets of audiences and makes a decision of how to match the picture to a particular audience. Unlike what happens in many privacy applications, here all elements involved in the creation of a sharing policy are vividly represented on the screen, preventing the policy-making process from becoming a set of abstract, text-based decisions. The very act of matching pictures to the different audiences causes the collector to construe meaning out of her audience structure.

The categorization process also functions as a personal viewing process for the collector and, as such, it helps her think about her pictures as she engages in the process of categorizing them. The process is made more tangible through the use of the graphical interface instead of having to go through the labor-intensive and cognitively awkward task of having to express all of these audiences in text form.

4. Future Work

In this chapter I situate the work done in Collections within a more encompassing research agenda. The chapter is divided into two portions: a section on The Collections System Today and a section on Future Scenarios. In the first section I outline the more immediate additions and improvements I envision for the system as it stands today. In the second section, I briefly explain the vision for a long-term exploration in the display of personal digital objects that is inspired on the Collections system and I outline future directions for the project that go beyond the scope of the current project.

4.1 The Collections System Today

Because the categorization toolkit is the place where the collector manages all decisions regarding the creation of audiences and the formation of privacy policies, its interface needs to reflect, in fairly clear and legible ways, the relationships among its elements: photographs, audiences, and access keys. The display of these relationships is crucial for users to understand, at any point in time, how changes and new decisions affect the content they wish to share. For that reason, more work needs to be done in the interface for the creation of access keys in the categorization toolkit of Collections. It is important to improve the interface so that it allows the collector to visualize in real time which keys affect which sets of audiences. Moreover, the concept of generating security privileges from negotiation is a novel approach to identify authentication and it needs to be pursued much further than the work done in this thesis.

In attempting to create situations in the digital world that are rich in social cues and mores, the categorization toolkit needs to be extended so that its privacy policies, which are based on audiences and sets of collections, can also count on one extra dimension: time. Social interaction changes with time; as people interact with each other, as they learn more about one another, their relationships evolve. The element of evolving self-disclo-

sure should be taken into account in the Collections system. To that end, the viewing application has to keep track of what content has been shown to what people and, according to the order in which the photographs were browsed, the application can be programmed to shown additional appropriate content.

Another important improvement in the categorization toolkit is to give collectors the ability to play not only with the access levels of the photographs, but also to control the access level of text comments attached to specific pictures. In this sense, the system would allow comments to be tailored to different viewers, the same way that pictures are tailored to different audiences. For example, one could think of a situation where an image of a group of friends in a bar is captioned "Fort Lauderdale vacation" whenever the collector's parents access the image. Whenever the same image is accessed by close friends, the caption reads "the night I drank two yards of beer and could not walk back to my hotel room.[4]" By the same token, situations are bound to happen where members of fairly specific audiences – those that have access to highly private content – might comment on public pictures as they relate to more private photos and, when such comments get viewed by members of more general audiences (as it would currently happen since the picture in question is viewable by general audiences), the comments would not make sense to them on top of possibly disclosing information that might be pertinent only to more private audiences. It is the case, then, that pictures might have a different privacy level than the comments attached to them and that needs to be addressed by the system. The same audience structure created by the collector can be used for text comments for categorization in terms of potential viewers.

In the viewing application, it is crucial to allow viewers to attach text comments to groups of pictures instead of limiting them to comment only on individual photographs. The concept of montage draws its expressive strength from the relationships that surface among different arrangements of pictures; this is an asset that needs to be expanded to the comments and stories attached to the pictures. This feature becomes more interesting when we consider the possibility that some pictures in a particular arrangement might be viewable by a certain audience X whereas other pictures in the same arrangement might not be viewable by the same audience X. Thus, the ability to attach comments to groups of pictures inherently touches upon the issue of extending audience access beyond photographs to text comments (as discussed in the previous paragraph).

4. My thanks to Brian Smith for providing me with this example.

Finally, the presence of visitors to a photographic album is the kind of information that can be of high interest for the collector. For that reason, the viewing application needs to have an instant messaging mechanism that allows visitors to communicate their presence to the owner of the site if they so wish. The ability to communicate in real time about the photographs one is looking at readily leads people to browse albums together and to generate much more spontaneous discussions around the photographic content than is possible via asynchronously posted comments – as is the case presently in Collections.

4.2 Future Scenario

4.2.1 The Home

People use the physical space of their homes not only for storage but also as an important display area for the things that are most important to them. More often than not, the objects in the home are highly invested with sentimental value [9]. Thus, a big part of what defines the meaningful space of the home are the numerous collections of things people have chosen to keep inside its walls. Among other things, people surround themselves with books, pictures, paintings, and music collections. What happens when these objects are no longer physical but rather digital? How will we surround ourselves and interact with these new objects?

Digital objects are, more than ever before, a reality of life today. As we move deeper into the realm of the digital world, a lot of the objects that have always been physical in our environment start to disappear into a digital void. In losing their physical incarnation, must these objects also lose their function as objects of display? While much attention has been paid to rendering the individual digital object [10][18] scant attention has been paid to the display of the aggregate, of the collection of many digital objects. Yet the display of collections is an important part of how we define our surroundings and present ourselves to others. Furthermore, the display of digital collections is potentially more expressive and adaptable that the display of static, physical items. Very few people rearrange their books and rehang their pictures in anticipation of each different guest to their home, yet such contextual responsiveness is quite possible in the digital domain.

The current version of the Collections system deals with the management and display of photographic information on the World Wide Web. It was designed to function in the scenario of home pages and Web sites. Nevertheless, the display of digital objects is not and should not be limited to the Web environment. For that reason, it is crucial to explore new ways in which to bring the presence of digital objects to the physical world we inhabit.

One of the main future research directions for the Collections project is to apply a lot of its current functionality to the creation of a system that deals with the display of digital objects that go beyond the scope of digital photographs - in the physical environment of the home; a system that takes the collections of computational objects out of the computer box and places them into the world around us. This vision assumes a domestic scenario where displays are a myriad and ubiquitous – flat-panel displays, projections, hand-held devices - a space where these multiple displays are aware of environmental changes such as the time of the day, the presence of people in the room, etc. The objective is to tightly integrate this expressive medium to the physical and symbolic setting of the home so that the system works seamlessly.

The goal is to devise a system that empowers people to use displays to create an expression of identity and to exhibit their computational collections for themselves and others. The key function of these displays is social communication. As with any personal collection, here too attention needs to be paid to the various levels of public and private display and the way in which these levels are integrated in the home setting.

4.2.2 Infrastructure

The idea is to make the collections of digital objects responsive to the domestic environment around them. This kind of research project can be comprised of two main parts: databases and interactive situations. The databases are the digital collections themselves; the interactive situations function as triggering mechanisms for the arrangement and display of the digital objects.

There are a few underlying structural aspects that are common to all digital collections in this sense: architectural layout, temporal layout, and sensorial layout.

4.2.3 Architectural Layout

How can we describe a physical room when we start thinking about it as a display unit?

The fact that houses are physical constructions that are familiar to its inhabitants is an important aspect of the interaction scenario I envision. Not only are there structural differences between, say, a wall and the ceiling or a bedroom and the living room, there are also cognitive differences that we attach to these physical constructions. Consequently, it is crucial to have the digital collections we display in the home relate to and take advantage of such structural and cognitive distinctions. This kind of connection enriches the prospect of the interactive experience by relating it to its physical context.

A networked system of multiple display units is one approach at answering the question about physical description of a space. In the Sociable Media Group, a project called NetSpace [44] has a basic, two-dimensional understanding of physical space where each display unit has the possibility of having four neighboring displays: above, below, right and left. Each unit also knows its absolute location within the X and Y coordinates of the room. This is a simple yet effective way of integrating multiple, networked displays within the constraints of a physical location. The displays can pass pieces of working code from one to another so that the same element can be viewed traversing along different displays. Another possibility is to display different parts of the same collection on multiple displays so that the assemblage of all objects being displayed forms a “collage” of the entire content.

4.2.4 Temporal Layout

How do we describe a house in terms of time?

One of the main elements that define the home environment is the rhythm in which things happen inside it. This domestic tempo is cyclical; it tends to repeat itself. For digital collections to be truly responsive to the ebb and flow of a house, they need to be aware of the temporal dimensions of that environment.

With that in mind, the server portion of the system will keep track of a simple calendar. The calendar contains two kinds of temporal data: “regular” time and time information that is specific to the house. It is important for this calendar to have both a “macro” and a “micro”

sense of time. The time information will keep track of:

- what time of the day it is: morning, afternoon, night
- week days versus weekends
- holidays that are observed by the family
- when people in the house wake up, have lunch, come back from work, etc.

4.2.5 Sensorial Layout

How can we understand a room in terms of sensorial input?

The intention is one of creating an interactive experience where user input does not happen solely through direct data entry onto a computer. For that reason, the future *Collections* system will have to resort to sensing technology. One possible scenario would be to have almost total control over the physical environment so that the system could trace people's identities, gaze, physiological responses, etc. The problem with this approach, however, is that it is highly obtrusive and therefore not appropriate for use in the home environment.

The system will take a less intrusive approach to making the home a sensory environment. The employed sensors will track presence, motion, and proximity. I feel that these are the most relevant kinds of data I need for the project.

5. Conclusion

I have presented Collections, a system designed for managing collections of digital photographs in terms of their intended audiences. The project introduces a graphical interface that addresses the creation of fairly complex privacy decisions relating photographs to their potential viewers. In this sense, Collections addresses the need to create tools that support personal disclosure of information at various levels, with the ability to negotiate audience boundaries and, consequently, create more focused, relevant social interactions. The system also presents an innovative approach to the display of digital pictures on the Web, taking advantage of computational information embedded in the digital pictures themselves such as display and interaction history, and the dynamic clustering of pictures on the screen.

I have discussed the notion that, whenever we share personal content over mediated environments such as the Web, the exchange goes beyond pure content: not only do we send and receive bits, we also engage in a social process; a process of interaction, exchange and self-disclosure. In order for such interactions to become socially relevant and successful, we need to design tools that go beyond the categorization of pure content to account for the social contexts that allow such interactions to take place in the first place. To a large extent, the future success of mediated interactions depends on how attuned our tools are to the social situations that frame them.

The discussion of social situations raised the importance of audiences in the sharing of online photographic collections. This is one of the core topics addressed by the Collections system. A major part of the efforts in the categorization toolkit were devoted to developing a sound interface to support the various scenarios of audience arrangements a collector might want to express when categorizing her pictures.

Privacy is a central part of this thesis. The importance of people's ability to control self-presentation was discussed in the theoretical framework behind the project and was applied in the design of the system. The need to create more appropriate ways of authenticating identity in terms of applications such as Collections, is also crucial. The system proposes

an alternative way of keying access to the different parts of digital collections: the creation of question/answer keys. This mechanism allows for a more flexible way of negotiating the identity of visitors to the collector's site. This portion of the project needs further work as a lot can be done in terms of giving collectors a better understanding of how their question/answer structure affects potential viewers to their site.

Finally, the system presented here also features a separate application that explores the display of the collections of photographs on the Web. The viewing application in Collections is an attempt at creating an alternative way of displaying and navigation large collections of digital pictures. Instead of keeping the viewing albums static, the ways in which these albums are perused is recorded to provide viewers with an evolving view of the photographic collection. Popular pictures are displayed bigger every time a viewer goes back to the album. In addition, text comments and discussions become part of the display of the collection, being tightly integrated to the pictures to which they relate.

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